Last updated: 8 February 2018

Goal 3: Ensure healthy lives and promote well-being for all at all ages
Target 3.3: By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases
Indicator 3.3.3: Malaria incidence per 1,000 population

Institutional information

Organization(s):
Global Malaria Programme at World Health Organization (WHO)

Concepts and definitions

Definition:
Incidence of malaria is defined as the number of new cases of malaria per 1,000 people at risk each year.

Rationale:
To measure trends in malaria morbidity and to identify locations where the risk of disease is highest. With this information, programmes can respond to unusual trends, such as epidemics, and direct resources to the populations most in need. This data also serves to inform global resource allocation for malaria such as when defining eligibility criteria for Global Fund finance.

Concepts:
Case of malaria is defined as the occurrence of malaria infection in a person whom the presence of malaria parasites in the blood has been confirmed by a diagnostic test. The population considered is the population at risk of the disease.

Comments and limitations:
The estimated incidence can differ from the incidence reported by a Ministry of Health which can be affected by:

- the completeness of reporting: the number of reported cases can be lower than the estimated cases if the percentage of health facilities reporting in a month is less than 100%
- the extent of malaria diagnostic testing (the number of slides examined or RDTs performed)
- the use of private health facilities which are usually not included in reporting systems.
- the indicator is estimated only where malaria transmission occurs.

Methodology

Computation Method:
Malaria incidence (1) is expressed as the number of new cases per 100,000 population per year with the population of a country derived from projections made by the UN Population Division and the proportion at risk estimated by a country's National Malaria Control Programme. More specifically, the country estimates what is the proportion at high risk (H) and what is the proportion at low risk (L) and the population at risk is estimated as UN Population * H + UN population * L/2.

The number of new cases, M, is estimated from the number of malaria cases reported by a Ministry of Health which is adjusted to take into account (i) incompleteness in reporting systems (ii) patients seeking treatment in the private sector, self-medicating or not seeking treatment at all, and (iii) potential over-diagnosis through the lack of laboratory confirmation of cases. The procedure, which is described in the *World malaria report 2008* (2), combines data reported by NMCPs (reported cases, reporting completeness and likelihood that cases are parasite positive) with data obtained from nationally representative household surveys on health-service use. Briefly,

$$Cases_{public\ sector} = \left(Cases_{confirmed} + Cases_{presumed} \times Test\ positivity\ rate\right)/Reporting\ completeness$$

$$Cases_{private\ sector} = Cases_{public\ sector} \times Prop.seeking\ care_{private\ sector}/Prop.seeking\ care_{public\ sector}$$

$$Cases_{Not\ seeking\ treatment} = Cases_{public\ sector} \times Prop.not\ seeking\ care/Prop.seeking\ care_{public\ sector}.$$

To estimate the uncertainty around the number of cases, the test positivity rate was assumed to have a normal distribution centred on the $Test\ positivity\ rate$ value and standard deviation defined as $0.244 \times Test\ positivity\ rate^{0.5547}$ and truncated to be in the range 0, 1. Reporting completeness was assumed to have one of three distributions, depending on the value reported by the NMCP. If the value was greater than 80% the distribution was assumed to be triangular, with limits of 0.8 and 1 and the peak at 0.8. If the value was greater than 50% then the distribution was assumed to be rectangular, with limits of 0.5 and 0.8. Finally, if the value was lower than 50% the distribution was assumed to be triangular, with limits of 0 and 0.5 and the peak at 0.5 (3). The proportions of children for whom care was sought in the private sector and in the public sector were assumed to have a beta distribution, with the mean value being the estimated value in the survey and the standard deviation calculated from the range of the estimated 95% confidence intervals (CI) divided by 4. The proportion of children for whom care was not sought was assumed to have a rectangular distribution, with the lower limit 0 and upper limit calculated as:
$1 - Prop.seeking\ care_{public\ sector} - Prop.ceeking\ care_{private\ sector}.$

Values for the proportion seeking care were linearly interpolated between the years that have a survey, and were extrapolated for the years before the first or after the last survey. Missing values for the distributions were imputed using a mixture of the distribution of the country, with equal probability for the years where values were present or, if there was no value at all for any year in the country, a mixture of the distribution of the region for that year. The data were analysed using the R statistical software (4). Convolution of the distributions is made using the package “distr” (5,6) (Afghanistan, Angola, Armenia, Azerbaijan, Bangladesh, Bolivia (Plurinational State of), Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Colombia, Dominican Republic, Ethiopia, French Guiana, Gambia, Georgia, Ghana, Guatemala, Guinea-Bissau, Guyana, Haiti, Honduras, Indonesia, Kyrgyzstan, Lao People's Democratic Republic, Liberia, Madagascar, Mauritania, Mayotte, Myanmar, Namibia, Nepal, Nicaragua, Pakistan, Panama, Papua New Guinea, Peru, Philippines, Rwanda, Senegal, Sierra Leone, Solomon Islands, Sri Lanka, Tajikistan, Timor-Leste, Turkey, Turkmenistan, Uganda, United Republic of Tanzania, Uzbekistan, Vanuatu, Venezuela (Bolivarian Republic of), Viet Nam, Yemen and Zimbabwe). For India, values are estimated at subnational level but adjusting the private sector for an additional factor due to the active case detection.

For some high-transmission African countries the quality of case reporting is considered insufficient for the above formulae to be applied. In such cases estimates of the number of malaria cases are derived from information on parasite prevalence obtained from household surveys. First, data on parasite prevalence from nearly 60 000 survey records were assembled within a spatiotemporal Bayesian geostatistical model, along with environmental and sociodemographic covariates, and data distribution on interventions such as ITNs, antimalarial drugs and IRS. The geospatial model enabled predictions of Plasmodium falciparum prevalence in children aged 2–10 years, at a resolution of 5 × 5 km2, throughout all malaria endemic African countries for each year from 2000 to 2016 (see http://www.map.ox.ac.uk/making-maps/ for methods on the development of maps by the Malaria Atlas Project). Second, an ensemble model was developed to predict malaria incidence as a function of parasite prevalence. The model was then applied to the estimated parasite prevalence in order to obtain estimates of the malaria case incidence at 5 × 5 km^2 resolution for each year from 2000 to 2016. Data for each 5 × 5 km^2 area were then aggregated within country and regional boundaries to obtain both national and regional estimates of malaria cases (7). (Benin, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Gabon, Guinea, Kenya, Malawi, Mali, Mozambique, Niger, Nigeria, Somalia, South Sudan, Sudan, Togo and Zambia)
For most of the elimination countries, the number of indigenous cases registered by the NMCPs are reported without further adjustments. (Algeria, Argentina, Belize, Bhutan, Cabo Verde, China, Comoros, Costa Rica, Democratic People's Republic of Korea, Ecuador, El Salvador, Iran (Islamic Republic of), Iraq, Malaysia, Mexico, Paraguay, Republic of Korea, Sao Tome and Principe, Saudi Arabia, South Africa, Suriname, Swaziland and Thailand).

Disaggregation:
The indicator is estimated at country level.

Treatment of missing values:

- At country level

For missing values of the parameters (test positivity rate and reporting completeness) a distribution based on a mixture of the distribution of the available values is used, if any value exists for the country or from the region otherwise. Values for health seeking behaviour parameters are imputed by linear interpolation of the values when the surveys where made or extrapolation of the first or last survey. When no reported data is available the number of cases is interpolated taking into account the population growth.

- At regional and global levels

Not Applicable

Regional aggregates:
Number of cases are aggregated by region, and uncertainty obtained from the aggregation of each country's distribution. Population at risk is aggregated without any further adjustment. Estimation at global level are obtained from aggregation of the region values.

Sources of discrepancies:
The estimated incidence can differ from the incidence reported by a Ministry of Health which can be affected by:

- the completeness of reporting: the number of reported cases can be lower than the estimated cases if the percentage of health facilities reporting in a month is less than 100%
- the extent of malaria diagnostic testing (the number of slides examined or RDTs performed)
- the use of private health facilities which are usually not included in reporting systems.

Methods and guidance available to countries for the compilation of the data at the national level:
Information is provided by each country's NMCP using a DHIS 2 application created specifically for this purpose.

Quality assurance

- We have a specific standardize form depending on the status of malaria control, elimination or prevention of reinfection. We perform internal validation for outliers and completeness and rise queries to countries through the regional offices for clarification. When necessary we rely on data quality assessment information from external sources such as partners working in malaria monitor and evaluation.

- The World Malaria Report is sent to the countries via regional offices for consultation and approval.

Data Sources

Description:
Cases reported by the NMCP are obtained from each country surveillance system. This include among others information on the number of suspected cases, number of tested cases, number of positive cases by method of detection and by species as well as number of health facilities that report those cases. This information is summarized in a DHIS2 application developed for this purpose. Data for representative household surveys are publicly available and included National Demographic Household Surveys (DHS) or Malaria Indicator Survey (MIS).

Collection process:
The official counterpart for each country is the National Malaria Control Program at the Ministry of Health.

Data Availability

Description:
91 countries

Time series:
Annually from 2000

Calendar

Data collection:

Data is collected every year.

Data release:
Data is release yearly. Next release is expected by December 2018.

Data providers

The National Malaria Control Program is the responsible to collect the information at each country.

Data compilers

The Surveillance. Monitoring and Evaluation Unit of the Global Malaria Control Programme is the responsible to compile and process all the relevant information. National estimates for some countries are estimated in collaboration with the Oxford University (Malaria Atlas Project).

References

URL:
http://www.who.int/malaria/publications/world-malaria-report-2017/en/

References:

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Related indicators

Not Applicable