Open review of

COVERAGE METHODOLOGIES

Questions, comments & ways forward

SQUEAC, SLEAC, S3M

epicentre
ÉPIDÉMIOLOGIE • EPIDEMIOLOGY

Centre Collaborateur de l'OMS pour la Recherche en Epidémiologie et la Réponse aux Maladies Emergentes

T: 00 33 (0)1 40 21 55 55
F: 00 33 (0)1 40 21 55 00
E: epimail@Epicentre.Msf.Org
W: www.Epicentre.Msf.Org

AUTHOR: **EPICENTRE** | **JANUARY 2015**

DONORS

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ABBREVIATIONS

ACF	Action Contre la Faim / Action Against Hunger
AACF	Active and Adaptive Case-Finding
CMAM	Community-based Management of Acute Malnutrition
CDC	Centers for Disease Control and Prevention
CMN	Coverage Monitoring Network
ECHO	European Commission Directorate-General for Humanitarian Aid and Civil Protection
IYCF	Infant and Young Child Feeding
MAM	Moderate acute malnutrition
MUAC	Mid-Upper Arm Circumference
OFDA	Office of Foreign Disaster Assistance
PLW	Pregnant or Lactating Women
PPS	Probability proportional to size
SAM	Severe Acute Malnutrition
SLEAC	Simplified-LQAS Evaluation of Access & Coverage
S3M	Simple Spatial Sampling Method
SQUEAC	Semi-Quantitative Evaluation of Access & Coverage
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
W/H	Weight-for-Height

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1 | INTRODUCTION

The Coverage Monitoring Network (CMN) is an inter-agency project led by Action Against Hunger (ACF) and its partners: International Medical Corps, Concern Worldwide, and Helen Keller International. Working together with UNICEF and the Global Nutrition Cluster, the CMN Project was launched in July 2012 with support from the European Commission Directorate-General for Humanitarian Aid and Civil Protection (ECHO) and USAID's Office of Foreign Disaster Assistance (OFDA).

The CMN project aims to increase and improve coverage monitoring in community-based management of acute malnutrition (CMAM) programs globally. Its focus is to build the capacity of nutrition stakeholders to design, implement and analyse coverage assessments. Additionally and most importantly, the CMN project has sought to create a national cadre of nutrition workers capable of carrying out and advocating for coverage assessments. The project has succeeded in meeting these objectives through a number of a coverage assessments completed worldwide. These coverage assessments were conducted using the SQUEAC and SLEAC methods.

2 | OBJECTIVE

To maximize buy-in and support for coverage assessments and their results, CMN proposed an independent review of the three most commonly used coverage methodologies in the nutrition sector (SQUEAC, SLEAC and S3M) in which users were invited to pose methodological questions.

The role of Epicentre was to facilitate a participatory study of the coverage methodologies where any interested party may comment and pose queries relating to the methods, and to suggest responses to these questions and comments.

Review of the coverage methodologies herein does not reflect validation of the methods but rather a directed response to individual questions and comments received during the review period. As part of the technical review, Epicentre was responsible for responding to questions and indicating areas where additional information and clarification is needed. Questions regarding practical implementation or interpretation of findings in specific cases are not addressed here, as responses might be obtained through existing forums, such as En-Net.

Any lessons learned or suggestions documents should be actioned by the CMN. If it is deemed that the methodologies are in need of adaptation, a second review will take place.

3 | METHODS

On the 2nd and 3rd of July 2014, a Call for Review was issued with a one-month open review period. The text of the message (see Appendices 1 and 2) and the list of addressees were provided by CMN. A reminder was sent to the same addressees on the 21st of July. In some cases, questions refer to documents that were not available for review. In this case, as this information is not available publicly, it was not referred to, referenced or discussed.

4 | RESULTS

4.1 | PARTICIPANTS

Questions and comments were received from the 20th of July to the 7th of August 2014. Participants included individuals and teams from the CDC, Concern Worldwide, the World Food Program, UNICEF, the International Rescue Committee as well as participants from unspecified affiliations.

4.2 | QUESTIONS, ANSWERS AND COMMENTS

In this section, the questions raised by the participants are presented as received. Answers are provided one-by-one, or when appropriate by group of similar questions/comments.

4.2.1 | PRACTICAL ISSUES REGARDING THE METHODS GUIDELINE & RESOURCES

	RESPONSE
QUESTION 1 **What is the most updated manual of the S3M method?**	**RESPONSE:** For S3M, participants are referred to the documents available on Valid International's Website: http://www.validinternational.org/coverage/workshop (accessed in July 2014). Although another version of the manual is under development, this was the only version available online at the time of this review.
QUESTION 2 **There is need for a simplified operational guideline for conducting combined MAM and SAM coverage surveys, one that is user friendly to field staff.**	**RESPONSE:** To our understanding, the methods developers plan to publish a simplified document that will be of great use (including a toolkit available on http://toolkit.coverage-monitoring.org/). In the meantime, improvements might be provided to the current manual to make it more user-friendly. Following the current structure, the manual could be organised in two parts: 1. PRACTICAL FIELD GUIDELINES/PROCEDURES and 2. DETAILED TECHNICAL INFORMATION to support the methods and relevant references. In addition, the core of the manual should focus on the assessment of SAM coverage. Clear separate sections might be added to summarise methodological adaptations necessary for other indicators or contexts that seems relevant to the methods developers (e.g. MAM coverage surveys, urban settings, camps, nomadic populations).

QUESTION 3

Lots of terminologies - SLEAC, SQUEAC, CSAS! Why not just have one, say SQUEAC and use that for MAM coverage? And can the 3 stages of SQUEAC be simplified to get vital information say in one go - stage 1?

RESPONSE: We do not feel that additional simplification should be introduced. Stages should not be combined as stages one and two are meant to inform stage three. These should be done sequentially and not simultaneously.

We agree for clarity that the SLEAC/SQUEAC manual could introduce, at the start of the manual, all the terminologies (various SQUEAC stages, SLEAC, LQAS, CSAS, and, even if not the topic of this manual, S3M as another coverage assessment method). Additionally a short overview of the context of implementation of each survey method could be provided. This would be useful as the methods are sometimes integrated, opposed or compared across the manual. The document available at the following link further details different terminologies for reference (http://www.coverage-monitoring.org/wp-content/uploads/2014/10/Coverage-and-CMAM-2012-v2-sept2014.pdf).

The SLEAC and SQUEAC manual could also contain a "roadmap" of activities and/or present the methods as a short "words and pictures" guide, including the appropriate references and websites to find the most updated manual relevant for each method. Such a summary might help clarify for users that different methods provide different assessment outcomes and results.
A possibility would be to integrate this into the technical brief available on http://www.coverage-monitoring.org/wp-content/uploads/2014/10/Coverage-and-CMAM-2012-v2-sept2014.pdf in the manual.

In addition to the manual, information on terminologies can be found on the Valid website http://www.validinternational.org/coverage/workshop and CMN website www.coverage-monitoring.org, which contains all of the most up to date discussions on coverage methodologies.

4.2.2 | PRACTICAL ISSUES REGARDING SURVEY TIMING AND CONTEXT OF IMPLEMENTATION

Several participants raised questions about the ideal timing and contexts for implementing coverage surveys. These may be categorized into two large categories. First, those regarding timing of coverage assessments in relation to program cycles and seasonality; and second, those about launching coverage evaluation in low-prevalence settings.

QUESTION 4

What is the appropriate timing of coverage assessment as compared to periodic campaign of screening and admission (making the result unreliable) so that the result will have better "forecasting" ability?

RESPONSE: Routine program data (stage 1 SQUEAC) should be monitored on a regular basis and this would include both periods before and after periodic screening campaigns, which we distinguish here from possible regular ongoing screening activities. The timing to conduct a full investigation should account for:

- The lean season when it is easier to find cases.
- Previous full SQUEAC investigations. It is recommended to repeat such comprehensive surveys at an interval not shorter than 3 months (emergency setting) or 6 to 12 months (development setting) to limit observer effect (i.e. improvements of coverage due to the assessment itself) (SQUEAC/SLEAC manual p112).
- Periodic screening campaigns.

A full investigation might be combined with a periodic screening campaign. This would maximize the use of the resources when visiting villages. In addition, this would allow a coverage assessment prior to the screening

campaign as well as improved coverage immediately after the screening campaign (by also accounting for malnourished children identified by the screening who would benefit from the nutrition program). However, it should be noted that the quality of the screening activities might be reinforced by the presence of survey teams following rigorous case finding procedures. This should be taken into account in the interpretation of results.

The tempting alternative would be to assess the coverage after the screening activities knowing that this would result in a best coverage scenario. (This would still be a reliable result as these screening activities are part of the program activities).

The preferred timing would be to conduct the full survey separate from screening campaigns and during a period of stable program admissions. However, it is important to note that there is no correct answer with respect to timing. During survey planning, it is essential to consider the timing of the survey and the timing of any screening activity. It should also be clearly stated in the introduction and discussion of the report.

In general, a coverage assessment can be implemented at any time of the year as long as a service-delivering programme is in place. More over the ability of "forecasting" program admissions with results of a coverage survey would be limited in time – as malnutrition prevalence usually fluctuates over time.

QUESTION 5

Duration of programmes: How long should the programme cycle be before a coverage survey can be conducted?

RESPONSE: It is important to remember that SQUEAC provides a toolkit that integrates with program activities. Many of the activities in stage 1 and some of the activities in stage 2 can and should be done on a regular basis by program managers.

Regarding a full SQUEAC survey (including the 3 stages), it is important to clarify the purpose of the coverage survey itself. Many resource intensive methods have led to a tendency for them to be used for program evaluation rather than for day-to-day program planning and monitoring purposes. Results of surveys have often been able to contribute to an understanding of why a particular program failed to achieve certain standards and spatial coverage. , However, this information has tended to arrive too late in the program cycle to guide action. It is important to think about how this information may be used. It will depend on the context of the program – broadly speaking, emergency versus development settings.

In emergency settings, large amounts of resources are made available quickly to implement a well-functioning program. In such situations, a coverage assessment might be planned within in a short time (e.g. 3 to 6 months) that would fit the time in which the project was expected to reach its objectives. Of course, as emergency programs are limited in time, the relevance of conducting a coverage assessment should be carefully considered. In an emergency context, a coverage assessment might be justified as part of the program evaluation.

In a development context with limited resources, longer delays will be necessary to reach expected program goals and coverage assessment can be conducted later in the program cycle. If the purpose of the assessment is for program monitoring, the assessment should be done earlier in the cycle, to allow for immediate adjustments in addition to ensuring that any challenges are addressed. Another important point to consider in the case of repeated SQUEAC surveys is that a new full SQUEAC survey should not be conducted before the program is able to address the recommendations and barriers identified by the previous SQUEAC survey.

QUESTION 6

The timing of coverage surveys should be considered. Seasonality can affect results as programs, disease outbreaks, caregiver's labor demands vary greatly over the year and affect results.

QUESTION 7

The circumstances immediately prior to coverage surveys should be documented systematically as part of a rigorous analysis of the data that includes secondary data review. These details need to be taken into account to determine how representative the results are of the regular program.

RESPONSE: These two comments underscore the importance of taking local factors into context in planning evaluations and interpreting surveys results. We agree that all these details should be considered when interpreting results and should be systematically documented in survey reports.

In addition, it should also be noted that the coverage survey results might provide key information on some contextual barriers, in particular seasonal barriers. The program should then be adapted accordingly.

QUESTION 8

Decline in the % of children under 5 years and SAM prevalence threaten the cost efficiency of coverage surveys. In some areas, the % of children under 5 years is low (about 12% or sometimes lover) and SAM prevalence may also be declining. This may be due to decline in admissions over the years, throughout all seasons and with observed variations resulting more from screening than the lean season itself. Consequently, the number of villages to investiagate in order to identify enough eligible children for coverage surveysbecomes larger and therefore affects cost of coverage surveys. In terms of potentially overcoming these barriers, there are many possibilities. For more easily implementable solutions, you could try:

1) conducting the survey during the lean season; and/or
2) integrating other indicators so that the cosr/indicator is further reduced.

QUESTION 9

At what level of GAM or MAM prevalence would coverage survey be most relevant because finding cases in low GAM prevalence locations can be extremely frustrating?

RESPONSE TO: 8 9

Ongoing coverage information is crucial for program monitoring, as coverage is a proxy indicator for population awareness, acceptability and for the efficiency of the nutrition program. We agree that identifying malnourished children in low prevalence contexts is time-consuming.

In general, a minimum prevalence is needed to have sufficient precision to estimate programme coverage without using a disproportionate amount of resources. Unfortunately, there is no prevalence cut-off for this.

Points to consider are the following:

- One possible rule of thumb would be to perform a coverage survey when the nutritional situation begins to deteriorate (for example, GAM >=10% or <10% with aggravating factors such as a high mortality rate; insufficient general food distribution; epidemics of infectious diseases; intense cold and unsuit able shelters; unstable situation). These factors may represent the gravity

of the situation, which may motivate a coverage survey. The above listed factors are examples and should be used as overall guidance rather than as a directive.

- **Another option is to conduct the survey during the lean season as this might increase the chance of finding malnourished children.**
- **In a stable situation with a very low prevalence of acute malnutrition (provided that this information is reliable), collecting information could still be useful.**

Survey resources could be focused on
1. collecting information on barriers and reasons for coverage failure;
2. investigating a small area with suspected lower levels of coverage or higher level of malnutrition. (This might provide important information on case finding difficulties);
3. not assessing the overall coverage (i.e. to perform SQUEAC stage 1 and 2 but not 3).

- **Beside the % prevalence, the absolute number of cases and their geographical distribution should also be taken into account. It could be easier to locate cases in a densely populated area (e.g. urban) with a low prevalence than in a dispersed population (e.g. remote rural, nomadic) with a higher prevalence.**
- **The addition of other indicators only reduces the cost per indicator (e.g. increases cost-efficiency) if these additional indicators are useful to monitor the program and allow reactive interventions for program improvement. Otherwise, more time and resources are needed.**
- **Finally, the relevance of conducting a full SQUEAC survey (and the relevance of the CMAM program itself) might be a matter of discussion in very low malnutrition prevalence setting.**

Some guidance can be found on: Page 19 of the following document:
http://www.cmamforum.org/Pool/Resources/Assessment-of-Coverage-of-CMAM-CMAM-Forum-TB-One-Oct-2012.pdf
http://www.en-net.org/question/696.aspx. The methods guidelines also currently describe a way to calculate a minimum sample size for the likelihood/wide-area survey or SLEAC survey under which it would not be recommended to conduct a survey (SQUEAC/SLEAC manual p97 and p193).

4.2.3 | METHODOLOGICAL QUESTIONS AND COMMENTS

Several participants raised questions about the ideal timing and contexts for implementing coverage surveys. These may be categorized into two large categories. First, those regarding timing of coverage assessments in relation to program cycles and seasonality; and second, those about launching coverage evaluation in low-prevalence settings.

4.2.3.1 | CASE-FINDING METHODS

Participants asked several questions and offered multiple opinions and comments on case-finding strategies during coverage estimation surveys. Comments and questions highlight an understanding that case finding is central to producing valid results, but also suggest that there are differences of opinion regarding best strategies, as well as a lack of confidence on implementing best practices.

QUESTION 10

There needs to be more guidance on the active and adaptive case finding methodology

QUESTION 11

Active and adaptive case finding is accepted for the complete enumeration of SAM cases. A review of research on comparing single versus double pass methods could help determine if the expedited single pass method is accurate and precise compared to capture/recapture methods.

QUESTION 12

Regarding active and adaptive case finding - what is the evidence that this method finds most all malnourished children compared to door to door exhaustive sampling? I would like to see some validation of each of the coverage methodologies compared to an exhaustive approach.

QUESTION 13

Is the active case finding the best methodology to find cases? The active case finding methodology seems quite subjective: I actually saw it done very differently with 2 people working with the same international organization, needless to say that it is not performed homogeneously among the surveyor teams working in the same survey. Why is this methodology recommended? Wouldn't it be easier to couple smart nutritional surveys with coverage surveys, i.e. every time we find a malnourished child we check if he is covered by the programme? Or if this is not valid, don't you think we would spend the same amount of time doing exhaustive screening door to door (using segmentation for bigger villages) but at least we would be more certain about the results in the sense that we know that all children would have been screened and checked for coverage. With the active case finding, I find the methodology depends too much on the subjectivity of the teams and therefore is not reliable while at the same time, probably uses the same amount of time.

QUESTION 14

In many settings coverage surveys alone may tend to overestimate rather than underestimate coverage prevalence. This is because children enrolled in feeding program may be more visible in the community, and therefore more likely to be identified through active and adaptive case finding procedure commonly used in SQUEAC coverage surveys. On the other hand, children that are not enrolled, in addition to being less visible in the community, may be less likely to be identified (or even intentionally concealed) if key informants or assessors are connected to the program and are interested in creating appearance of high program coverage.

QUESTION 15

How can active and adaptive case finding be applied to MAM cases, urban areas and camp situations where malnutrition may not be very visible, may not be associated with infection and neighbors may not know each other?

QUESTION 16

In some locations where selection of the households requires segmentation or use of EPI method (EPI-3 or EPI-5) may not be applicable for exhaustive MAM case finding (door-to-door), isn't it?

RESPONSE TO: 10 11 12 13 14 15 16

We agree with the review participants who raised the above questions/ comments that more guidance and methodological background on the active and adaptive case-finding (AACF) should be furnished by the methods developers to guide implementation.

- **AACF, often referred to as snowball sampling or chain-referral sampling, is recommended for SQUEAC small-area surveys, SQUEAC likelihood surveys, and CSAS surveys. The methods developers of the SQUEAC/ SLEAC manual discuss the benefits and weaknesses of this approach on page 65. The methods developers mention, "formal evaluations" of AACF have been conducted, and on page 190, the methods developers specify that "Active and adaptive case-finding was tested during the development of the CSAS coverage survey method using capture-recapture studies[1]." The methods developers should refer to reports or publication of such testing. In general, it may be useful to conduct a thorough review (or to summarise available information if such review has already been done), explaining the rationale behind using AACF (compared to other potential strategies). At a minimum, estimations of the AACF sensitivity to identify children with a mid-upper arm circumference (MUAC) < 115mm[2] (and/or oedema) should be provided. This means repeating in different settings (e.g. small and big villages, and eventually urban areas), the evaluation of the AACF methods as conducted previously based on previous admission criteria[3]. Evidence on the validity of the AACF might also be provided for contexts other than SAM coverage where the methods developers would recommend its use.**

- **AACF is highly dependent on the key informants used in the approach. The methods developers rightly discuss the importance of finding the right key informants, especially key informants independent from the nutrition program (e.g. to avoid potential diversion away from non-covered cases). As the methodology is adaptive, this will vary in different contexts. AACF also highly depends on the case-definition used (see basic case-definition and guidance on SQUEAC/SLEAC manual p65). As pointed out in the guidelines, the use of a case definition which is not context and culturally appropriate (i.e., using stigmatized terms) might bias the sample as the community might be reluctant to identify these children. In addition, some children enrolled in feeding programs may be more noticeable in the community and consequently more likely to be identified in AACF. However, in other contexts, the community might tend to hide these children expecting a result of low coverage might benefit the community by motivating reinforced relief and nutrition activities. This highlights the importance of ensuring that AACF is possible in the context before embarking on this methodological approach.**

- **Difficulties with AACF result from "snowballing" occurring only amongst certain groups. As the methods developers point out in the guideline, the AACF methodology has also been shown to do poorly in urban areas[4] or in displaced or refugee camp scenarios[5] where there is a high population turnover or few social connections. Given the diversity of situations in which coverage monitoring is implemented, this expected variable sensitivity of the AACF in such settings is problematic. The methods developers also state that AACF does not perform well for conditions**

[1] *Guidance to conduct such capture-recapture studies are available in VALID International. Notes on using capture-recapture techniques to assess the sensitivity of rapid case-finding methods. Version 0.71; July 2006. Available on: http://www.brixtonhealth.com/CRCaseFinding.pdf*
[2] *Although in hospital context, Mogeni et al (2011) reported a low performance (<60%) of visible severe wasting to detect children with MUAC<115mm.*
[3] *Capture-recapture studies conducted during the development of the CSAS methods relied on MUAC<110mm, and/or W/H (NCHS standards).*
[4] *SQUEAC/SLEAC manual Case study p174-177*
[5] *SQUEAC/SLEAC manual Case study p171-173*
[6] *That might have consequences as discussed later in this report concerning LQAS.*

other than SAM (e.g. MAM p 190). For MAM, house-to-house screening (preferably preceded by verbal census) is the suggested alternative even if this involves increased time and resources.

▶ A key element is that the case-finding methods should find all or nearly all cases in the sample communities. Failure to do so will result in reduced sample size, selection bias (that would not be compensated by increasing the number of sampled villages), and/or reduced sampling fraction[6]. The methods developers should clearly mention in which contexts the assumption of "finding nearly all cases" is likely to be valid. If this is limited for SAM coverage in rural settings, clear guidance should be given on alternative methods to use in other settings. The limitations of alternative methods should also be clearly stated. House-to-house case-finding might need more time and resources and might not be possible in large villages/urban areas. If for this reason the case-finding is limited to a restricted area (e.g. segmentation or EPI method), the consequences of non-exhaustive case finding, of potential clustering and reduced sampling fraction should be discussed.

The methods developers might also consider updating the available materials[7] to allow users to test AACF procedures using capture-recapture studies when used in a particular area for the first time.

REMARK: ***The comparison of the reviewed methods with SMART/ PPS nutritional survey is discussed later in this report***

◆ 4.2.3.2 | SPATIAL SAMPLING, MAPPING, HOMOGENEITY ASSUMPTION VS CLUSTERING

Many questions were raised about spatial sampling techniques – some of which were purely technical, others of which asked for further detail about the statistical and philosophical underpinnings of the most common methods. We begin by presenting questions regarding practical implementation and continue on to questions and comments that seek further clarification about the assumptions and justifications underlying the currently recommended methods. We point out several paths for possible clarification and further validation of the methods.

QUESTION 17

Why was it not possible to use enumeration areas instead of village for large SLEAC and S3M surveys?

RESPONSE: It is possible to use enumeration areas instead of villages. An example of SLEAC survey using census enumeration areas as primary sampling unit is presented in the SQUEAC/SLEAC manual (p182: Case Study: Applying SLEAC: Sierra Leone National Coverage Survey). In rural districts, enumeration areas were individual villages and hamlets. In (peri-) urban districts, enumeration areas were city blocks.

QUESTION 18

What is the optimal # of quadrates in S3M and what is the rationale behind?

RESPONSE: We understand that this question refers to the number of triangles in S3M (however, the same idea might be applied for the number of quadrats in CSAS). There is no optimal number of triangles in S3M. This number will be determined by "d" (see next comment) with the aim that the resulting areas are spatially homogeneous. Numerous small triangles are more likely to satisfy this assumption than few large triangles. Therefore, one should investigate as many triangles as possible within the time and resource constraints of the survey.

[7] *Guidance to conduct such capture-recapture studies is available in VALID International. Notes on using capture-recapture techniques to assess the sensitivity of rapid case-finding methods. Version 0.71; July 2006. Available on: http://www.brixtonhealth.com/CRCaseFinding.pdf*

QUESTION 19

In S3M, what is the rationale, supported by published evidence, to use d=10, 12, 14?

RESPONSE: In the S3M method, "d" is the intended maximum distance of any community/eligible child's residence from the nearest sampling point. In other words, "d" fixes the limits of the area that will be covered or represented by the sampling point.The rationale to choose a value for "d" is that it should be small enough to allow the assumption of spatial homogeneity in the area of investigation (i.e. all children living in this area and eligible for the nutrition program should have equal access to this program).

The S3M guidelines suggest that, in most settings, a value of 10 km for "d" will likely not violate the assumption of spatial homogeneity. Meaning, the smaller the "d", the more likely this assumption will hold but the number of sampling points and the consequent workload will also be higher. However, to our knowledge, this suggestion of 10 km is an assumption that does not rely on published evidence. We recommend this as an area requiring further clarification from the methods developer(s).

The choice for a value of "d" should ideally be influenced by the size of the total survey area (for practical issues) and the knowledge of the nutrition program (characteristics that might impact the spatial homogeneity i.e. geographical distribution of the nutrition centres in the survey area and centres catchment area; urban versus rural area; topography of the area and distance that carers are willing or able to walk to access services; etc.).

QUESTION 20

Implications of hand drawn maps on coverage estimation: As a principle, low cost methods for estimation of coverage recommend the use of simple ways in developing maps rather than sophisticated GIS software that require rarely available complete geospatial data. On the other hand estimating coverage is dependent upon where villages/people are located/live in relation to the location of the program sites (e.g. high and low coverage areas, villages' coverage, and population coverage) so inaccuracy of the location of sites and villages can drastically affect coverage estimation.

RESPONSE: This is an important comment. There are strengths and weaknesses of using hand drawn maps. The important aspect to consider here would be the ability of the survey team to draw the map accurately. This area frequently may be neglected in implementation. There are several aspects of hand drawn maps that may necessitate further guidance. For example, insuring that a map scale and legend is included and other aspects of the map itself are essential to avoid problems noted in the comment. Although there are guides available to construct hand drawn maps, they are more appropriate to Europe and North America The most difficult aspect in respect to mapping is population density. Unfortunately, the only way to ensure the map closely reflects reality is to invest frequently the necessary time and energy to update them.

The SQUEAC/SLEAC and S3M methods were designed in order to "not require the use of sophisticated mapping or geographical information system (GIS) software packages or the use of Global Positioning System (GPS) receivers" (p31 of the manual). Therefore, these methods do not rely on GIS. However, the methods developers do not discourage the use of such mapping (for example, see p 217) and they and we would recommend using it, as well as satellite maps, as often as possible. Detailed and updated maps are more easily accessible on the internet (e.g. Google Earth). Alternatively, maps can also be obtained from partner organisations. In addition, user-friendly GPS devices and basic software are increasingly available at relatively affordable prices.

Method developers also suggest sampling alternative (spatially stratified samples) when maps are not available (SQUEAC/SLEAC manual p93, 96 and case study on p154-155).

QUESTION 21

S3M - On the effect of post-survey re-triangulation on the validity of the result: Re-triangulation, to overcome the lack of information in some sampling points, will jeopardize the basic requirement that the area of the triangle remains reasonable to be represented by the values of the edges. Some areas will become large while others remain small, but they all remain represented by the same values.

RESPONSE: When presenting the results on a map, "post-survey re-triangulation" involves dropping sampling points that do not provide information (i.e. with denominator equals zero; for example in sampling points where neither cases of malnutrition nor "recovering cases" were found) and to "re-triangle" the remaining sample points (by connecting the nearest sampling points providing data to each other, of course, using the appropriate techniques by computer or by hand).

Indeed, this process might result in triangles of different sizes. As long as the area of the triangle remains consistent with the spatial homogeneity assumption, this would not be a problem (and it seems that re-triangulation infrequently results in overly large triangular tiles even when a substantial number of sampling points are dropped randomly). However, if the increased size of the triangles resulting from "re-triangulation" jeopardizes the spatial homogeneity assumption, you can consider these options:

1. FURTHER SAMPLING: Sampling points that do not provide information might result from poor-quality sampling that has missing cases in the investigated area, or from a low prevalence of malnutrition in the sampled locations. If quality of the data collected from the field teams is satisfactory, you might consider sampling extra villages in the sampling points that did not provide information to identify cases (this might also help clarify any doubt about the prevalence of malnutrition). In order to avoid null points when you expect a low prevalence of malnutrition, you might sample clusters of villages at each sampling point.

2. SPECIFIC LEGEND: You might decide to present the complete re-triangulation result on a map using a specific legend to underline the limited reliability of these new triangles (for example, dash the outline of these triangles). In any case of re-triangulation, both maps (with or without "post-survey re-triangulation") should be presented in the results and discussion of these results should be accompanied with contextual interpretation.

3. NOT PRESENTING THE RESULTS OF SOME AREAS: You might decide to leave some triangles blank/unfilled on the map. For example, you might exclude from re-triangulation all the triangles that are delimited by three sampling points without information. However, the methods developers should clarify this option, as it might be preferable for re-triangulation to be exhaustive.

However, the above advice should be considered with caution. We would recommend that the re-triangulation process be clearly explained in the new version of the S3M manual under development. In addition, if alternative techniques that might not need re-triangulation have been developed, these should also be described in the manual.

QUESTION 22

Spatial sampling approach and loss of variance/increased design effect: In S3M and stage 3 SQUEAC and probably in SLEAC when SAM prevalence is high we need few sampling points to reach the required sample size, (sometimes 3 sampled locations in 1 locality), Is the effect of generalizing results derived from e.g. three SPs in a locality of 60 villages - in terms of reliability - ignorable?

RESPONSE: This question points to one of the inherent complexities of these methodologies. In theory, if the sample is entirely homogeneous (high prevalence across the entire space sampled), then we can extrapolate safely. However, this assumption is often violated and relies upon contextual local knowledge. We do not feel that this can be ignored, but rather highlights the importance of choosing the methodology and its implementation to fit the context as well as the aims of the survey. Here it is also important to ensure that implementers are clear on the different types of sampling used and their strengths, weaknesses and objectives. S3M and stage 3 SQUEAC use different types of sampling with different ends. Standard cluster based sampling using population proportional to size are also subject to weakness. This technique may also lead to bias as sampling points are distributed across the survey area according to population size. Malnutrition prevalence, however, may not have a link to population size and density and is context dependent. The methods developers aimed to address issues of spatial heterogeneity using spatial stratification thereby aiming to capture more variance than cluster-based sampling.

QUESTION 23

Complete enumeration of SAM cases within the lot/ data collection point means there is no design effect for coverage estimates. When other indicators are included that depend on a second stage sample, then the effect of clustering must be taken into account. LQAS methods were not designed for use with 2 stage random sampling. Clarifications are requested.

RESPONSE: This is an important point that has been widely criticized in the published and grey literature. Here, we are suggesting to the developers to provide additional justification for this approach (i.e. not including the effect of clustering at the second stage). There is a wide body of literature on LQAS methodologies in other fields with documentation of methodological strengths and weaknesses.

However, it would be useful for the developers to provide explicit information on LQAS within the manual so that users may refer to the different options for second stage sampling.

QUESTION 24

Careful consideration for inclusion of indicators is needed with LQAS based methods. Some indicators have very high homogeneity within the lot (vaccination coverage, vitamin A supplementation, salt iodization), while others have low homogeneity (GAM, exclusive breastfeeding, hand washing). These indicators can also be very age specific changing dramatically by age in months. Robust methods with adequate sample sizes are needed to ensure stable survey estimates and efficient surveys that can capture more than one variable of interest.

RESPONSE: As in any survey including several indicators, sample size should be calculated for each of the most important indicators and for each of the targeted sub-groups/ strata (e.g. age sub-group). The highest sample size of the relevant indicators should be used to guide recruitment. The methods developers may want to mention this general issue in the guidelines.

QUESTION 25

In coverage survey reports reporting is often not done following nationally defined representative areas (See Sudan S3M 2013). This prevents using the results in global databases and comparison to other country level estimates.

RESPONSE: In principle, the spatial sampling should be consistent with national representative areas and this should be done for wide area estimates and at the country level, allowing comparisons. In the Sudan National S3M survey (2013), most of inhabited Sudan was investigated (apart from some areas bordering South Sudan inaccessible during the survey). State estimates were calculated (see executive summary available online[8]). Data might also be combined in a national estimate that can consequently be used in "global databases" to make comparisons.

4.2.3.3 | ANTHROPOMETRY

Several participants asked questions and made comments regarding anthropometric measures. Some of these were more focused on the need to ensure quality anthropometric measurements, but there was considerable discussion on which anthropometric measures to use when evaluating program coverage, as there are sometimes conflicting recommendations. We discuss some of these aspects below.

QUESTION 26

How do you classify recovering cases, e.g. those with MUAC ≥12.5 cm but still enrolled in OTP/TSFP because they haven't yet met the criteria of MUAC ≥12.5 cm for two consecutive visits at the time of the survey?

RESPONSE: The program exit criteria should be specified in the protocol and report of nutritional program coverage (e.g. MUAC≥12.5cm for two consecutive visits as in many protocols). As far as a child has not yet reached the exit criteria defined in the protocol of the nutrition programme, the child will be considered "in the programme" and will be accounted for in the "period coverage" equation. In this example, the child would be considered "in the programme" if the OTP protocol mentions MUAC≥12.5cm for two consecutive visits as exit criteria. However, such situations would not be very frequent in coverage surveys and would not influence substantially the coverage estimates. Description of such cases might be specified in the survey report.

In addition, comments from M. Myatt are available online: http://www.en-net.org/question/846.aspx.

QUESTION 27

When the regular CMAM program uses MUAC and W/H as admission criteria, shouldn't we use also MUAC and W/H for the coverage survey? Mark Myatt and CMN strongly advise to only use MUAC in coverage surveys, even if the regular programme use both MUAC and admission criteria. Isn't there a risk of leaving some children out of the coverage survey if we do so? What impact might this have on your coverage result?

QUESTION 28

In Sudan context where both MUAC ≥115 and <125mm & WHZ>=-3 z-score and < -2 z-score are used in admission into TSFP, some children enrolled with WHZ may be classified as not malnourished during SQUEAC surveys - what do you do in such instances?

QUESTION 29

In most coverage surveys, only MUAC data are collected. There is a variable correspondence between cases identified as SAM by MUAC and WHZ- due to variation between populations as well as variation due to data quality. While MUAC should be promoted for programming, MUAC and WHZ can be collected in surveys. Does survey coverage based on MUAC versus annual caseloads based on WHZ explain any of the incoherence of direct versus indirect estimates of coverage?

[8] *http://www.coverage-monitoring.org/wp-content/uploads/2014/12/Sudan_S3M-_2013_FINAL-Endorsed-EXECUTIVE-SUMMARY_25Nov2014.pdf*

RESPONSE TO: 27 28 29

RESPONSE: The relationship between prevalence of acute malnutrition estimated based on MUAC versus weight-for-height (W/H) has been explored and remains unclear. In 2007, Myatt and Duffield examined the relation between MUAC and W/H using 560 surveys[9] and concluded that the relationship was region-dependent. Other studies have suggested that the relation between W/H and MUAC may change according to the prevalence of malnutrition such that MUAC overestimates with low prevalence based on W/H and underestimates with high prevalence[10]. Also, recently, Laillou et al[11] reported that a MUAC cut-off <115 mm and a W/H cut-off <-3 identify different set of malnourished children, with hardly any overlap between the 2 indicators. Several other studies also showed that the MUAC criterion identifies different children from weight-for-height. This is largely because MUAC will be biased towards selecting younger malnourished children. This is considered a good characteristic because younger children tend to be at a higher risk of death. A necessary consequence is that MUAC-based case finding tends to exclude older children with low W/H.

Many publications have however emphasized the advantages of using MUAC including: better identification of children at high risk of mortality, simplicity of training, ability to allow high coverage and adherence to the WHO/UNICEF joint statement of maintaining consistency between screening method and admission criteria to avoid rejected referrals[12,13]. Because of these advantages, many organizations are now discussing moving to MUAC-only programs. With this approach, many have suggested that there remains a risk that some children at high risk of death will be excluded from treatment[14,15].

The SQUEAC methods developers advise to use only MUAC in coverage surveys because the W/H measurements are resource intensive and not suitable for a community based screening. That MUAC should be used in a coverage survey is not a matter of discussion. Yet, the subject of debate is whether W/H should also be included in coverage surveys to be consistent with W/H entry criteria used in some programs. This question is thus program dependent.

Usually, in CMAM programs, malnourished children are mainly identified in the community and referred to treatment based on MUAC/oedema[16]. Children admitted based on W/H will mainly be so through the health facilities when presenting for medical consultations. Consequently, children admitted based on MUAC/oedema would represent the vast majority of the beneficiaries. Thus, they might be considered as a fairly representative sample. Children admitted based on W/H may not be frequent enough to have a substantial impact on the coverage estimates[17].

By contrast, in programs where children admitted based on W/H represent a substantial proportion of the cases, relying on MUAC only would likely affect the coverage result[18]. However, the key issue is whether the barriers to access the nutrition program are different for children with low MUAC/oedema compared to children with low W/H only. Indeed, the main objective of a coverage survey is to assess the quality of the nutrition program and identify modifiable barriers.

[9] *Myatt M, Duffield A (2007) Weight-for-height and MUAC for estimating the prevalence of acute malnutrition. IASC Global Nutrition Cluster.*
[10] *Fernández MA, Delchevalerie P, Van Herp M (2010) Accuracy of MUAC in the detection of severe wasting with the new WHO growth standards. Pediatrics. 126(1): p. 195-201*
[11] *Laillou A, Prak S, de Groot R, Whitney S, Conkle J, et al. (2014) Optimal Screening of Children with Acute Malnutrition Requires a Change in Current WHO Guidelines as MUAC and WHZ Identify Different Patient Groups. PLoS ONE 9(7): e101159.*
[12] *World Health Organization, United Nations Children's Fund (2009) WHO child growth standards and the identification of severe acute malnutrition in infants and children: A Joint Statement by the WHO and the UNICEF. Available at: http://www.who.int/nutrition/publications/severemalnutrition/9789241598163/en/index.htm. Accessed 10 January 2014*
[13] *Guerrero S, Myatt M, Collins S (2009) Determinants of coverage in Community-based Therapeutic Care programmes: Towards a joint quantitative and qualitative analysis. Disasters. 34(2): 571–585.*
[14] *Onis M, Yip R, Mei Z (1997) The development of MUAC-for-age reference data recommended by a WHO Expert Committee*
[15] *Berkley J, Mwangi I, Griffiths K et al. (2005) Assessment of severe malnutrition among hospitalized children in rural Kenya: comparison of weight for height and mid upper arm circumference. JAMA. 294(5):591-7*
[16] *Myatt M, Khara T, Collins S (2006) A review of methods to detect cases of severely malnourished children in the community for their admission into community-based therapeutic care programs. Food Nutr Bull. vol. 27, no. 3 (supplement).*
[17] *Covered cases admitted based on W/H would be counted in the period coverage if they were picked up during a survey.*
[18] *It would be difficult to estimate in which direction (under or overestimation) this would influence the "point coverage". However, the "period coverage" would tend to be overestimated. Indeed, children admitted based on W/H only (i.e. with a MUAC above admission criteria) in the program at the time of the survey would be counted among "recovering case" but children not in the program with a W/H below and a MUAC above admission criteria will not be counted as uncovered cases.*

REMARK: ***The use of MUAC in coverage survey versus annual caseloads based on WHZ would not explain a substantial part of the incoherence between direct and indirect estimates of coverage. Contrast between direct and indirect estimated are discussed later in the report.***

If there is a reason to believe that barriers (and consequent actions) are different for both groups of children, it might be important to include W/H in the case-finding definition. If the expectation were for barriers to be similar, the survey would likely remain valid by using only MUAC in the case-finding definition.

As each program is different, each organisation should make its own assessment as to the costs and benefits of using MUAC only or both measures. If both MUAC and W/H are used, a sub-analysis might be conducted based on MUAC only.

Irrespective of the choice, the case-finding definition (MUAC only; MUAC and W/H) should be noted in the protocol and report of nutritional program coverage survey. It is also essential to note that the coverage results will only apply to individuals assessed by that specified case-definition.

In addition, see comments from M. Myatt available online: http://www.en-net.org/question/846.aspx

QUESTION 30

Coverage surveys often collect data from MUAC measures. Standardization of anthropometric measures is not adequately or systematically included in survey trainings and yet forms the basis for measurement quality. Bias in MUAC based estimates is common as tension on the MUAC strip varies significantly among data collectors. Accuracy in MUAC measures is often of some +/- 5 mm even in trained / skilled data collectors. Greater effort to eliminate bias in measurements and documentation of those processes are needed.

RESPONSE: We strongly recommend ensuring standardisation of MUAC measurements before field data collection. MUAC measurements are reported to be reliable and reproducible when assessors are properly trained and supervised. Similar standardisation procedures as those described for SMART surveys might be considered in coverage surveys. However, the SMART methods are suited for quantitative measures while MUAC is used as a qualitative measure in SQUEAC/SLEAC surveys. Consequently, after assessor training and before implementing a survey, users of SQUEAC/SLEAC might consider assessing the agreement inter- and intra-assessors using methods such as Cohen's Kappa.

This is not a specific concern of the coverage methods discussed here but a more general issue of data quality that applies in any situation where nutrition data are collected (e.g. nutrition program, nutrition survey, research in nutrition, etc.).

4.2.3.4 | QUESTIONNAIRE AND QUALITATIVE INFORMATION

Some of the questions were raised about qualitative information collected during coverage surveys.

QUESTION 31

Qualitative data in SQUEAC/S3M/SLEAC when assessing barriers to service access and uptake

i. Do we know how the users overcome the barriers? The survey allows to identify some barriers (for example the distance, workload etc) based on the information collected from non-users. But, how do we consider that other cases are overcoming the challenge?

RESPONSE: This point is interesting and highlights an important step following any survey: suggesting actions to reduce barriers and improve the intervention. Investigating and understanding how some users are overcoming challenges might help design appropriate measures to support non-users overcome the same challenges. Such information might be collected through semi-structured interviews with child caregivers in the program (by adapting the suggested structure in Box 1, SQUEAC/SLEAC manual p47) or informal group discussions with child caregivers in the program (as suggested in SQUEAC/SLEAC manual p46-50). Non-users might also suggest solutions. Both would be complementary.

ii. Is the way how questions are asked influencing the results (response bias)?

For example, we keep observing low awareness of program and malnutrition despite the massive scale up of CMAM, globally. Do mothers understand "Wasting" and "Malnutrition" differently? In other words, would mother respond the same way if asked: "Do you think that your child is (severely) wasted / has swollen body part?" versus "Do you think that your child is malnourished?" Also: "Do you know a program providing food / plumpy for children with severe wasting / swelling?" (showing the therapeutic food distributed in the area), versus "Do you know a program that treats malnourished-children?" The translation might be different in local language with consequent different answers (for example, malnourished might mean "the mother is not feeding the child well" which is different from the child being physically wasted / swollen). Hence, the following two questions need testing: "Do you think your child is severely wasted or is his/ her body is swollen?" "Do you know any program (in the health facility or not) providing plumpy/milk to severely wasted children?"

RESPONSE: We agree that the way a question is worded and translated will highly influence the response. This is an important point inherent to any methodology in every context.

The SQUEAC/SLEAC manual gives an example of a simple structured interview questionnaire that may be applied to caregivers of non-covered cases found during the surveys. The first question is "Do you think that this child is malnourished? => If yes, do you know of a program that can treat malnourished children?" We understand that this is provided as an example, and we strongly encourage piloting the wording, local understanding and translation of these questions before the start of any survey. The questionnaire and its translation should be adapted accordingly.

Local representations of malnutrition (its expressions, causes and treatments) will vary from one geographical and cultural setting to another, and will likely be very different from the representation given by nutritionists and scientists. If necessary, a qualitative approach (such as a focus group with local key informants) might help to find the relevant words (with the relevant meaning and avoiding stigma or other sensitive connotation) to translate how a mother would understand and describe "acute malnutrition" (in order to fit your program entry criteria and/or case-finding definition). If necessary, one might even use a pictorial tool. The wording in the local language should be in line with the awareness messages used to improve the populations' understanding of acute malnutrition and the nutrition program.

In the guidelines, the methods developers refer several times to

the importance of identifying and strictly following local terms and definitions familiar to the community (mainly when describing the active and adaptive case finding but this is a general recommendation that would apply for any kind of data collected in the community).

QUESTION 32

Review of the questionnaire in the SLEAC survey: the questionnaire seems to be reducing the importance of the other reasons for non-attendance, other than recognition of sickness and recognition of malnutrition.

One has the feeling these reasons (non-recognition of sickness and non-recognition of malnutrition) are always the 2 main reasons for non-attendance in program because these 2 questions are asked first and if the caretaker does not recognize her child as sick or malnourished, further questions of the questionnaire are not asked. So, a mother could see that her child is not well but because she says she does not know he is malnourished, further questions will not be asked about why she did not go to the health centre, in spite of knowing her child is not well. We therefore lose a lot of information on reasons for low access to treatment.

RESPONSE: This issue was already posted and answered in en-net.org forum in December 2013. Available at: http://www.en-net.org/question/1228.aspx

As mentioned in the preceding question, we would strongly encourage adapting any questionnaire to the specific context and objectives of any survey. Before starting any survey, questionnaires should be piloted. In addition, we would recommend using the "the filter" question with flexibility. Question 2 (Box 2, the SQUEAC/SLEAC manual p49) might be asked systematically, irrespective of the answer provided to question 1.

Another option would be that the methods developers review and validate the questionnaires and ensure the resulting questionnaires are widely available.

4.2.3.5 | LQAS HYPOTHESIS

Several participants asked questions and made comments regarding anthropometric measures. Some of these were more focused on the need to ensure quality anthropometric measurements, but there was considerable discussion on which anthropometric measures to use when evaluating program coverage, as there are sometimes conflicting recommendations. We discuss some of these aspects below.

QUESTION 33

Comments on "simplified LQAS classification technique" proposed for use in SQUEAC and SLEAC assessments. Refers to SQUEAC/SLEAC manual pages 69-72 and 121-122, p. 198-200. http://www.fantaproject.org/sites/default/files/resources/SQUEAC-SLEAC-Technical-Reference-Oct2012_0.pdf

The methods developers propose to use the LQAS decision rule for classifying coverage "accurately and reliably" in small samples of severely malnourished subjects which are used in SQUEAC and SLEAC assessments. The decision rule is intended to classify the coverage as "higher" ("meets or exceeds the standard") or "not higher" ("does not meet or exceed the standard") than 50% (the Sphere standard for coverage in rural areas). Sampling is without replacement, and sampling ratios can vary depending on the size of the area. The methods developers propose to derive the threshold value d by dividing the sample size by 2, and rounding down if the product is not a whole number. The area is classified as above 50% coverage if the number of covered subjects in the sample is larger than the threshold value, and classified as below 50% if the number of covered subjects is equal or smaller to threshold value. The methods developers state (p.198): "The method is "simplified" because it does not bother the user with matters such as the selection of appropriate probability distributions, specification of lower and upper triage thresholds, or the specification of provider and consumer errors."

In reality, however, this is identical to making a decision based on observed prevalence of coverage in the sample: if the observed coverage is above 50%, even by one percentage point, the area is "classified" as above 50%, and if observed coverage is below 50% the area is classified as below 50% coverage. In the example with the sample size of 50, the area would be "classified" as above 50% coverage if the number of covered cases is 25, equivalent to observed prevalence of 50%, and classified as below 50% if the number of covered cases is 24, corresponding to prevalence of 48%. This type of faulty inference is illustrated in Concern 2C, page 66 of the recent paper by Rhoda, Fernandez, Fitch and Lemeshow, published in the International Journal of Epidemiology 2010; 39:60-68.

The methods developers then proceed to justify this method in the Technical Appendix (p.198-200). They specify the LQAS model with lower threshold of 40% and upper threshold of 60% and surmise that alpha error (the probability of classifying the area above the threshold when in reality the coverage is below) is likely to be small enough. This proposed model cannot be used to derive error values for the method proposed by the methods developers (classifying prevalence as above or below 50%) because the threshold values specified are 40% and 60%. To be able to derive alpha error value for classification at 50% prevalence level, this prevalence level has to be specified as a lower threshold P0 in the model (see Rhoda et al., p.62). To conclude that the area has >50% coverage with sufficiently small alpha error, the threshold value needs to correspond to prevalence substantially above 50% (see Rhoda et al. paper, page 67, Recommendation 3 and 5), especially if sample size and sampling fraction are small. In the method proposed by the methods developers, the threshold value coincides with 50% prevalence, and therefore results in a very large alpha error. Depending on the sample size and the sampling fraction of the survey this error can be as large as 0.5, or 50%. Large alpha error denotes high risk of erroneously declaring the services adequate when in fact they are substandard. Keeping alpha error (also called "consumer error") low is essential for protecting beneficiaries, and these high levels of alpha error have never been used (to our knowledge) in the published LQAS studies.

In summary, the method of deriving the threshold value proposed by the methods developers is very problematic, as it results in high risk of "false positives" (i.e., classifying the coverage as adequate when in fact it is not) to the detriment of the beneficiaries. The methods developers need to correctly specify the underlying model (including 50% as a P0 threshold, as described in Rhoda et al., p. 62) and derive the decision rule high enough to ensure sufficiently low alpha error, especially in the situations where sampling ratios are low. Of course, the comments above apply also to suggested decision rules proposed by the methods developers to classify at 70% coverage benchmark, which is the Sphere standard for urban areas.

RESPONSE: We agree that the simplified LQAS methods would benefit from further clarification and we share your concern about the risk of high alpha error in case of a low sampling fraction.

We agree that, as stated in Rhoda et al.[19], to conclude with sufficiently small alpha error that a lot/area has coverage >P0, the quotient "d/n" would need to be substantially above P0. If the quotient "d/n" is too close to P0, the alpha error would increase and might become as large as 50% (or more), especially if sample size and sampling fraction are small.

The explanation in the guideline could be revised to provide clear guidance. Indeed, in the appendix (p199-200), the lower proportion threshold P0 is set at 40% and the upper proportion threshold at 60%. As in LQAS, where the lower threshold constructs the null hypothesis, the latter would consequently be stated as "the coverage is ≤ 40%". Using a quotient "d/n" of 50% (thus > P0 [i.e. 40%] and equivalent to the so-called "swing point") might be relevant. However, this would allow rejecting (or not) the null hypothesis of a "coverage ≤ 40%" (but not a null hypothesis of a coverage ≤ 50%). Consequently, to conclude that the coverage "exceeds or not the standard" may be confusing to implement because it seems to refer to the 50% Sphere standard (that would not fit the null hypothesis). In this example, we think that, if the current lower threshold P0 and "d" calculations are kept, the decisions taken should be rephrased as "the lot/area coverage exceeds/does not exceed 40%". Alternatively, in order to classify a lot as above or below the "standard", the methods developers should select this "standard" as a lower threshold P0 and adapt the calculation of "d" accordingly. This calculation of "d" should ensure that the alpha error is kept low (and this would definitely not be guaranteed if the quotient "d/n" is equivalent to the "reference standard"). We recommend modifying the guidelines accordingly (and this might be extended for LQAS classifications in more than 2 categories).

We would also like to insist on the need to clarify the sampling fraction. When the sampling fraction is low (i.e., n, the sample size is < N, the total target population), the risk of alpha and beta error might be very high, especially if the sample size is small. When the sampling ratio is high (as in the example[20] on p.199 with n=11 and N =14), the risk of alpha and beta errors will decrease and this might need to be accounted for in the calculation of "d". Implementers should consider that although high sampling fractions might be realistic in some surveys of SAM coverage in small areas, it might not be the case for other surveys such as surveys on MAM coverage, or in a wider area. Due to the important influence of the sampling fraction on the errors, we recommend that the methods developers clarify the impact of the sampling fraction on the interpretation of results in the guidelines.

It is also important to point out that questions concerning LQAS methodologies are greatly debated. The methods developers report that a simplified (i.e. compared to standard LQAS) method was found to be useful and resulted in acceptable errors in simulations and in field tests (undertaken by World Vision and VALID International and recently reported in Field Exchange)[21]. The simplified LQAS classifier was tested against operational requirements (i.e. relating to probability of classification, overall error, and probability of gross misclassification error) and was found to function as required in the report. As operational requirements may change, at a minimum, classification rules should be reviewed and references provided to users so that they may adapt accordingly.

Simplified LQAS is used in SQUEAC for both classification and hypothesis testing. Simplified LQAS is used in SLEAC for classification. LQAS in SQUEAC is used to confirm (or deny) hypotheses generated using SQUEAC stage 1 (and in some cases some SQUEAC stage 2) data. The methods developers' report that the risk of error discussed above is small.

Nevertheless, debates concerning different approaches in terms of the theoretical underpinnings of this methodology remain and merit further discussion in the peer-reviewed literature and user manual. This is important to ensure that there is an understanding of methodologies by users and programmers.

[19] *Rhoda D, Fernandez S, Fitch D, Lemeshow S. LQAS: User Beware. International Journal of Epidemiology 2010; 39:60–68.*

[20] *As a remark, using the LQAS sampling plan calculator on line http://www.brixtonhealth.com/hyperLQAS.findD.html and the hypotheses of page 200, an alpha and beta error of 0.0656 can be obtained instead of the 0.1538 presented in the guidelines.*

[21] *Asrat Dibaba, Charles Chimombo, Ari Uotila, Whitney King and Mark Myatt (2014). Comparison of LQAS and 30-by-30 two-stage cluster sampled survey method for the assessment of coverage indicators. Field Exchange 47, April 2014. p29. www.ennonline.net/fex/47/indicators*

QUESTION 34

When hypothesis testing on LQAS samples are done in coverage surveys, there needs to be a validation that the test errors are on the side of the beneficiary (Rhoda et al, 2010).

RESPONSE: This comment is linked to the previous. It is essential to minimize the alpha error for beneficiaries. "To believe that errors will be small" as stated on page 199 merits further discussion. The alpha and beta errors are cornerstones of the LQAS methods and users of the simplified LQAS should be able to estimate the alpha error resulting from their sample size (also accounting for the sampling fraction) without the need for sophisticated calculations or software. There is a clear advantage to simple methods, where all calculations can be done by hand, but it is important to ensure that users understand these calculations and their applications. We would advise the methods developers to add more explanations about the alpha error for the users of the simplified LQAS.

This might be presented with additional explanation on the beta error. Indeed, it seems relevant for the users to understand that if a design with a low alpha error allows rejecting the null hypothesis where truly the coverage is good, the same design might still have a high beta error and classify many lots as having low coverage when they actually have good coverage (i.e. not enough evidence to reject the null hypothesis). Understanding the power and beta error might also sometimes limit disappointment of the program managers.

4.2.3.6 | BAYESIAN APPROACH AND CALCULATING THE PRIOR

The following questions suggest that there is a need to provide further clarification and validation for the calculation of the prior and posterior in the Bayesian approach. The comments are answered all together.

QUESTION 35

How to minimalize the subjectivity of assigning weights to barriers and boosters in SQUEAC?

QUESTION 36

There is potential for a wide range of interpretation and confusion in calculating the prior during a SQUEAC, particularly with less experienced field staff which makes the process prone to error. I would suggest more clarity, guidance or standardization in the process to come up with the prior.

QUESTION 37

Bayesian methods can be defended from a methodological point of view. In real implementation conditions, tests are needed to demonstrate that these Bayesian methods (based on assumptions) for coverage estimates have validity greater than simple estimates. Are they critically affected by the poor quality of information that is available to include as inputs to the equation?

QUESTION 38

There is potential for a wide range of interpretation and confusion in calculating the prior during a SQUEAC, particularly with less experienced field staff which makes the process prone to error. I would suggest more clarity, guidance or standardization in the process to come up with the prior.

QUESTION 39

Bayesian methods can be defended from a methodological point of view. In real implementation conditions, tests are needed to demonstrate that these Bayesian methods (based on assumptions) for coverage estimates have validity greater than simple estimates. Are they critically affected by the poor quality of information that is available to include as inputs to the equation?

QUESTION 40

Comments on using Bayesian technique to estimate overall program coverage. Refers to SQUEAC/SLEAC manual pages 73-92

The authors propose using Bayesian technique to estimate program coverage in a given area. Instead of directly using the coverage prevalence obtained in a survey, they advocate for using a conjugate analysis where "small-area survey results" (likelihood) are combined with the "informed guesstimate" about what the coverage is likely to be formulated prior to the survey (prior). The final prevalence estimate (posterior) resulting from such conjugate analysis depends on the mode and distribution density of both likelihood (coverage observed in a survey sample) and prior (coverage "estimated" from contextual data prior to survey). This method presumably increases the precision of the estimate, and depending on the credibility (or accuracy) of the point estimate (or mode) of the prior may increase or decrease the bias. One problem with the proposed approach lies in the limited ability of the average survey manager to accurately estimate both the credible value for the mode as well as degree of uncertainty around this mode described by minimum and maximum probable values. Although many techniques in the SQUEAC "toolbox" can be very useful in understanding the spatial variations in coverage, barriers and boosters to coverage, whether admissions are "early" or "late" and many other aspects of the program, they do not necessarily allow for accurate estimation of the absolute coverage prevalence in a given area. The techniques to derive a credible value of the mode of the prior described in the manual are also of limited utility. For example, as the authors themselves demonstrate, the method of adding positive and subtracting negative findings is very imprecise and "can produce silly results" such as estimates very close to 100%. Weighting positive and negative factors requires much sophistication, can be confusing to many, and does not necessarily result in better estimates. Another approach proposed by the authors uses estimates of program performance (such as proportion of all cases found and referred for treatment, proportion of those referred who accept referral and present for treatment, etc.) to arrive at expected program coverage. Since these proportions are themselves only approximate estimates, and the coverage estimated this way is a product of 4 or 5 of such estimates, the final result may be quite far from reality.

Most importantly, as the authors state on page 91 (1st paragraph), in reality the mode of the prior proposed by survey managers is almost always higher, and often substantially so, than the proportion coverage observed in the survey. Unless these priors are more accurate (i.e., closer to the true population coverage) than the coverage estimates from the surveys, they would result in a substantial and systematic bias overestimating coverage, since the coverage observed in the surveys would almost always be revised upward driven by high prior modes. On the other hand, the authors do not present any empirical evidence to prove that modes of the prior estimated by the survey managers are consistently and sufficiently credible, in other words, that using Bayesian "correction" of the survey results in more accurate estimate of the true population coverage than the survey estimate itself.

To justify using Bayesian methods in SQUEAC assessment, there needs to be a body of evidence clearly demonstrating not only that survey managers can "guesstimate" a mode of the prior "close enough" to the true population coverage, but also that posterior estimates resulting from the conjugate Bayesian analysis are consistently more accurate (i.e. closer to the true population coverage) than surveys estimates of the coverage alone. Until such evidence is available, there is no sufficient justification for routine use of Bayesian method in SQUEAC assessments.

If modes of the priors are systematically too high as is often observed in the field, using Bayesian methods would result in systematic overestimation of the coverage, and thus in increased risk of erroneously concluding that the coverage is adequate where in fact it is substandard. Decreasing variance through use of Bayesian analysis cannot alone justify introducing large bias, often of a systematic nature, into coverage estimates. Is there any objective evidence that SQUEAC assessors can consistently develop accurate priors? Is there objective evidence if priors tend to be consistently higher than the likelihood estimates, and what is the magnitude of the discrepancy?

QUESTION 41

Have there been instances when SQUEAC assessors followed the guidance of the manual and actually conducted a new likelihood survey when there was a discrepancy (conflict) between prior and likelihood?

On page 91 of the manual (last paragraph) the authors state: "There is nothing that you can do to fix the problem if the prior and the likelihood conflict other than report the problem or start the survey from scratch with a more realistic prior and collect new data." In other ways, in the case there is a large discrepancy (conflict) between prior and likelihood prevalence, those conducting SQUEAC assessment MUST either declare that they could not estimate coverage at all, or (preferably) start the process anew, including developing a new prior, and most importantly, conduct a new small-area survey.

RESPONSE TO: 35 36 37 38 39 40 41

The main objective of the SQUEAC is to understand barriers and boosters. Consequently, the information used to calculate the prior is the corner stone of the assessment. If the available information is reliable, calculating the prior is an interesting exercise that makes the programme manager critically interpret the impact of program barriers and boosters on coverage. However, we recognize that this process is susceptible to subjectivity and not straightforward, especially for first-time users.

It seems difficult to fix any rule to provide weights to specific barriers, as they have different impact on different programs. Consequently, there will always be uncertainty about the value of the prior mode. The methods developers suggest different procedures to translate the prior information into the mode of a probability density: un-weighted scoring, weighted scoring, scaling the maximum score. It may be important to have one standardized procedure to avoid subjectivity.

In addition, the above comments rightly point out the importance of establishing a body of evidence to demonstrate clearly that SQUEAC assessors can consistently "guesstimate" an accurate mode of the prior. To do this, on the one hand, it might be useful to assess (or report if already done in practice) the reproducibility of the prior estimates, for example by comparing the prior mode and minimum/maximum probable values estimations of different (groups of) assessors working independently with the same program data. On the other hand, it might be necessary to provide evidence that assessor can estimate a prior mode "close enough" to the true population coverage based on information sometimes of questionable quality (i.e. routine data). At the minimum, empirical evidence from previous SQUEAC surveys might be provided.

The above comments also point out the importance of demonstrating that posterior estimates resulting from the conjugate Bayesian analysis are more accurate (i.e. closer to the true population coverage) than surveys estimates of the coverage alone. For example, slight discrepancies between the prior and the likelihood might get unreported and result in slightly overestimated coverage where assessors tend to minimize barriers. In such situations, the posterior might be less accurate than the likelihood alone. As suggested in the comment above, it might be interesting to review previous coverage surveys to quantify the frequency of such overestimation of the prior and to report the magnitude of influence on the posterior.

The added value of the beta binomial conjugate analysis compared to surveys estimates of the coverage alone are
1. to ensure the programme manager critically interprets the impact of program

barriers and boosters on the program coverage and

2. to allow a smaller sample size of the stage 3 SQUEAC and consequently to reduce the cost. This second point suggests that where it is possible to reach an appropriate sample size (without correction with alpha and beta prior), the likelihood might be enough and the prior not necessary (which might be equivalent to replace SQUEAC stage 3 by the SLEAC survey technique). However, the consequent increase in expense should be considered and the process of translating barriers and boosters into coverage would be lost. Users should not be tempted to use Bayesian approaches to compensate for the limitations of very small sample sizes. These would provide misleading results as the posterior coverage would be dominated by the prior.

The way to deal with substantial discrepancies between an inaccurate prior and the likelihood should be clarified. Such conflict jeopardizes the interpretation of survey results. On page 91 of the manual, the methods developers state that in such situations, the assessors should "either declare that they could not estimate coverage at all, or (preferably) start the process anew, including developing a new prior, and most importantly, conduct a new small-area survey". We did not conduct an exhaustive review of all coverage survey reports but we found 8 surveys[22,23] reporting a prior-likelihood conflict (6 of them with a prior lower than the likelihood). We searched only for surveys using the criteria listed[22]. The overall coverage estimate was rejected in two surveys. In one survey, the posterior was reported. In another, the uncertainty of the prior was increased and the posterior recalculated afterwards. In four surveys, the likelihood estimate[24] was adopted. None of the reports reported the conduct of new survey. Clearer guidance seems necessary to ensure user understanding of interpretation of results in this scenario.

4.2.3.7 | "POINT COVERAGE" AND "PERIOD COVERAGE"

QUESTION 42

The period coverage indicator needs review for validity.

QUESTION 43

Reporting of coverage results is given in point or period prevalence. These indicators are often juggled and not reported in a standard manner.

QUESTION 44

Comments on using "point coverage" and "period coverage" estimators to report coverage prevalence. Refers to SQUEAC/SLEAC manual pages 104-106.

The authors propose to decide whether to use point or period coverage estimators depending on the characteristics of the program (p.106): "If the program has good case-finding and recruitment and short lengths of stay then the period coverage estimator is likely to be appropriate. If the program has poor case-finding and recruitment and long lengths of stay due to late presentation and/or late admission then the point coverage estimator is likely to be appropriate."

The authors however do not provide any concrete guidance what is considered a good versus a poor case finding and recruitment, and how to define short versus a long length of stay. Not having clear objective (preferably numeric) thresholds for these criteria is problematic, as the decisions on which estimator to use becomes open to wide interpretation. As the authors show mathematically, the period coverage is ALWAYS higher than the point coverage when derived from the same coverage data, and discrepancies can be very large (such as 0% vs. 94.4%; or 25% vs. 73.5%, see example on page 105). There may be a strong bias to always use period coverage as it shows higher coverage and therefore makes the programs look better. This may be detrimental to the beneficiaries if inadequate programs are judged adequate because period prevalence is used instead of the point prevalence. There are ways to quantify the use of period vs. point coverage based on the survey results. For example, the use of period coverage should be allowed ONLY if the number of current cases is MUCH lower than the number of recovering cases (by 6-7 times, as in the first example on page 105); otherwise, if the ratio of recovering to current cases is less than 6 (or whatever number is decided), then point coverage must be used. In addition, the authors explicitly prohibit from reporting both point and period coverage estimators (p. 106), therefore in cases where the choice of the estimator is judged wrong post hoc there would be no way to know the value of the other estimator that would have been more appropriate to report.

What percentage of SQUEAC assessments report period coverage, and what percentage report point coverage? Has there ever been a comprehensive audit of whether the choice of the estimator to report (point or period) in SQUEAC assessment reports was actually correct, and properly justified? Has there ever been a defined clear numeric criteria or decision tree to objectivize this extremely important decision on what indicator to use (e.g., what length of stay is considered "short" versus "long", how is defined "good" vs. "poor" case-finding, etc.)? Would it be more appropriate to mention in the report the value for both point and period coverage, and then provide a justification as to why one should be used and not the other?

[22] *Survey reports were downloaded from CMN website in September 2014. An automatic search was made for reports including the words "(conflict OR overlap) AND prior AND likelihood". These documents were checked for reported prior-likelihood conflict. Although the CMN website is augmented regularly, this search was conducted in September and included only reports using the abovementioned search-criteria. This search aimed to look at reports specifically mentioning the above key words only.*

[23] *Meyu Muluke woreda, Ethiopia, 2013; Guri, Birnin Kudu & Gwiwa LGAs, Jigawa State, Nigeria, 2013; Garbatulla district, Isiolo county, Kenya, 2012 ; Northern Rakhine State, Maungdaw and Buthidaung ownships, Myanmar, 2011 ; Fune LGA, Yobe State, NIGERIA, 2011 ; Mogadishu CTC; Somalia, 2013; Freetown, Sierra Leone, 2013; Kisantu: DRC, February 2013.*

[24] *Three of them using the SQUEAC Bayes calculation using values 1:1 for α and β*

RESPONSE TO: 42 43 44

We did not review coverage surveys to assess which proportion reports point coverage or period coverage. However, it might be interesting to do so and to assess whether the choice of the indicator (point or period coverage) is well justified and appropriate.

We agree that the choice and reporting of point or period coverage might be more standardized. Because the period coverage will likely be higher, assessors might be tempted to choose this indicator instead of the point coverage and risk creating bias. Consequently, the choice between coverage indicators might gain in objectivity with further guidance.

It may be useful to suggest numeric references (quantifying program characteristics) to guide the indicator choice (e.g., What length of stay is short enough and what "case-finding" is good enough to allow reporting the period coverage? Which ratio of current cases compared to recovering cases in the program?).

Although the methods developers mention that it is not appropriate, the alternative would be to systematically report both indicators, together with program characteristics to allow their interpretation (e.g. length of stay, proportion of uncomplicated incident cases [due to early treatment seeking behaviour and timely case-recruitment], MUAC at admission as a proxy of timeliness of admission).

Based on all the reported information, the assessors might then discuss in their report and justify the indicator that would better fit their program (also the indicator on which the prior estimation would be based).

We think that reporting both indicators might avoid confusion when comparing coverage of the same program over time (as performance might change and consequently the most appropriate indicator) or over geographical area (see next question).

This discussion goes beyond the scope of SQUEAC/SLEAC/S3M methods (in other words, the distinction between point and period coverage also applies to any other coverage methods).
Coverage indicators are problematic (this is clearly mentioned in the SQUEAC/SLEAC manual) and might need revision. The influence of the length of stay and timeliness of case finding needs further reflection. As the methods developers rightly state on page 22: "Long treatment episodes may be due to late admission or poor adherence to the CMAM treatment protocol by program staff and beneficiaries". A program improving/reducing its average length of stay might reduce its period coverage, all other things being equal. For a same number of SAM cases in the population a program with a very early case-detection would have a lower point prevalence (covered cases becoming quickly "recovering cases") - even if access to care is granted for majority of the children - than a program with late admission. The Sphere standard itself might need to account for the length of stay and the timeliness of admission.

Research on this issue, particularly on the development of a single coverage estimate, is currently ongoing and might be published soon according to several sources.

REMARK: ***Examples given on page 105 of the SQUEAC/SLEAC manual should be considered as extremes that would be exceptionally encountered.***

QUESTION 45

Choice between point and period coverage for a national survey:

Although the basic principles on when to use point and period coverage are quite clear, using one or the other for a national survey might be penalizing for some health districts, as not all of them have the same level of performance, active case finding and duration of stay (there is usually major differences in health districts supported by NGOs and those not supported by NGOs). Can you therefore use different coverage estimators for different health districts, not being at the same level of progress in a national survey (some districts have good case finding and short duration of stays; others have low case finding and long duration of stay)?

RESPONSE: This comment relates more to application and synthesis of findings. As mentioned, national surveys are usually heterogeneous and highly dependent on program performance at a more local level. There is nothing inherently wrong with presenting national coverage estimates using different estimators for different health districts as long as they are reported as such, however, this would make comparison less straightforward. It would be essential to explain this within the context of the survey report and the justification of the choice of the indicator should be clearly specified. Interpretation of national survey results would be easier if one or the other indicator was used but the choice might not be easy. Again, a clear option would be to report both indicators.

4.2.4 | AGGREGATED VALUE AND INTERPRETATION OF RESULTS AT DISTRICT OR NATIONAL LEVEL

Several participants raised questions or comments that focused on the methods and limitations of reporting a weighted or an aggregated coverage value.

QUESTION 46

S3M - The maps produced together with the aggregate values enhance misjudgement:

The S3M has no way of doing weighted analysis, because, the triangular areas are artificial and weight is almost impossible to get. Hence, the aggregate value that is reported in earlier reports does not make sense. Its strongest point is at mapping and showing the status spatially. Even the mapping is itself misleading. If there is a situation where wide area survey shows low performance in almost all areas but better performance at the few urban areas of higher population density, then the mapping will mislead as if a large proportion of the population is weakly performing because we tend to assume that distribution is uniform. Unfortunately, our judgment is also supported by the aggregate coverage. Hence, some method has to be developed to clear this confusion supported by the aggregate value.

RESPONSE: This is an important comment and there is a clear limitation to visual representation (mapping) without any inherent weighting mechanism to inform an aggregate estimate if one is needed, which is true in any methodology.

The strength of the S3M methods is to provide a detailed visual representation of coverage from regional up to national-level. The idea is to provide results that would directly be useful for programmatic/operational purposes (to guide the reinforcement of interventions). To that end, the value at the triangle/area level is more useful than the aggregated value. The latter estimate, however, is sometimes requested from donors or other institutions/organisations and should consequently be calculated.

The assumption in the S3M survey is that the coverage is uniform at the triangle level (though not at the level of the all area investigated[25]). If the coverage is heterogeneous between triangles, the relevance of an aggregated indicator itself is questionable and subject to the same limitations as all weighting procedures based on population. This being said, an un-weighted aggregated estimation would definitely be misleading because of the variation of the target population density over the overall area. Unfortunately, the distribution of the density of the target population is not easy to assess, and it is not always directly linked to the density of the general population. For example, the weights needed to estimate the aggregate coverage of a nutritional program would be the density of children with acute malnutrition that might not necessarily be higher in a dense urban area compared to a less dense rural area. An advantage of the S3M method is that you might try to collect data in order to assess this population variation when visiting each sampling point – and this might provide better information to derive weights compared to any administrative information from the location.

Methods to calculate the aggregated value (with confidence interval) include bootstrapping approaches[26]. The developers of the S3M methods are developing an open-source software (based on R software and language). To our knowledge, this software is not yet available but will hopefully become fully user-friendly soon. As this becomes available, it would be important for the developers to provide a detailed methodological appendix that accompanies this software. In any case, the aggregated value should not be interpreted independently from the overall map coverage. You might also add more information on the coverage map itself. For example, you might add information on the population densities in the area (if this is available) or you might otherwise identify urban areas (dashing these areas for example).

The methods developers mention in the SQUEAC/SLEAC manual (p109) that "Coverage is complicated and can rarely be adequately summarised by one number (i.e., the overall coverage estimate). Any report of overall program coverage should be accompanied by contextual information that enables the overall coverage estimate to be interpreted correctly". This also applies to S3M.

[25] *The methods developers suggest to assess heterogeneity "by eyes" or using a chi² test – see SQUEAC Manual.*

[26] *Utilizing re-sampling with replacement of the sampling points replicated thousands of times.*

QUESTION 47

When coverage is not heterogeneous, it's not useful to have one coverage figure – even though that's what all donors want. Is there a way to present spatial coverage (or small scale coverage surveys) ensuring that the sample size is large enough? Mapping coverage seems to use very small samples from each quadrat. For example, presenting coverage by catchment area probably only includes coverage from 1 or 2 sites, which isn't very representative

RESPONSE: As pointed out in the comment, this is a usual and frequent problem. Although donors may request one coverage figure, this may not be appropriate for planning and program monitoring purposes on a smaller spatial scale. The methods developers rightly mention that on p107 and 109 of the SQUEAC/SLEAC manual ("If coverage is patchy, it is reasonable to not estimate overall program coverage"). It would be important to highlight the purpose of the survey itself. If the survey was designed to cover a large area and the sampling scheme designed as such, then the results should be presented in this manner. Alternately stated, the results are only as representative of the survey itself. Precise estimates for small areas are not obtainable without investing in a reasonably large sample size for the entire area. Further, if the aim of the survey is to present disaggregated estimates, as an overall estimate is not desirable, this should be considered from the outset in the design.

This comment is also linked to underlying assumptions of the methods, i.e. the homogeneity of coverage in each quadrat and the quasi-exhaustive of the case-finding strategy (see question 16). Only if these assumptions are satisfied, a small sample might be representative of a quadrat.

QUESTION 48

The weighting of survey results in the different coverage methods needs review. In some cases, no weighting is recommended, where others recommend posterior weighting of results. Sensitivity testing and validation of weighting methods is recommended.

RESPONSE: Several approaches for calculating the aggregated value are proposed/reported from no weighting (e.g. SQUEAC stage 3), posterior weighting on the number of cases (or on population estimates), or bootstrapping. It might be interesting to compare, possibly based on data from previous surveys, aggregate estimates of coverage calculated based on the different approaches. However, it might not be relevant to recommend a single weighting approach but rather presenting the different options in a section of the manual. If there is evidence that the different weighting approaches (including no weighting) make little differences, this should be shared with the users.

QUESTION 49

In coverage survey reports, often the recommended global indicators are not used as they are considered incorrect, such as the recommended IYCF indicators. This prevents using the results in global databases and comparison to other country level estimates.

RESPONSE: It is important to remember that the aim of the SQUEAC/SLEAC/S3M is to provide a visual representation of coverage – consequently, the primary goal is not to assess the global coverage value (that might be the primary objective of a cluster/PPS survey). Here again, clarifying the weighting methods might help a better acceptance of global indicators. With appropriate weighting methods, there is no reason that global indicators assessed in a coverage survey might not be compared to other country level estimates if the comparison is of the same indicator and is appropriate for the study design and sample size[27].

4.2.5 | VALIDITY AND COMPARABILITY OF RESULTS

Participants also posed questions about the comparability of results obtained using different methods. Methodological validation of any of the methods is well beyond the scope of this review, but given the interest in doing this formally, we believe that this may be a pertinent activity in the near future. Some of the responses below are more general, but others touch on specific aspects of the methodologies that may be controversial. It is our hope that these responses serve as the first steps of a framework for more in-depth and independent work on this very important topic.

QUESTION 50

There is general agreement that Probability Proportional to Size (PPS) samples will over-estimate SAM coverage because the sample is proportional to the population and has a higher probability to select multiple clusters in more populated areas which may impact coverage estimates- however this will depend on the conditions in each country.

For example, in Bangladesh there are millions of urban children with SAM while in Senegal very few. The spatial sampling techniques, which do not favor populated areas, are considered to be more accurate for SAM coverage estimates (for example as captured in Spatial Sampling methods and discussions on EN-Net). In the one review identified of coverage estimates using the two methods, the PPS sample underestimated coverage compared to spatial sampling (Myatt et al, 2005). Clarification is welcome.

RESPONSE: First, we would like to add nuances the above comment:

1. Coverage is not systematically higher in an urban area than in a rural area. If geographical barriers are less important, other barriers may also play a role. Consequently, PPS will not systematically end-up with higher coverage than the SQUEAC/SLEAC.

2. In Myatt et al 2005, we do not think that there was evidence for a real underestimation of the coverage estimates using the two methods, as the confidence intervals were very wide. This publication instead illustrates that the CSAS methods can reach higher sample size that EPI/PPS and consequently provides a point estimate with better precision.

3. That "PPS samples will over-estimate SAM coverage because the sample is proportional to the population and has a higher probability to select multiple clusters in more populated areas which may impact coverage estimates" is a bit misleading. It seems to point to biases where they are not. This issue was well explained in http://www.en-net.org/question/865.aspx : "In short, selection of PSUs using probability proportional to size produces a sample which is representative of the entire population with respect to the size of the village or town in which the households are located. It does NOT produce a biased or disproportionate sample unless something is done incorrectly."

This being said, this comment raises an important point, which addresses a fundamental difference in the main objective of the two approaches (Cluster/PPS/SMART versus SQUEAC/SLEAC/S3M). PPS sampling weights are based on population size – and provide one single overall estimate representative of the target population. Spatial sampling methods have been proposed to map coverage (calculating an aggregated value can be seen as a secondary objective). Again, this is clearly explained in http://www.en-net.org/question/865.aspx : "If a primary goal is to map heterogeneity, then pick a design that will reasonably answer that question. If a primary goal is to estimate overall coverage, use a design that will reasonably answer that question. No one survey type is perfect for all purposes." We can simply comment that before embarking on any sampling scheme it would be essential to ensure that it is the most appropriate for the survey objective and that the underlying assumptions of the methodologies are explored and highlighted. This is also essential when results are reported.

The limits of each sampling scheme should also be known. One limit of a cluster/PPS/SMART survey to assess SAM coverage is the limited sample size that can be reached and the resulting low precision in the estimations (although this might not be the true for cases for other indicators such as IYFC or even MAM coverage). Second, in theory, the PPS should be based on the density of children with SAM

[27] *Some indicators are not appropriate for small sample size because they focus on a narrow age range and estimations would therefore results in wide confidence intervals.*

density (that might not necessarily be higher in a dense urban area compared to less dense rural area) rather than the total population. Third, cluster/PPS/SMART do not allow presenting spatial coverage.

QUESTION 51

Spatial sampling uses maps as the sampling inputs instead of the national master sample. There is no doubt that maps are usually more up to date compared to national sample frames, as maps are updated more than once a year. Sample frames are updated once every 10 years. Greater clarification is needed on the comparability of estimates produced by PPS and spatial sampling methods.

RESPONSE: This question is linked to the previous one in that inaccurate population figures might be a limitation when using a PPS strategy. Updating of population information is variable temporally, spatially and dependent upon context. However, it should be kept in mind that the relative size of the PSUs compared to each other is more important than exact population figures. Nevertheless, such relative size might be inaccurate. Here, it would be important to consider in each context what basic population demographic and spatial data is available before selecting a sampling scheme. We prefer to insist on the fact that this information first be obtained, explored, and used to guide possible methodological choices. Population data can be collected during survey data collection although it would be preferable to have this information prior to the start of a survey. Specifically with respect to PPS samples and spatial sampling, the results would be comparable although the weighting applied would be different, with both reliant on accurate population data.

QUESTION 52

S3M - The comparability of aggregate values of Infant and Young Child Feeding (IYCF) or other indicators against cluster survey (based on a PPS sampling approach) needs through investigation. At the moment there is no way to validate whether the aggregate score of spatial surveys matches with the cluster surveys we are used to.

RESPONSE: We are not aware of comparisons between S3M surveys and cluster surveys based on a probability proportional to size (PPS), and we agree that such a comparison might be useful in validating the aggregated value resulting from a S3M survey. Such comparison would likely be difficult in assessing the coverage of a nutrition program, where classical PPS survey might fail to reach enough children with severe acute malnutrition and consequently fail to provide a coverage estimate with good precision. Such comparisons could be more appropriate for some IYCF indicators (mainly these focusing on the 6-23 months age range or on children born in the last 2 years, or the novel IYCF indicators suggested in S3M methods[28]) or equivalent indicators for which a satisfactory sample size might be reached in a classical cluster PPS survey.

Again, it should be kept in mind that S3M was not designed to estimate an aggregated value but rather to provide a spatial pattern of coverage where a classical cluster survey (PPS based) usually provides only an aggregated estimate (even where coverage or prevalence are spatially not homogeneous). The choice of which method to use might differ according to the survey objective (overall versus local estimations).

It should be kept in mind that the population figures on which PPS procedures are based can have a limited accuracy in many settings. In addition, using PPS and accurate population figures would ensure that an equal probability of selection for each individual in the sampling frame but it might not ensure an equal probability of selection for malnourished children if they are not homogeneously distributed in the population. Also, as far as population figures are valid, the results between PPS and weighted results from spatial sampling would likely be similar – the methods varying mainly on the timing when the relative weight of population unit is accounted for (sampling stage in PPS and analysis stage [posterior weighting] in spatial sampling).

Comparison of SMART surveys and a rapid assessment method (RAM) based on spatial sampling is underway to assess nutritional status of older adults[29]. The results, when published, might possibly be applied to some IYCF indicators.

QUESTION 53

The numerous sampling techniques for coverage surveys (e.g. CSAS, SQUEAC, SLEAC, S3M, Urban S3M and PPS sampling) suggests that accepted robust methods have not been clearly identified, and that there is variable understanding of what methods are most appropriate under specific conditions.

The numerous methods indicate that this is still a work in progress. Greater acceptance and comparability would be outcomes of one validated standard sampling and reporting framework. There is also a need for greater clarity on what to use when, and what is viable and what needs to be phased out.

REMARK: ***A clarification: the sampling techniques are similar for CSAS, SQUEAC and SLEAC. All allow two different approaches according to the availability of a map (e.g. spatial stratified sampling from a list of administrative units when maps are not available).***

[28] *Some IYCF indicators used in DHS and MICS are not appropriate for small sample size surveys because they focus on a narrow age range and estimations would therefore results in wide confidence intervals. Only indicators focusing on the age range of 6-23 months or children born in the last 2 years might be assessed in smaller scale cluster PPS survey - or also, the novel IYCF indicators suggested in S3M methods and more appropriate for small sample size (Ernest Guevarra (VALID International), Katja Siling (VALID International), Faraja Chiwile (UNICEF Sierra Leone), Mueni Mutunga (UNICEF Sierra Leone UNICEF Sudan), Joseph Senesie (UNICEF Sierra Leone), Walton Beckley (UNICEF Sierra Leone), Hamidine Has (2014). IYCF assessment with small-sample surveys - A proposal for a simplified and structured approach. Field Exchange 47, April 2014. p60. www.ennonline.net/fex/47/iycf).*

[29] *http://www.helpage.org/blogs/pascale-fritsch-2312/new-tool-measures-malnutrition-in-older-people-in-emergencies-679/*

QUESTION 54

With estimates of SAM coverage, there is little to no opportunity for validation of estimates by comparing to prior estimates with similar methods except in the cases of repeat coverage surveys in small areas such as Matam in Senegal. There are only comparisons between direct and indirect estimates. Sometimes IYCF indicators (for example exclusive breastfeeding) are collected in Spatial Sampling and other LQAS based method surveys which gives an opportunity to compare results across surveys. The differences in estimates based on the two methods are often off by orders of magnitude. This indicates that errors are present in one or both surveys. These errors should be identified.

QUESTION 55

It might be interesting to have some validation of indicators (particularly for IYCF) between population-based cluster surveys and SLEAC and/or S3M survey.

RESPONSE TO: 53 54 55

For these three comments, we would like to repeat that "No one survey type is perfect for all purposes" and that before embarking on any sampling scheme it would be essential to ensure that it is the most appropriate for the survey objective. The choice of study design will vary according to the objectives and setting of the survey. It is obviously unrealistic to suggest one single design that would be appropriate for several main objectives and several settings. Oversimplification might be detrimental to survey quality. In some situations, epidemiologists might have to be consulted before embarking on a survey.

With respect to validation, the developers could provide a fuller discussion of the biases possible in each of the methods in the manual to aid in their interpretation and comparison. In addition, we agree with the need for a full validation of the different possible methodologies – if not possible for SAM due to small sample size in cluster design, it might be considered for other indicators (MAM or some IYCF indicators).

4.2.6 | ADAPTABILITY OF METHODS

Several participants presented specific situations (different populations or new settings) in which it might be advisable to slightly alter the "classic" methodologies.

QUESTION 56

Could we evaluate, with one of these methods, the coverage of a nutrition program focusing on preventive intervention, more specifically, a program about infant and young child feeding ?

RESPONSE: The methods (especially S3M) have been used to assess IYCF oriented programs. Several useful documents on this topic are available on line. For example:
http://portfolio.validmeasures.org/wp-content/reports/nigerS3Mreport.pdf
http://portfolio.validmeasures.org/wp-content/reports/reportEthiopiaS3M.pdf
http://www.ennonline.net/fex/47/iycf

QUESTION 57

The SQUEAC method is efficient to evaluate the level of coverage in programs managing acute malnutrition. However, the questionnaires might be modified to be adapted to each study setting. Regarding the question about community health workers, it would be good to add the question of daily screening capacity, the number of malnourished children in their village/block/area and the monthly number of children who recovered.

RESPONSE: We recommend adapting the SQUEAC questionnaires to each new context of implementation. When planning and preparing a SQUEAC survey, it is recommended to collect information on the number of community health workers per village as well as the number of children under-five screened per month. The additional information that you propose to collect seems interesting and might be relevant in your context (and maybe in other contexts) to document strengths and barriers of programs managing acute malnutrition.

QUESTION 58

Logistics: Conducting MAM coverage surveys using exhaustive case finding (door-to-door) requires large resource inputs (particularly in rural settings) and can be tiring to the teams, what would be the minimum sample size per location (Village) in case MAM cases are much lower than had been thought, e.g. among nomadic populations or scattered locations/villages?.

RESPONSE: This comment is linked to question 9 above. As the comment highlights, conduct of MAM coverage surveys are time consuming and resource intensive. Sample size calculations depend of the objective of the survey and how the results are intended to be used among other factors. We do not feel that it is prudent to think in terms of minimal sample size when prevalence is lower than expected, but rather to adapt the sampling strategy to best fit the population being surveyed (see below for nomadic or sparsely populated areas). A small sample might be representative of a specific location only if the assumptions of homogeneity of coverage and of the (quasi-)exhaustive of the case-finding strategy are satisfied.

REMARK: ***More generally, further development of the methods might make them more useful and adapted for MAM coverage.***

QUESTION 59

Are there any specific sampling modifications required and feasible for nomadic populations?

RESPONSE: Surveys among nomadic populations are known to be both difficult and prone to bias. Several adaptations have been suggested which principally involve a formative phase to ensure that the characteristics of the population to be surveyed are as well understood as possible. This means, what proportion of the population is mobile, fixed or semi-fixed?; where do they gather?; and when and where are the best places and times to interact with them? It is also important to investigate and clarify recourses to care for these populations before beginning a survey. There is a wide body of literature on potential adaptations to survey methodologies for these populations. For example, see www.alnap.org/pool/files/psm-innovations-case-study.pdf, which presents a case study examining nomadic pastoralist populations. This specific question was also addressed in Mali, which may provide added insight (see: http://www.ennonline.net/fex/33/mali). Overall, the formative phase will help respond to if and how different modifications should be employed in the population of interest.

This issue had been also discussed in en-net.org forum in 2012. Available at: http://www.en-net.org/question/872.aspx

QUESTION 60

Combined surveys for SAM and MAM tend to focus on children U5, are the sampling procedures for Pregnant or Lactating Women (PLW) similar to that of U5?

RESPONSE: In general, children are the focus of nutrition coverage surveys. PLWs can be assessed, but this needs to be addressed during the design phase of the survey. House-to-house case-finding might be used to sample PLW (although using a sampling interval might be necessary if the expected number of PLW in the sampled community is expected to be much higher than the target sample size). However, the validity of AACF to identify all PLW (e.g. using traditional birth attendants as key informants) might not be the best option and might therefore be evaluated. Therefore, not all sampling procedures outlined for nutrition coverage assessment in children would apply to PLW, and the sample size requirements will be different as assumptions change.

As mentioned above, there is no survey design perfect for all purposes. Surveys aiming to assess at the same time SAM, MAM, PLW related-indicators needs to ensure that each indicator will be assessed with the most appropriate method (e.g. each indicator might need its own sampling scheme etc.).

4.2.7 | DATA QUALITY AND REPORTING

Several participants made comments about the importance of ensuring quality data collection throughout the evaluation process.

QUESTION 61

Often, the larger the survey sample corresponds with a larger the number of data collectors. As coverage surveys of management of SAM programs are most often conducted in resource poor environments, rigorous data collectors are not easy to find. Standards and recommendations are needed to reduce the bias that can be introduced by less than professional data collection. There is a critical need for supervision standards and tools as well. There are also examples of surveys where the errors seem to change over time- potentially because of feedback from plausibility checks that are then fed back to enumerators who then do other types of errors since the initial ones were found.

QUESTION 62

Active supervision is needed throughout data collection. Longer data collection periods often suffer from poor supervision leading to poor data quality.

QUESTION 63

The duration of data collection has an effect on estimates. Arguments can be made for increasing and decreasing data quality as the duration increases. Longer data collections are often expensive, time consuming and delays to produce final results reduce the utility of results.

RESPONSE: As for any study or survey, we agree that ensuring data quality is a key issue. Proper training on all survey procedures including standardisation of data collection (especially of anthropometric measurements as mentioned above) is critical. Moreover, supervision is essential during the entire survey duration. The methods developers of the manual might want to add a section on that topic in the guidelines provided.

QUESTION 64

Data quality indicators for coverage surveys are needed. Possible indicators could be:

- **Analysis of number of identified cases by data collection points (min, max, mean, median)**
- **Distribution of cases with MUAC < 115mm, Bilateral Oedema - Age estimation and sex of child**
- **Verification of child in programme with RUTF in HH, treatment programme follow-up cards**
- **Quality of MUAC measures (accuracy and precision of anthropometrist measures, digit preference, flagged data, use of colored vs non colored MUAC strips)**
- **Population size of sampling points**
- **GPS validation of survey sampling points**
- **Socio-demographic variables of child and or household - comparison to survey data results in households with children with GAM.**

RESPONSE: We agree that the above information would be worth reporting when available. Interesting information available in all surveys would include the number of identified cases by data collection point, the proportions of cases with MUAC <115m or oedema or both, age and sex of cases and the proof that a child was covered (presentation of RUTF, card, bracelet etc.). Other suggested indicators will vary according to the study methods and objectives.

QUESTION 65

Reporting - Standardized reporting methods including data quality measures are needed.

RESPONSE: As for the previous questions, we agree that standardized reporting methods and quality measures would be useful.

A standard SQUEAC report template has been proposed (Binns 2014) and can be accessed: http://www.coverage-monitoring.org/wp-content/uploads/2014/02/CMN-evaluation-of-reports.pdf

4.2.8 | DIRECT AND INDIRECT ESTIMATIONS

QUESTION 66

Is it possible to use indirect coverage from program data for 3rd stage SQUEAC? That is replacing the 3rd stage by indirect coverage (aggregate admission/ expected caseload). Is there any way to use indirect coverage with first and second stage of SQUEAC for routine monitoring of CMAM Coverage?

RESPONSE: We would recommend avoiding indirect coverage estimations for any stage of the SQUEAC[30]. Discrepancies between direct and indirect estimations of coverage are well recognized. Indirect estimates are usually higher than direct ones and should be treated with caution. Ensuring accurate indirect estimates based on prevalence, population data, routine information remains an important challenge, and currently, direct coverage estimations from surveys are preferable.

[30] *Some elements (such as trends in admission) used to evaluate the indirect coverage might be useful as part of the 1st and 2nd stages of SQUEAC.*

QUESTION 67

Currently in many countries, the available SAM program monitoring data gathered through HMIS systems may not be robust enough or comprehensive enough to review or support active program management, in addition to limited systems for translating available information into active decision making. Investment in improved program reporting will contribute to long-term strength of health systems.

With our current levels of knowledge, the information presented in the table below illustrates some challenges with direct coverage surveys in relation to improving our understanding of annual coverage of for shorter specific time periods. This corresponds to the issue that they are cross sectional surveys measuring programs in flux and not having robust models for converting prevalence to incidence for annual burden estimates.

Issues with comparisons between direct and indirect methods of coverage assessment In 2011, Niger treated 299,358 cases of SAM according to national monitoring system. Maradi Niger has one of the strongest management of acute malnutrition programmes in the world. There are several NGOs (Befen, Forsani, MSF, ACF, Alima) that support health districts with high quality care and training for other regions. In 2011, 1/3 of the reported new admissions in Niger were delivered in Maradi. The region of Dosso has a much smaller program with lower numbers of admissions. A review of estimated coverage using direct and indirect methods was done for these two regions.

In Maradi, with the coverage estimate of 24.1% and assuming no over reporting error, the annual caseload corrected by the coverage estimate would be 425,700 SAM cases. This corresponds to 67% of the Maradi under five children (3.1 million population * 20.3% population <5 years).

In Dosso, with the coverage estimate of 11.5% and assuming no over reporting error, the annual caseload corrected by the coverage estimate would be 167,000 SAM cases. This corresponds to 40% of the Dosso under five children (2.0 million population * 20.3% population <5 years).

While backward calculations are likely flawed, they do highlight that we need to determine where the errors are in our assumptions. While the direct coverage estimates appear to be closer to our understanding of the situation in the region where low coverage was expected, still the correspondence between admissions and numbers of children covered does not make sense.

INPUT	MARADI	DOSSO	SOURCE
Population 2011	3,111,709	2,074,286	Census 2011
Population 6-59m	634,465	422,935	Calculated (20.3% de la total population
SAM Prevalance (WHZ) Mai 2011	1.6 (1.1 - 2.3 95IC)	3.1 (2.2 - 4.2 95% CI)	National Nutrition Survey May 2011
Annual Estimated Caseload of SAM 2011	54,818	70,799	Calculated (Factor of 4.5 with 20% de margin of security)
New Admissions 2011	102,594	19,197	Scalling up Rapports (end of 2011)
Estimation Indirect Coverage	187.2%	27.1%	Calculated
Estimation Direct Coverage	24.1%	11.5%	S3M survey Oct 2011 - Fev 2012
Annual Estimated Caseload of SAM corrected by direct Coverage	425,701	166,930	Calculation
Percentage of the estimate out of the toal infant population	67.1%	39.5%	Calculation

INDIRECT ESTIMATES

There is a need for a clear and robust discussion on appropriate methods for estimating SAM caseloads that take into account incidence as well as oedema. WHO uses only prevalence while UNICEF follows Mark Myatt's suggestion of prevalence x 2.6. Both methods have their limitations, but at the same time there are no viable alternatives under research/discussion. More research/analysis and discussion is needed to improve these planning figures would be appropriate.

RESPONSE: As mentioned in the previous questions, discrepancies between direct and indirect estimations of coverage are well recognized[31]. This comment provides a clear illustration and explanation. Prevalence and coverage surveys are cross-sectional measures where the caseload and admissions reflect the annual dynamic and the cumulative activities of the program. Coverage estimations measured at one point in time cannot be applied easily to a full year and yearly incidence (with seasonal changes) should be accounted for instead of prevalence. In addition, the new program admissions likely include children who have been admitted several times. Finally, the denominators (burden of SAM) are often inaccurate limiting the possibility to calculate indirect coverage. Consequently, correcting the annual caseload by the direct coverage is not straightforward.

We agree that further research on appropriate methods for estimating SAM caseloads would help better understanding the SAM (indirect) coverage. However, this is out of the scope of the SQUEAC/SLEAC methods.

4.2.9 | MISCELLANEOUS

QUESTION 68

We strongly recognize the need for an understanding of the coverage of programming as one component of overall programme management. With limited financing available for M&E for management of Severe Acute Malnutrition, we are highlighting the need for progress in several areas including:

- **Standardized robust and cost appropriate sampling and coverage survey methods**
- **Data collection in about one month (ranges noted from 1-6 months) with production of final report within one month of data collection**
- **Standardized reporting models including data quality measures**

QUESTION 69

Combined SLEAC and SQUEAC surveys (All 3 stages of SQUEAC?)

Is it possible to create a mechanism for rapid analysis to identify locations for SQUEAC instead of having to wait after completion of SLEAC then go back for in-depth investigations?

[31] *UNICEF/Coverage Monitoring Network/ACF, International. The State of Global SAM Management Coverage 2012; New York & London, August 2012.*

RESPONSE TO: 68 69

This question presents an underlying concern regarding resources and time, but there is no immediate short cut. The three SQUEAC stages should be conducted successively. The SLEAC will help identifying delivery units where to undertake SQUEAC investigations (SQUEAC/SLEAC manual p114), so both surveys cannot be conducted at the same time.

QUESTION 70

The call stated that all 3 methods have undergone substantial peer review. Some participants asked for the names and affiliations of the statisticians that reviewed and approved these methods as well as a list of the related peer-reviewed publications.

RESPONSE: The spatial sampling design has been used widely in agriculture, forestry, ecology, and geography. The application of the CSAS method to the field of nutrition has been published in peer-reviewed journals[32]. LQAS and Bayesian methods are also well recognised methods. Their application to the field of nutrition and their combination in the SQUEAC/SLEAC/S3M methods themselves have been discussed in forums and 'non-peer reviewed' journals. However, we are not aware of an official and published peer-review of the SQUEAC/SLEAC/S3M methods done by reviewer's independent from the methods developers of the methods.

Participants were referred to the CMN network website (Resources Tab: http://www.coverage-monitoring.org/resources/) where discussion and various documents about the methods can be found.

QUESTION 71

The final reports for coverage surveys are often never produced (?) See Niger and Sudan.

QUESTION 72

National and regional spatial sampling surveys have been conducted in coordination with National Institutes of Statistics, yet later government rejected the survey results (e.g. Niger 2011, Sudan 2012). Greater efforts are needed to explain sampling differences and possible outcomes to ensure government buy-in from the beginning.

RESPONSE TO: 71 72

RESPONSE: Unfortunately, factors that influence government buy-in maybe completely independent from the method itself. We can only hope that addressing questions raised during this review will help clarify the methods and their acceptance by agencies and governments for more consistent acceptance and dissemination of results.

[32] *See for example: Guerrero S, Myatt M, Collins S. Determinants of coverage in community-based therapeutic care programmes: towards a joint quantitative and qualitative analysis. Disasters 2010 April; 34(2):571-85; Myatt M, Feleke T, Sadler K, Collins S. A field trial of a survey method for estimating the coverage of selective feeding programmes. Bull World Health Organ 2005 January;83(1):20-6.;*

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5 | SPECIFIC RECOMMENDATIONS

ISSUES TO CONSIDER WHEN INTERPRETING THE COMMENTS RAISED BY THE USERS OF THE METHODS DURING THIS REVIEW:

- Only users having concerns with the methods participated in this review. The present compilation of questions and comments is thus only representative of this sub-group of users. Fully satisfied users did not express themselves in this review and we do not know which fraction of the users this actually represents.
- Some questions raised by the users were sometimes unclear, mixing concepts and terminologies, which suggests that users were likely confused by the methods or their related documentation. All questions and comments are presented as sent by the users[33].
- This review does not constitute validation of the methods reviewed, and our discussion herein is limited to documents available publicly online (e.g. the information available to the users of the methods invited to pose questions in this open review). The methods developers might have access to more material and pilot/filed test results and already have evidence/answers to address some of the following recommendations.

STRENGTHS OF THE METHODS:

- There were few questions/comments about the stage 1 SQUEAC, suggesting that users feel comfortable and satisfied with this part of the methods. Stage 1 SQUEAC is a cornerstone of the methods, having as a main objective the understanding of programs barriers and boosters. A major strength of SQUEAC lies in stage 1, where program managers critically analyse available program data and other qualitative data. Most importantly, programme managers are encouraged to conduct this critical analysis as an ongoing integrated process reinforcing day-to-day program planning and monitoring.
- The methods were developed to allow assessing coverage based on small sample sizes. In that sense, these innovative methods address the weaknesses of preceding study designs (e.g. cluster surveys) used to assess coverage of nutrition program.
- These methods allow spatial representation of coverage where alternative study designs provide only aggregated coverage estimates (even in settings with geographical heterogeneity of coverage).
- The methods encourage program managers to explore different aspects of their program (monitoring data, qualitative data) and to monitor these over time.

COMMENTS AND RECOMMENDATIONS:

A number of comments received during the review period do not raise substantial concerns but rather represent solvable misunderstandings that require clarification from the methods developers. Other comments highlight grey zones or limitations of the methods that need to be elaborated further. As a way forward and in order to improve the current guidance, we would suggest the following as a summary of the above list of questions and answers that warrant clarification.

[33] *Except some French to English translation, spelling mistake corrections and split of groups of questions to allow thematic sections.*

1

ACTIVE AND ADAPTIVE CASE-FINDING

More guidance and methodological background on AACF should be furnished by the methods developers to guide implementation.

1. **The methods developers should make reference to reports of the evaluation of AACF. At the minimum, estimations of the AACF sensitivity to identify children with a mid-upper arm circumference (MUAC) < 115mm (and/or oedema) in small and big villages should be included.**
2. **Evidence on the validity of AACF might also be provided for contexts other than rural SAM coverage, if the methods developers recommend its use in such settings (e.g. urban areas, displaced or refugee camp, MAM, PLW). If the validity of AACF is limited to SAM coverage in rural settings, this should be clearly stated. Otherwise, clear guidance should be given on alternative methods for each other context. This may seem clear to experienced users, but it would be helpful to restate clearly. The limitations of such alternative methods should also be clearly stated. House-to-house case-finding might need more time and resources and might not be possible in big villages/urban areas. If for this reason case-finding is limited to a restricted area (e.g. through segmentation or EPI method), the consequences of non-exhaustive case finding, potential clustering, and a reduced sampling fraction should be discussed.**
3. **The methods developers might also consider updating the available material to allow users to test AACF procedures using capture-recapture studies when used in a particular area for the first time.**

2

EVALUATING THE PRIOR AND THE CONJUGATE BAYESIAN ANALYSIS:

1. **The process of calculating the prior is subjective and not straightforward, especially for first-time users. The methods developers suggest different procedures to translate prior information into the mode of a probability density: un-weighted scoring, weighted scoring, scaling the maximum score. We suggest providing more guidance and one single standardised procedure in the process of deciding about the weights of the score.**
2. **It seems important to establish a body of evidence clearly demonstrating that SQUEAC assessors can consistently estimate an accurate mode of the prior. To do this, it might be useful to assess (or report if already done in practice) the reproducibility of the prior estimates, for example by comparing the prior mode and minimum/maximum probable values estimations of different assessors working independently with the same program data. It might also be useful to provide evidence that assessors can estimate a prior mode "close enough" to the true population coverage. At a minimum, empirical evidence from the previous SQUEAC surveys might be provided.**
3. **It seems important to demonstrate that posterior estimates resulting from the conjugate Bayesian analysis are more accurate (i.e. closer to the true population coverage) than surveys estimates alone (likelihood). It might be interesting to review previous coverage surveys to quantify discrepancies between the prior and likelihood and to identify situations where the posterior is dominated by the prior due to very small sample sizes.**
4. **The reporting of substantial discrepancies (conflicts) between the prior and the likelihood should be clarified. Despite being explained in the current manual, it currently varies importantly between reports.**
5. **The methods developers might also point out that the likelihood might be enough where it is possible to reach an appropriate sample size (calculated without correction of alpha and beta prior) and the prior and posterior would not be necessary.**

3 AGGREGATED VALUE AND COMPARISON WITH OTHER STUDY DESIGNS

1. **Regardless of the study design, an aggregated coverage value is not always relevant due to heterogeneous coverage. A spatial representation of coverage would be more useful for programmers, but a global value is sometimes requested from donors or other institutions and should consequently be calculated. For that reason, clarifications are needed on the weighting process (when it is relevant to weight data or not, and how to weight the data). Several approaches of calculating the aggregated value are proposed from no weighting (e.g. SQUEAC stage 3), posterior weighting on the number of cases (or on population estimates), or bootstrapping (S3M). It might be interesting to compare, possibly based on data from previous surveys, aggregate estimations of coverage calculated based on the different approaches. It might not be relevant to recommend a single weighting approach, however, it might be helpful to present and discuss the different options in a section of the manual. If there is evidence that the different weighting approaches (including no weighting) make little difference, this should be shared with the users.**
2. **In theory, it might be interesting to compare the aggregated value obtained with spatial sampling (SLEAC/S3M) to a classical PPS cluster sampling as a way to explain the difference between the two and the trade-offs in terms of sample size and precision. It might however be a challenge in practice because the classical PPS survey based might not be an ideal gold standard because of its inherent limitations: (1) classical PPS survey might fail to reach enough children with SAM and the comparison would be restricted to indicators for which a satisfactory sample size might be reached (e.g. some IYFC indicators or maybe MAM coverage); (2) PPS based is usually based on the total population instead of the target population (e.g. the density of children with SAM).**

4 POINT OR PERIOD COVERAGE:

One interesting contribution of the coverage methods (especially CSAS) was to raise the distinction between point and period coverage. Unfortunately, both indicators are problematic and this does not only apply to the methods under review but also to any other possible cross-sectional coverage assessment methods. Coverage surveys usually provide cross-sectional measures at one point in time, while admissions and recovery are dynamic processes evolving over a longer period. Coverage indicators need further research and the influence of the length of stay and timeliness of the case finding need further consideration[34]. In the meantime:

1. **The reporting between point/period coverage should be clarified. It might be useful to suggest quantitative decision rules to guide the indicator choice (e.g., what length of stay is short enough and what "case-finding" is good enough to allow reporting the period coverage? Which ratio of current cases compared to recovering cases in the program?).**
2. **Although the methods developers advise against the practice, the alternative would be to systematically report both indicators, together with programs characteristics to allow their interpretation (e.g. length of stay and timeliness of the case finding). Further research on the development of a single coverage estimate, might provide other alternative soon.**

5 SIMPLIFIED LQAS TECHNIQUES

The simplified LQAS techniques need clarifications and review.

1. **The method of deriving the quotient "d/n" and threshold value needs clarification in line with the response to Questions 33 and 34 about LQAS. The methods developers should clarify the impact of the sampling fraction on the interpretation of results in the guidelines.**
2. **We recommend adding more explanation for users on the alpha error (and the influence of the sampling fraction). Information on the beta error might also be considered.**
3. **As there are different opinions regarding LQAS, we recommend an independent statistical review of the simplified LQAS techniques as applied in the SLQUEAC/SLEAC manual. This would allow for a clear and inclusive discussion on these issues.**

[34] *Ensuring accurate indirect estimates based on prevalence, population data and routine information also remains an important challenge and currently, direct coverage estimations from surveys are preferable. Further research on appropriate methods for estimating SAM caseloads would help better understanding the SAM (indirect) coverage. However, this is out of the scope of the SQUEAC/SLEAC methods.*

6

S3M

As now there have been different experiences with implementation, it would be of great interest to finalise and circulate a revised user manual for the S3M method. The revised manual would be improved by addressing the following general and specific aspects.

1. **Provide references to guide the choice of the "d" value.**
2. **Clarify "post-survey re-triangulation" and the decision to take in case multiple sample points that do not provide information.**
3. **Clarify the methods to calculate the aggregate value from all sampling point values.**
4. **Present available further work on triangulation and possible alternatives.**

7

IMPROVE THE MANUAL/GUIDELINES:

The SQUEAC/SLEAC and S3M surveys are often implemented after an initial training conducted by persons experienced in these methods. The benefit of such training will never be outweighed by even the best guidelines. CMN is also working on a toolkit website http://toolkit.coverage-monitoring.org/ that will likely be very helpful.

However, the SQUEAC/SLEAC manual would benefit from further improvement and the new S3M manual should be made more easily available. Many misunderstandings might be solved by improving the guidelines. In addition to the modifications in line with above recommendations, it would be worthwhile to restate and clarify the following aspects:

1. **Improvements to the structure of the manual (a very simple suggestion would be to number the section's titles).**
2. **Following the current structure, the manual might be organised in two parts: (1) practical field guidelines/procedures, (2) detailed technical information to support the methods and relevant references. Also, the core of the manual might concentrate on the assessment of SAM coverage and clear, separate sections might be added summarising and centralising the methods adaptations necessary for other indicators or contexts that seem relevant to the methods developers (e.g. MAM coverage surveys, urban settings, camps, nomadic populations; IYCF, PLW, context of low SAM prevalence).**
3. **The terminologies should be clearly introduced at the start of the manual together with a short overview of the context of implementation of each method. It might be presented as a "roadmap" of activities, including the appropriate references and website where to find the most updated manual relevant for each method. A possibility would be to integrate the technical brief available on http://www.coverage-monitoring.org/wp-content/uploads/2014/10/Coverage-and-CMAM-2012-v2-sept2014.pdf in the manual.**
4. **A clear explanation of the benefits and weaknesses of coverage surveys in general (including the limits of the point and period prevalence indicators), not limited to these methodologies. Many comments concerned questions, which concern the implementation of surveys in general, and the difficulties that may be faced.**
5. **The timing of coverage surveys should be considered (e.g. duration of the program, seasonality, possible disease outbreaks, caregiver's labour duties, screening exercise)**
6. **Provide clear guidance on the means and a proposed schema for supervision and data quality checking. This could also be done with a specific implementation guide that could contain a practical FAQ section for implementers. This is currently under-development at the CMN website.**
7. **Provide guidance on standardization of data collection (including possibly reviewed and validated questionnaires) and measurement biases as well as interactions between MUAC and W/H.**
8. **Provide guidance on results reporting and discussion of study limitations (including a discussion about the underlying assumptions of the methods, i.e. the homogeneity of coverage in each quadrat and a (quasi-)exhaustive of the case-finding strategy – as only if these assumptions are satisfied, a small sample might be representative of a quadrat).**
9. **In the technical annex, documentation of the theoretical underpinnings of the methodologies should be provided, as well as information on their validation.**

6 | IMPROVING UNDERSTANDING AND COMMUNICATION WITH STAKEHOLDERS, DONORS AND THE SCIENTIFIC COMMUNITY

All survey methodologies have strengths and weaknesses. Their uptake among stakeholders and donors is reinforced by clear and consistent discussion among the wider scientific community. To date, much of the concerns raised about coverage survey methodologies have been confined to the nutritional community. However, the fundamental components of these methodologies (e.g. spatial sampling, LQAS, Bayesian methods), are used across a variety of fields in public health, nutrition and medical programs. Here, in order to ensure that the discussion about their combination and adaptation to the nutrition field is shared with a wider audience, publications in more generalist scientific journals as well as an open forum for debate on these questions would be helpful. We recommend:

- Publication of the methodological underpinnings of SQUEAC/SLEAC/S3M in an independent, generalist, peer-reviewed open-access journal, ensuring statistical review.
- Publication of a two-sided debate with a critique and support argument for the methodology in an open-access peer-reviewed journal.
- A forum, hosted by CMN, where supporters and detractors of the methods could share a public and web-streamed discussion on the methodology. This forum should include the methods developers as well as recognized experts in statistics and epidemiology both within the field of nutrition and outside of it

Without further discussion, understanding of these methodologies, and others, will remain obscure for many stakeholders. The aim of the above recommendations is to ensure that coverage methodologies are discussed and continually improved so as to provide better information for program managers and in turn better programs for the populations they serve.

REFERENCES

The below lists specific publications and reports cited within this document. There is a great deal of additional information, including reports published after the time of this review and are now available on the CMN website.

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7 | APPENDICES

7.1 | ENGLISH AND FRENCH CALL FOR REVIEW - CONTENT OF THE ATTACHED NOTICE

PARTICIPATORY REVIEW OF COVERAGE METHODOLOGIES

Epicentre will be leading an independent and enhanced technical review of coverage methodologies to inform possible improvement and suggest future development activities for the most commonly used coverage methodologies in the nutrition sector; SQUEAC, SLEAC and S3M. Users of the methods are invited to pose methodological questions, comments and suggestions to Epicentre, over a period of 30 days, **opening on the 04/07/2014, closing on the 04/08/2014.**

Please submit comments and questions via email to **Coverage.Review@epicentre.msf.org** during this time period. It is essential that inputs are submitted during this time otherwise they will not be considered.

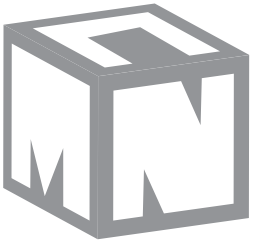
All comments would then be answered by Epicentre after a period of 60 days.

If an overwhelming amount of questions and comments are submitted, Epicentre will group questions thematically and respond to these accordingly. A report responding to all these questions will be disseminated after the 60 day period. Any lessons learned or suggestions will be documented and actioned by the Coverage Monitoring Network.

It is important to note that the independent review is responsible for responding to methodological questions, and not questions about how to practically implement or interpret findings in specific cases. There are existing forums to respond to these queries, namely En-Net. This review is only concerned with questions relating to the methodology itself.

Finally, all 3 methods have undergone substantial peer review. The present process has been initiated in order to improve any areas of the methodology based on constructive suggestions and comments from users.

For any additional information please contact Coverage.Review@epicentre.msf.org directly or visit www.coverage-monitoring.org



COVERAGE MONITORING NETWORK

The Coverage Monitoring Network (CMN) project is an inter-agency initiative led by ACF, Save the Children, Concern Worldwide, International Medical Corps, Helen Keller International, MSF, World Vision, IRC, GOAL and COOPI. The project aims to increase and improve coverage monitoring in CMAM programs globally. It also aims to identify, analyse and share lessons learned to improve CMAM policy and practice across the areas with a high prevalence of acute malnutrition.

EVALUATION PARTICIPATIVE DES MÉTHODES D'ENQUÊTE DE COUVERTURE

Epicentre va mener une évaluation technique indépendante des méthodes d'enquête de couverture. L'objectif est d'identifier les possibilités d'amélioration et de suggérer de futurs développements pour les méthodes les plus souvent utilisées pour évaluer la couverture dans le secteur de la nutrition: SQUEAC, SLEAC et S3M. Nous invitons les utilisateurs de ces méthodes à poser des questions, faire des suggestions ou des commentaires d'ordre méthodologique à Epicentre, pendant un période de 30 jours, **commençant le 04/07/2014 et se terminant le 04/08/2014.**

Merci de soumettre vos commentaires et questions par mail à l'adresse **Coverage.Review@epicentre.msf.org** pendant cette période. Il est essentiel de respecter cette période pour soumettre votre contribution sans quoi elle ne sera pas prise en compte.

Epicentre répondra à tous les commentaires après un période de 60 jours.

Si un très grand nombre de questions et commentaires sont soumis, Epicentre regroupera les questions par thématique et y répondra en conséquence. Un rapport adressant toutes ces questions sera diffusé après une période de 60 jours.

Les leçons à en tirer et les suggestions seront documentées et mises en oeuvre par le Coverage Monitoring Network.

Il est important de préciser que cette évaluation indépendante apportera une réponse aux questions méthodologiques et non aux questions relatives à la mise en oeuvre pratique ou à l'interprétation des résultats dans des situations spécifiques. Des forums existent pour répondre à ces demandes, à savoir En-Net. Cette revue ne concerne que les questions portant sur la méthodologie même. Enfin, les trois méthodes ont fait l'objet d'importantes évaluations par des pairs (peer-review). La démarche actuelle a été initiée pour améliorer certains aspects de la méthodologie sur base des suggestions et commentaires constructifs des utilisateurs.

Pour plus d'informations, merci de contacter Coverage.Review@epicentre.msf.org directement ou de consulter le site www.coverage-monitoring.org

COVERAGE MONITORING NETWORK

Le projet Coverage Monitoring Network (CMN) est une initiative inter-agences menée par ACF, Save the Children, Concern Worldwide, International Medical Corps, Helen Keller International, MSF, World Vision, IRC, GOAL et COOPI. Le projet vise à augmenter et améliorer le monitoring de la couverture dans les programmes de prise en charge à base communautaire de la malnutrition aiguë (PCMA) de façon générale. Il vise aussi à identifier, analyser et partager les leçons acquises de l'expérience pour améliorer les politiques et pratiques dans les régions à haute prévalence de malnutrition aiguë.

7.2 | ENGLISH AND FRENCH CALL FOR REVIEW - EMAIL'S TITLE AND BODY

PARTICIPATORY REVIEW OF COVERAGE METHODOLOGIES

Epicentre has been asked to lead an independent technical review of coverage methodologies to inform possible improvement and suggest future development activities for the most commonly used coverage methodologies in the nutrition sector: SQUEAC, SLEAC and S3M. We invite users of the methods to pose methodological questions, comments and suggestions over a period of 30 days, beginning 4 July 2014 and ending 4 August 2014. Further details are provided in the attached notices (in French and English). Please circulate widely among your networks.

EVALUATION PARTICIPATIVE DES MÉTHODES D'ENQUÊTE DE COUVERTURE

Epicentre a été sollicité pour mener une évaluation technique indépendante des méthodes d'enquête de couverture. L'objectif est d'identifier les possibilités d'amélioration et de suggérer de futurs développements pour les méthodes les plus souvent utilisées pour évaluer la couverture dans le secteur de la nutrition: SQUEAC, SLEAC et S3M. Nous invitons les utilisateurs de ces méthodes à poser des questions, faire des suggestions ou des commentaires d'ordre méthodologique pendant un période de 30 jours allant du 4 juillet au 4 août 2014. Davantage de détails se trouvent dans le document attaché (en français et en anglais). Merci de faire circuler cette information largement parmi vos réseaux.

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