8: Monitoring and evaluation

LLIN scale up efforts, especially mass distribution campaigns, represent unprecedented financial, planning and logistical challenges. Countries can benefit from a careful monitoring and evaluation (M&E) strategy in order both to determine optimal use of resources during the campaign and to provide lessons for future distributions. The international shift toward universal coverage of malaria interventions, and the trend toward more stand-alone versus integrated campaigns, will require a thorough assessment of how well existing and new strategies meet the objective of universal coverage. This assessment will require careful monitoring and evaluation as well as a comprehensive analysis of results.

An M&E strategy focused on a campaign must be consistent with, and complementary to, the country's overall malaria M&E plan. However, each campaign needs a specific M&E plan to ensure data are collected in order to determine if it has met its objectives, to assess the strategies used and to provide lessons for future activities. Activities carried out through M&E may also help inform other countries and partners on the design of ITN[1] hang-up interventions and assessments, whether these are campaign or continuous distributions.

Monitoring is "the routine tracking of the key elements of programme performance through record-keeping, regular reporting, surveillance systems and periodic surveys", while evaluation is
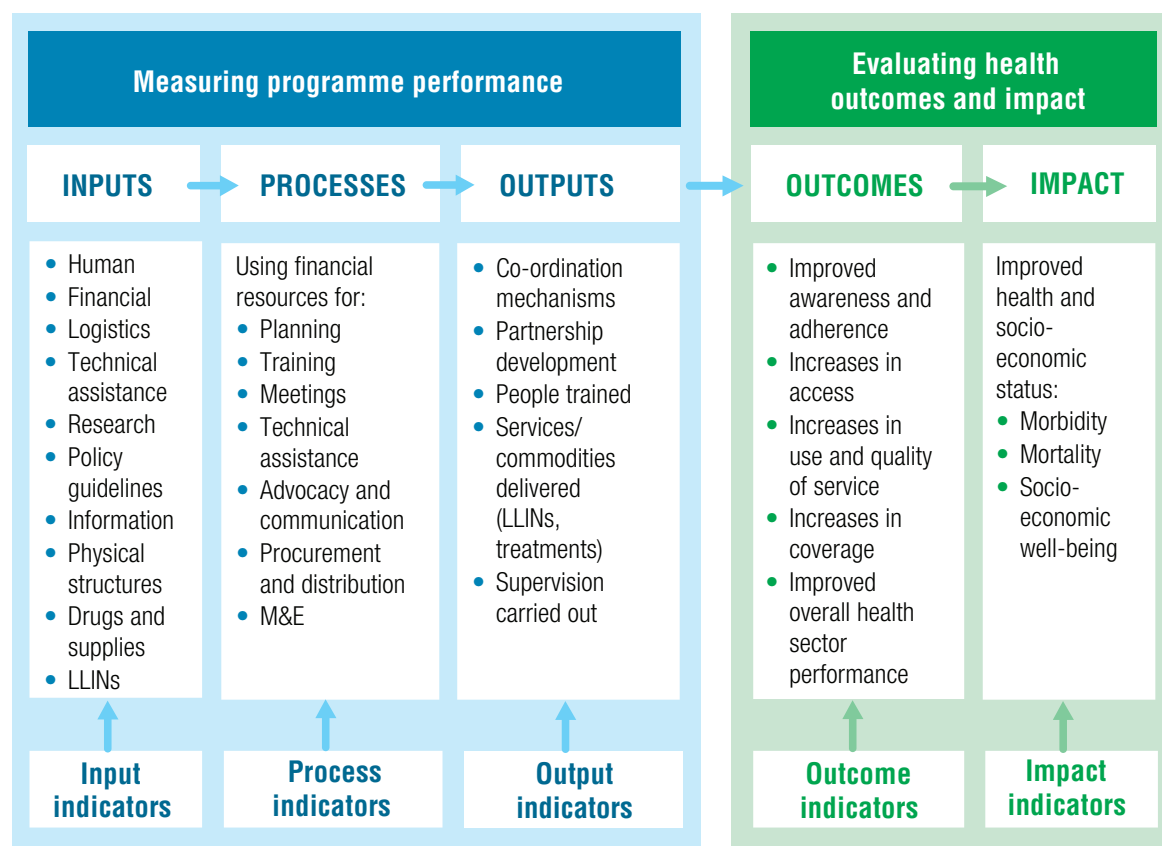
"the periodic assessment of the change in targeted results that can be attributed to an intervention"[a]. This chapter will focus on the monitoring of the entire campaign process, evaluating campaign outcomes (in terms of ITN ownership and use), the monitoring of ownership and use over time, and briefly on estimating the impact achieved by the campaign.

Figure 1 provides a basic framework for M&E related to LLIN campaigns. This framework gives examples of key inputs, processes, outputs, outcomes and impact that can be considered in formulating measurable indicators. Records from the National Malaria Control Programme (NMCP) and its partners, the National Coordinating Committee (NCC), supervisory checklists, minutes of meetings and similar documents are good sources of information for assessing inputs, processes and outputs. Household surveys or high-quality routine reporting systems may be used to measure outcome and impact.

Senegal. © Robert Perry, USA/PMI

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[1] Though most campaigns distribute LLINs, non-long-lasting insecticide treated nets, whether treated during production or by the end user, also provide protection for around 6—12 months. When assessing coverage and use, the standard indicators include insecticide-treated bednets (ITNs) of all types, not just LLINs.

Figure 1: Basic monitoring and evaluation framework

Measuring programme performance			Evaluating health outcomes and impact	
INPUTS	**PROCESSES**	**OUTPUTS**	**OUTCOMES**	**IMPACT**
• Human • Financial • Logistics • Technical assistance • Research • Policy guidelines • Information • Physical structures • Drugs and supplies • LLINs	Using financial resources for: • Planning • Training • Meetings • Technical assistance • Advocacy and communication • Procurement and distribution • M&E	• Co-ordination mechanisms • Partnership development • People trained • Services/ commodities delivered (LLINs, treatments) • Supervision carried out	• Improved awareness and adherence • Increases in access • Increases in use and quality of service • Increases in coverage • Improved overall health sector performance	Improved health and socio-economic status: • Morbidity • Mortality • Socio-economic well-being
Input indicators	**Process indicators**	**Output indicators**	**Outcome indicators**	**Impact indicators**

Adapted from *Framework for monitoring and evaluation of integrated child health interventions*, draft February 2006, WHO/AFRO, page 8.

8.1 Contents of the M&E section of a LLIN campaign or scale-up plan

A group of persons responsible for designing and implementing M&E strategies should be formed early in the planning process, whether as part of the NCC's technical sub-committee or as a separate M&E sub-committee. It can include NMCP and partner staff designated for M&E activities, along with members of the Census Bureau, academic institutions and others with relevant experience. To develop the M&E section, this group should start by reviewing and building on M&E chapters of an existing strategic plans such as health sector plans, national malaria plans and Global Fund proposals and plans. The key documents at the end of this chapter give general guidelines for M&E of malaria programmes and examples of indicators that might be included. The M&E section of a LLIN campaign plan of action or broader continuous distribution plan should describe the planned activities such as training, monitoring, surveys and reporting of results. It should also clearly delineate the partners involved and the responsibility of individuals for each activity, the timeframe and the resources (human, financial and infrastructural).

The M&E section of the LLIN campaign plan of action should contain:
- Introduction
- M&E framework: goals, objectives, indicators, outputs, outcomes, relationship to national malaria M&E plan
- Methodological approach: M&E design, data sources, data collection methods and tools (tally sheets, supervision checklists for monitoring, post-campaign surveys for evaluating outcome)

- Implementation plan: description and schedule of activities, roles and responsibilities
- Reporting and dissemination plan for the information collected; use of indicators for improving the LLIN distribution programme
- Budget for all activities, materials and equipment

The M&E group, together with NMCP managers and others overseeing LLIN distribution campaigns should consider developing an **advocacy and fundraising plan** for M&E. Preparing a concise, well thought-out and thorough M&E section and presenting it early in the campaign planning process to government officials and partners will help ensure adequate attention and funding. The guidelines for measles and polio vaccination campaigns (see key documents) give good examples and suggestions for the M&E section of a LLIN distribution campaign plan.

Questions to answer and indicators to use

The first and often overlooked step in developing an M&E plan for a campaign is determining key questions requiring answers, together with identifying the indicators that will help to answer them. Relevant indicators should be linked to the goals of both the national programme and the LLIN campaign plan of action. Remember that a viable indicator is **SMART**:

- **S**pecific: identifies concretely what will be accomplished
- **M**easurable: quantifies the amount of resources, activity or change
- **A**ppropriate: makes sense in terms of what the programme wants to do
- **R**ealistic: achievable with available resources, plans and experience
- **T**ime-based: specifies when it will be achieved

Each indicator should specify exactly what is to be measured for the numerator and denominator (for example, number of volunteers actually trained for household visits versus number planned to be trained), the link to a campaign goal or activity, and the methods and frequency of data collection. When identifying and prioritizing indicators, consider the cost and feasibility of collecting the data, and keep the number of indicators to a minimum.

> **In brief: what information does the programme need now, how will each indicator be used, and how might measuring this indicator influence future decision-making for action?**

Indicators developed for LLIN campaign evaluations typically answer these questions:
- Ownership: Do you own a net? Where did you get it?
- Use and determinants of non-use: Was it used (e.g. last night)? Who used it? If not, why was it not used?
- Knowledge: Why are nets used? How long does a net last?

Indicators found in the sample post-campaign survey questionnaires may also answer questions related to campaign operations:
- Were you visited by a door-to-door team?
- If a voucher scheme was used, did they give you a voucher?
- Did you exchange the voucher?
- Do you still have all the nets?

Appendix 8A gives examples of process and output indicators that have been used during universal coverage campaigns[b] and Appendix 8B describes standard ITN-related outcome indicators, many recommended by the Monitoring and Evaluation Reference Group (MERG) of Roll Back Malaria (RBM) as key measures to include in national population-based surveys such as the Malaria Indicator Survey (MIS), and additional indicators proposed for measuring progress towards universal coverage.

See Section 8 of the Resources CD for examples of M&E plans (R8-1 to R8-5).

8.2 Monitoring campaign performance

Monitoring campaign performance is an assessment of process. Process assessment can cover monitoring campaign inputs and activities during three parts of the overall campaign timeline:

1. Pre-campaign assessments of the quality of the budgets, maps and timeline used in micro-planning.
2. Assessments during the campaign (or "intra-campaign") using supervisory checklists, narratives and rapid monitoring surveys.
3. Post-campaign summaries of logistics and other inputs used and administrative estimates of coverage.

The process monitoring flowchart (below) gives a sample of activities that could be conducted during each phase of the campaign.

A key part of the process assessment comes from post-campaign review meetings that can be conducted at each level of the health system. These meetings should involve a standardized summary and assessment of delivery and use of LLINs and other items or services provided in the campaign. The information presented in these meetings should be collected to calculate the process and output indicators in the M&E plan, and should be used to develop a short post-campaign technical report and a larger campaign report, as described in Chapter 9.

Examples of information to review during these meetings include the number of LLINs delivered, the number and duration of stock-outs and the implementation of training workshops. The data should come from stock inventory forms documenting delivery of LLINs and other commodities at all levels, tally sheets, storeroom logbooks and if possible a physical count of key remaining materials (LLINs, vouchers, etc.). These data should be collected at district level using a spreadsheet similar to those in the key documents and compiled at higher levels. Evaluation of the logistics process, including commodity management assessment, is covered in Chapter 5.

Monitoring of process

Which phase of LLIN campaign implementation is to be assessed?

Quality of pre-LLIN distribution planning:
- Visit planned distribution sites
- Meet with local health staff and community officials
- Observe and assess training
- Visit households to assess community awareness about campaign

Quality of household registration:
- Review micro-plans and budgets specific to registration
- Observe and assess training
- Monitor registration field activities and identify areas for mop-up
- Review registration form summaries for accuracy and follow-up actions
- Conduct rapid monitoring to identify areas missed by registration teams

Quality of in-process LLIN distribution implementation:
- Conduct supervisory visits to distribution sites, provide feedback
- Conduct facility exit interviews and visit households to assess community awareness about campaign
- Conduct rapid monitoring in target problem areas
- Meet supervisors and officials to refine strategies immediately based on feedback

Quality of overall LLIN distribution implementation:
- Verify regular tabulations
- Calculate administrative coverage
- Conduct rapid monitoring to identify areas for mop-up
- Summarize observations from supervision to identify lessons learned
- Conduct national and district level evaluation meetings

These meetings and reports should also provide the overall budget for the campaign at the local level, the sources of the funds used to support the budget and the actual amounts spent. Key factors contributing to or detracting from the success of the activity can be added.

Process assessment can also include a general qualitative process review, involving structured interviews of key personnel at various points during preparation, implementation and follow-up phases of activity. Much of the information for the process assessment and review meetings will come from monitoring and supervisory activities described in Chapter 7. Communications activities should also be addressed in the meetings and process evaluation, as described in Chapter 6. Supervisors' observations recorded on checklists along with specific tips to monitor social mobilization can all add to this assessment. People can also be assigned to listen to local radios and/or scan newspapers for campaign announcements. Some campaigns have also used exit interviews and rapid monitoring (described in Chapter 7) to assess the success of communication activities in terms of reaching the target populations with LLINs. Key issues for process evaluation and for supervisors at each level to address during campaigns depend on the exact strategy used but might include:

- **Registration:** how complete was the registration process in each administrative unit? Were large numbers of households missed during the registration process? Entire communities? For what reasons?
- **Distribution:** how many LLINs were delivered? How many households collected their nets? Why did households not pick up their nets? Did any households not receive the number indicated at registration?
- **Stocks of LLINs:** do the numbers of LLINs match at each dispatch and receiving point in the supply chain? Are tally sheets complete and accurate? Who is responsible for checking, and are they able to match on-loading and off-loading tally sheets quickly?

This information will help in detecting possible "leakage" or diversion of LLINs.
- **Training:** did training workshops for each cadre (supervisors, village registration teams, etc.) occur on schedule (or at all)? Did they follow the established curriculum? How many days did the training really last? What proportion of workers in each cadre attended training? If trainees received a post test, what were the results?
- **Supervision:** did each team receive a supervisory visit? How many? What were the results from the supervisory checklists?
- **Communications:** compared to the number planned, how many times were television and radio spots played? How many banners produced? Home visits made? Community health education sessions done?

Another priority is to decide how the programme would respond to information about areas identified with weak household registration, or as poorly covered during distribution. When the villages visited first are covered well, teams may run out of nets, leaving other villages completely without nets.

Teams may also inadvertently skip villages altogether, notably villages thought to have been covered by other teams. If a mop-up activity is indicated, then programmes must determine whether nets are available, and if so, how soon they would arrive. If adequate nets have been procured and the problem is re-distribution, then teams may want to focus on covering entire villages and leaving others for mop-up activities when additional nets are available. However, if additional nets are not available, district managers may elect to cover all villages but to reduce the number of nets going to any one family. A description of the areas of high and low coverage and the decisions made in response to inadequate numbers of nets can be used to adjust the continuous distribution system to target areas of low coverage.

Note that coverage should *not* be estimated from rapid monitoring tools. Instead, these reports

should be used for a qualitative assessment of the completeness of the campaign and to identify reasons for non-participation and the success of communication strategies. Coverage should instead come from data on LLINs delivered ("administrative coverage", see below) and if possible from surveys using statistically sound sampling methods and standardized questionnaires.

Administrative coverage

Coverage achieved for an intervention can be assessed simply by comparing the number of people reached or the number of LLINs delivered to the target population. Usually called "administrative coverage", this indicator is based on data collected on tally sheets during the campaign. As this information is readily available during the campaign, it can be used to monitor progress and quickly identify any areas or populations requiring mop-up activities. The spreadsheets included in the key documents are good examples that countries should adapt and use to collect this data at district level for compilation at regional/provincial/state and national levels. These data can also provide coverage estimates soon after the campaign for any level of the health care system, from national to local. The accuracy of administrative coverage depends on the quality of the collection, synthesis and transmission of data on the number of LLINs and other interventions delivered during the campaign and on the quality of the estimates of the target population.

Often population estimates are inaccurate in countries with high birth and mortality rates, poor vital registration systems, or significant population movements. The nature of administrative data only allows the calculation of coverage estimates, leaving no opportunity to learn about ITN utilization or communication strategies, or to collect information from persons who did not participate in the campaign. These data also do not allow for calculating key indicators such as the proportion of households with an ITN, the number of ITNs per household, or the proportion of households reaching universal coverage.

Figure 2 gives the formulae for calculating administrative coverage. See Section 8 of the Resources CD (R8-18 to R8-20) for examples of spreadsheets showing recording and summarizing of administrative data collected during campaign operations.

Figure 2: Administrative coverage

$$\text{Coverage} = \frac{\text{Number of targeted people receiving a LLIN}}{\text{Estimated size of target population}} \times 100$$

This formula can be modified for universal coverage campaigns. For example, when the strategy is distributing one LLIN for every two people, the administrative coverage is:

$$\text{Coverage} = \frac{\text{Number of LLINs delivered X 2*}}{\text{Estimated size of target population}} \times 100$$

If an estimate for household coverage is needed this can be obtained as:

$$\text{Coverage} = \frac{\text{Number of LLINs delivered}}{\text{Mean LLIN/household delivered x estimated households}} \times 100$$

For campaigns targeting sleeping spaces, the formula might be:

$$\text{Coverage} = \frac{\text{Number of LLINs distributed}}{\text{Number of sleeping spaces needing nets**}} \times 100$$

* Needs estimation may use a different ratio in order to account for households with an odd number of members. For administrative coverage the ratio remains one bednet will cover two people.

** The number needing nets depends on how pre-existing nets are handled. Some countries choose to ignore pre-existing nets because their age and treatment status may be unknown so the number of sleeping spaces needing nets is the total number found. For countries opting to account for existing nets, the number here would be the total number of sleeping spaces not already covered by an ITN.

8.3   Outcome evaluation

Further assessment of the campaign's outcomes will often use surveys to focus on measuring rates of net ownership, hanging and utilization. Surveys should also be used to assess the success of distribution and communications strategies and to identify reasons for participation or non-participation in the campaign. For integrated campaigns the survey should assess coverage and reasons for participation or non-participation for all interventions provided.

Roll Back Malaria MERG recommends that malaria-endemic countries regularly monitor coverage of key malaria control interventions based on data derived from high quality and statistically-sound household surveys, such as the Multiple Indicator Cluster Survey (MICS), Demographic and Health Survey (DHS) or Malaria Indicator Survey (MIS). The methods for these surveys are given in the key documents listed in Appendix 8D. They use a standardized methodology and questionnaire to determine, among other indicators, the rates of household possession of ITNs and of ITN utilization in the general population (for universal coverage) and for vulnerable groups such as children under five years of age and pregnant women.

Options for measuring outcomes of LLIN distributions range from a DHS, MIS or MICS to more focused "stand-alone" post-campaign surveys. A stand-alone survey could use a methodology similar to the MIS or others such as the International Federation of Red Cross and Red Crescent Societies' RAMP (rapid mobile phone-based) surveys, based on a modified Expanded Programme on Immunisation (EPI) survey methodology. Simple estimates of ownership, though not of hanging or utilization, can also come from routine administrative data.

COUNTRY CASE STUDY

An example of a two-phase process assessment approach to improve campaign implementation and planning for follow-up activities comes from Nigeria's National Malaria Control Programme.

For the in-process assessment, monitors and supervisors are embedded into the local government area (LGA) supervisory structure to assess campaign operations using a standard data collection tool. The information is used to take immediate corrective action. Such activities have helped identify missed households and inadequately covered zones in urban areas, poor distribution of net cards (vouchers) and inadequate supplies of LLINs.

The end-process assessment is used to assess overall campaign implementation and address any follow-on problems. This phase involves a rapid assessment conducted by independent monitors one day after the campaign ends. The assessment uses convenience sampling[2] to identify gaps in household registration, LLIN ownership and use, and to learn how household members heard about the campaign (and, thus, the reach of communications activities). The LGAs summarize the data and use them to identify follow-up activities, such as mop-up in poorly served areas, and hang-up efforts. The key process indicators being assessed in both phases are:

- quantity of LLINs moved to secured storage sites at LGA warehouses
- quantity and cadre of campaign personnel trained prior to implementation activities
- quantity of net cards issued to households
- number of LLINs distributed
- number of persons who received correct information about the campaign (reasons to get a LLIN, where and when to access the LLINs, how to install LLINs properly, etc.)

[2] Convenience sampling: a sample of households/individuals that can easily be reached or observed, but may not be representative of the actual population of the area since they are not selected at random.

An outcome evaluation should measure the indicators noted above and those listed in Appendix 8B. The percentage of persons of all ages using an ITN last night is the most important indicator of ITN utilization and the most important indicator for monitoring universal coverage. The indicators for monitoring ownership and access are still being finalized, as are questions on sleeping spaces or loss of nets, or information about why nets are not being used. Updates to these indicators are on the RBM[c] website as they become available, and AMP will post updates to its website[d] as well. It is important to remember that usage rates depend on the timing of a survey relative to the rainy season and when communications strategies to improve usage have been implemented. As the DHS and MICS are often conducted in the dry season those surveys may show ITN use to be lower than if conducted in the rainy season.

Communications assessment is covered in Chapter 6 with a discussion of key indicators on knowledge and behaviours that can be incorporated into outcome evaluations.

Selecting the best approach to measuring campaign outcomes depends on a number of factors:
- LLIN distribution programme objectives
- questions to be answered
- anticipated uses of the data
- timeframe needed for obtaining the information to help improve the LLIN distribution programme
- smallest difference (between subgroups, e.g. regions/provinces or urban/rural or between surveys) that is programmatically relevant and the level of statistical precision that is needed to detect that difference
- timing of the campaign, relative to data collection activities planned by the NMCP, and the availability of partners to help collect information on coverage and use
- budget and personnel available for the evaluation

Mozambique. © Ramesh Khrishnamurthy, CDC Malaria Branch

In general, given the large investments made in the campaign and the innovative nature of the activity, the outcomes and operations for the distribution should be assessed by means of a survey using a standard methodology. The survey should ideally be conducted during the next rainy season following the distribution. Countries are urged to take advantage of already-planned surveys, if one is scheduled sometime between the distribution and the end of the following rainy season, in order to increase efficiency, save costs and reduce the burden on health workers that comes with multiple surveys. If a national survey is not conducted in the desired timeframe and if resources are available, a specific post-campaign survey should be considered. Figure 3 gives a flowchart with key questions to consider in deciding whether to conduct a stand-alone versus an already-planned survey. Additional important questions include:
- Is the proposed post-campaign survey clearly described and justified in a LLIN mass distribution plan of action or the campaign M&E plan?
- What new information is needed to evaluate the campaign strategies, such as targeting

sleeping spaces, accounting for pre-existing nets, household distribution of vouchers, behavioural questions surrounding ITN care and use, hang-up visits and targeting universal coverage rather than vulnerable populations alone?

- Can the new information be measured through an already-planned population-based survey? If the distribution was sub-national, will the already-planned survey provide results for the area covered by the campaign? Are the indicators for the campaign consistent with those recommended by MERG for use in the DHS, MIS and MICS? If a key goal is measuring ITN usage, would that survey be conducted during the high transmission season when the usage information would be most useful for programme development?

- Will the results of the stand-alone survey answer critical questions for improving LLIN ownership and use?

- Which critical questions can be answered through an end-process assessment immediately post-campaign, and which questions require a household survey? Do the additional indicators and results justify a survey or adding extra questions to an already-planned survey? If you could not conduct the survey or add the extra questions to an already-planned survey, how would you answer your key evaluation questions in the required timeframe?

- At which level (national, regional, district) should the results ideally be available? Does the survey need to be national or sub-national? Remember that national post-campaign surveys are not usually designed to detect local areas with low coverage.

- How will the results be used in programme management? If areas of low coverage are found, whether through end-process assessment or through the survey, what sort of a reaction is planned? Is further distribution feasible?

- If areas of high coverage and low use are found, whether through end-process assess-

ment or through the survey, what kind of reaction is planned? Is intensified BCC an option?
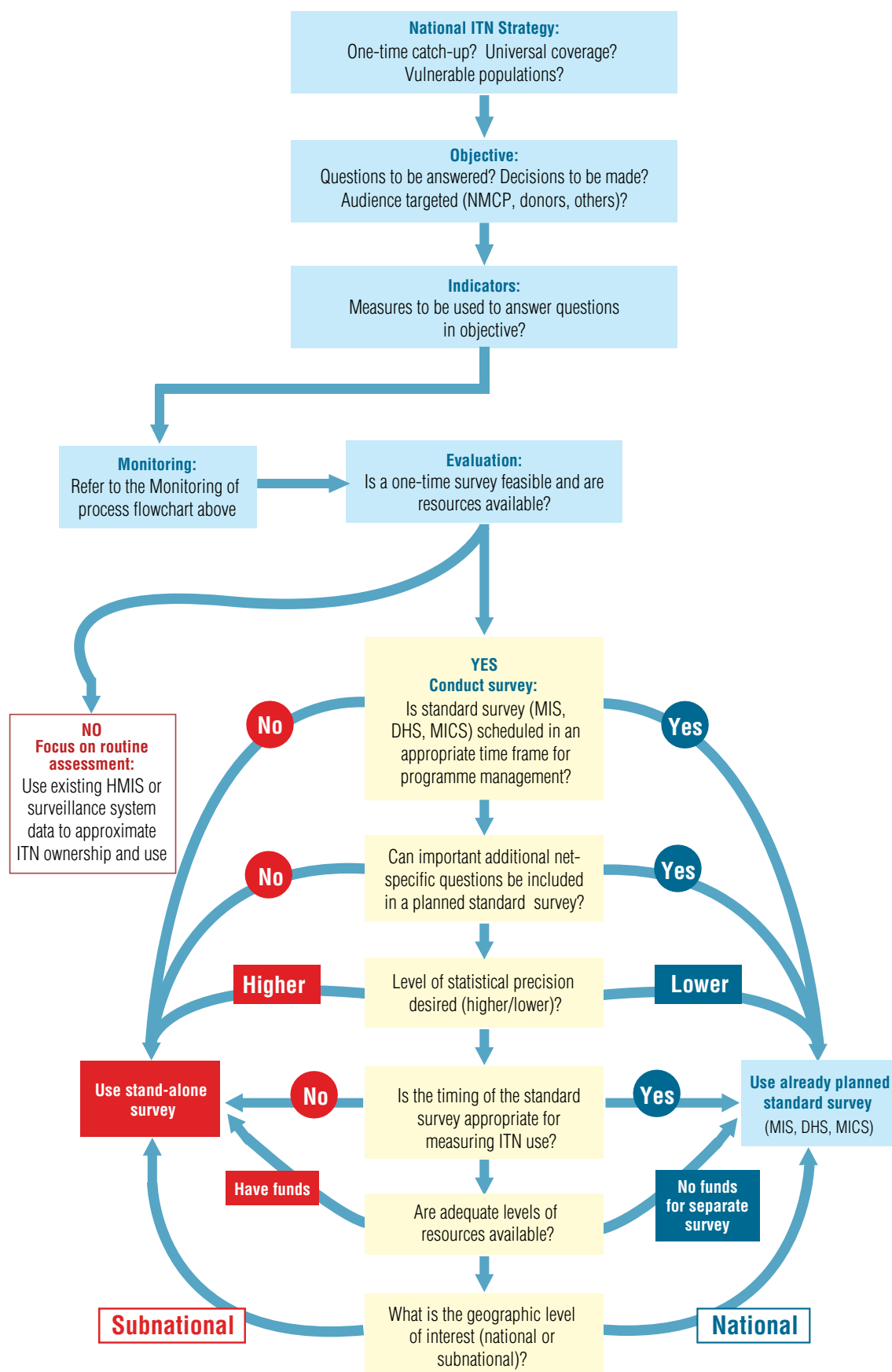
- How quickly is the information needed? If the NMCP is conducting a rolling campaign, is the information needed quickly to adjust strategies midway as needed? Or is the next campaign planned for some years in the future to replace old LLINs?

Periodic nationally representative surveys

Most countries regularly monitor coverage of key malaria control interventions through surveys such as the DHS, MIS or MICS and if possible such a survey should be used to evaluate a LLIN distribution. The list of key documents includes references for the methods and questionnaires used. An advantage of these surveys is the inclusion of impact measures such as parasitaemia prevalence and under-five mortality rates. They also collect data on many confounding factors such as education and those used to construct a relative wealth index (see Rutstein reference in key documents). The interpretation of results from these surveys depends on their timing relative to the malaria transmission season. The DHS or MICS are typically conducted during the dry season for logistical reasons, while the MIS is normally conducted during the high transmission season for malaria, that is, during or at the end of the rainy season.

A potential disadvantage is that the campaign M&E group may not have the power or influence to modify the questionnaire used for DHS, MICS or MIS surveys to collect information specific to the campaign, such as a roster of sleeping spaces, information on the success of communication strategies and the location of any LLINs received during a prior campaign. Countries may be reluctant to add questions to already lengthy survey instruments. These comprehensive household surveys may take many months from the time of planning the survey to receipt of results. They are expensive, but are usually funded through other sources and may not affect the campaign's operational budget.

Figure 3: Decision flowchart to guide the choice of methods for monitoring and evaluation of LLIN distribution campaigns

National ITN Strategy:
One-time catch-up? Universal coverage? Vulnerable populations?

Objective:
Questions to be answered? Decisions to be made? Audience targeted (NMCP, donors, others)?

Indicators:
Measures to be used to answer questions in objective?

Monitoring:
Refer to the Monitoring of process flowchart above

Evaluation:
Is a one-time survey feasible and are resources available?

NO
Focus on routine assessment:
Use existing HMIS or surveillance system data to approximate ITN ownership and use

No

YES
Conduct survey:
Is standard survey (MIS, DHS, MICS) scheduled in an appropriate time frame for programme management?

Yes

No — Can important additional net-specific questions be included in a planned standard survey? — **Yes**

Higher — Level of statistical precision desired (higher/lower)? — **Lower**

Use stand-alone survey

No — Is the timing of the standard survey appropriate for measuring ITN use? — **Yes**

Use already planned standard survey (MIS, DHS, MICS)

Have funds — Are adequate levels of resources available? — **No funds for separate survey**

Subnational — What is the geographic level of interest (national or subnational)? — **National**

Post-campaign LLIN coverage and utilization surveys

Stand-alone post-campaign coverage and utilization surveys are another means to confirm campaign coverage estimates from administrative data, to assess the implementation of campaign strategies (including communication), to measure ITN utilization and to collect information on members of the target population who did not participate in the campaign. These surveys can also determine rates of possession and use of ITNs from any source, ask questions specific to the LLINs given out during the campaign, and assess communication strategies for increasing net use. They were initially conducted twice, once just after a mass distribution, then again six to nine months later, during the following rainy season. As no significant differences in ownership have been found in several countries, it is now recommended that a single survey be done during the first rainy season following the campaign. As indicated earlier, these stand-alone surveys should only be conducted if the periodic nationally representative surveys are not feasible or timely for programme planning. These surveys usually do not include the collection of blood samples for parasitaemia or anaemia testing, as these tests are included in the DHS and MIS. Stand-alone surveys, with a shorter questionnaire and often a smaller sample size, can cost much less and be completed much more rapidly than the periodic surveys.

> **Appendix 8C and the key documents listed under this section in Appendix 8D contain more detailed descriptions of possible methods to use when conducting post-campaign surveys.**

The International Federation of Red Cross and Red Crescent Societies (IFRC) and the WHO's Global Malaria Programme are collaborating on developing rapid mobile phone-based (RAMP) surveys based on the EPI cluster survey methodology, with the goal of reducing the cost and the need for outside technical assistance. The RAMP survey follows standard survey methods and uses a questionnaire similar to the one used in a MIS. It uses inexpensive public-domain mobile phone-based tools and software for data entry and a smaller sample size (30 clusters of 10 households each) to reduce costs. Additional innovations are questions on net possession, use and physical condition in aggregate together with a net and household roster, with the aim of assessing whether these rosters could be dropped. The goal is to simplify the methods and tools to allow malaria programme managers to conduct repeated surveys to track rates of ITN possession and use after a mass distribution campaign. Disadvantages include the wider confidence intervals[3] for stratified analyses, and for a national survey, the need to increase the sample size greatly to have results for provincial/regional levels. These methods and the questionnaire are currently in the process of being validated.

Three pilot surveys were conducted in 2011, in Kenya, Namibia and Nigeria, using Red Cross volunteers to collect data on mobile phones. Further details are available from the IFRC.

See the Resources CD for examples of a post-campaign survey questionnaire (R8-6 to R8-9).

8.4 Practical considerations

The choice of survey methodology depends on a careful assessment of the advantages and disadvantages of each possible approach. Though the costs of periodic nationally representative surveys are often borne by other groups and the methods are sound, they require a long period of time for data collection and may not be well timed relative to the campaign and the malaria transmission season. It may also be difficult to make modifications to standard questionnaires to include specific questions about campaign interventions, campaign operations and

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[3]Confidence interval: an interval calculated from the observed data that gives an indication of the precision of the result, for example the precision of the estimate of household coverage with one or more ITN.

communication activities. A stand-alone survey allows a more focused collection of information on the campaign and may be less costly, but the costs and organization of the survey must be handled by the groups supporting the distribution campaign. The methods and questionnaire of a stand-alone survey should be as similar as possible to the relevant parts of a periodic nationally representative survey.

A less costly alternative should ideally be considered only it if has been compared to standard methods. For example, the sampling methods and questionnaire of a style of survey exemplified by an EPI coverage survey would have to be modified to overcome sampling errors, properly account for net possession and use, and include the larger target age group. Appendix 8C and the article by Luman et al. in the key documents address several important methodological issues for improving the quality of these surveys.

For all survey types, increasing the sample size to obtain results below the regional/provincial level is often operationally and financially challenging.

Statistical sampling and analysis

The M&E group (as part of the NCC's technical sub-committee or as a separate M&E sub-committee) should consider accessing specialized statistical expertise within the MoH, the National Statistics Agency or Census Bureau, universities and non-governmental partners to assist with sampling, design and analysis. The ideal survey method will give statistically valid, relatively simple measurements of campaign indicators at low cost, with little or no external technical assistance. Campaign M&E staff and the NMCP M&E focal persons should work closely with the statistician and provide appropriate guidance in analysing the data. As campaign organizers and the NMCP M&E team review the approaches

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recommended by statisticians, they should keep the following points in mind:

- The standard method for a large-scale survey in malaria endemic countries is a multi-stage cluster survey. (Appendix 8C gives more detailed definitions and information on this kind of methodology.) The method for selecting clusters and selecting households within clusters should be well described and statistically valid. The method should also give results at the desired level, typically the level of region or province.
- Determine the desired precision of sampling. In cluster sampling, generally select at least 20 to 30 clusters so as to give reasonable bounds of precision around the resulting estimate. Fewer clusters will not give estimates with the desired precision, while additional clusters will give more precision than necessary. In order to have results at the provincial/regional or district levels, each unit (province, region or district) will require 20 to 30 clusters giving a total of 120 to 475 clusters depending on the size of the country and the area at risk for malaria.
- Select at least 10 households per cluster, but no more than 30 per cluster. A large number of households may not be necessary to obtain an acceptable confidence interval for programme planning purposes and may increase the time spent (and cost) per cluster.
- Use appropriate software for the analysis, if stratification[4] or cluster sampling is used.

When reviewing the results of the survey and comparing it to earlier ones, programme managers and the campaign M&E group should keep these points in mind:

- Any comparison of surveys should take into account the timing of data collection

relative to the malaria transmission season. For example, the DHS is often conducted in the dry season, while ITN usage and parasitaemia prevalence are best measured during the rainy season (when the MIS or most stand-alone post-campaign surveys are done).
- Understand and agree on the "programmatically significant" threshold level of key indicators where additional action should take place, and what additional actions are possible. Regional estimates for indicators are less precise than national estimates. For a typical DHS or MIS, differences should be at least 10 to 15 per cent before they could be statistically significant.
- Be sure the analysis properly accounts for the survey design.
- Small differences in survey findings between regions or other groups are not important.

Implementing post-campaign surveys

Various resources are available that describe in detail the organization and implementation of surveys. Based on experience with numerous LLIN post-campaign surveys, some practical considerations and lessons learned include:

- Mobilize partners for conducting the survey, but have a written agreement about roles and responsibilities.
- Develop a standardized survey protocol adapted from existing examples used within the country and elsewhere.
- Obtain clearance from a national ethical review board. Partners may have different requirements, and thus the process may be lengthy.
- Prepare a budget and timeline of activities together with the protocol.
- Develop, test and revise the questionnaire. Strive for consistency with the most recent model available from the MERG or on other recent MIS or other surveys done nationally or in the region to save time and ensure consistency of results. Add questions based on the campaign objectives, but only

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[4] Stratification: dividing the population into distinct categories, for example rural or urban, and drawing a sample from each category. This sampling method helps to obtain representative results from each stratum.

those critical for LLIN programme needs. For example, previous surveys have added the creation of rosters for sleeping spaces and recently discarded nets, and questions about knowledge of malaria causes and prevention, visits by community health workers, reasons for non-use of ITNs and the condition of ITNs.

- Establish clear criteria for selecting survey workers, clear definitions of their roles and clear policies for how they are paid.
- Focus training on good interview techniques, the definition of a household (or other sampling frame), obtaining interviewee's consent and handling data. These issues are as important as the questionnaire itself and an understanding about why questions are being asked.
- Plan well to ensure security and well-being of interviewers in the field. Consider taking out insurance policies from a local firm.
- Plan adequate and reliable transportation and always have a back-up plan in case of problems.
- Ensure that the fieldwork itinerary will allow teams to make any follow-up visits needed.
- Ensure adequate funding and that cash is available in the field.
- Arrange for regular supervision of teams and monitor the supervisors.
- Set up a system for data entry for paper-based surveys, or for downloading data from electronic data collection devices. Paper forms should be double-entered to ensure accuracy.

See the Resources CD (R8-6 to R8-9) for examples of model post-campaign survey questionnaires.

8.5 Continuous post-campaign monitoring of ITN possession and use

Assessment of changes in the ownership and utilization of ITNs and the coverage of other proven preventive measures has traditionally relied on periodic nationally representative surveys. Relying only on data from periodic

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national surveys, however, does not allow measurement of interim progress critical to programme management and does not provide data at the operational level.

Programmes can take advantage of campaigns to revisit and strengthen the routine collection of data on ITN possession and use. Many strategies can be used for the collection of these data, each with its strengths and weaknesses, and countries should consider what is feasible locally. For example, after a mass campaign, programmes can strengthen the reporting of routine LLIN distributions to the national Health Management Information System (HMIS) or to the NMCP.

Other methods are available for tracking ITN possession and use. For example, during campaigns for indoor residual spraying of insecticides for malaria control, the spray teams could also collect data on the number and utilization of nets in each house visited. Lot quality assurance sampling (LQAS), described in detail in Appendix 8C and the key documents, has also been proposed as a low-cost, easily-analysed method to determine if local areas (such as a health facility catchment area or a health district) meet certain criteria for the rate of ITN possession or utilization. This method has been used in many contexts for assessing coverage but has not been widely used as a post LLIN distribution campaign coverage survey approach.

8.6 Assessment of impact on malaria

The ultimate goal of LLIN campaigns is to reduce the intensity of malaria transmission in the total population at risk, and especially to reduce the burden of disease in the most vulnerable groups (children under five years of age and pregnant women). Assessing impact may be challenging for several reasons, among them the availability of data on the number and causes of deaths occurring outside the formal health system, where a significant proportion of deaths may take place. Other confounding factors, such as other health interventions affecting child mortality and factors such as climate affecting disease incidence must also be considered. Potential sources of data to measure such impact include nationwide household surveys such as a DHS, MICS or MIS, routine nationwide reporting of malaria morbidity and mortality, and sentinel surveillance[e] data.

The relationship between ITN coverage and use and impact on all-cause mortality in children under five years of age has been well documented in the last decade, and the impact on malaria morbidity and mortality is established in the literature through well-recognized plausibility arguments[f]. Nevertheless, mass distribution of LLINs on a national or sub-national scale is relatively new; every campaign provides additional data and insights into the effects of different programmatic choices on outcome and impact.

In malaria endemic areas, national household surveys should include measurement of the prevalence of parasitaemia and anaemia in children 6—59 months of age as well as measurement of overall infant and under-five mortality. Impact of campaigns can be monitored using routinely reported surveillance data (inpatient and laboratory-confirmed outpatient) from HMIS, though in many countries these data are often of poor quality. Data from sentinel sites could also be used to measure impact if the country has such a system in place for malaria surveillance, but these sites may not be representative. To address these limitations and to build capacity, countries and their partners should consider including support for strengthening routine reporting of malaria morbidity and mortality into the campaign planning process, similar to the scheme the Measles Initiative promoted for countries conducting measles supplementary immunization activities. For example, by implementing the WHO recommendation for parasitological confirmation of all suspect malaria cases, countries can begin to strengthen the capacity of the HMIS to improve the quality of reported malaria data. In addition, countries can implement periodic (typically quarterly) review meetings for districts to present malaria surveillance and programme performance data to ensure that data are being used for decision-making. Partners should support a national government entity such as the NMCP or the MoH's Disease Surveillance Unit to improve such efforts, and possibly expand it to include data collection and reporting on indicators for other malaria programme strategies, such as case management or the number of LLINs distributed through continuous distribution systems.

Additional information on approaches to post-campaign impact evaluation is available through the Surveillance, Monitoring and Evaluation Unit at WHO's Global Malaria Programme and through the RBM MERG.

8.7 Reporting and use of evaluation results

The assessments of the various phases of the campaign can be summarized in a post-campaign report, described in Chapter 9 of this toolkit. More detailed reports of evaluations should be shared and discussed widely when available. Early in the planning process, the campaign M&E group and the NMCP M&E focal persons should obtain consensus on where the survey data will be stored, who will be authorized to use the data for further analysis, and what authorization will be necessary to share the data. The data collected are valuable resources to improve future

campaigns and guide continuous distributions, and must be used for those purposes. Analysis of results and lessons learned must feed back into the planning cycle.

Examples of how the information collected during post-campaign surveys was used to improve LLIN distribution efforts come from Senegal and Madagascar (see below).

See the Resources CD for examples of reports and use of evaluation results (R8-10 to R8-17 and R8-21).

COUNTRY CASE STUDY

In 2009 Senegal conducted a nationwide mass distribution of LLINs targeting children 6—59 months of age in two phases. Two months after the second phase, at the beginning of the dry season, a nationwide survey was carried out. This survey provided results for standard RBM indicators as well as information on sleeping spaces[5] and various potential universal coverage indicators. The results of the study were used to:

- show the limitations of a targeted approach when the goal is universal coverage
- estimate needs for a nationwide rolling universal coverage campaign from 2010—2011
- prioritize regions in the universal coverage campaign
- prepare submissions to the Global Fund
- develop strategies and goals for the new 2011—2015 National Strategic Plan

In 2007 Madagascar conducted a mass distribution of LLINs targeting children 6—59 months of age in malaria-endemic zones. Six months after the campaign, during the rainy season, a post-campaign survey was conducted. Results confirmed that free mass campaign distribution was the most equitable method of distributing LLINs in Madagascar to ensure they reach the most geographically remote and vulnerable populations. The NMCP and partners used the survey results to advocate with the Global Fund, PMI and UNICEF to increase their support for scaling up to achieve universal LLIN coverage, for estimating the LLIN gap and resources needed, and to refine the malaria programme objectives regarding LLIN availability.

In 2009 the country began a universal coverage campaign in three phases. After the second phase, the findings of the process evaluation and lessons learned based on campaign monitoring and supervision were used to modify and improve strategies for the final and largest phase. These results were used to:

- revise and clarify the method to distribute LLINs equitably to households
- eliminate the voucher system resulting in cost savings
- revise and improve the training curriculum, implement training at the community level and improve the quality of training
- standardize the micro-planning process at peripheral level
- improve selection criteria of local staff
- improve IEC/BCC messages and methods
- split heavy bales of LLINs to facilitate manual transport when needed

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[5] Countries have established their own definitions of a sleeping space. In Madagascar, the evaluation team used the following definition: "a place where an individual spent the majority of their time sleeping the night before".

Appendix 8A: Examples of process and output indicators for use or adaptation in ITN universal coverage campaigns

The following table lists examples of key ITN process indicators that countries have used during universal coverage campaigns[6]. Focusing on measuring **well** a limited number of key indicators—perhaps 15 to 20—may help avoid overburdening staff and increasing monitoring costs. The indicators should be chosen only if they correspond to campaign strategies. The level of collection or measurement should focus on the district level or its equivalent, although it can be adapted to the region, province, state or zone if relevant and if resources are available. A complete table could include additional columns showing for each indicator:

- justification for the indicator (i.e. how the information will be used to improve campaign quality and reach coverage targets)
- data collection method and timing (such as supervisory visits, household visits and population-based surveys)
- persons responsible for overseeing data collection and reporting
- method for sharing the results (such as weekly meetings with supervisors and national post-campaign summary workshops)

KEY ITN PROCESS INDICATORS

No.	Description	Definition	Comments
1	Number and proportion of districts with functioning campaign coordination mechanisms in place	*Numerator:* Number of districts with functioning campaign coordination mechanisms in place *Denominator:* Number of districts targeted for the campaign	Countries can define "functioning" as appropriate, such as "containing at least one focal person each for planning, logistics and communications and meeting at least twice prior to the campaign".
2	Number and proportion of expected supervisory reports received at the district level	*Numerator:* Number of supervisory reports received at the district level at least one week before the campaign *Denominator:* Number of supervisory reports expected at the district level by one week before the campaign	
3	Number and proportion of planned regional campaign sensitization sessions conducted	*Numerator:* Number of regional campaign sensitization sessions completed as scheduled *Denominator:* Number of regional sensitization sessions planned	Countries can adapt the setting (province, district, etc.) as well as the target group being sensitized (district officials, community and religious leaders, etc.).
4	Number and proportion of household registration form summaries completed correctly	*Numerator:* Number of household registration form summaries observed during supervision that are completed correctly *Denominator:* Number of household registration form summaries observed during supervision	"Correct" completion needs to be defined, but can include: no missing information, no targeted household members or sleeping spaces missed, and the like.
5	Number and proportion of micro-plans finalized by targeted district	*Numerator:* Number of micro-plans completed by targeted district *Denominator:* Number of targeted districts	The reporting level can be modified for zonal, regional, provincial or any appropriate level.
6	Number and proportion of planned radio spots broadcast	*Numerator:* Number of radio spots that stations report having broadcast *Denominator:* Number of radio spots that stations planned to broadcast	Similar indicators can measure planned quantities of supporting print materials, interpersonal and community communication sessions, and other IEC/BCC activities.

[6] Sources: LLIN campaign indicator tables or supervisory checklists from Burkina Faso, Côte d'Ivoire, Ghana, Madagascar and Senegal.

APPENDIX 8A KEY ITN PROCESS INDICATORS (continued)

No.	Description	Definition	Comments
7	Number and proportion of community mobilizers trained	*Numerator:* Number of community mobilizers trained *Denominator:* Number of community mobilizers planned for training	
8	Number and proportion of community mobilizers with campaign job aids	*Numerator:* Number of community mobilizers observed during supervision who have campaign job aids *Denominator:* Number of community mobilizers observed during supervision	Similar indicators can show whether community leaders, health officials and health workers have job aids appropriate to their target group. Some countries require job descriptions, standard operating procedures, or a list of roles and responsibilities to be posted at health posts, and the indicator can be adapted accordingly.
9	Number and proportion of households visited by a community mobilizer before the campaign	*Numerator:* Number of households observed during supervision that were visited by a community mobilizer before the campaign *Denominator:* Number of households observed during supervision	This indicator can be derived from the mobilizers' own reports and compared to the households on the registration lists.
10	Number and proportion of districts that received operational funds in time for the campaign	*Numerator:* Number of districts that received their required operational funds at least two weeks prior to the campaign *Denominator:* Number of districts targeted in the campaign	Countries can define the appropriate level(s) that they would like to assess (provincial, zonal, etc.), and the appropriate definition of "in time"
11	Number and proportion of district-level campaign teams supervised during the campaign	*Numerator:* Number of district-level campaign teams supervised at least once during the campaign by a campaign official *Denominator:* Number of district-level campaign teams	Countries can modify the level of campaign teams to be supervised (e.g., regional, provincial, zonal, etc.). The campaign official can be NMCP staff or others trained and designated by the NMCP to support teams on the ground.
12	Number and proportion of distribution sites properly equipped with trained staff	*Numerator:* Number of distribution sites observed during supervision that have adequate quantities of supplies and trained staff *Denominator:* Number of distribution sites observed during supervision	The definition of "properly equipped" and "trained staff" should follow the minimum standards set in a country's campaign guidelines. "Adequate supplies" should also be clearly defined and should focus on quantities of key inputs such as ITNs and forms.
13	Number and proportion of distribution sites that report a gap in stocks of ITNs	*Numerator:* Number of distribution sites visited by supervisors that report a gap in ITNs received at the start of the campaign compared to the quantity ordered *Denominator:* Number of distribution sites visited by supervisors	
14	Number and proportion of distribution sites with ITN stocks correctly stored and accounted for	*Numerator:* Number of distribution sites visited during supervision with ITN stocks correctly stored and accounted for *Denominator:* Number of distribution sites visited during supervision	The definition of "correctly stored" should meet NMCP guidelines and can include such elements as cool enclosed area, secure, dry and with adequate capacity. Correct accounting can be verified with the supply chain management tools in use.
15	Number of ITNs or re-treatment kits distributed to people	*Numerator:* Number of ITNs + number of re-treatment kits *Denominator:* not applicable.	Potential sources of information are the records of the NMCP, medical store stock records, and the health management information system. Data can be collected quarterly and annually.
16	Number of ITNs distributed to pregnant women through antenatal clinics	*Numerator:* Number of ITNs delivered through ANC *Denominator:* not applicable.	Potential sources of information are ANC records and the health management information system. Data can be collected quarterly and annually.

Appendix 8B: Suggested outcome indicators for ITN scale-up

The following ITN outcome indicators were recommended in June 2011 by Roll Back Malaria's Monitoring and Evaluation Reference Group (MERG), or by the Global Fund's Monitoring and Evaluation Toolkit, 3rd Edition. Data to measure these indicators should be collected every three to five years through population-based surveys such as the DHS, MICS, and MIS.

No.	Description	Numerator	Denominator
1	*Households with at least one insecticide-treated net (ITN) (percentage)[7]	Number of households surveyed where number of ITNs ≥ 1	Total number of surveyed households
2	*Children younger than five years of age who slept under an ITN the previous night (percentage)	Number of children under five who slept under an ITN the previous night	Total number of children under five who reside within surveyed households
3	*Pregnant women who slept under an ITN the previous night (percentage)	Number of pregnant women who slept under an ITN the previous night	Total number of pregnant women who reside within surveyed households
4	**Households with at least one ITN for every two people (percentage)[8]	Number of households surveyed where ratio of ITNs to household residents is ≥ 0.5	Total number of surveyed households
5	**Household residents who slept under an ITN the previous night (percentage)	Number of household residents who slept under an ITN the previous night	Total number of household residents who reside within surveyed households
6	**Persons of all ages with "access" to an ITN in their household (percentage)[9]	*Number of individuals surveyed who have access to an ITN if each ITN covers two people	Total number of individuals in surveyed households
7	Households with at least one ITN for each sleeping space (percentage)[10]	Number of households surveyed where ratio of ITNs to sleeping spaces is ≥ 1.0	Total number of surveyed households
8	Number of ITNs versus number of household members in the household (ratio)	Number of ITNs in surveyed households	Number of household members
9	Number of ITNs versus number of sleeping spaces in the household (ratio)[11]	Number of ITNs in surveyed households	Number of sleeping spaces in surveyed households
10	Percentage of existing ITNs that were in use the previous night	Number of ITNs in use the previous night	Number of ITNs in surveyed households
11	Percentage of ITNs owned by a household hanging the previous night	Number of ITNs hanging the previous night	Number of ITNs in surveyed households
12	Average number of ITNs per household	Number of ITNs found in all surveyed households	Total number of surveyed households
13	Number and proportion of households that received an appropriate number of ITNs during the campaign	Number of households visited by a survey team that had received an appropriate number of ITNs during the campaign	Number of households visited by a survey team
14	Number and proportion of households that received a hang-up demonstration in the home	Number of households visited by a survey team that had received a hang-up demonstration in the home during or after the campaign	Number of households visited by a survey team
15	Number and proportion of people from targeted households who understand the reasons for using an ITN	Number of people surveyed from targeted households who can name at least one correct advantage of using an ITN	Number of people surveyed from targeted households
16	Number and proportion of people from targeted households who understand correct ways to care for an ITN	Number of people surveyed from targeted households who can name at least one correct way to care for an ITN	Number of people surveyed from targeted households

[7] Outcome indicators with a single asterisk * sign are current RBM core population-based indicators for ITNs as of June 2011.

[8] Outcome indicators with a double asterisk ** sign were recommended by MERG in June 2011 as new, additional RBM core population-based indicators for ITNs.

[9] This indicator assumes that one ITN covers two persons. It requires calculating "people with potential access to ITN" by first multiplying the ITN variable by 2.0 and then replacing it with the number of people in the household if the determined number of potential ITN users is greater than the actual household members. The indicator can then be calculated manually by dividing the sum of all potential ITN users in the sample by the total number of residents. It can also be calculated by creating a variable of "persons with access/all persons" which is the proportion of people with access at household level and then calculate the mean of that proportion using the household members as frequency weight.

[10] Appropriate for countries distributing ITNs by sleeping space.

[11] Appropriate for countries distributing ITNs by sleeping space.

Appendix 8C: Detailed technical background on post-campaign survey methodology

The post-campaign surveys, like the DHS, MIS or MICS, are typically multi-stage cluster surveys[g]. Initially, EPI-style surveys were conducted, for example after the integrated campaigns in Lawra District of Ghana in 2002 and the first of two surveys in five districts in Zambia in 2003. More recent surveys have used sampling methods similar to an MIS that allow the calculation of the probability of selection for any household in the survey. These probabilities are not usually known for EPI-style surveys but are necessary to be able to use standard statistical methods for calculating the variation in the results. Recent surveys have typically created maps of the households using pen-and-paper or a global positioning system (GPS) unit that are then used to take a random or systematic sample of households to visit. Recent surveys have also included all households in the enumeration area, not just those with target-age children. Surveys using these improved methods were conducted after the campaigns in Eritrea (2003), Togo (in 2004 and 2009), Niger (in 2005), Kenya and Sierra Leone (both in 2006), Mali and Madagascar (both in 2007), and Senegal (in 2009 and 2011). The questionnaires used in these more recent surveys have also been harmonized with those used in the DHS, MIS or MICS to assess ITN possession and use, with additional questions specific to the campaign. These surveys can provide results at the national, regional/provincial, or sub-national levels depending on the number of clusters and sample size selected.

For most malaria-endemic countries, these surveys typically use a multi-stage randomized cluster design, with first stage selection of clusters using probability proportionate to size (PPS)[h]. At the second stage, the selection of households within the enumeration area (EA) varies between methods, trading off between the cost and complexity of the survey on one hand, and simplicity and wider confidence interval

of the estimates on the other. For example, minimizing the cost and the complexity of the survey by selecting fewer samples will increase the confidence interval of the resulting estimates. In some situations, this may be an acceptable trade-off. In all cases, it is critical to ensure that a statistically valid method is used for the survey so that the results can be interpreted properly.

Survey methods should minimize four common sources of survey error. Sampling error is the error resulting from methods used in sampling, whether in the selection of the EA or in the selection of households in the EA. Non-coverage error is the error resulting from the exclusion of areas that are difficult to access or are far from primary population centres. For example, the sampling frame from which clusters and households are selected should be independent of the distribution records so that communities and households missed during the campaign can be captured. Non-response error is the error arising when households that are unavailable for interview at the initial visit are not revisited. Measurement error is the use of only a single or inaccurate source of information for critical outcomes.

Traditional EPI cluster survey methods are described in the WHO manual[i]. The number of clusters and households per cluster are determined based on the desired confidence interval and logistic concerns. After selecting clusters using PPS, households are selected by going to the centre of the village or EA and selecting a direction at random. The houses from the centre to the periphery along that direction are counted and one of these houses is randomly selected. After completing the survey at that house, the next nearest house is visited until at least seven children 12—23 months of age are found; all eligible children in each household are included, even if more than one is found. Households with

children outside the target age group are skipped. The advantages of this method are that it is well-known, requires minimal external technical assistance, is relatively inexpensive and uses a standardized questionnaire.

The disadvantages of the EPI cluster survey are the significant modifications needed to account for a target age range wider than 12—23 months and to assess ITN possession and use accurately. Households and children also do not have a known probability of selection using this method, thus traditional statistical testing and estimations cannot be applied to the data. The methods of household selection in the enumeration area may over- or under-estimate the coverage achieved. When estimating overall household ITN ownership and use, the exclusion of childless households introduces a non-coverage error and prevents the survey from being able to measure these indicators directly. Coverage estimates coming from surveys involving only households with children in the target age are usually higher than those coming from surveys involving all households. The traditional method also may lead to non-response error as households with no-one home are not revisited. Several modifications proposed to overcome these problems are included in the key documents. Several groups have tested modifications to the standard EPI methods. One common method is to divide the EA into equal or unequal sized segments and to randomly choose a segment using simple random sampling. This process is continued until the segment is small enough to permit the listing or mapping of all households and drawing a simple random sample for the survey. For example, in Eritrea the NMCP and partners used a sampling method including segmentation to assess ITN coverage after a distribution campaign, and compared the design efficiency and accuracy of the methodology to a DHS-style survey done just before the distribution[j].

The DHS, MIS, MICS and many post-campaign surveys also select clusters using PPS but at the EA all households are mapped and either a systematic or simple random sample of households is chosen. The sampling methods for these surveys are designed to minimize sampling errors and are recognized as the standard for statistically valid and representative results. These surveys also avoid the problems of non-coverage and non-response errors possible with EPI coverage surveys. They are also easily adapted to universal coverage campaigns. The advantage to using methods and questionnaires similar to the DHS, MIS or MICS is that the results from the post-campaign survey are well adapted to assessing ITN possession and use. Results from post-campaign coverage surveys using these methods are comparable to these periodic surveys, an important consideration as DHS, MIS or MICS are used to routinely monitor coverage. These surveys usually only provide results at the national level or at the regional/provincial levels, with greatly increased costs to have results at district or other lower levels.

Beginning with Togo in 2004, several countries have begun using personal digital assistants (PDAs) and more recently tablet computers and/or smart phones to collect and record data for coverage and utilization surveys and MIS rather than using paper forms. The use of electronic data collection devices reduces the number of errors during data collection and allows for a more rapid analysis compared to paper forms and tools. With a GPS unit and appropriate software the devices can also help to map the EA and more easily select a statistically valid sample. While the units themselves are an added cost, they are balanced by the absence of paper and photocopying charges, the faster pace of data collection, and elimination of data entry teams. However, using these technologies requires additional technical support for programming the questionnaires, training interviewers, and troubleshooting technical problems during the survey, plus additional time during the interviewer training. More information about using PDAs in sampling and conducting a survey can be found in the key documents for Appendix 8C.

Lot quality assurance sampling or LQAS is another method for assessing the coverage attained after a distribution campaign and the utilization of ITNs. This method originated to sample production lots of a product to determine if the number of defects was small enough to allow the lot to be accepted. In the context of a post-campaign survey, the "lot" is the EA. Indicators are then constructed so that each household can have a "yes" or "no" result, for example "the number of ITNs is equal to or greater than the number of household members divided by two". For each indicator the result for the EA is the number of households with a "yes". This number is compared to a predetermined cut-off. If the number is at or above the cut-off the EA is classified as "high performing", otherwise it is "low performing". The value for the cut-off is determined by the number of households surveyed in the EA, the campaign objectives, and the acceptable levels of types of decision error (i.e., type 1 or type 2 errors). The simplest use of LQAS has the survey workers stop once the decision threshold has been reached. If, however, all households are visited the results from the EAs can be combined to determine the overall coverage. The advantages of LQAS are the simple decision rules and the possibility of assessing the success by EA. However, the method assumes that a simple random sample of households is made for each EA, so that most surveys would require mapping all households in the EA. The key documents for Appendix 8C give further details; the article by Biedron et al. describes the application of LQAS to the assessment of household ITN coverage.

Appendix 8D: Key documents

Section 8.1: Contents of the M&E section of an ITN campaign or scale-up plan

- *Evaluation guidelines for measles supplemental immunization activities*, WHO/AFRO, revised January 2006. See: www.measlesinitiative.org/mi-files/Tools/Guidelines/AFRO/Evaluation_guidelines.pdf
- *Framework for monitoring and evaluation of integrated child survival interventions*, draft February 2006, WHO/AFRO.
- *Guideline For Evaluation Of The Promotion And Implementation Of Insecticide Treated Mosquito Nets And Other Materials In The African Region*, revised trial edition, WHO/AFRO, September 2004.
- *Monitoring and Evaluation Toolkit HIV, Tuberculosis and Malaria and Health Systems Strengthening*. Part 1: The M&E system and Global Fund M&E requirements and Part 2: Tools for monitoring programs for HIV, tuberculosis, malaria and health systems strengthening: Malaria. Third Edition. Global Fund for AIDS, Tuberculosis and Malaria, February 2009. See: www.theglobalfund.org/en/me/
- *Framework for Monitoring Progress, Evaluating Outcomes and Impact*. Roll Back Malaria, 2000. See: www.rollbackmalaria.org/cmc_upload/0/000/012/168/m_e_en.pdf

See also examples of M&E plans on the Resources CD (R8-1 to R8-5).

Section 8.2: Monitoring campaign performance

See examples of spreadsheets showing recording and summarizing of administrative data collected during campaign operations on the Resources CD (R8-18 to R8-20).

Section 8.3: Outcome evaluation

- MIS survey documents are available at: www.rollbackmalaria.org/merg.html#MIS
- DHS survey documents and questionnaires are available at: www.measuredhs.com/pubs/search/search_results.cfm?Type=35&srchTp=type&newSrch=1
- MICS survey documents available at: www.childinfo.org/mics4.html
- Model post-campaign coverage survey questionnaire based on the MIS and MICS questionnaires (see examples on AMP website) www.allianceformalariaprevention.com
- Rutstein, SO. and Johnson K (2004). *The DHS Wealth Index*. DHS Comparative Reports No. 6. Calverton, Maryland: ORC Macro. See: www.measuredhs.com/pubs/pdf/CR6/CR6.pdf

Published articles describing previous campaign evaluations
Eritrea:
- Eisele TP, Macintyre K, Yukich J, Ghebremeskel T. *Interpreting household survey data intended to measure insecticide-treated bednet coverage: results from two surveys in Eritrea*. Malar J. 2006 May 5;5:36. See: www.ncbi.nlm.nih.gov/pubmed/16677379
- Macintyre K, Keating J, Okbaldt YB, et al. *Rolling out insecticide treated nets in Eritrea: examining the determinants of possession and use in malarious zones during the rainy season*. Trop Med Int Health. 2006 Jun;11(6):824-33. See: www.ncbi.nlm.nih.gov/pubmed/16772004

APPENDIX 8D continued

Ghana:
* Grabowsky M, Nobiya T, Ahun M, et al. *Distributing insecticide-treated bednets during measles vaccination: a low-cost means of achieving high and equitable coverage.* Bull World Health Organ. 2005 Mar;83(3):195-201. See: www.ncbi.nlm.nih.gov/pubmed/15798843
* Grabowsky M, Nobiya T, Selanikio J. *Sustained high coverage of insecticide-treated bednets through combined Catch-up and Keep-up strategies.* Trop Med Int Health. 2007 Jul;12(7):815-22. See: www.ncbi.nlm.nih.gov/pubmed/17596247

Kenya:
* Hightower A, Kiptui R, Manya A, et al. *Bed net ownership in Kenya: the impact of 3.4 million free bed nets.* Malar J. 2010 Jun 24;9:183. See: www.ncbi.nlm.nih.gov/pubmed/20576145
* Noor AM, Amin AA, Akhwale WS, Snow RW. *Increasing coverage and decreasing inequity in insecticide-treated bed net use among rural Kenyan children.* PLoS Med. 2007 Aug;4(8):e255. See: www.ncbi.nlm.nih.gov/pubmed/17713981

Madagascar:
* Kulkarni M, Desrochers R, Goodson J, et al. *Evaluation de l'appropriation et l'utilisation des moustiquaires imprégnées d'insecticide à longue durée (MIDs) au Madagascar six mois après la campagne intégrée rougeole/paludisme d'octobre 2007 : Rapport Final.* Unpublished manuscript dated June 2008. See: www.healthbridge.ca/assets/images/pdf/Malaria/RapportFinalMIDMadagascar.pdf
* Kulkarni M, Desrochers R, Goodson J, et al. *Evaluation of the ownership and usage of long-lasting insectisidal nets (LLINs) in Madagascar six months after the October 2007 measles and malaria integrated campaign. Final report.* Unpublished manuscript date June 2008. See: www.healthbridge.ca/reports_e.cfm#Malaria

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Section 8.5: Continuous post-campaign monitoring of ITN possession and use

- *Evaluation guidelines for measles supplemental immunization activities,* WHO/AFRO, revised January 2006. See: www.afro.who.int/measles/guidelines/measles_sias_field_evaluation_guide_jan2006.pdf

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Section 8.7: Reporting and use of evaluation results

Draft LLIN Technical Report.
Examples of Measles – Malaria Technical Reports:
- Rapport technique de la campagne de vaccination contre la Rougeole, Togo.
- Sierra Leone Measles Supplementary Immunization Activity (SIA) Technical Report.
- Kenya Measles SIA Technical Report July 2006 – final.
- Rapport synthèse de la campagne intégrée (Rougeole, MII, MBZ, Vit A), Rwanda, September 2006.

More extensive reports:
- Ministry of Health and Sanitation, Sierra Leone. National Measles – Malaria Campaign Report. January 2007.
- Togo Campagne Intégrée de Vaccination Contre la Rougeole & la Polio, Administration de Mebendazole et Distribution de Moustiquaires Imprégnées d'Insecticide : Une Approche Intégrée de la Réduction de la Morbidité et de la Mortalité Infantiles au Togo. Unpublished manuscript, April 2005.
- Rwanda integrated campaign process indicators, 2006.

See examples of reports on the Resources CD (R8-10 to R817 and R8-21).

Appendix 8C: Detailed technical background on post-campaign survey methodology

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LQAS surveys

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See the Resources CD for examples of LQAS surveys (R8-22 and R8-23).

Endnotes

a   Definition from WHO/AFRO.

b   Sources: LLIN campaign indicator tables or supervisory checklists from Burkina Faso, Côte d'Ivoire, Ghana, Madagascar and Senegal.

c   www.rollbackmalaria.org/mechanisms/merg.html=expand_node

d   www.allianceformalariaprevention.com

e   Sentinel surveillance: collecting data from selected health facilities that have received additional training, supervision and supplies so that they are capable of reporting monthly on inpatient and/or outpatient malaria cases as well as on other indicators of care not included in the routine information system. Such data, collected at a small set of health facilities, can demonstrate trends in malaria morbidity and mortality, complement information obtained through other sources, and help estimate malaria burden for the country as a whole.

f   Plausibility arguments are based on an assumption that mortality reductions can be attributed to programmatic efforts if improvements are found in steps of the causal pathway between intervention scale-up (of LLINs and other malaria interventions) and mortality trends. See Rowe A K, Steketee R W, Arnold F et al. *Viewpoint: evaluating the impact of malaria control efforts on mortality in sub-Saharan Africa.* Trop Med Int Health, 2007. 12(12):1524-39.

g   Multi-stage sampling: in the first stage a sample of areas ("clusters") is chosen; in the second stage a sample of households or respondents within those areas is selected.

h   Probability-proportional-to-size (PPS) sampling: the selection probability for each cluster is set to be proportional to the number of households (or people) it contains.

i   World Health Organization (2004) *Immunization coverage cluster survey – Reference Manual.* Available at: www.who.int/vaccines-documents/DocsPDF05/www767.pdf

j   Eisele T P, Macintyre K, Yukich J. Ghebremeskel T. *Interpreting household survey data intended to measure insecticide-treated bednet coverage: results from two surveys in Eritrea.* Malar J. 2006 May 5;5:36.