## Introduction

Malaria infection during pregnancy is an enormous public health problem, with substantial risks for the mother, her fetus and the neonate. In areas of low transmission of *Plasmodium falciparum*, where levels of acquired immunity are low, women are susceptible to episodes of severe malaria, which can result in stillbirths or spontaneous abortion or in the death of the mother (Luxemburger et al., 1997). In areas of high transmission of P. falciparum, where levels of acquired immunity tend to be high, women are susceptible to asymptomatic infection, which can result in maternal anaemia and placental parasitaemia, both of which can subsequently lead to low birth weight (Steketee, Wirima & Campbell, 1996). Although there are fewer data about the role of *P. vivax*, there is evidence that it can also cause anaemia and low birth weight (Nosten et al., 1999). Low birth weight is an important contributor to infant mortality (McCormick, 1985; McDermott et al., 1996). It has been estimated that malaria during pregnancy is responsible for 5–12% of all low birth weight and 35% of preventable low birth weight (Steketee, Wirima & Campbell, 1996) and contributes to 75 000 to 200 000 infant deaths each year (Steketee et al., 2001). The World Health Organization (WHO) currently recommends a package of interventions for controlling malaria during pregnancy in areas with stable (high) transmission of P. falciparum (WHO, 2004), which includes the use of insecticidetreated nets (ITNs), intermittent preventive treatment (IPT) and effective case management of malaria and anaemia (Box 1).

Effective implementation of the recommended strategy for malaria in pregnancy requires close collaboration between malaria control and reproductive health programmes at all levels, including policy development, planning, logistics, procurement, training and service delivery. Expanding programme coverage will require careful monitoring of implementation and evaluation of impact. Monitoring and evaluation of the interventions for malaria prevention and control during pregnancy require close collaboration between the two programmes.

To assess progress in and effectiveness of the delivery of interventions for the control of malaria during pregnancy, core indicators of process, outcome and impact have been identified (**Box 2**). The goal is to ensure that these indicators are collected, either routinely at health facilities and incorporated into national health information systems or through regular surveys and other Roll Back Malaria monitoring and evaluation mechanisms. Examples of the questionnaires used to elicit

## BOX 1. Recommended interventions for malaria prevention and control during pregnancy

Policies for malaria prevention and control during pregnancy in areas of stable transmission should emphasize a package of intermittent preventive treatment and use of insecticide-treated nets and ensure effective case management of illness and anaemia. Insecticide-treated nets and prompt effective case management are recommended for all pregnant women living in malarious areas.

## Intermittent preventive treatment

All pregnant women in areas of stable (high) malaria transmission should receive at least two doses of intermittent preventive treatment after quickening, the first noted movement of the fetus (WHO, 2004). WHO recommends a schedule of four antenatal clinic visits, with three visits after quickening. Intermittent preventive treatment at each scheduled visit after quickening will ensure that a high proportion of women receive at least two doses. Doses should not be given more frequently than monthly.

Currently, the recommended drug for intermittent preventive treatment is sulf-adoxine–pyrimethamine, because it is safe for use during pregnancy, effective in women of reproductive age and can be delivered as a single dose under observation by a health worker.\*

#### Insecticide-treated nets

Insecticide-treated nets should be provided as early in pregnancy as possible to all pregnant women living in malarious areas, including epidemic and disaster situations, according to the perceived need in the locality. Their use should be encouraged for women throughout pregnancy and postpartum. Nets can be provided in the antenatal clinic or through other sources in the private and public sectors.

## Effective case management of malaria illness and anaemia

Effective case management of malaria illness for all pregnant women in malarious areas must be ensured. Iron supplementation for the prevention and treatment of anaemia should be given to pregnant women as part of routine antenatal care. Pregnant women should also be screened for anaemia, and those with anaemia should be managed according to national reproductive health guidelines.

There is no evidence that a third dose carries any additional risk, that more than 3 doses during pregnancy offers additional benefit or that receiving 3 or more doses of sulfadoxine–pyrimethamine increases the risk for adverse drug reactions. Research to assess the safety, efficacy and programme feasibility of other antimalarials in intermittent preventive treatment is under way.

<sup>\*</sup>Current scientific evidence suggests:

<sup>•</sup> At least two doses are required to achieve optimal benefit in most women.

<sup>•</sup> One study of intermittent preventive treatment in HIV-infected pregnant women showed that monthly dosing (most women receiving 3–4 doses) was necessary to achieve optimal benefit.

<sup>•</sup> In settings with an HIV prevalence among pregnant women greater than 10%, it is more cost-effective to treat all women with a 3-dose regimen than to screen for HIV and provide the regimen only to HIV-infected women.

information are provided in Annexes 1–5, and the household survey questionnaires are available on the internet (http://rbm.who.int/merg).

The indicators were chosen by an expert technical meeting organized by WHO (Headquarters and the Regional Office for Africa). Participants included academic institutions, development agencies, the Centers for Disease Control and Prevention in the United States, the Maternal and Neonatal Health Program of the Johns Hopkins Program for International Education in Gynecology and Obstetrics in the United States, the Malaria Consortium and the Pregnancy, Malaria, Anaemia-European Unionfunded project. The indicators were selected on the basis of the following guiding principles:

- Monitoring of malaria during pregnancy should be part of National Malaria Control and Making Pregnancy Safer reproductive health programmes.
- Data collection, interpretation and corrective actions within routine health management information systems should primarily be conducted by reproductive health making pregnancy safer programmes, with support from malaria control programmes.
- Data collection at survey sentinel surveillance sites should primarily be conducted by malaria control programmes.
- Data should be easily collected.
- Data should be quickly summarized and analysed and feedback given to the persons at the health units that collected the data.
- Data should be locally useful.
- The creation of new or parallel systems of data collection should be avoided.

The indicators were subsequently pilot tested in three sub-Saharan African countries (Kenya, Nigeria and Uganda) to assess the feasibility of collecting data for these indicators through routine health management information systems. The protocol for this pilot study was prepared by WHO (Headquarters and the Regional Office for Africa) and various Roll Back Malaria (RBM) partners who are members of the Malaria in Pregnancy Working Group of the RBM Partnership and discussed with the three countries.

The current guidelines are based on experience gained from initial implementation and pilot testing in the three African countries. The objective is to provide guidance to malaria control and reproductive health care workers, particularly those in antenatal care clinics, for monitoring and evaluation of key indicators of malaria in pregnancy.

## BOX 2. Recommended indicators for monitoring and evaluation of programmes to control malaria during pregnancy

## **Output indicators**

- percentage of antenatal clinic staff trained: pre-service, in-service or during supervisory visits) in the control of malaria during pregnancy during the past 12 months (including intermittent preventive treatment, counseling on use of insecticide-treated nets and case management for pregnant women;
- percentage of health facilities reporting stock-out of the recommended drug for intermittent preventive treatment (currently sulfadoxine-pyrimethamine) in the past month or in the determined period (according to national guidelines).

## **Outcome indicators**

- percentage of pregnant women receiving intermittent preventive treatment under direct observation (first dose, second dose, third dose, according to national guidelines);
- percentage of pregnant women who report having slept under an insecticidetreated net the previous night.

## Impact indicators\*

- percentage of low-birth-weight singleton live births (< 2500 g), by parity;</li>
- percentage of screened pregnant women with severe anaemia (haemoglobin < 7g/dl) in third trimester, by gravidity.

The target audience includes national malaria control programme managers, reproductive health programme managers, health workers at the health facility level and policy-makers.

The indicators are grouped into two categories, according to whether they could be measured through existing health management information systems or through routine or regular household surveys, such as a malaria indicator survey, multiple indicator cluster surveys, demographic and health surveys and other RBM monitoring and evaluation tools and mechanisms (e.g. demographic surveillance sites). For each indicator, the rationale for data collection and a precise definition are given, followed by a description of the source and method of measurement and the strengths and limitations of the indicator. Summary tables are provided on pages 24–28 of this document. A summary of the types of survey that can be used to derive information on indicators is shown in **Box 3**.

<sup>\*</sup> Influenced by other factors, such as nutrition, hookworm infection and pre-term birth

# Framework for monitoring and evaluation

Monitoring and evaluation are needed to measure progress in and effectiveness of health programmes at all levels. Monitoring can help to verify that activities are being implemented as planned, ensure accountability and detect problems and constraints, to provide local feedback to the relevant authorities and to support them in better planning. Evaluation of outcomes and impact is needed to document periodically whether defined strategies and implemented activities are leading to expected results. Monitoring is continuous, while evaluation should be conducted intermittently.

A number of frameworks are used in selecting indicators for monitoring and evaluation. Indicators are used to measure what goes into a programme or project and what comes out of it. A widely accepted framework that has commonly been used is the "input-process-outputoutcome-impact". For a programme or project to achieve its goals, inputs such as money and staff time must result in outputs, such as new or improved services, trained staff or persons reached with services. These outputs are the result of specific processes, such as training of staff, which should be included as key activities for achieving the outputs. If these outputs are well designed and reach the populations for which they were intended, the programme or project is likely to have positive short-term effects or outcomes, for example increased use of ITNs or adherence to IPT. These short-term outcomes should lead to changes in the longer-term impact of the programme, measured as fewer new cases of malaria and related burden of disease among those infected and affected, such as pregnant women and vulnerable children. In the case of malaria during pregnancy, a desired impact among infected women includes improved birth outcomes. The use of standard indicators provides national programmes with valuable measures of the same indicator in different populations, permitting analysis of trends. This helps to direct resources to regions or sub-populations with greater need and to identify areas for intensification or reduction of effort at the national level, ultimately improving the overall effectiveness of the national response. Over time, the use of standard indicators also ensures comparability of information across countries. When data from different sources are combined for analysis, such "triangulation" of data allows national, regional or local evaluation of programme efforts (WHO, 2006).

## **BOX 3. Surveys that provide information on malaria indicators**

Three main types of surveys are relevant to monitoring and evaluation of interventions to prevent and control malaria in pregnancy in malaria control programmes.

## Demographic and health surveys<sup>1</sup> and multiple indicator cluster surveys<sup>2</sup>

Nationally representative surveys of 4000–12 000 women aged 15–49 years, living in households that are sampled in a multiple-stage cluster design, are conducted in many developing countries at 5-year intervals. As the question-naires are standardized and structured, the results are reasonably comparable between countries and over time. The indicators measured include mortality of children under 5 from all causes, possession and use of insecticide-treated nets by children under 5 and pregnant women, use of antimalarial treatment for children under 5 with fever, and use of intermittent preventive treatment by pregnant women. Recent demographic and health surveys also measured the prevalence of anaemia by measuring haemoglobin in children under 5 and women. The results are freely available on the internet.

## Malaria indicator surveys

To supplement the standardized data collected from the demographic and health and multiple indicator cluster surveys, in 2004 the Roll Back Malaria programme and MACRO International developed a package that can be used at national or sub-national level. The sample size proposed for these surveys is smaller than that required for demographic and health and multiple indicator cluster surveys, because the malaria indicator survey is used mainly to monitor intervention coverage and not child mortality. Malaria indicator surveys are therefore less expensive than the other surveys and could be conducted at sub-national level. A malaria indicator survey could be used to design surveys in countries where no other surveys are being conducted or to fill gaps in the 5-year intervals between demographic and health or multiple indicator cluster surveys, for more rapid assessment of progress.

For operational reasons, both demographic and health and multiple indicator cluster surveys are conducted during the dry season, therefore outside the peak malaria transmission season. In contrast, malaria indicator surveys can be conducted at the time of peak transmission and combined with measurements of haemoglobin and parasite prevalence, in areas where these are considered relevant indicators of malaria burden or impact. The entire malaria indicator survey package (including questionnaire, training manual, guidance on sampling and sampling sizes with costing and analysis plans) is available for use by countries in hard copy, on CD ROM and on the internet (http://rbm.who.int/merg, section Survey and Indicator Guidance Task Force).

A scaled-down version of the malaria indicator survey is also available, called the 'lean malaria module', with standard questions on malaria intervention coverage that could be added to other planned household surveys.

<sup>1</sup> Demographic and health surveys are organized by MACRO International, Calverton, Maryland, USA, and are funded primarily by the United States Agency for International Development (USAID) (http://www.measuredhs.com).

<sup>2</sup> Multiple indicator cluster surveys are organized and supported by UNICEF (http://www.childinfo.org).

Although countries rely on surveys, such as demographic and health surveys or multiple indicator cluster surveys (see Box 3), these produce data that are valuable for broader monitoring and evaluation but might not be easy to integrate into the usual sources of health information, such as national health information and surveillance systems. Building or strengthening national health management information systems is a prerequisite for proper monitoring of malaria in pregnancy control programmes and the necessary responses. An effective health management information system provides a solid basis for evaluating large-scale programmes, ultimately leading to improved planning and decision-making. On the basis of these findings, urgent decisions, such as how to allocate new resources to achieve the best overall results, will become easier to make (WHO, 2006).

For effective monitoring and evaluation of services being provided for malaria during pregnancy, disease control programmes should put in place systems for supervision at all levels of health care. This system must ensure that supervisors focus on the needs of the staff they oversee, to help them to conduct monitoring activities effectively, thus producing high-quality data. The approach should stress mentoring, joint problemsolving and dialogue. Supervisors must recognize lapses in skills and identify opportunities for training. It is the responsibility of the supervisor to manage workloads and to lobby for human and financial resources where necessary. Supervisors should themselves be good communicators, be knowledgeable about monitoring and evaluation and be conversant with the monitoring tools. Supervisors must be ready to review and discuss the tools with those they are supervising to ensure they are used properly. Supervisors must also analyse the data collected with the persons who collected them and encourage them to use the data for decision-making at their own level of operation. A supervisory schedule of 3-6 months is recommended.

# Indicators to be measured at health facilities



Percentage of antenatal clinic staff trained in the control of malaria during pregnancy in the past 12 months

#### Rationale

Successful control of malaria during pregnancy requires delivery of the recommended interventions by skilled, well-informed health workers in the facility.

#### Definition

This is an indicator of the proportion of health workers who, among all health workers providing antenatal services, have received training in the prevention and control of malaria during pregnancy at the time of data collection, within the last calendar year.

**Numerator:** number of antenatal clinic staff trained in the control of malaria during pregnancy in the past 12 months

**Denominator:** total number of antenatal clinic staff during the same period

#### Measurement and data collection

Data for this indicator should be collected during supervisory visits and training activities and from annual reports. If a routine reproductive health supervisory form exists, it should be modified to include:

- the number of antenatal clinic staff and other health workers, and
- the number of staff trained in the control of malaria during pregnancy in the past 12 months.

If no supervisory form exists, it should be designed accordingly. Health workers who provide antenatal care are defined locally. The frequency of supervisory visits is often determined locally; however, it is recommended that at least one supervisory visit per facility per year is ensured.

## Strengths and limitations

## Strengths

- Data for this indicator can readily be collected at supervisory visits.
- In malarious areas where less than 100% of antenatal clinic staff are trained in malaria control, feedback can be given rapidly to the antenatal clinic supervisor or clinic manager to take corrective action.

#### Limitations

- The denominator might be difficult to determine, as some countries
  have limited information on the pool of human resources available
  in various facilities, and transfers of personnel between facilities are
  frequent. In this case, the numerator should be considered an
  adequate indicator on its own.
- The indicator does not provide any information about the quality of the training or the quality of services provided.

#### **Comments**

Training of clinic staff in the prevention and control of malaria in pregnant women should, at a minimum, include guidelines for IPT, effective case management, including referral when necessary, and counselling about the use of ITNs. The training should also include data collection, analysis, interpretation and use for local decision-making. To avoid duplication of efforts, the training should be integrated as much as possible into predefined or existing curricula (e.g. pre-service and inservice programmes) or other Making Pregnancy Safer training orientation courses. It should also be a part of malaria control training programmes for implementing new antimalarial drug policies.

Quality assurance methods and tools for improving the quality of malaria in pregnancy service delivery (Regional Centre for Quality of Health Care Institute of Public Health, 2006) should be used to strengthen supervision of health workers. Frequent supportive supervision might be needed to reinforce knowledge and skills acquired during training. The frequency of supervisory visits is often determined locally; however, it is recommended that at least one supervisory visit per facility per year be ensured. A system should be developed for training new staff in case of high staff turnover.



Percentage of health facilities reporting stock-out of the recommended drug for intermittent preventive treatment (currently sulfadoxine-pyrimethamine) in the past month

#### Rationale

Ensuring adequate supplies of the recommended antimalarial drug for IPT is key to the success of prevention and control of malaria during pregnancy in areas of stable (high) malaria transmission. This indicator assesses the frequency and adequacy of supply of the recommended drug for IPT in health facilities over a defined period.

#### Definition

This indicator provides information about the proportion of health facilities that were out-of-stock of the recommended drug for IPT during the past month.

**Numerator:** Number of health facilities reporting stock-out of the recommended drug for IPT (currently sulfadoxine-pyrimethamine) in antenatal clinics within the past calendar month

**Denominator:** Total number of health facilities offering antenatal services

#### Measurement and data collection

Data for this indicator should be obtained during periodic (monthly) supervisory visits. Stock-outs of sulfadoxine-pyrimethamine should be measured at the level of antenatal clinics, not pharmacies, because stocks in pharmacies do not necessarily reflect those in antenatal clinics.

To avoid multiple, overlapping data collection forms, relevant questions should be included in the routine reproductive health supervisory form.

The frequency of data collection should be monthly but could be determined locally to ensure that data collection is in tandem with other supervisory and data collection activities and schedules.

## Strengths and limitations

Strengths

- Data for this indicator can readily be collected during supervisory visits.
- The collected data can be used locally for prompt corrective action.

#### Limitations

Although the recommended frequency for collection of data for this
indicator is monthly, supervision might not be regular enough for
effective monitoring of the availability of drug supplies and stockouts, which can then be reported and rectified. Regular, constant
supervision and reporting of data might be needed to avoid disruption of the delivery of IPT in antenatal clinics. Such data could also
be included in health management information system reports if
sulfadoxine-pyrimethamine is listed as a tracer drug that is reported
to districts monthly.



Percentage of pregnant women attending antenatal care who receive a first dose of intermittent preventive treatment (IPT1) under direct observation

#### Rationale

In areas of stable (high) malaria transmission, IPT with two to three doses of the recommended antimalarial medicine (currently sulfadoxine-pyrimethamine) during pregnancy has been shown to reduce the risk for severe maternal anaemia, placental parasitaemia and low birth weight significantly. Therefore, WHO recommends that all pregnant women in areas of stable malaria transmission receive at least two doses of IPT, during regularly scheduled antenatal visits under direct observation of a health worker.

#### Definition

This indicator assesses the proportion of women attending antenatal clinics who receive IPT1 as directly observed treatment by a health worker to maximize compliance.

**Numerator:** Number of pregnant women who receive IPT1 under observation

**Denominator:** Number of first antenatal clinic visits

#### Measurement and data collection

Data for this indicator should be collected at routine antenatal visits on an antenatal clinic register. To facilitate data collection and avoid duplication of work, the existing register should be modified to include columns to record the doses of IPT (first, second or third) dispensed. Antenatal clinic cards should also be adapted to include a record of the doses received.

To facilitate data abstraction for reporting, it is advisable that records for each month be started on a new page. The frequency of data collection should be daily, with monthly summaries and monthly reporting within health management information systems, and should link to the data collection schedule for health management information systems .

The indicator can also be measured at the population level through household surveys, in which case the denominator would be the total number of pregnant women in the population surveyed.

## Strengths and limitations

#### Strengths

- Data on IPT1 can readily be collected and analysed.
- The results might be comparable across countries.
- This indicator can be useful locally, as it can be linked to impact
  indicators such as low birth weight and severe anaemia to determine
  corrective action. A visual indication or presentation of the effectiveness of IPT in reducing the number of severe malaria and anaemia
  cases observed in an antenatal clinic can boost the morale of health
  workers.

#### Limitations

- Data on IPT coverage at national level can be misleading in countries
  with mixed transmission patterns, as malaria transmission is often
  localized and IPT might not be implemented in all areas of the
  country. Therefore, the indicator should be calculated only for areas
  in which the IPT strategy is implemented, and first antenatal visits in
  these areas should be used as the denominator.
- Antenatal clinic data might be incomplete and not reflect the true situation in settings where a substantial number of women have antenatal care at private clinics. Private clinics should be encouraged to provide IPT to pregnant women according to national guidelines and maintain appropriate records.
- Most women attend antenatal clinics for the first time during the second trimester and are therefore eligible for IPT1 at that time. A few women, however, make their first antenatal visit during the first

trimester, at which time they are not eligible for a first dose of treatment. The total number of first visits used as the denominator in this calculation is therefore an overestimate of the total number of women eligible for a first dose of treatment.

#### **Comments**

The column for IPT should not be marked if dosing is not observed directly. If no first dose is dispensed, the reasons should be marked in a column of the register designated for comments (e.g. stock-out, allergy, refusal, treatment for malaria illness, see Annex 1).

Treatment received for acute malaria illness episodes during pregnancy should not be recorded as IPT, which is administered for prevention. The antenatal clinic register should include a column for recording treatment of malaria illness episodes during pregnancy with the nationally recommended drug for pregnant women.

The denominator, i.e. first antenatal clinic visits (new attendances), is an approximation of the total number of pregnant women attending antenatal clinics during a specified period. To avoid difficulties in counting new attendance versus re-attendance, health workers should determine appropriate ways of identifying new attendees in the antenatal clinic register, such as adding a column labelled 'visit' for recording the visit number (e.g. visit 1, 2, 3, 4).

Receipt of IPT as recorded on antenatal clinic cards can also be reflected in maternity registers. A column could be included in the delivery register that indicates the number of doses of IPT received. Such data are easily linked to impact indicators and can be used to assess the effectiveness and impact of national programmes.



Percentage of pregnant women attending antenatal care who receive a second dose of intermittent preventive treatment (IPT2) under direct observation

#### Rationale

In areas of stable (high) malaria transmission, IPT with two to three doses of the recommended antimalarial medicine (currently sulfadoxine-pyrimethamine) during pregnancy has been shown to reduce the risk for severe maternal anaemia, placental parasitaemia and low birth weight

significantly. Therefore, WHO recommends that all pregnant women in areas of stable malaria transmission receive at least two doses of IPT, during regularly scheduled antenatal clinic visits under direct observation of a health worker.

#### Definition

This indicator assesses the proportion of women attending antenatal clinics who receive IPT2 under direct observation by a health worker.

**Numerator:** Number of pregnant women who receive IPT2 under observation

**Denominator:** Number of first antenatal clinic visits

#### Measurement and data collection

Data for this indicator should be collected at routine antenatal visits in the antenatal clinic register. To facilitate data collection and avoid duplication of work, the existing antenatal clinic register should be modified to include columns to record the doses of IPT dispensed (first, second, third). Antenatal clinic cards should also be adapted to include a record of IPT doses received.

IPT2 should be administered under direct observation by a health worker, to maximize compliance. To facilitate data abstraction for reporting, it is advisable that records for each month be started on a new page. The frequency of data collection should be daily, with monthly summaries and monthly reporting within the health management information systems, and should be linked to the data collection schedule for health management information systems.

The indicator can also be measured at the population level through household surveys, in which case the denominator would be the total number of pregnant women in the population surveyed.

## Strengths and limitations

Strengths

- Data on IPT2 can readily be collected and analysed.
- The results are comparable across countries.
- This indicator can be useful locally, as it can be linked to impact indicators such as low birth weight and severe anaemia to determine corrective action. A visual indication or presentation of the effective-