SQUEAC and SLEAC Case Studies

The case studies presented in this section were written by experienced SQUEAC and SLEAC practitioners and were drawn from their experiences applying the SQUEAC and SLEAC methods and in training others to use the SQUEAC and SLEAC methods.

The first three case studies provide insight into defining priors for programs with varying levels of coverage. The opening case study describes how the prior of a very high (> 80%) coverage program was defined. This is followed by a case study of defining a prior for a program with a moderate (about 50%) coverage. The third case study is an example of a prior that was set unrealistically high and illustrates the need for realism when defining the prior.

The next five case studies describe various sampling strategies that have been applied in conducting SQUEAC likelihood surveys. Two of these case studies illustrate techniques to address issues frequently encountered when selecting villages in the first-stage sample of the likelihood survey. One case study shows what to do when there are no maps or lists of villages or when the available maps and lists of villages are not useful. The other case study illustrates the use of satellite imagery for selecting and mapping areas to survey. The next three case studies present the use (and misuse) of active and adaptive case-finding during the within-community sampling stage of the likelihood survey. The lessons of these case studies also apply to small studies and small-area surveys that use active and adaptive case-finding. The first of these three case studies describes how to conduct active and adaptive case-finding in a rural setting. This is followed by a case study of how active and adaptive case-finding was adapted for use in an internally displaced persons (IDP) camp setting. The third case study shows how the use of active and adaptive case-finding may fail in urban settings and suggests alternative sampling strategies.

The final two case studies are special cases. One case study describes an investigation of 'hidden defaulters' through triangulation of various information and data. The final case study presents the application of SLEAC to the assessment of the coverage of a national CMAM program.

Case Study: Defining a Prior for Very High Coverage Programs

This case study describes a method that may be used to define a prior for a program in which coverage is believed to be very high (> 80%). It is taken from a SQUEAC assessment of the coverage of a program implementing community-based management of SAM, acute respiratory infection (ARI), and diarrhoea delivered by CHWs within a growth monitoring and promotion (GMP) program in Southern Bangladesh.

The Prior

Table 7 summarises the findings of the initial SQUEAC assessment of the program. Negative findings are highlighted in the table and are described in more detail in **Table 8**. The collected data indicated that coverage was likely to be very high.

The probable range of the impact on coverage associated with each negative finding was decided by presentation and consideration of the available data with program staff, including CHWs (see Table 8). The prior was defined by assuming that coverage could be 100% (no uncovered cases were found in small-area surveys of probable poor coverage areas) and that a reasonable prior could be defined by accounting for the probable range of impacts on coverage associated with the negative findings in the collected data.

Table 7. Summary of the findings of the initial SQUEAC assessment

Method	Source	Topic	Summary findings*
Quantitative	Routine data	Admissions	Consistent with high coverage
		Cure, default, etc.	Consistent with high coverage
	Patient records	Admission MUAC	Consistent with high coverage
	Small-area surveys	Coverage	No uncovered cases found
	GMP coverage data	Coverage	GMP coverage below 100%
Semi-structured interviews	Carers of active cases	CHW activities	Regular screening
			Watch-list system
			CHWs recruit carers
			Post-discharge screening
			CHWs well regarded
		SAM - Aetiology	Infection
			Infection-nutrition cycle
			Early weaning
			Household economy
		SAM - Awareness	Signs recognised
			Treatable
			Preventable
		Pathways to care	CHW case-finding
			Self-referral welcomed by CHWs
			Community referrals welcomed by CHWs
			No referrals from hospital
			Referrals between CHWs
		'Coverage'	Migrating children not covered
			Islamist agitation against the program
	CHWs	Case-finding	Small catchment for each CHW
			ARI and diarrhoea cases screened
			Integrated with GMP and EPI
			Referrals from village doctors/pharmacists
			Self-referrals
			Referral by community leaders
			Routine screening
			Weekly screening of borderline cases
			No referrals from hospital
		Logistics	No problems with RUTF and SAM drugs
			Problems with supply of ORS and ARI drugs
			RUTF well accepted
		Awareness	MUAC had raised awareness of SAM
			Acceptance of program by 'grandmothers'
			Islamist agitation against the program
	Key informants	Several	Program accepted, well known, well regarded
			Informants recruited as case-finders
	Community leaders	Several	Program accepted, well known, well regarded
			Informants recruited as case-finders
			Regular contact with program staff
Informal group discussions	Male-only groups	Several	Limited awareness of the program
	Female-only groups	Several	Good awareness of SAM
			Good awareness of the program
	Mixed sex groups	Several	Limited awareness in males.
	'Baday' nomads	Several	No awareness of the program
			No contact with the program

* White cells indicate positive findings (boosters), shaded cells indicate negative findings (barriers).

Table 8. Summary of the assessed effects of the identified barriers

Barrier	Probable impact (percentage points)*		
	Maximum	**Most Likely**	**Minimum**
GMP coverage below 100% Government and NGO sources estimated the coverage of GMP services to be about 95%. A few sub-villages without GMP coverage were found in some villages. Informal group discussions with female caregivers in these communities indicated that distance from GMP stations was an issue only in areas where women's movements were restricted to their immediate home neighbourhood. The program recruited cases by means other than screening at GMP sessions, but it was believed likely that some SAM cases may have remained undetected in areas where GMP coverage was poor.	10%	5%	5%
No referrals from hospital Program staff and CHWs were confident that SAM cases discharged from hospital would be identified and admitted shortly after their return home. This was confirmed by a small study. This problem had already been identified by program managers and staff appointed to review hospital discharges and create watch lists for CHWs. It was thought likely that cases may remain uncovered for a maximum of about 2 weeks.	5%	1%	0%
Migrating children not covered Program staff, CHWs, and community members were confident that SAM cases entering the area would be picked up by CHWs shortly after their arrival in the program area.	5%	1%	0%
Islamist agitation against the program A small study indicated that some agitation against the program had occurred at the start of the program but was **not** ongoing at the time of the SQUEAC assessment.	2%	1%	0%
Problems with supply of ORS and ARI drugs Further interviews with CHWs suggested that problems with the supply of ORS and ARI drugs may have had an effect on the timeliness of case-finding, because carers of children with diarrhoea or ARI tended to seek care from village doctors or pharmacists. CHWs reported that village doctors and pharmacists usually referred such cases to them for screening. This was confirmed by interviews with village doctors and pharmacists.	5%	2%	0%
Limited male awareness of SAM and the SAM program Care decisions in the program area were made by the mother and grandmother of the case. Very little impact expected.	1%	0%	0%
Exclusion of nomads A small survey that screened all children in the nomad troupes present in the program area at the time of the SQUEAC assessment found **no** SAM cases. There is only a small number of nomads in the program area at any one time.	1%	0%	0%
Sums of probable impacts	29%	10%	5%

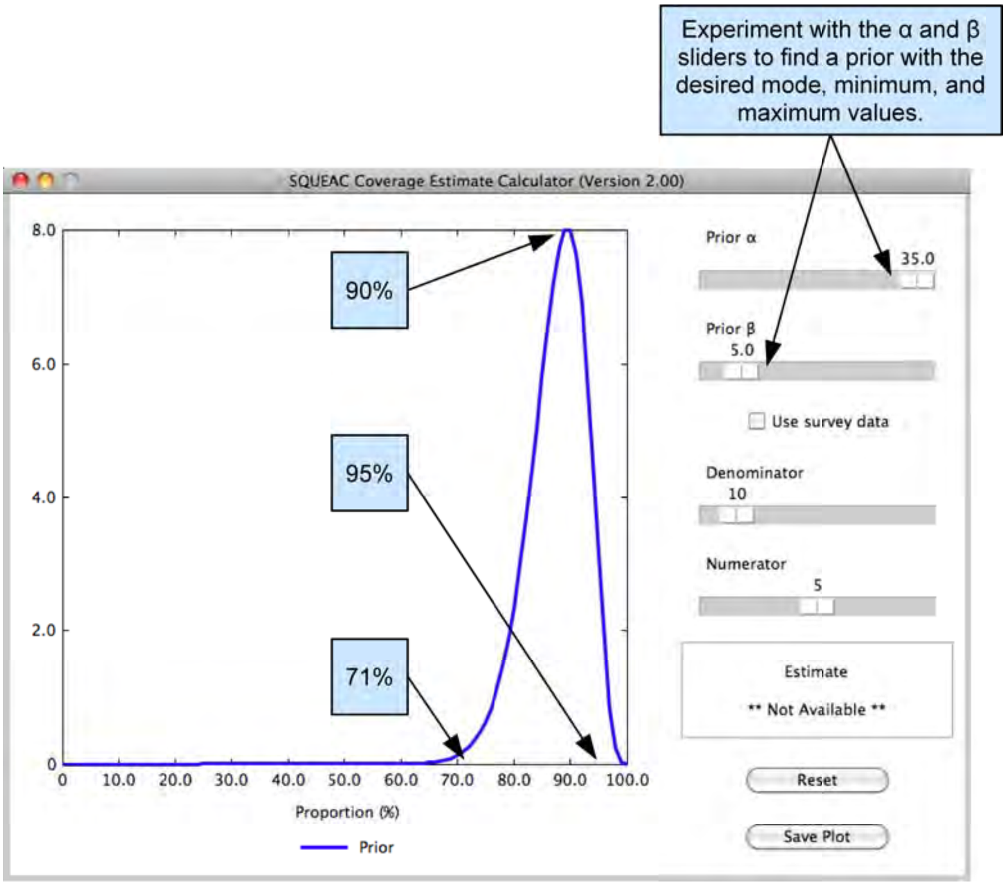
* Expected magnitude (in percentage points) of the drop in coverage associated with the listed barrier

The mode and range of the prior was decided using the probable impacts of the identified barriers:

Prior parameter	Value
Mode	$100\% - 10\% = 90\%$
Lower limit	$100\% - 29\% = 71\%$
Upper limit	$100\% - 5\% = 95\%$

Suitable α_{Prior} and β_{Prior} parameters for the prior were found by experimenting with the **BayesSQUEAC** calculator to find a combination of α_{Prior} and β_{Prior} parameters that yielded a prior with the desired mode, minimum, and maximum values (**Figure 72**).

Figure 72. Finding suitable α_{Prior} and β_{Prior} parameters for the prior using **BayesSQUEAC**

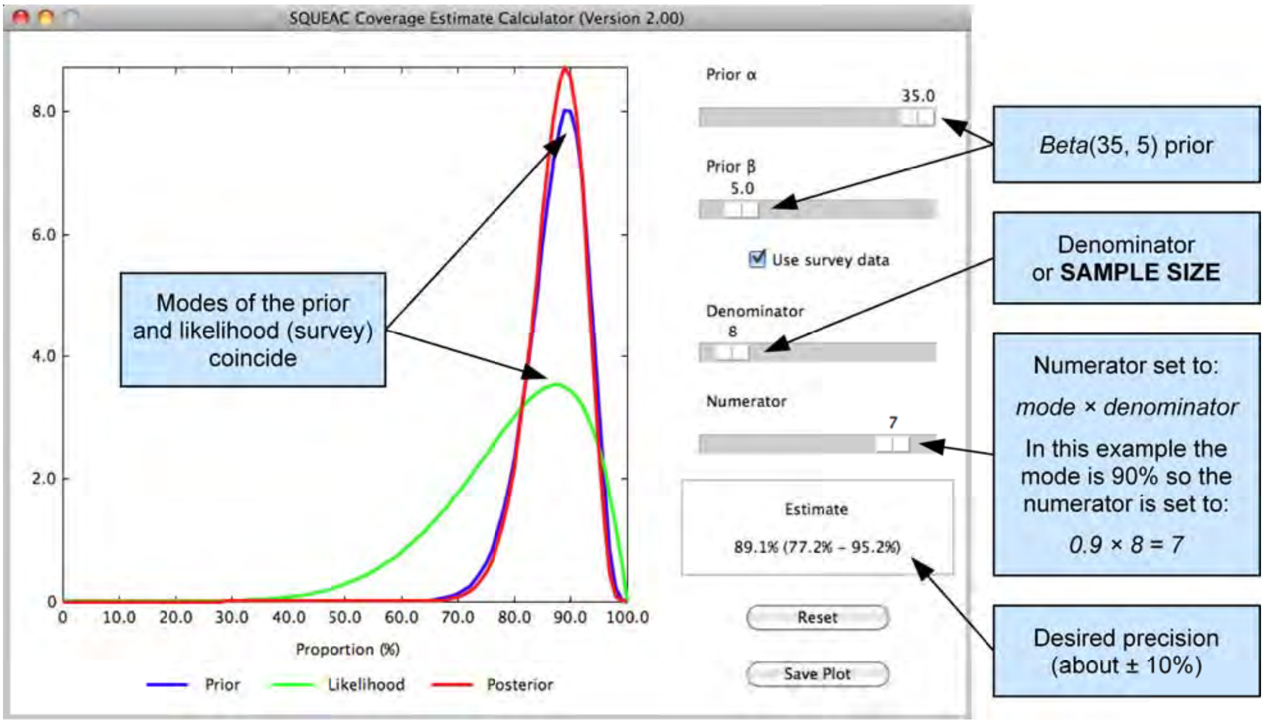


Sample Size and Sample Design for the Likelihood Survey

The sample size for the *likelihood* survey was calculated, using the simulation approach with the **BayesSQUEAC** calculator (see **Figure 73**). The minimum sample size needed was found to be $n = 8$ current or recovering SAM cases. It was estimated, from program data and recent survey work that 13 GMP station catchment areas would need to be exhaustively sampled to find eight current or recovering SAM cases:

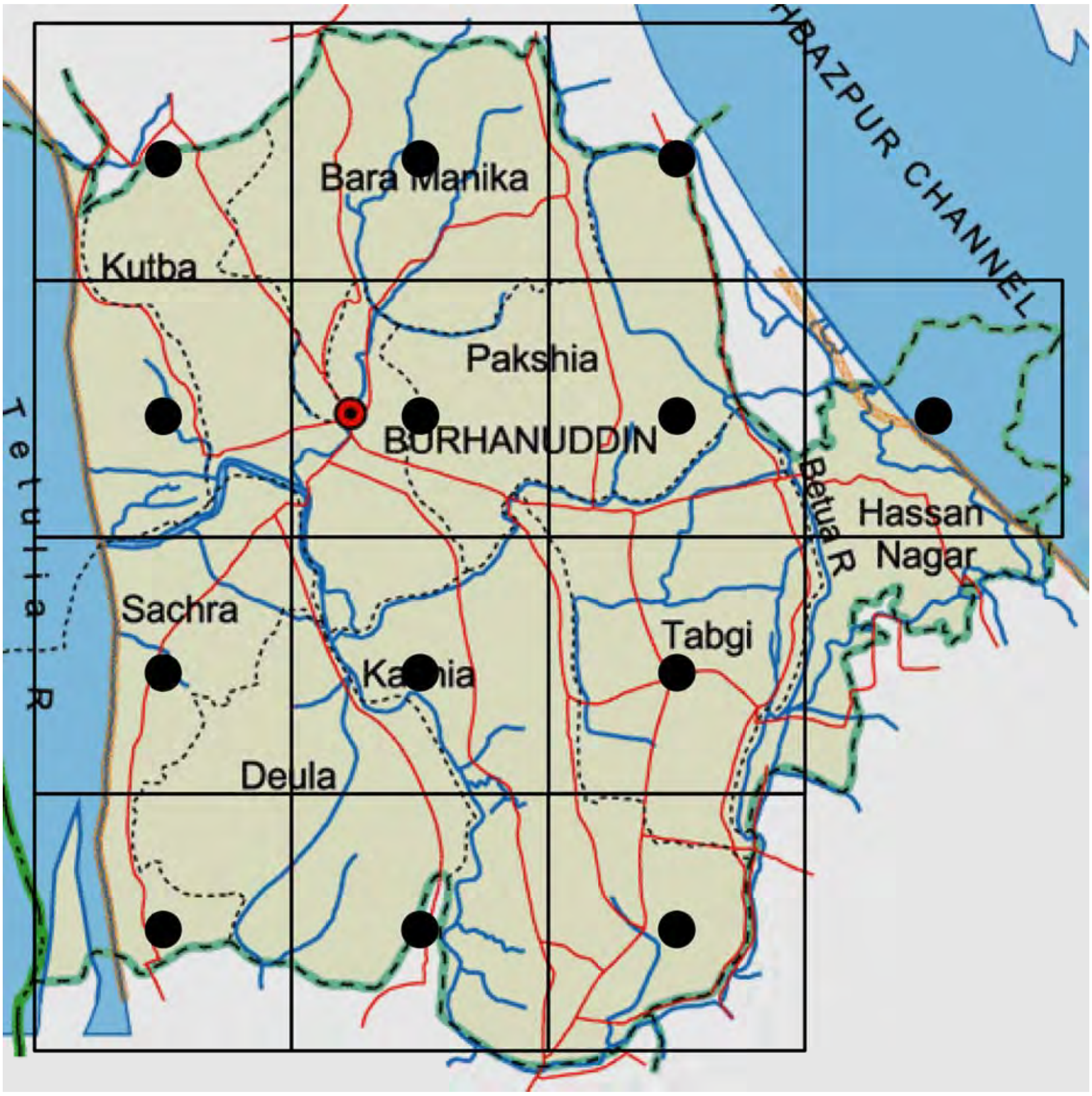
$$n_{GMP} = \left\lceil \frac{n_{cases}}{\text{average GMP catchment population} \times \frac{\text{SAM prevalence}}{100}} \right\rceil = \left\lceil \frac{8}{38.9 \times \frac{1.59}{100}} \right\rceil = \lceil 12.93 \rceil = 13$$

Figure 73. Finding the likelihood survey sample size by simulation using **BayesSQUEAC**



A grid (CSAS) sampling framework was used. Thirteen 3 km × 3 km quadrats were used to locate the primary sampling units (PSUs). PSUs were the catchment areas of the GMP station located closest to the centre of each quadrat (**Figure 74**). Active and adaptive case-finding was used to find SAM cases within the selected PSUs.

Figure 74. Grid (CSAS) sample used for the likelihood survey



The catchment areas of the GMP stations located closest to the centre or each quadrat (marked with a ●) were sampled using active and adaptive case-finding

Selecting the Appropriate Coverage Estimator

The program admitted on MUAC < 110 mm or oedema. A tabulation of admission MUAC indicated case-finding, treatment seeking, and admission:

		Admission MUAC (mm)									
	Oedema	**108–109**	**106–107**	**104–105**	**102–103**	**100–101**	**98–99**	**96–97**	**94–95**	**92–93**	**≤ 90**
Number of admissions	5	308	55	17	5	15	3	4	6	3	4
Proportion of admissions	1.2%	72.5%	12.9%	4.0%	1.2%	3.5%	0.7%	0.9%	1.4%	0.7%	0.9%

The mean duration of treatment episode from admission to cure was 30.44 days. This is shorter than is seen in many CMAM programs and probably reflects timely case-finding, resulting in a patient cohort dominated by uncomplicated SAM cases.

Routine program monitoring statistics were:

All exits	512	
Cured	478	93.4%
Deaths	1	0.2%
Non-response	1	0.2%
Defaulters	32	6.2%

Defaulting was highest in the first few months of program operation. CHWs reported that many defaulters had returned to the program as ‘new admissions’ and completed treatment. This was confirmed by a review of patient records.

The collected quantitative and qualitative data were consistent with a high coverage program with timely admissions and short length of stay, so the period coverage estimator:

$$\begin{matrix}\textit{Period} \\ \textit{coverage}\end{matrix} = \frac{\text{Number of current and recovering cases attending the program}}{\begin{pmatrix}\text{Number of current and recovering cases attending the program} \\ + \text{ Number of current cases } \textbf{not} \text{ attending the program}\end{pmatrix}}$$

was considered to be the most appropriate indicator of program coverage to use for this program.

The likelihood survey found:

$$\begin{aligned}\text{Number of current cases :}\quad & 1 \\ \text{Number of current cases in the program :}\quad & 0 \\ \text{Number of recovering cases in the program :}\quad & 6\end{aligned}$$

The numerator for the period coverage estimator was:

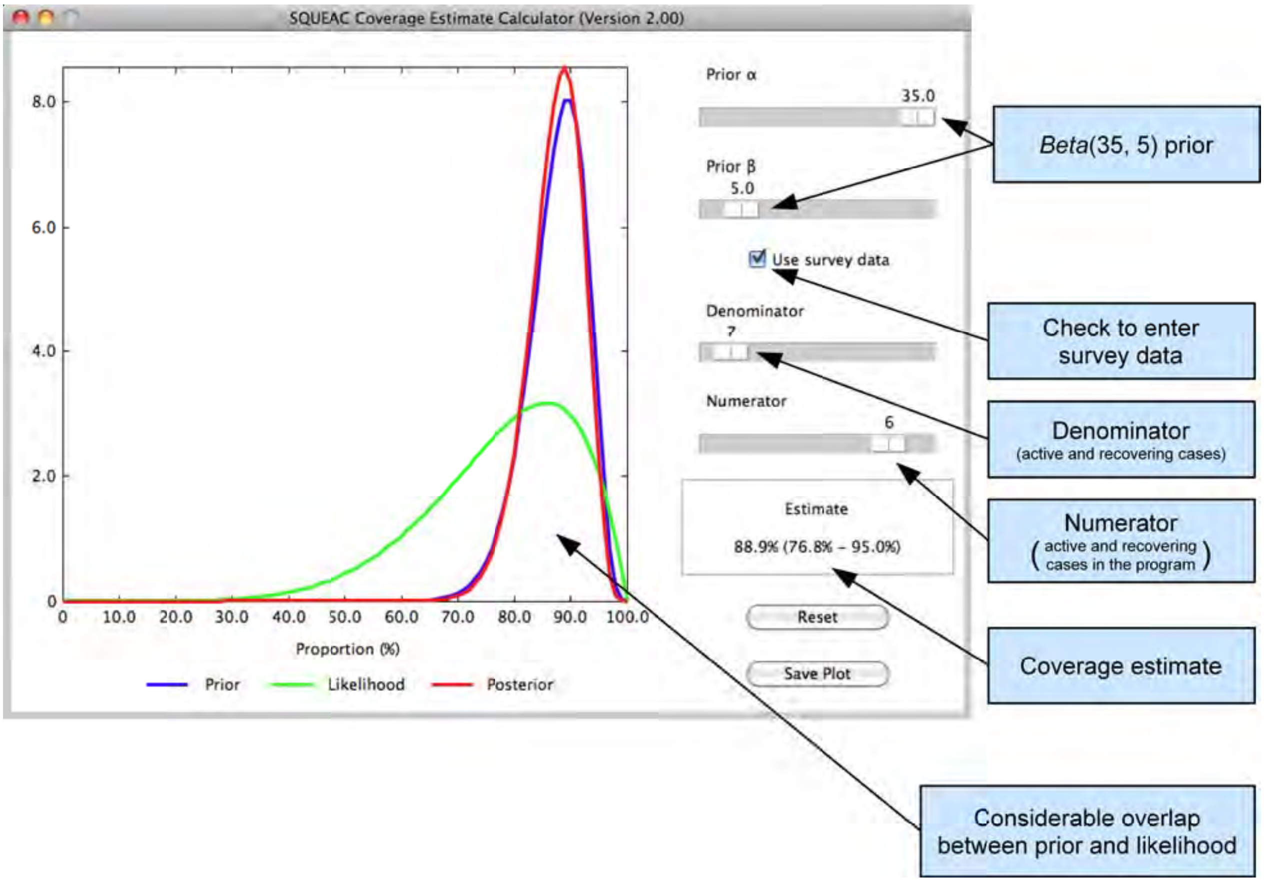
$$\text{Number of current and recovering cases attending the program} = 6 + 0 = 6$$

The denominator for the period coverage estimator was:

$$\begin{pmatrix}\text{Number of current and recovering cases attending the program} \\ + \text{ Number of current cases } \textbf{not} \text{ attending the program}\end{pmatrix} = 6 + 1 = 7$$

Data were analysed using the **BayesSQUEAC** calculator (see **Figure 75**). Coverage of the program was estimated to be 88.9% (95% CI = 76.8%–95.0%). The precision of the coverage estimate was slightly worse than expected from Figure 73 because the likelihood survey found fewer cases than expected.

Figure 75. Estimating *period coverage* using **BayesSQUEAC**



Case Study: Defining a Prior for Moderate Coverage Programs

This case study describes how the prior for a program with coverage between the typically observed limits of about 20% and 80% can be defined. The case study is taken from a SQUEAC investigation of a program implementing CMAM in an east African country. The intervention was implemented through selected government primary healthcare centres and supported by an international NGO.

Figure 76 presents a simplified mind map of the SQUEAC investigation findings. **Table 9** summarises boosters and barriers to coverage found in the SQUEAC investigation and triangulated by source and method.

Figure 76. Simplified mind-map for the SQUEAC investigation findings

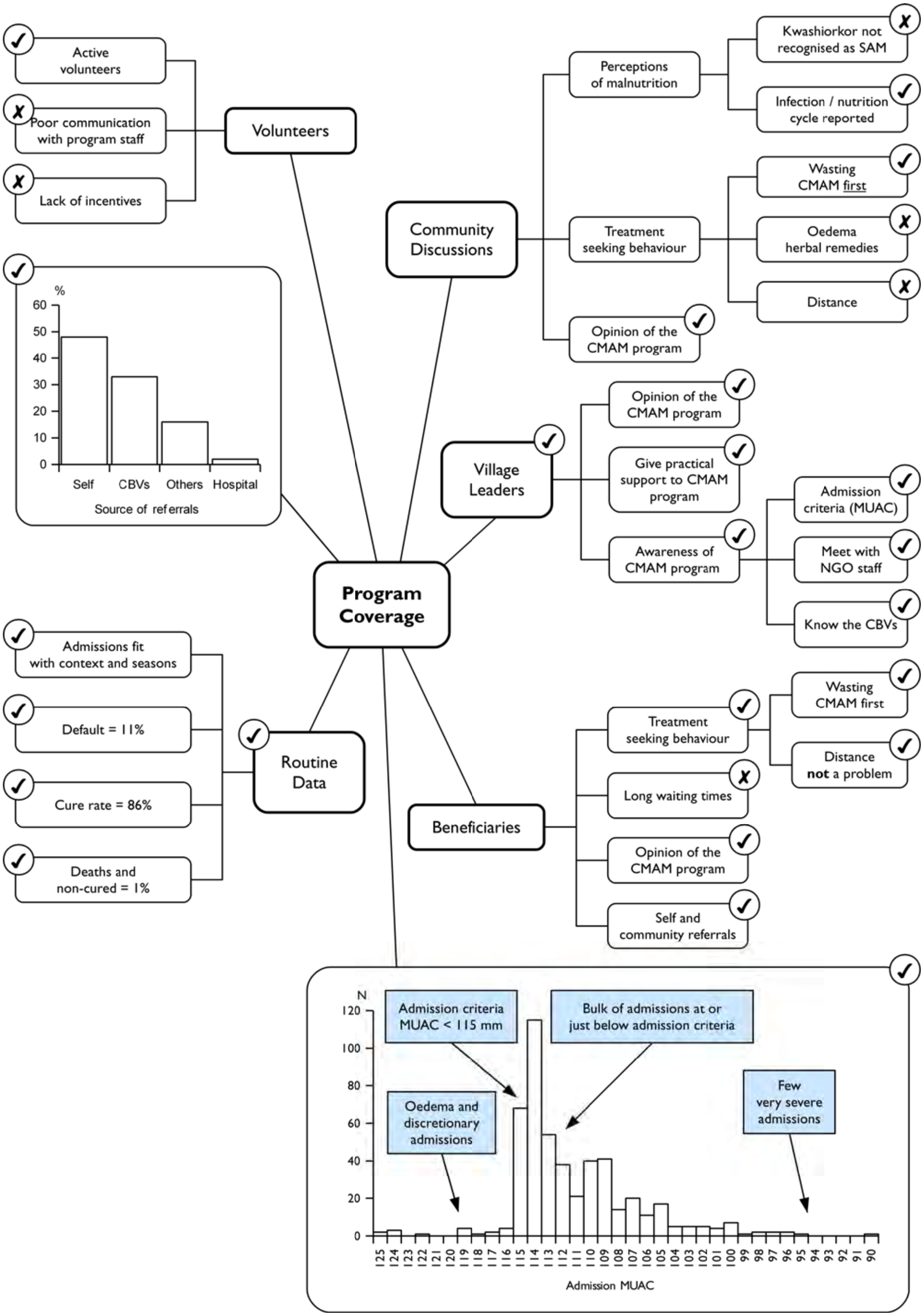


Table 9. Boosters and barriers to coverage found in the SQUEAC investigation

Boosters	Findings
High numbers of self-referrals High numbers of peer-to-peer referrals Volunteer referrals respected	Data on referral source showing about 50% of admissions are self-referrals.
	Informal group discussions with program beneficiaries found that other mothers with children in the program were referring cases.
	Case histories of children currently in the program found that many came to the program after having been referred by volunteers.
Early treatment-seeking behaviour	Plots of MUAC on admission revealed that the majority of cases were admitted at or close to the programs admission criteria.
	Informal group discussion with program beneficiaries found that carers were seeking care at CMAM sites when they thought that their child was wasting or wasted.
	Informal group discussions with the community members found that they sought care at the CMAM clinic for wasting.
Community perception of wasting is consistent with program case definition	Community members, community-based volunteers, and program beneficiaries all identified and described wasting consistent with the program's case-definition of wasting.
General community understanding and acceptance of program admission criteria	Community members, community-based volunteers, and program beneficiaries all understood and accepted the program’s admission criteria.
Discretionary admissions	Examination of plots of MUAC at admission revealed a number of admissions with MUAC above the program admission criteria but without oedema. Discussions with program staff revealed that these were discretionary admissions based on visible severe wasting or moderate wasting with infection. Staff reported that they felt that they should err on the side of sensitivity (or caution) rather than specificity.

Barriers	Findings
Movement of nomadic populations	Mapping of defaulters found high defaulting in nomadic populations.
	Case histories of recent defaulters revealed that movement as part of nomadic practices was an important reason for defaulting.
	Interviews with community leaders and NGO staff found that nomadic populations were most prone to defaulting.
Disconnect between volunteers and the program staff	Observations during CMAM sessions at clinics revealed that volunteers did not perform any specific function.
	Interviews with volunteers found that NGO staff did not routinely co-ordinate or communicate with volunteers.
	Interviews with NGO staff previously in charge of community mobilisation activities revealed that meetings with volunteers were not held regularly.
Lack of motivation for volunteers	Trend of admissions and defaulting revealed that program recruitment and retention was highest when volunteers were incentivised (e.g., by training sessions).
	Interviews with volunteers found that they felt unappreciated.
	Community leaders reported that volunteers needed more practical support from the program in order to perform their duties.
Kwashiorkor is not recognised by the community as treatable within the CMAM program	Community members, program beneficiaries, and community leaders all reported that *libai* and *lobute* (local terms for kwashiorkor) cannot be treated in the clinic.
Lack of communication between program staff and the community regarding CMAM schedule	Program beneficiaries, community-based volunteers, and NGO staff all reported a recent lack of co-ordination and communication between the program and the community regarding the schedule of clinic days.

The findings suggested a moderate level of coverage (about 50%), with boosters and barriers appearing to mitigate each other. The prior was determined by ranking and weighting the boosters and barriers according to their perceived relative contribution to overall coverage. The weights were then summed for the positive and negative factors. The sum of the weights of the boosters was added to 0%. The sum of the weights of the barriers was subtracted from 100%. The resulting figures were then averaged to come up with the mode of the prior. The mode of the prior was located at 50%. This process is summarised in **Table 10**.

Table 10. Ranking and weighting of boosters and barriers to find a credible prior mode

Rank	Boosters	Weight	Rank	Barriers	Weight
1	Self-referrals	+5%	1	Lack of communication between volunteers and program staff	-5%
2	Early treatment-seeking behaviour	+4%	2	Lack of information dissemination from program staff regarding OTP schedule	-3%
3	Perception of wasting consistent with program definition	+3%	3	Motivation of volunteers	-3%
4	Population understands and accepts criteria for admission	+1%	4	Kwashiorkor **not** seen as treatable	-2%
5	Discretionary admissions	+1%	5	Nomadic populations	-1%

Sum :	**+14%**	**Sum :**	**-14%**
Lower value anchor :	**0%**	**Upper value anchor :**	**100%**
Total :	**14%**	**Total :**	**86%**

$$\textit{Prior mode} = \frac{14\% + 86\%}{2} = 50\%$$

The range of the prior was decided by drawing a histogram prior. This was done as a group exercise involving the SQUEAC investigation team. The histogram was drawn on flipchart paper:

1. The peak of the histogram was set at 50%, since this was the most credible value for coverage consistent with the available data.
2. Highly unlikely values were identified by starting at 0% and asking ‘Do we believe coverage could be 0%?’ and ‘If not, then why not?’. This was repeated for 10%, 20%, 30%, etc., until a level of coverage that was not extremely unlikely was identified. At each step, the available data were reviewed and debated. It was agreed that coverage was unlikely to be below about 30%.
3. Step 2 was repeated starting at 100% and working down in 10% steps (i.e., 90%, 80%, 70%, etc.) until a level of coverage that was not extremely unlikely was identified. At each step, the available data were reviewed and debated. It was agreed that coverage was unlikely to be above about 70%.
4. The group was then asked to judge how likely coverage was to be 30%, 35%, 40%, 45%, 55%, 60%, 65%, and 70%. At each step, the available data were reviewed and debated.

This process is illustrated in **Figure 77**. Sufficient information to define the prior for this SQUEAC investigation was available after Step 3 of this process was completed. Step 4 is usually required when the prior mode is considerably above or below 50% and the histogram prior is not symmetrical about the mode, as in **Figure 78**.

Figure 77. Building the histogram prior

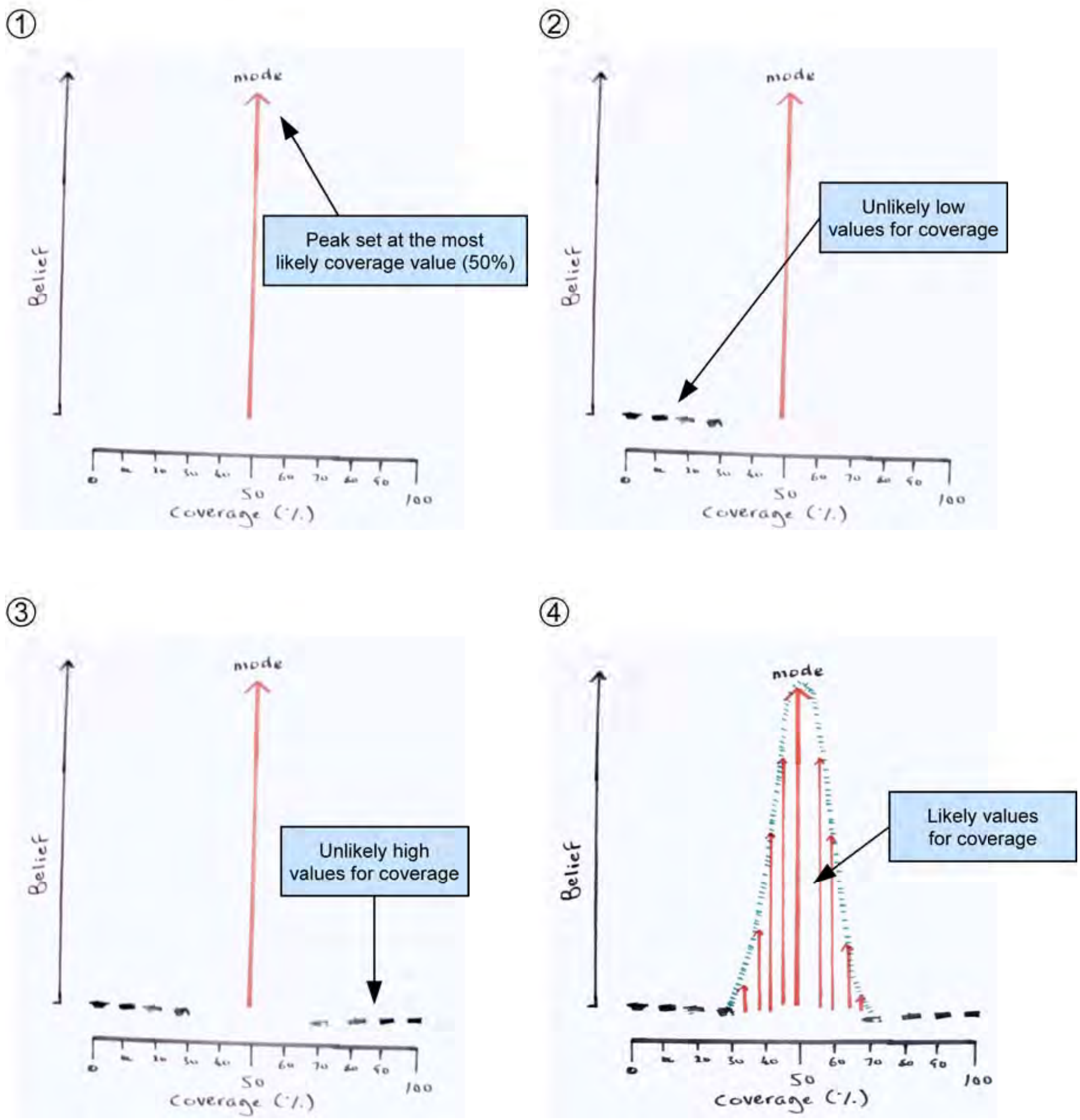
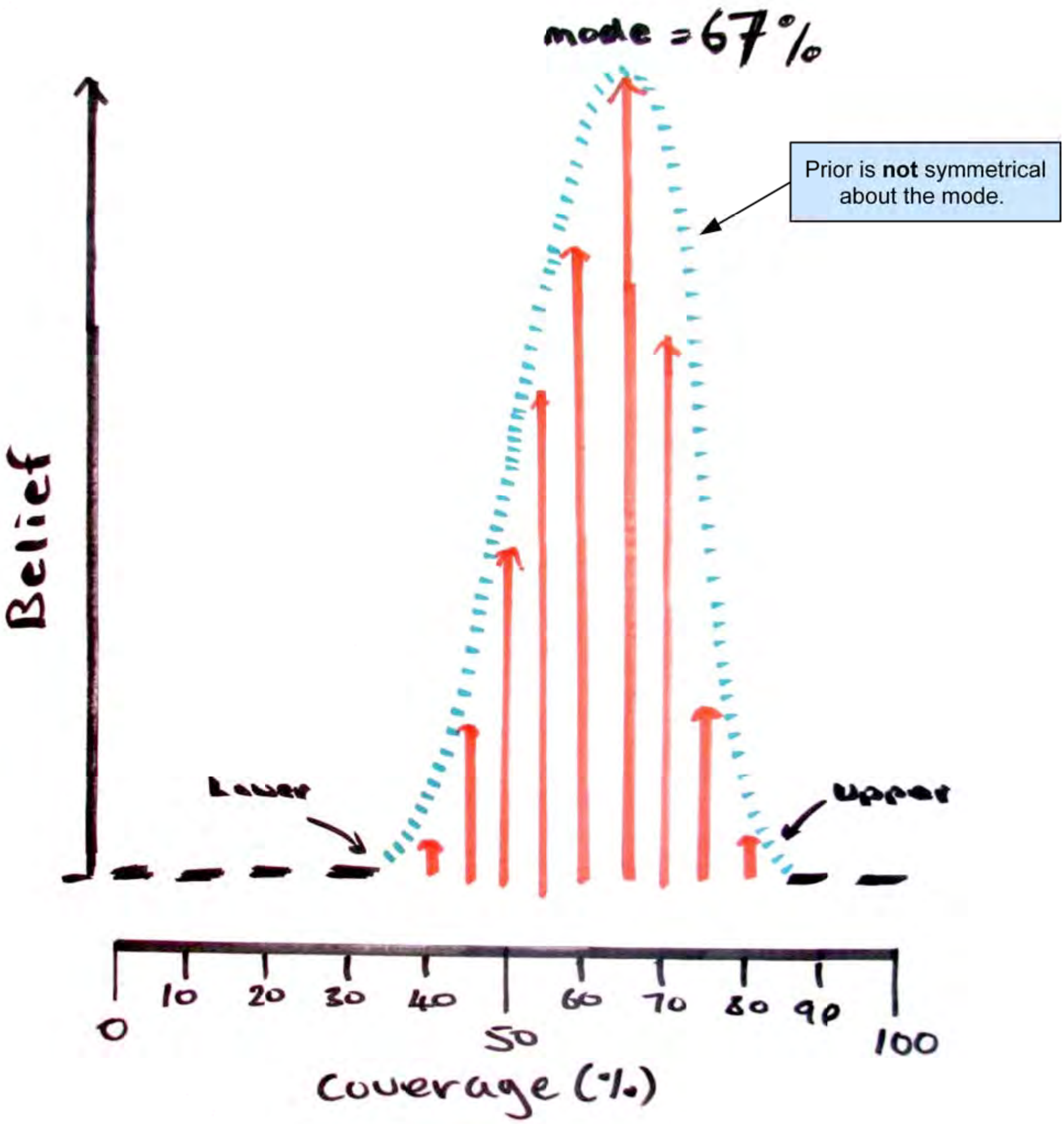


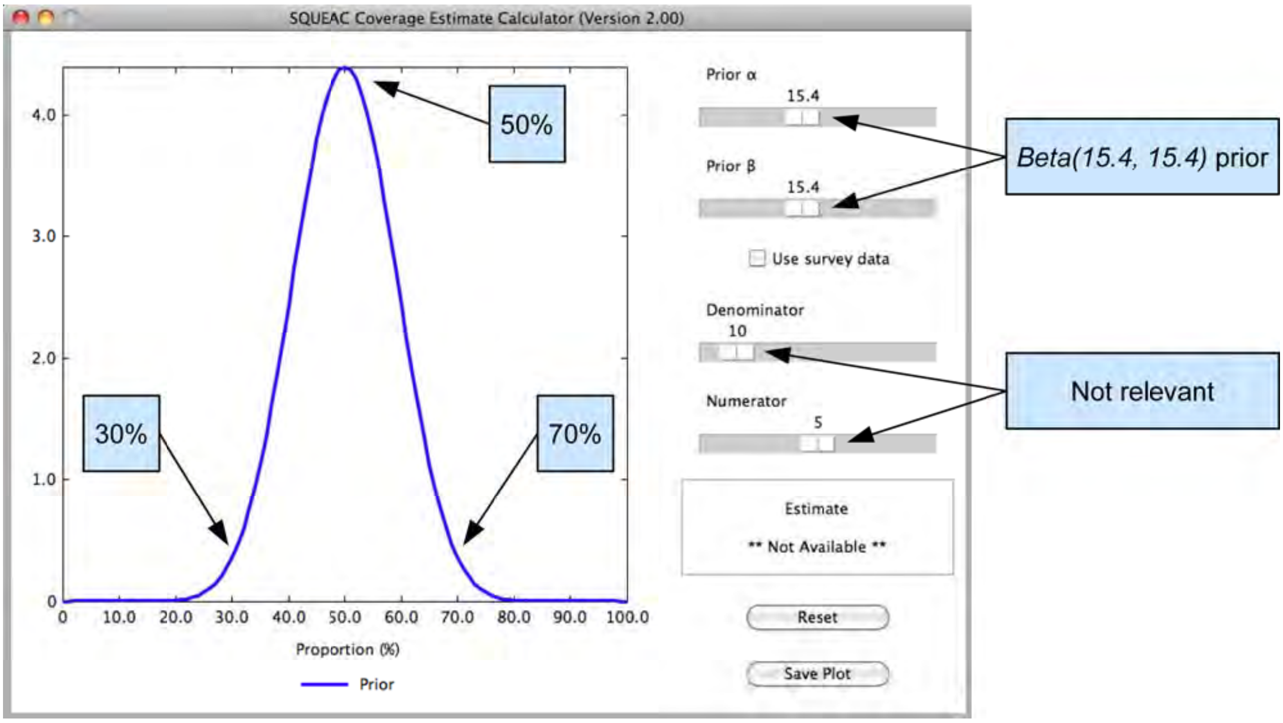
Figure 78. A prior that is not symmetrical about the mode



This process generated a prior range of 30% to 70%. The α_{Prior} and β_{Prior} shape parameters for the prior were found by experimentation with the **BayesSQUEAC** calculator (see **Figure 79**). A *Beta*(15.4, 15.4) summarised prior belief as described by the histogram prior.

Subsequent data collection and analysis revealed that the selected prior was reasonable (i.e., the prior and likelihood did not conflict and coverage was estimated to be 58%).

Figure 79. *Beta*(15.4, 15.4) prior matching the histogram prior developed in Figure 78

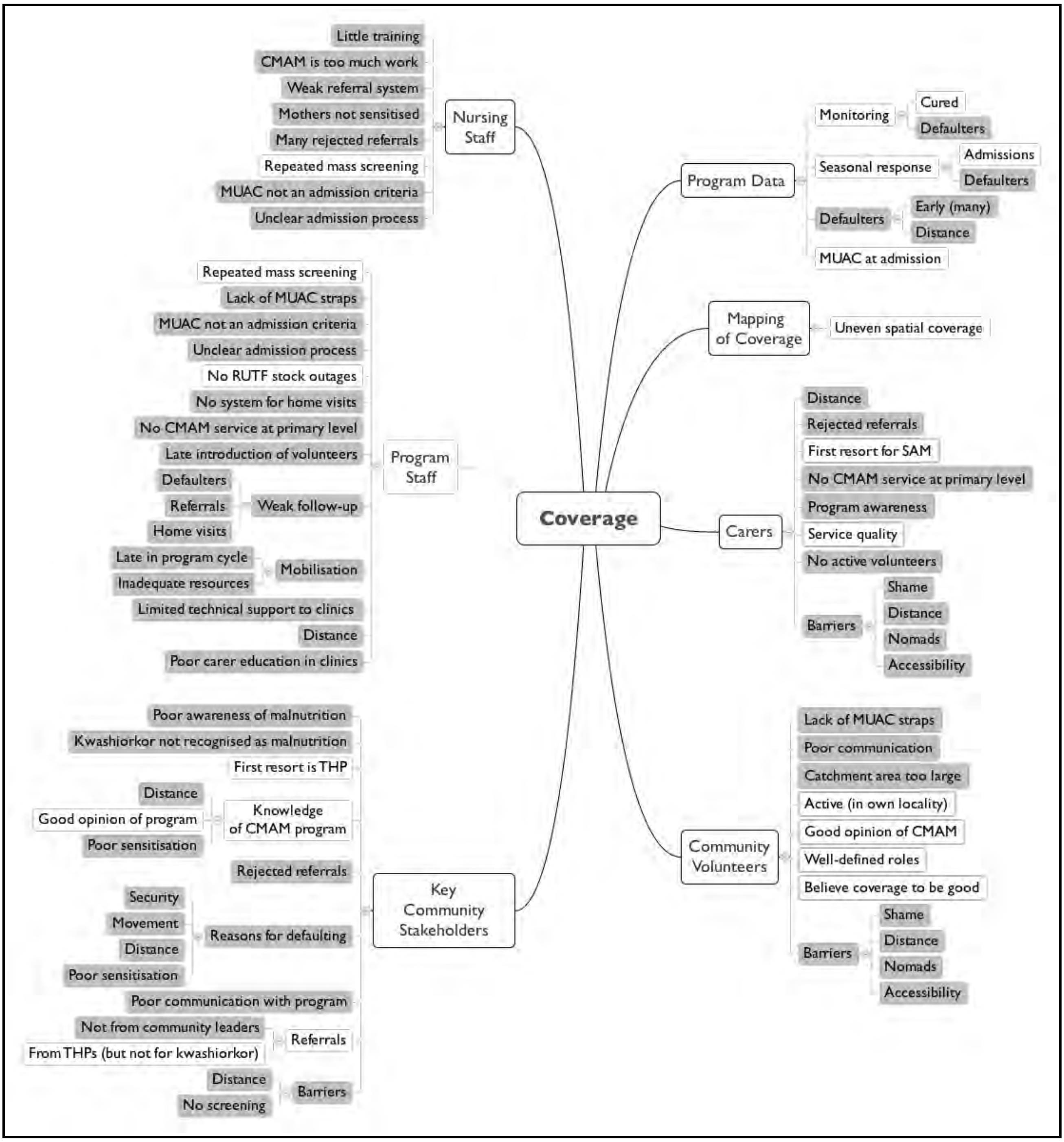


Case Study: Defining a Prior by Wishful Thinking

This case study illustrates how wishful thinking can lead to defining a prior with an inappropriate mode, resulting in potentially misleading coverage estimates and additional work. The case study is taken from a SQUEAC investigation of a program implementing CMAM in a west African country. The intervention was implemented through government health facilities and supported by an international NGO. The survey team was drawn from the supporting NGO. Team members had no prior SQUEAC experience and were undergoing on-the-job training in the SQUEAC method.

Figure 80 shows a simplified (i.e., detailed findings are not shown) mind-map of the findings of the SQUEAC investigation. It is evident from the mind-map that coverage is likely to be very low (< 20%). Identified boosters to coverage are greatly outnumbered by identified barriers to coverage. Some very important barriers to coverage have been identified, including the use of weight-for-height as the sole admission criteria coupled with the use of MUAC by community-based volunteers. This pairing gives rise to the *problem of rejected referrals*. This is one of the earliest and most consistently identified barriers negatively affecting CMAM program coverage. Programs in which the *problem of rejected referrals* operates seldom achieve coverage above 20%. As can be seen from Figure 80, the program under investigation suffers from many additional problems. A sensible choice for the mode of the prior would be a value considerably below 20%.

Figure 80. Simplified mind-map of SQUEAC findings
(mind-map created with **`XMind`**)

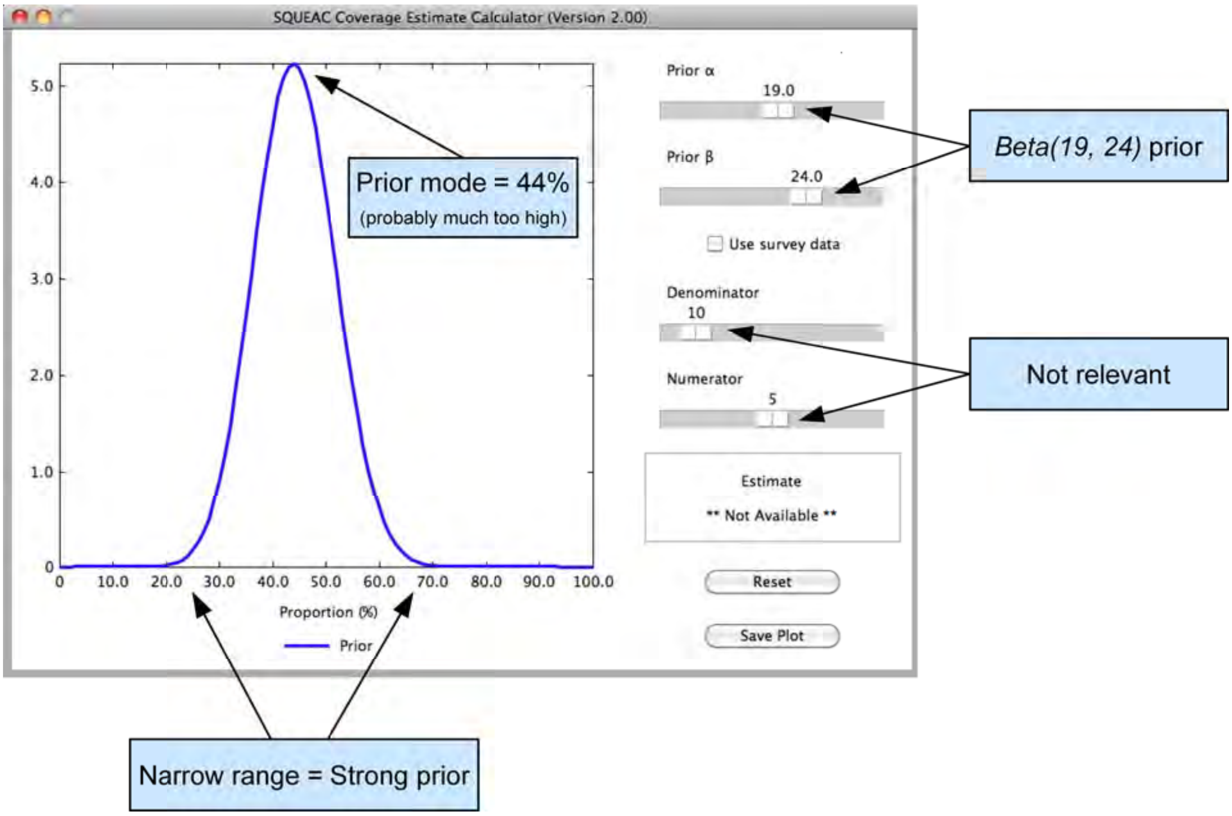


Unshaded boxes show positive findings (boosters). Shaded boxes show negative findings (barriers).

The survey team was divided into three groups, each of which was asked by the SQUEAC trainer to define an appropriate prior based on the results of the SQUEAC investigation. All three groups returned strong priors, with modes of 40%, 44%, and 48%. It was decided that the average (44%) of these three modes would be used.

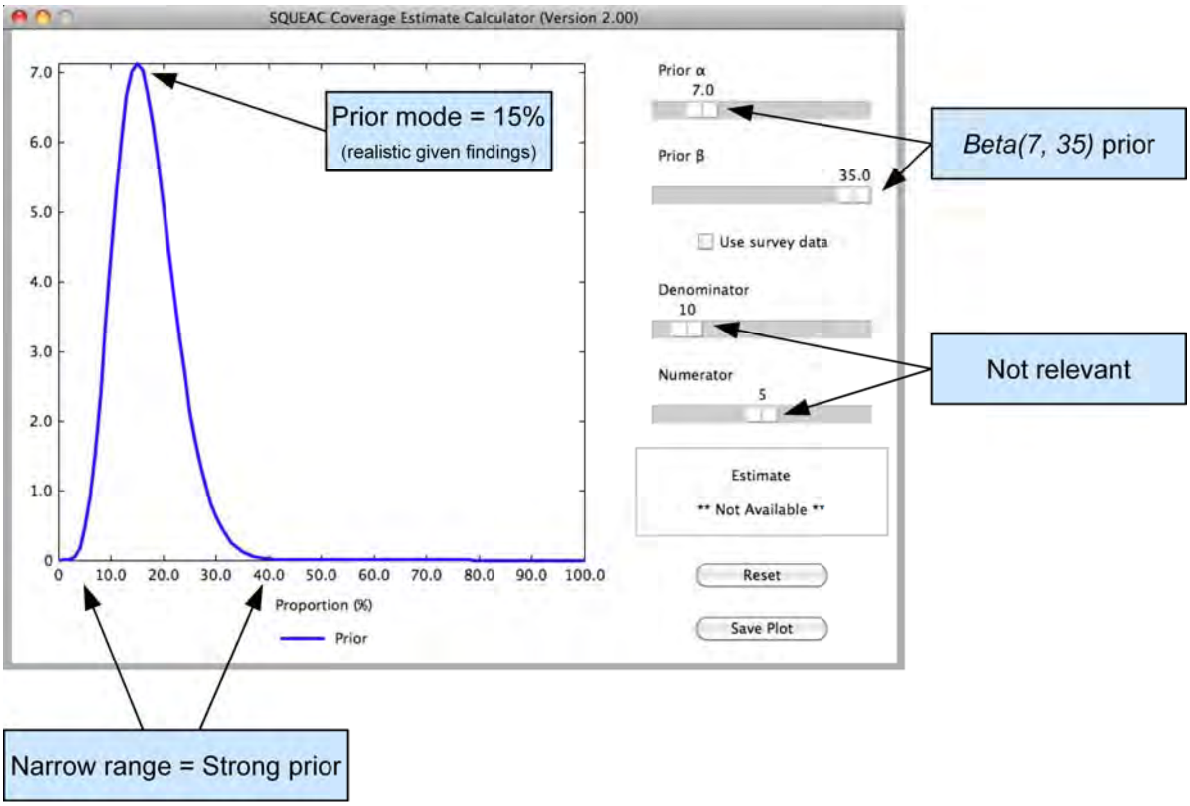
The α_{Prior} and β_{Prior} shape parameters for the prior were found by experimentation with the **`BayesSQUEAC`** calculator. A *Beta*(19, 24) prior was selected using input values of mode = 44% and a range of about 30% to 60% (see **Figure 81**).

Figure 81. The prior selected by the survey team



Gentle prompting by the SQUEAC trainer to re-assess the selected prior was ignored. The SQUEAC trainer (secretly) developed her own *Beta*(7, 35) prior using input values of mode = 15% and a range of about 10% to 30% (see **Figure 82**).

Figure 82. The prior selected by the SQUEAC trainer



Using the survey team's prior, a likelihood sample size of n = 54 cases was selected. This was calculated to yield an estimate with a precision of about ± 10 percentage points:

$$n = \left\lceil \frac{0.44 \times (1 - 0.44)}{(0.1 \div 1.96)^2} - (19 + 24 - 2) \right\rceil = 54$$

Using the SQUEAC trainer's prior, a likelihood sample size of n = 9 cases would have been selected:

$$n = \left\lceil \frac{0.15 \times (1 - 0.15)}{(0.1 \div 1.96)^2} - (7 + 35 - 2) \right\rceil = 9$$

This was also calculated to yield an estimate with a precision of about ± 10 percentage points.

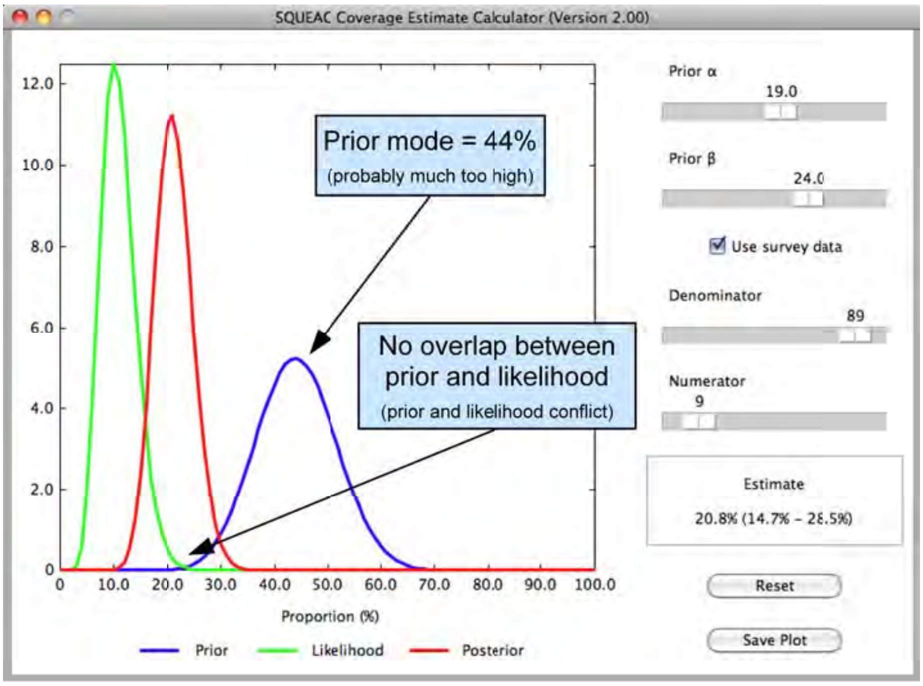
The likelihood sample returned:

Numerator	:	9 current cases in the program
Denominator	:	89 current cases (including current cases in the program)

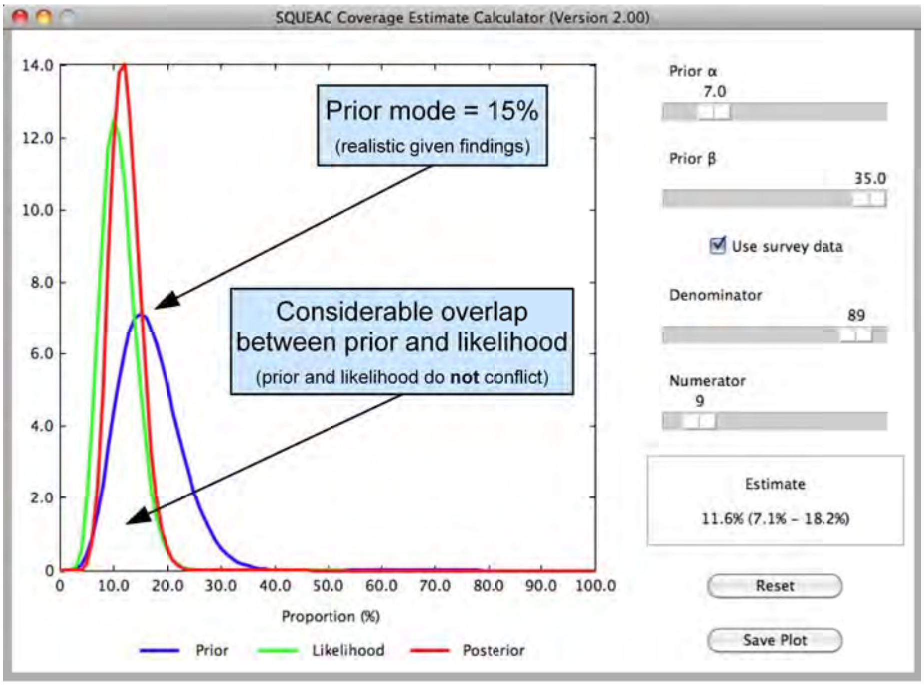
Figure 83 shows the results of the beta-binomial conjugate analyses performed with the team's *Beta*(19, 24) prior and the SQUEAC trainer's *Beta*(7, 35) prior. The results of the two analyses are very different from each other.

Figure 83. Results of the beta-binomial conjugate analysis performed with the team's *Beta*(19, 24) prior and the SQUEAC trainer's *Beta*(7, 35) prior

A : Team's prior and likelihood conflict



B : SQUEAC trainer's prior and likelihood do **not** conflict



In the analysis performed using the team's *Beta*(19, 24) prior there is no overlap between the prior and the likelihood, and the coverage estimate calculated using the likelihood survey data alone:

$$Coverage_{Likelihood} = \frac{9}{89} \times 100 = 10.1\,\%$$

is very different from the prior mode of 44%. The prior and likelihood are said to *conflict*. When this happens, the results of the analysis are suspect and are usually discarded. In this case, the problem was caused by the use of a strong prior with an unrealistic mode. It is **not** reasonable to use the results of this analysis.

In the analysis performed using the SQUEAC trainer's *Beta*(7, 35) prior there is considerable overlap between the prior and the likelihood, and the coverage estimate calculated using the likelihood survey data alone (10.1%) is not very different from the prior mode of 15%. The prior and the likelihood do not conflict. It is reasonable to use the results of the analysis.

The use of the unrealistic prior would have led to a gross overestimation of coverage. Checking for a conflict between the prior and the likelihood identified the problem and the misleading results were rejected. When this happens, a **new** prior needs to be defined (i.e., by re-examination of existing data and incorporation of the data collected for the likelihood survey) and a **new** likelihood survey undertaken. This is a lot of additional work. It is best to avoid the problem by being scrupulous and realistic when specifying the prior.

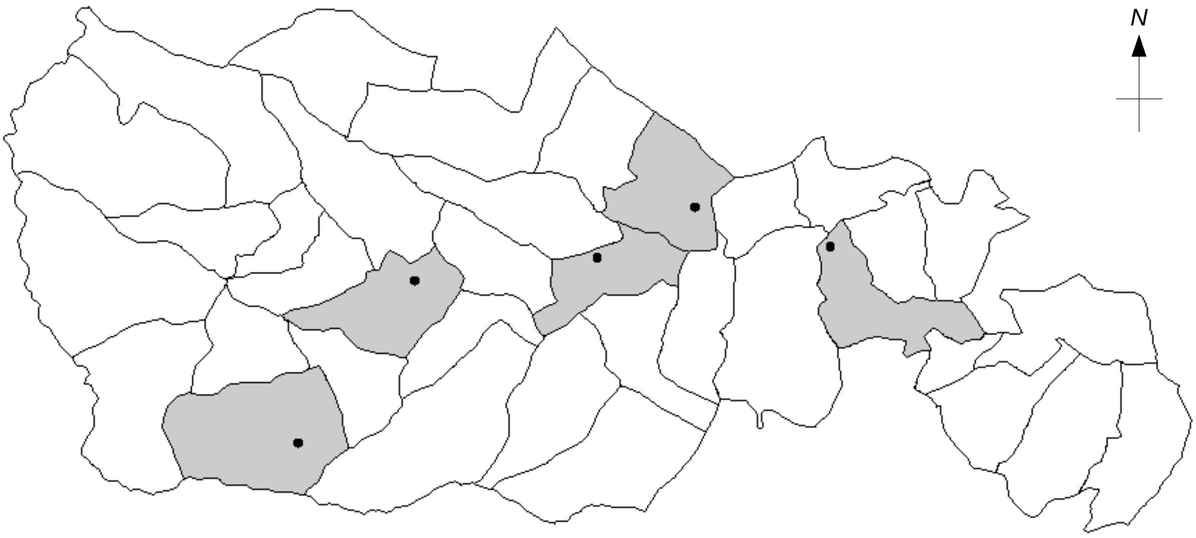
The mode of the prior chosen by the survey team was unrealistic in this case because they *wanted* the coverage to be high, and this led them to underestimate the effect of negative findings and overestimate the effects of positive findings. The survey team's prior reflected what the team *wanted* the coverage to be rather than what the collected data indicated the coverage was likely to be.

Case Study: Sampling without Maps or Lists

This case study describes how a likelihood survey sample was taken in a SQUEAC assessment when neither maps nor useful village lists were available. A similar method could also be used for a SLEAC survey.

Figure 84 shows the most detailed map of the program area that was available at the time of the assessment. The map showed only district and sub-district boundaries. The shaded areas on the map represent the sub-districts in which the CMAM program was active. The filled circles on the map represent the approximate locations of CMAM clinic sites.

Figure 84. The most 'detailed' map available



Attempts to take a systematic sample of villages using an official list of villages in each sub-district proved difficult because administrative boundaries, the names of administrative areas, and the official names of villages had been subject to frequent change as the result of ongoing government reorganisation. It was found that a large number of villages had official names that were different from their everyday 'folk names' and were not recognised by residents. Village names recorded on patient records cards often did not match official village names.

After spending 2 days trying to find villages using official names the assessment team decided that they needed to create their own list of villages. Interviews with program outreach workers validated by informal group discussions in markets, guesthouses, 'tearooms', and at CMAM clinic sites indicated that the 'parish' (i.e., the catchment area of a named church) was a stable areal designator that was readily recognisable by the entire population regardless of their religion. Key informants (program outreach workers, priests, council leaders, and agricultural extension workers) were asked to list the parishes in their home sub-district. They were then asked to list the villages belonging to each of the listed parishes. A second list was made using different key informants. The two lists were compared and discrepancies resolved with the assistance of a third, fourth, or fifth key informant. The list was then (partially) checked for completeness by checking that all of the village names recorded on patient records cards were also present in the list. This process resulted in a list of villages in each sub-district stratified by parish and validated by triangulation by source and method.

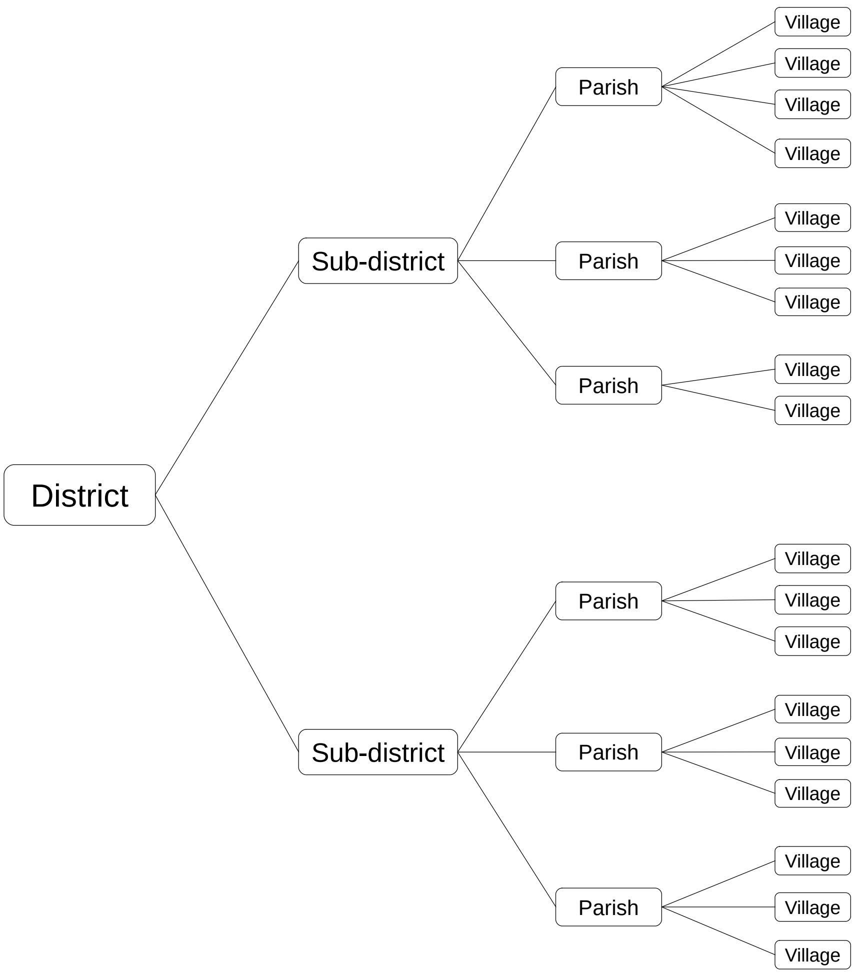
A systematic sample was selected from this list:

- It was calculated that a sample of 40 villages was required.
- The list of villages was sorted by sub-district and parish (see **Figure 85**).
- There were 218 villages in the list, so a sampling interval of:

$$\textit{Sampling interval} = \left\lfloor \frac{218}{40} \right\rfloor = \lfloor 5.45 \rfloor = 5$$

was used. A random starting position of 2 (selected using **`=RANDBETWEEN(1,5)`** in a Microsoft Excel spreadsheet) was used. This lead to a systematic sample of 44 villages being selected.

Figure 85. The list of villages was sorted by sub-district and parish



The selected villages were sampled using house-to-house screening. House-to-house screening was used because it was the case-finding method used by program outreach workers and each survey team contained at least one program outreach worker who could share their experience with other members of the team. The adoption of house-to-house screening reduced training overheads and saved the time and effort required to develop and test an adaptive and active case-finding procedure.

Villages close to a market town were not visited on the market day. Also, sampling did not take place on days when CMAM sessions were held at the local CMAM clinic site.

T e use of parish as the areal designator proved easy to use in the field. Teams started by finding the parish church and were then directed to the villages selected for sampling by the parish priest or another church official.

Additional validation of the within-parish lists of villages with the parish priest or church official revealed very few errors. An additional seven small villages were identified (i.e., the list was estimated to be about 97% complete). These additional villages were not sampled.

The process of creating the list in each sub-district took 1 day. The process of creating the complete list, selecting the sample, and planning the fieldwork took 4 days.

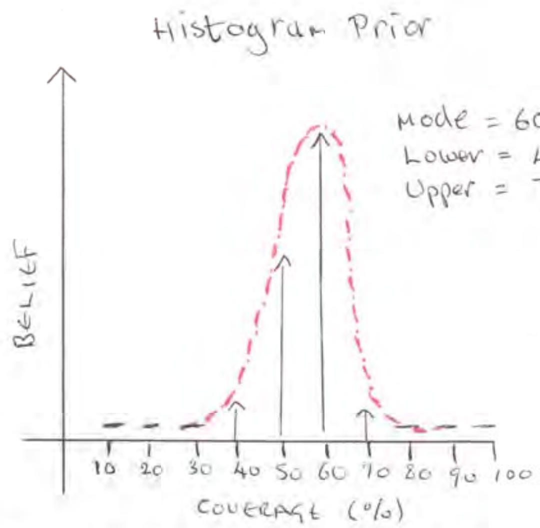
Case Study: Using Satellite Imagery to Assist Sampling in Urban Settings

This case study illustrates the use of lists, maps, and satellite images when sampling for a likelihood survey for a SQUEAC assessment of program coverage in Mogadishu, Somalia.

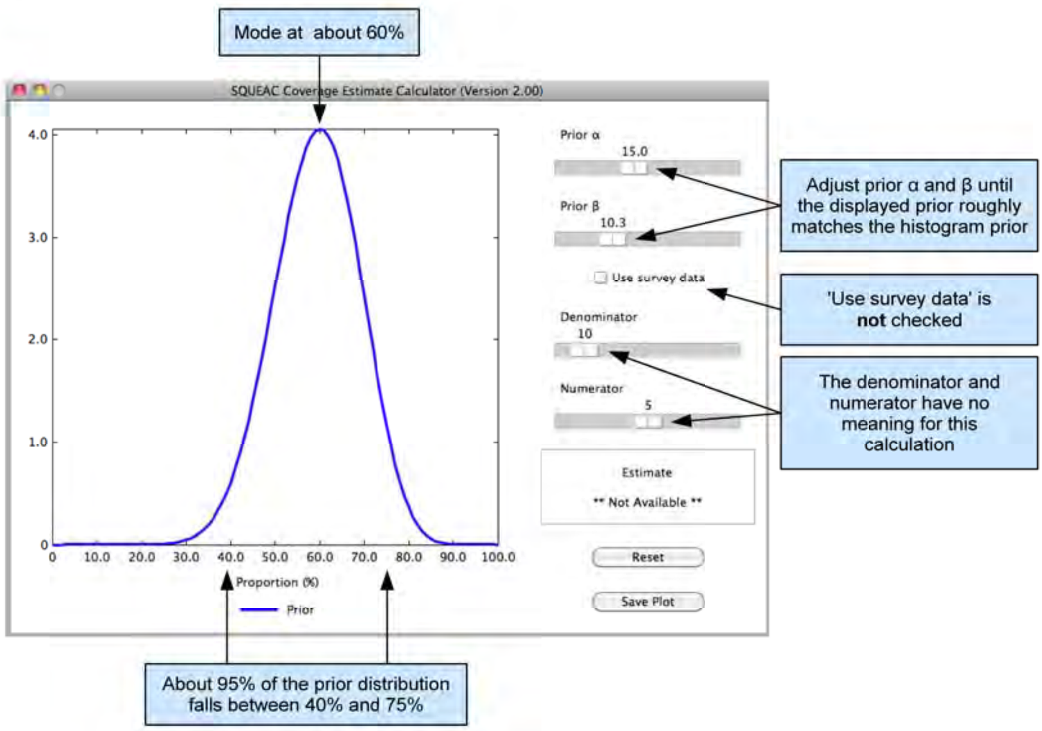
A histogram prior was developed using routine program data, qualitative data, and the findings of small studies and small-area surveys. The prior had a mode of 60% with credible values ranging between about 40% and about 75%. Experimentation with the **`BayesSQUEAC`** calculator found that a prior defined as *Beta*(15.0, 10.3) provided a reasonable match to the histogram prior (**Box 4**).

Box 4. Using **`BayesSQUEAC`** to find α and β values that match a histogram prior

The histogram prior:



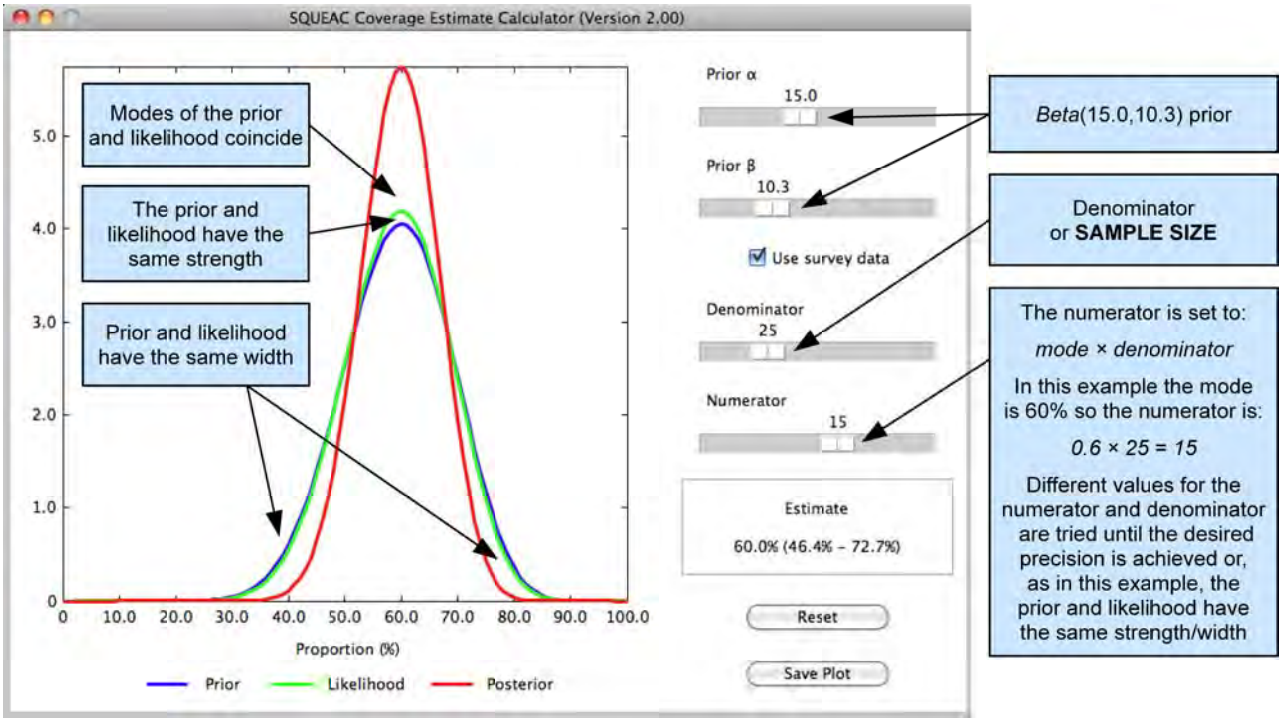
A matching *Beta*(α, β) prior was found by adjusting the Prior α and Prior β sliders until the displayed prior matched the histogram prior:



This approach will yield similar (but not necessarily the same) values to those obtained using the formulas for calculating α and β presented in the SQUEAC section of this document.

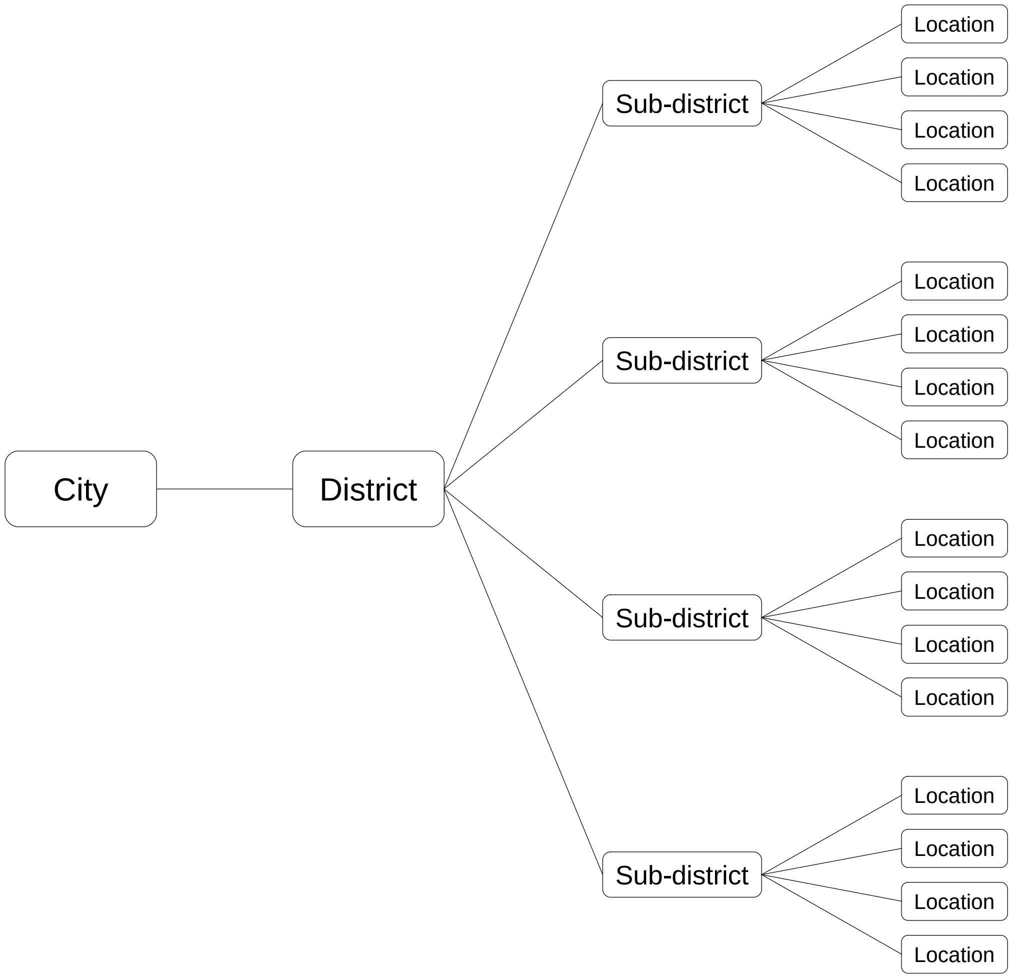
The minimum sample size required for the likelihood survey (n_{min} = 25) was calculated by simulation using **BayesSQUEAC** so that the expected likelihood had the same mode and the same strength and width as the prior (**Figure 86**). Calculating the minimum sample size in this way ensures that the sample size of the likelihood survey is sufficiently large to be able to correct a poorly specified prior.

Figure 86. Calculating a minimum sample size using the **BayesSQUEAC** calculator



Note: This approach will yield a similar (but not necessarily the same) value to that obtained using the formulas for calculating the sample size for the likelihood survey presented in the SQUEAC section of this document

Sampling locations were selected using a spatial hierarchy:



that reflected the organisational hierarchy of the program that was organised by district, each with four sub-districts each containing four locations. The city and the districts within the city had well-defined ‘official’ boundaries. Sub-districts and locations were *program entities* and, at the time of the SQUEAC coverage assessment, had poorly defined boundaries. It was necessary, therefore, to create a map of sub-district and location boundaries for the purposes of sampling.

No recent map of the city was available. A low-resolution satellite image of the city was available. District boundaries were marked on this satellite image (**Figure 87**).

Figure 87. District boundaries marked on a low-resolution satellite image

Higher resolution satellite images of the individual districts that the program was active in and could safely access at the time of the SQUEAC assessment were downloaded using Google Earth (`http://earth.google.com`). District boundaries were marked on these higher resolution satellite images (**Figure 88**).

Figure 88. District boundary of Shingani district marked on a satellite image

Sub-district boundaries were decided by discussion with program staff and marked on the satellite image (**Figure 89**). Main roads, shorelines, rivers, drains and canals, and obvious landmarks were used to locate boundaries. This simplified fieldwork by making sub-districts and their boundaries easy to locate and sample.

Figure 89. Sub-district boundaries added to the satellite image of Shingani district

Lists of locations and their boundaries were decided by discussion with program staff using rough hand-drawn maps to focus discussion (**Figure 90**). Location boundaries were marked on the higher resolution satellite images of the districts (**Figure 91**). Again, main roads, shorelines, rivers, drains and canals, and obvious landmarks were used to locate boundaries. This simplified fieldwork by making locations and their boundaries easy to locate and sample.

Figure 90. Rough hand-drawn map use to create lists of locations by sub-district

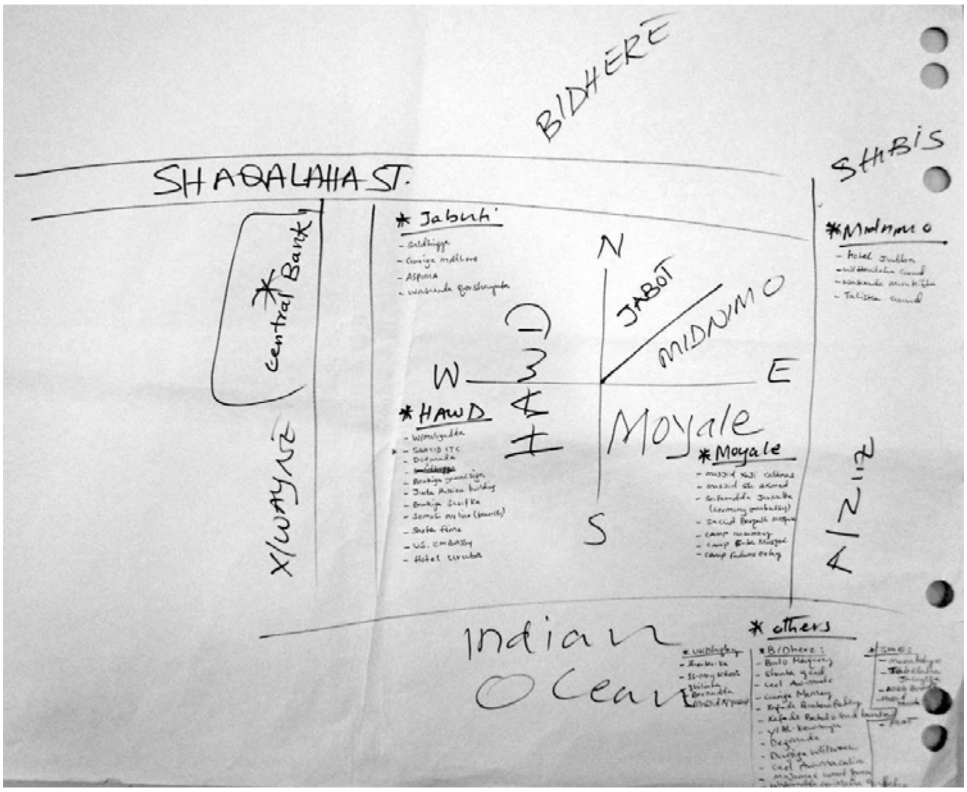


Figure 91. Location boundaries added to the satellite image of Shingani district

At the end of this process, there was a set of district maps showing sub-district and location boundaries. These maps were translated into a list of locations sorted by district and sub-district (**Figure 92**).

Figure 92. List of locations sorted by district and sub-district created from the mapping process (also showing systematic sampling with start = 3 and interval = 9)

District	Sub-district	Location	Sampled
Shingani	Hawd	Degmada	
		Fiimo	
		Sportiga	●
		Curuba	
	Mooyale	Baer Italia	
		Sharif Abow	
		Dalsan	
		Sharud Zenow	
	Midnimo	Caymiska	
		Bortamaha	
		Jubba	
		Ishima	●
	Jabuuti	Madbacadda	
		Hawlaha Mareekubta	
		Safeeroda Etobia	
		Giisha Baraa	
Waberi	Hawl Wadaag	Xawo Tako	
		Lulyo	
		Jabuuti	
		26 Juun	
	Horseed	Hillac	●
		Iskaashi	
		Adari	
		Halgan	
	Ida Mayo	Ahmed Gurey	
		1 May	
		Mohamed Hassan	
		Bolotikniko	
	October	Xooge	
		Wajeer	●
		J. Da'ud	
		Dhagextuur	
Wadajir	Hawo Tako	Nasteexo	
		Hilaac	
		Gelow	
		Ali Hussein	
	Tima Cadde	Heegan	
		Aargo	
		Sudi	●
		Hassan Jiis	
	J. Da'ud	Buula Xubey	
		Danwadaagaha	
		Wasaradda Macden	
		Badaadir Hospital	
	Xalane	Timanka	
		Qurunbow	
		Horseed	
		Adon Gabyow	

to next column ...

... from previous column

District	Sub-district	Location	Sampled
Dharkeynley	Xanaono	1 aad	
		2 aad	
		3 aad	
		4 aad	
	Dhagaxfur	Xoosh	
		Warshsada	
		Garas Baalay	
		Nuur Aduunyo	
	Sacud Reorge	Dahageynko	●
		Shawrida	
		Abe Geddo	
		Kaxda	
	Dhamme Yasun	Hegan	
		Halgari	
		Horseed	
		Iftin	
Hamar-Jajab	Gahayr	Xalene	
		Sh'Shaacir	●
		Ahmed Gurey	
		Saqawadin	
	Horseed	Mohamud Horbi	
		Wajeer	
		Nashib Bundo	
		Hawass	
	J. Da'ud	26 Juun	
		Ida July	
		Iftim	●
		Taleex	
	Ida Mayo	Ahmed Gurey	
		Jabuuti	
		12 October	
		Id Luulyo	
Hamar-Weyne	Gobamimo	Koodka	
		Cadayga	
		W'Lacoqte	
		Buur Fuule	●
	Kacaan	Aweyska	
		Via Rome	
		Yunlaye	
		Aweys Geedow	
	Horseed	Rapayga	
		Binguber	
		Cadule Shideya	
		Dacarey	
	Hilaac	Yoobsen	●
		Macian Jacmoc	
		Via Ejato	
		Hawo Take	

Note: The sampling interval is applied until the end of the list is reached. In this example the method selected 11 sampling locations. All 11 locations were sampled.

A systematic sample was taken using this list. The number of locations to sample was calculated using the standard formula:

$$n_{locations} = \left\lceil \frac{n}{average\ location\ population_{all\ ages} \times \frac{percentage\ of\ population_{6-59\ months}}{100} \times \frac{SAM\ prevalence}{100}} \right\rceil$$

The average population in each location was estimated to be 500 people, the percentage of the population aged between 6 and 59 months was estimated to be 20%, and SAM prevalence estimated to be 2.5% (this was taken from a recent nutritional anthropometry survey) giving:

$$n_{locations} = \left\lceil \frac{25}{500 \times \frac{20}{100} \times \frac{2.5}{100}} \right\rceil = 10$$

The sampling interval was calculated as:

$$Sampling\ Interval = \left\lfloor \frac{\text{Total number of locations}}{\text{Number of locations to sample}} \right\rfloor = \left\lfloor \frac{96}{10} \right\rfloor = \lfloor 9.6 \rfloor = 9$$

A random sample location was selected using a random number between 1 and 9 generated using coin tosses. The generated random number was 3, so the third location on the list was selected. The method for generating random numbers by tossing coins is described under “A Note on Generating Random Numbers” in the SQUEAC section of this document. Subsequent sampling locations were selected by repeated addition of the sampling interval. This process (see Figure 92) ensured that the sample was distributed over the entire program area. **Figure 93**, for example, shows the two locations selected for sampling from Shingani district.

Figure 93. Locations in Shingani district selected for sampling

Selected locations were sampled using building-to-building and door-to-door sampling to account for multiple occupancy of compounds and buildings. Satellite images, such as the one shown in **Figure 94**, provided sufficient detail to allow fieldworkers to reliably identify locations, location boundaries, and dwellings in each of the selected locations.

Figure 94. Satellite image showing a single sampling location

Case Study: Active and Adaptive Case-Finding in a Rural Setting

This case study describes the procedure used to conduct active and adaptive case-finding (see Box 3, page 65) during SQUEAC investigations in two rural districts of Niger.

The case-finding method described here was used for both the small-area surveys and the likelihood survey and was based on the following two principles:

The method is *active*. SAM cases were specifically targeted. Case finders did not go house to house in the selected villages measuring all children aged between 6 and 59 months. Instead, only houses with children with locally understood and accepted descriptions of malnutrition and its signs were visited.

The method is *adaptive*. At the outset, key informants helped with case-finding in the community, but other sources of information found during the survey were used to improve the search for cases.

Preparatory Research

For the active and adaptive case-finding method to be effective, research must be conducted during the qualitative phase of the SQUEAC investigation to determine:

- The appropriate case-finding question
- The most useful key informants to assist with case-finding
- Any context-specific factors affecting the case-finding process

The Case-Finding Question

Appropriate local terminology used by the population to describe the signs of SAM had to be identified and community definitions and aetiologies understood so that these could be used to facilitate the active search for cases. Carers of children with SAM enrolled in the CMAM program and carers of children recovering from SAM enrolled in the CMAM program were asked:

- To describe the condition of their child
- What terms should be used and how the signs should be described in local languages if we wanted to find children with the same condition in other villages
- To explain the signs and symptoms that led them to consult the CHW or attend the health centre

Pictures of children with SAM were shown to a wide variety of community members who were asked to name the local terms for particular signs (e.g., skin signs, hair signs, baggy-pants, thin arms, swollen feet), the conditions (i.e., severe wasting and kwashiorkor), and their causes. Care was taken to identify derogatory and insulting terms.

The research indicated that the following terms were understood and used by the community to describe children with malnutrition:

- *Tamowa* (flaccid and/or wrinkled skin)
- *Kwamaso* and *kwameshewa* (wasting)
- *Raama* (thin, wasted)
- *Tsimbirewa* (child is small and resembles an old man)
- *Koumbiri* (swelling)

The research also revealed that malnutrition was not always recognised as a specific condition but as the outcome of illnesses (predominantly diarrhoea and fever). It was considered important, therefore, to ask for children that currently had or were recovering from conditions such as:

- *Masas sara* (fever)
- *Zawo* (diarrhoea)

It should be noted that the information collected while determining the appropriate case-finding question is often useful in other aspects of a SQUEAC or SLEAC investigation. For example, these findings should be compared with program messages. If program messages do not match all of these findings (e.g., the program messages do not explicitly mention diarrhoea and fever or exclude some local language terms), there may be a negative impact on coverage. Also, if program messages use derogatory or insulting terms, there may be a negative impact on coverage, since not many people would proudly identify themselves as, for example, dirty, ignorant, drunken whores.

Identifying Key Informants

It was necessary to identify the types of people who, because of their position in the community or their contact with and knowledge of small children, were likely to be able to identify SAM children.

Such *key informants* would be able to direct survey teams to the homes of potential SAM cases and avoid the need to conduct a house-to-house search for SAM cases. Specifically:

Carers of children with SAM enrolled in the CMAM program and carers of children recovering from SAM enrolled in the CMAM program were asked:

Who would know which children were sick or had the same condition as your own child in the village and could help us find cases?

A wide variety of community members were asked:

Who in your village is best placed to tell us about the health of young children and to know which children are sick?

Treatment-seeking behaviours were also explored to see which people were first consulted for help and advice when a child became sick or wasted.

The following people were identified as useful key informants:

The *matrone* (senior TBA in a village)

The *kungiya* (women's leader)

Grandmothers and respected older women

Village and religious leaders

Traditional health practitioners

Village pharmacists

It should be noted that this information is often useful in other aspects of a SQUEAC or SLEAC investigation. For example, these findings should be compared with the types of people that are recruited as community-based case-finders or that are regularly and frequently contacted in program outreach activities. If some types of people are not recruited as community-based case-finders or are not in regular and frequent contact with the program, there may be a negative impact on coverage. Also, if carers initially seek treatment with traditional health practitioners and traditional health practitioners are not recruited as community-based case-finders or are not in regular and frequent contact with the program, there may be negative impact on coverage.

Context-Specific Factors Affecting the Case-Finding Process

Any potential cultural or practical constraints that could influence the conduct of the case-finding had to be identified to ensure that these were taken into account and the method adapted accordingly if necessary. Specifically:

- Community members were asked about daily activity patterns so as to inform timing of case-finding activities (e.g., to know when carers and children are likely to be at home, to avoid sampling at meal times or on market days).
- Cultural norms regarding the acceptability of male case-finders speaking to women and entering houses and compounds were discussed with the SQUEAC team and verified during village visits.
- Observations were made with respect to the general structure of villages.

No major constraints were identified. However, findings showed that it was important to establish if any hamlets were attached to the village or if the village was made up of more than one cluster of houses so that these populations were not overlooked during sampling.

Survey Stage

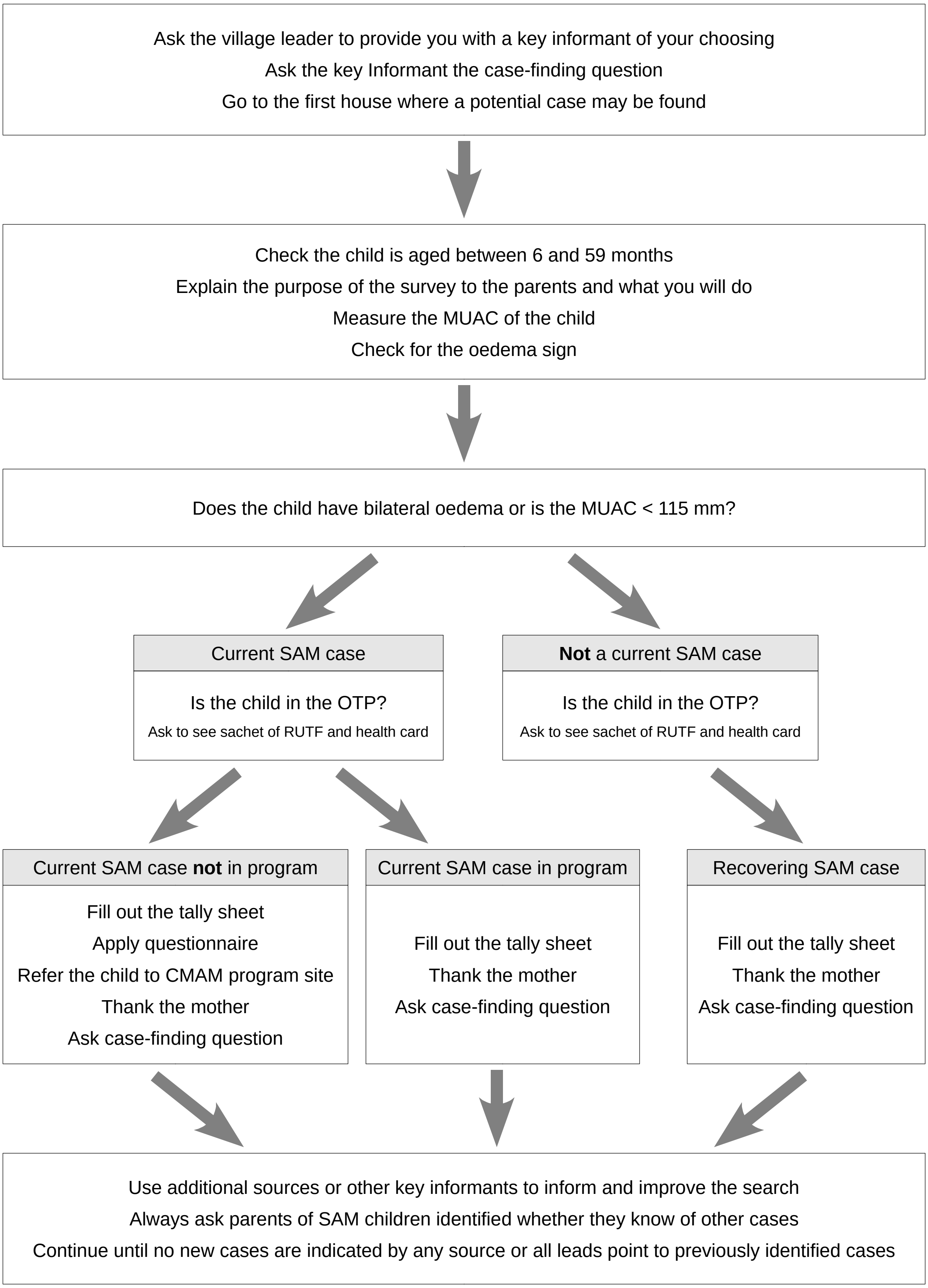
Active and adaptive case-finding proceeded in the following way in each village selected for the surveys:

1. The survey team presented themselves to the village leaders and requested the help of a key informant.
2. The case-finding question and, in addition, knowledge of children attending a feeding program were asked of the key informant.
3. The team arrived at the first house indicated by the key informant and, after checking that the identified child was aged between 6 and 59 months and explaining the purpose of the visit to the carers, the team measured the identified child as a potential case.
4. If the child was found to be a SAM case, confirmation was sought as to whether the child was enrolled in the CMAM program. If the child was **not** in the CMAM program, then a short questionnaire (similar to that shown in Box 2, page 49) was administered to discover the reasons for coverage failure and the child was referred to the nearest CMAM program site. If the child was **not** currently a SAM case, confirmation was sought as to whether the child was enrolled in the CMAM program to check whether the child was a recovering SAM case.
5. All cases identified (i.e., covered and uncovered SAM cases and recovering SAM cases in the CMAM program) were noted on a tally sheet.
6. Before proceeding to the next potential SAM case known to the key informant, the carers of the case just identified were asked if they knew of any children with a similar condition or who were in a feeding program.

Case-finding was considered to be exhaustive when no new leads to potential cases were forthcoming and when information given by different sources (e.g., key informants and carers) identified children that had already been seen by the team.

The survey process is summarised in **Figure 95**.

Figure 95. The survey process using active and adaptive case-finding



Observations

The case-finding method targeted SAM cases and recovering SAM cases. Case-finding was quicker and more effective than if a blanket screening method had been used. It was possible for each survey team to sample at least two villages per day, even when villages had more than 3,000 inhabitants.

Using familiar terms and definitions understood by the community enabled a large number of cases to be identified, including many severe kwashiorkor cases whose condition had not been recognised as malnutrition.

Potential cases were identified that were not in the village at the time of the survey because they had gone to a CMAM program site. The names of these children were checked on the CMAM register in the health centre at the end of the day and their current measurements verified on the beneficiary card to determine whether they were current or recovering SAM cases.

The *matrone* (the senior TBA in a village) proved to be a very useful key informant and was the usual starting point. Her knowledge was often supplemented by that of the *kungiya* (women's leader) as the search progressed.

A *snowball effect* was often seen once the first SAM case was identified. The carer of the first case gave information on another child with the same signs as her own, the carer of that case and their neighbours in turn gave leads to further potential cases, the carers of these cases in turn knew of other cases, and so on.

During the search, a number of carers with uncovered SAM cases also approached the case-finding team, having heard of the survey from others in the village.

Summary

Before undertaking active and adaptive case-finding determine:

> **The case-finding question.** Appropriate definitions, terms, and descriptions for malnutrition, its signs, and its aetiology in the local language(s).
>
> **Key informants.** People that have frequent contact with small children or know which children are or have recently been sick.
>
> **Context-specific factors affecting the case-finding process.** These are cultural or practical constraints that need to be considered.

Case Study: Within-Community Sampling in an Internally Displaced Persons Camp

This case study describes an application of active and adaptive case-finding in IDP camps. A SQUEAC investigation was carried out in two IDP camps, Adn and Nu'ma, in a north African country to assess coverage for an established NGO-implemented TFP. The surveys reported here are small-area surveys of suspected low coverage areas, but the approach used and the lessons learned could be applied to wider-area likelihood surveys in similar settings.

Challenges and Constraints

An initial investigation identified two challenges to within-community sampling in the camps:

1. The physical and social boundaries of 'communities' in the camps were not known.
2. There was an absence of persons typically recruited as key informants to assist with case-finding.

Security constraints also limited access to the camps.

Physical and Social Boundaries of Communities

Adn and Nu'ma camps were nominally divided into 'sectors'. Each sector accommodated the influx of a new group of IDPs. A sector was not a cohesive unit, but was composed of a set of smaller communities based on pre-displacement community of origin. Each community identified with a particular *sheikh* (village leader). Sector numbers were not recorded in the OTP registration book because these were were often not known to carers. The name of the *sheikh* was, however, always recorded.

The influx of large numbers of IDPs resulted in organic growth. Individual sectors and communities were not clearly delineated and 'official' sector boundaries varied both within and between agencies working in the camps. There was no obvious structure in terms of the arrangement of streets and houses in the camps. Communities were not always accommodated together and some were dispersed throughout the camp. The population and extent of each community was not, therefore, immediately or easily identifiable.

The reproduction of home communities also meant that, although some new acquaintances were made, it was common for people to have limited knowledge of and contact with members of neighbouring households if they belonged to different communities. Initial case-finding efforts in Nu'ma camp proved ineffective until it was realised that the failure to find SAM cases in a particular area of the camp was due to the informant's lack of knowledge of people that they lived in close proximity to but who belonged to different communities.

Absence of Typical Key Informants

The need to gain an income meant that looking for work and maximising opportunities for casual labour were household priorities. People tended to leave the camps during the day to find work in neighbouring towns. Many houses stood empty or were occupied only by children during the day.

The need for income also applied to those in positions of responsibility. These included many of the key informants that are typically used for active and adaptive case-finding in SQUEAC investigations. TBAs were prohibited from working as midwives in the camps.

It was not possible to survey in the evening, when many would have returned from work in the town, due to security restrictions.

Active and Adaptive Sampling

One sector was selected for assessment of coverage by small-area survey in each camp. These sectors were selected because routinely collected and qualitative data indicated that coverage was likely to be low in these sectors.

Adn – Sector 5	Nu'ma – Sector 7
Vulnerable sector: • Many recent arrivals • Poor sanitation and hygiene • Risk of flooding Pockets of malnutrition identified by screening Very few admissions to CMAM program Very low awareness of malnutrition Very low awareness of the CMAM program Neglected sector: • No responsible NGO • Focus of activities on Sector 10 • Known poor coverage of general ration	High population movement: • Daily workers to local towns • High numbers of defaulters • Many children left alone or with neighbours Small number of admissions for population size Low awareness of malnutrition Low awareness of the CMAM program Large number of women-headed households Large number of children-headed households

Each sector contained 100 or more communities.

Communities were mapped by a process of determining belonging (see below).

Case-finding was done using community-specific informants identified by social network analysis (see below).

Mapping by Determining Belonging

To ensure that case-finding was exhaustive, each community in the selected sector was sampled separately, assisted by informants specific to that community. The number and location of houses belonging to each community was established and boundaries were continually reconfirmed during the exercise to avoid:

a. Eligible houses being missed

b. Straying inadvertently into a different community

c. Getting lost

This mapping of communities involved moving from house to house and asking:

> *Which sheikh do you belong to?*
>
> *Do the adjacent houses belong to the same sheikh?*
>
> *Are there people that belong to the same sheikh but that live in a different part of the camp?*

Communities were sampled one at a time using key informants specific to each community.

Communities were **not** 'mapped' in the usual sense of the term (i.e., a diagrammatic representation of an area drawn on paper). The process of mapping was dynamic, with community boundaries located and membership confirmed during case-finding by constant questioning. This way a working *mental map* of communities was built up.

Exploit Social Networks for Case-Finding

Social networks were explored to facilitate the identification of potential SAM cases when no obvious key informant was available. Family members of persons typically recruited as key informants in SQUEAC assessments were recruited because they often shared knowledge of the wider community. Some women were able to provide information that extended beyond their immediate neighbours because they were often linked in both formal and informal ways. Faced with a common problem, social ties had frequently been strengthened and groups of women would join together to travel in safety to undertake work outside of the camps. Similarly, they would take turns collecting rations to enable others to continue working. A number of women also participated in NGO-organised craft activities and, as a consequence, widened their social networks.

Although they were no longer practising, the continued friendship of TBAs with different families proved useful in identifying potential cases. Common interests also drew wider groups of people together at water points, shops, and ceremonies (e.g., christenings, marriages, and funerals), which often transcended community boundaries. The awareness and contacts of people found at these sites were also exploited to ensure exhaustive sampling. Communities were sampled one at a time using informants specific to each community. These informants were identified and recruited as case-finding moved from community to community.

Lessons Learned

Conducting a SQUEAC assessment in these camps raised a number of sampling issues and underlined the importance of adapting methods to the particular context. Case-finding methods need to be designed and adapted for specific contexts. There is no guarantee that a method that works well in one setting will work well in another.

For future SQUEAC investigations in camp settings the following steps are recommended:

- Allow time to understand the complexities of camp structure.
- Allow time to understand the social and economic realities of camp life.
- Allow time to identify and map individual communities during case-finding.
- Allow time to identify and recruit (key) informants during case-finding.

Conclusions

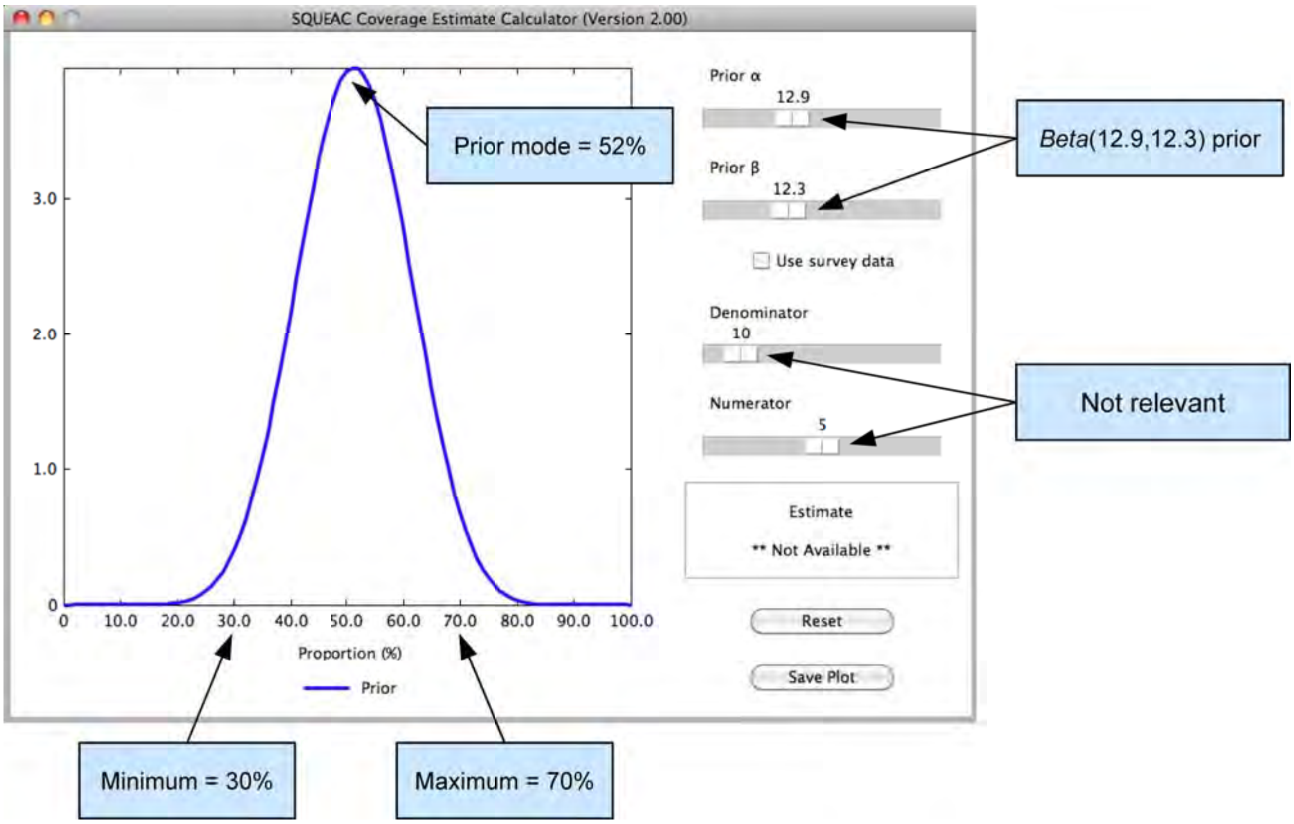
It should not be assumed that active and adaptive case-finding methods that usually work well in rural communities will also work in other settings. Our experience is that active and adaptive sampling can work in IDP camps, but only if efforts are made to identify and map communities and social networks during case-finding.

Case Study: Within-Community Sampling in Urban Settings

This case study illustrates the challenges faced when sampling in an urban setting. The case study is based on a SQUEAC assessment of a MOH-implemented CMAM program in a city in northern Nigeria.

With information from the initial SQUEAC investigation, the mode of the prior was defined to be at 52%, and the minimum and maximum credible values of the prior were defined to be about 30% and 70% respectively. Using the **BayesSQUEAC** calculator, the α_{Prior} and β_{Prior} values were found to be 12.9 and 12.3, respectively. The prior distribution is shown in **Figure 96**.

Figure 96. The *Beta(12.9, 12.3)* prior in **BayesSQUEAC**



Once the prior had been defined, the sampling frame for the likelihood survey was designed. Based on the administrative hierarchy of the city (**Figure 97**), the section was chosen as the primary sampling unit. A minimum sample size of 23 current and recovering SAM cases was calculated using the simulation approach for a precision of better than about ± 15 percentage points (**Figure 98**). Given the high prevalence of SAM and the high number of admissions observed from routine program data, it was estimated that a total of five sections would need to be sampled to reach the target sample size. Five sections were selected at random from a full list of all sections in the city by drawing section names from a hat.

Figure 97. Administrative hierarchy of the city

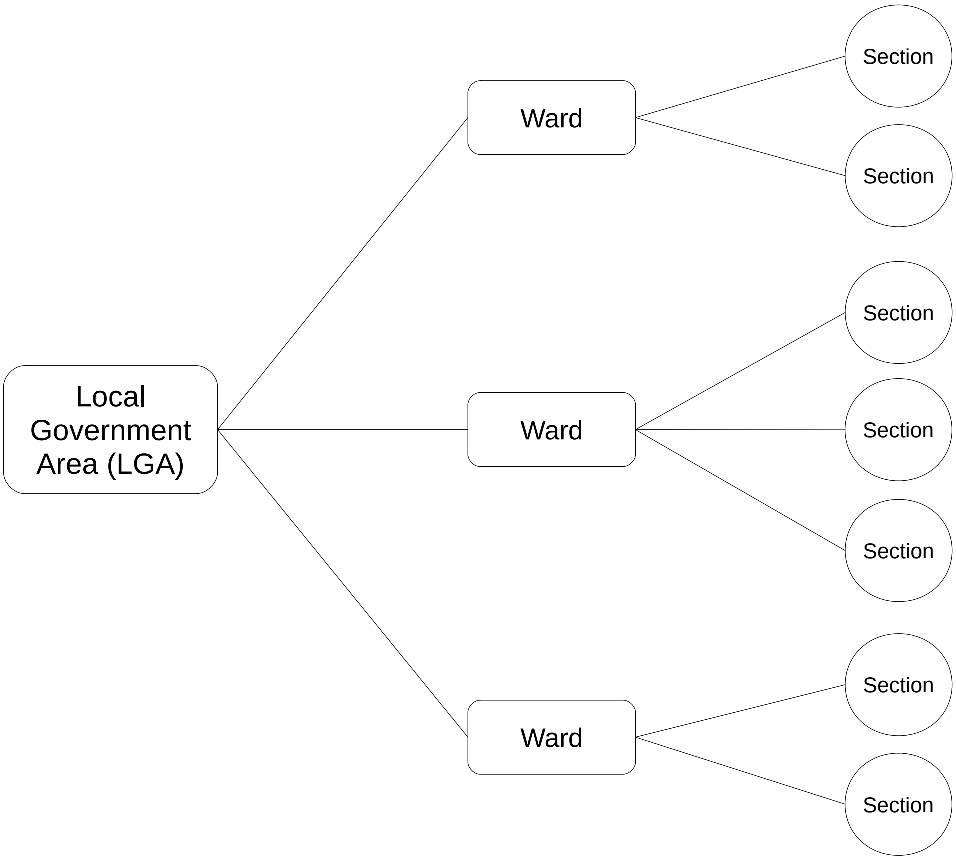
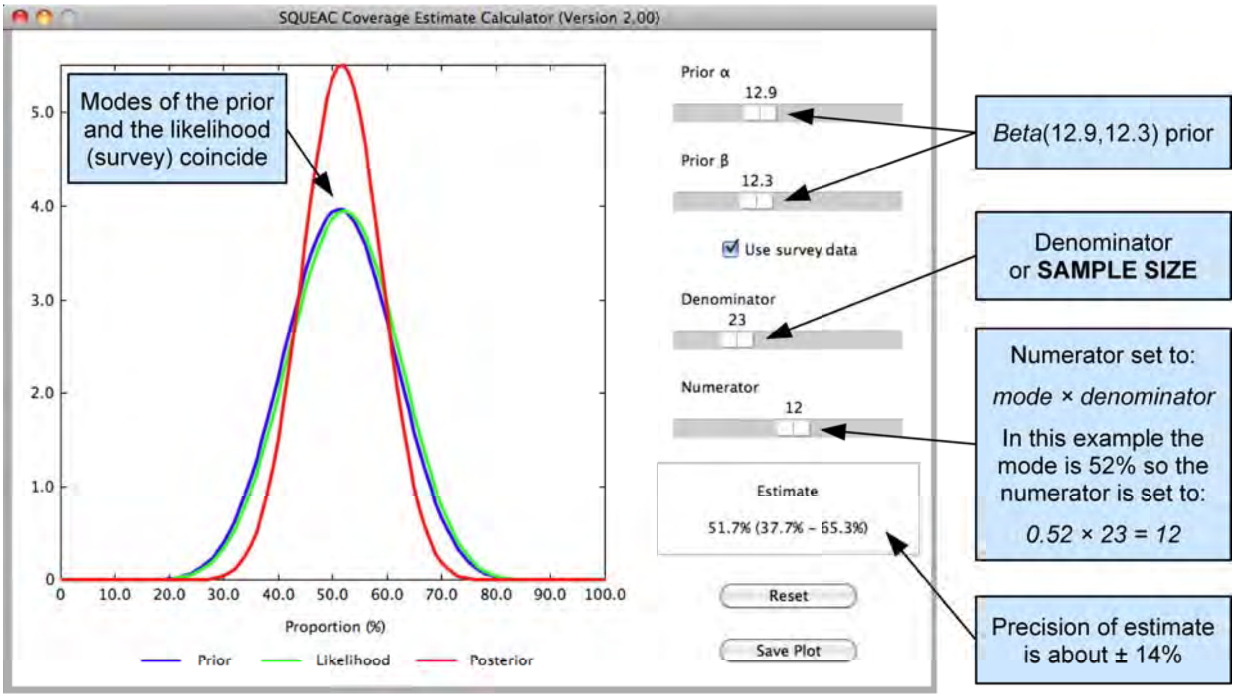


Figure 98. Sample size by simulation approach using **BayesSQUEAC**



Different numerators and denominators are tried until the displayed estimate shows the required precision

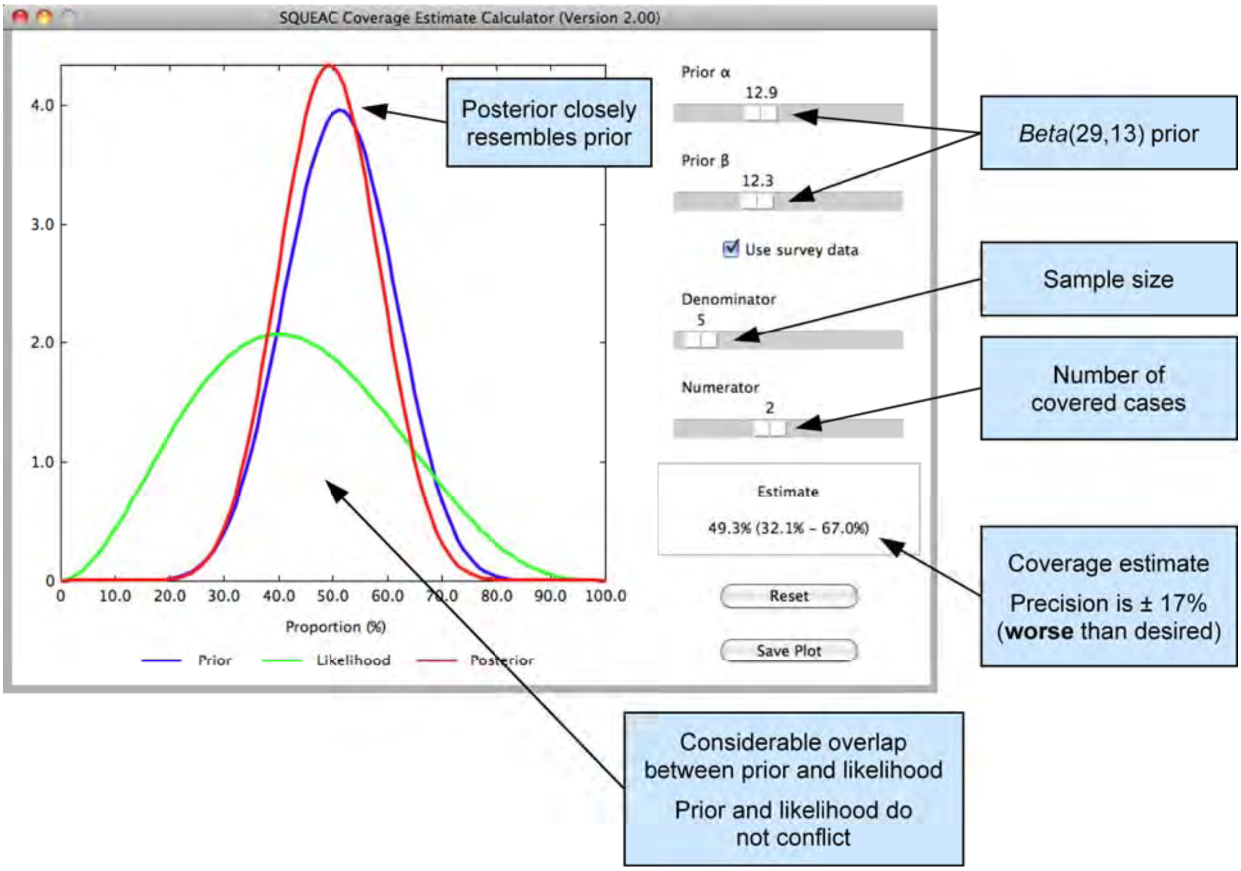
The active and adaptive case-finding method (see Box 3, page 65) was used for within-section sampling in each of the five selected sections. The district or ward heads served as the community *entry points* and were consulted to determine the boundaries of the selected sections. Once the boundaries were determined, the sections were divided into smaller geographical blocks in which different survey teams were assigned to conduct case-finding. This was initiated by locating identified key informants, such as district or ward heads, *imams* or *sheikhs*, TBAs, traditional healers or *wanzami* (persons who perform circumcisions). Key informants were asked whether they knew of children suffering from *olu*, *tamuwa*, *sefa* or *nono* (the terms that most people in the city use for children that are very thin or have distended abdomens, brownish or discoloured hair, and scaling of the skin) or children that had *kumburi* (the term used for children with kwashiorkor). In addition, the key informants were asked if they knew of children that had *kurga*, a condition in which the child is passing loose or watery stools and was associated by most local people with wasting and kwashiorkor. If they knew of such children, they were asked to lead the team to the children's homes, where the children were examined and their MUACs measured. The same case-finding questions described above were asked of carers of children examined and of other key informants identified. This process was repeated until all identified key informants had been consulted.

Active and adaptive case-finding was unsuccessful in this context. Only five current and recovering SAM cases were found. During the case-finding process, key informants were unable to lead the survey teams to more SAM cases despite high prevalence in the area and many current cases in the program at the time of the survey reported to be living in the selected sections. One possible explanation for this failure is that social dynamics in a big town or city are different from those in villages or rural areas, where active and adaptive case-finding has been shown to work well. The method is based on the assumption that the community being sampled has considerable social connections amongst its members. In large towns and cities, such assumptions often do not hold true.

As can be seen in **Figure 99**, the posterior distribution is only marginally stronger/narrower than the prior distribution. This is because the small sample size likelihood adds little new information to inform the posterior. The effect of not finding enough SAM cases on the coverage estimate is that the coverage estimate is dominated by the prior. The prior and likelihood do not conflict so any bias is likely to be small.

The problems finding cases suggests that building-to-building and door-to-door sampling would have been better in this urban setting and should probably be used as an alternative to active and adaptive case-finding in situations where the assumption of social connectedness amongst people in the survey area is uncertain.

Figure 99. The conjugate analysis in **BayesSQUEAC**



Case Study: The Case of the Hidden Defaulters

This case study describes how a SQUEAC investigation identified and investigated the issue of 'hidden defaulters' in a CMAM program implemented in a southern African country by the MOH supported by an international NGO.

Routine program monitoring data were analysed. A plot of admissions over time revealed that the program was probably responsive to need. Rises in admissions coincided with periods when SAM incidence was expected to be high (e.g., during periods of food insecurity and of increased incidence of infections associated with wasting). The results of the analysis of program exits were consistent with a well-performing program. Cure, default, and death rates were all within Sphere minimum standards:

Cured	:	81%
Default	:	8%
Transfers to hospital	:	9%
Deaths	:	2%

Qualitative data revealed that carers heard of the CMAM program from their local health centres and through program-sponsored announcements on local radio. Carers of children in the program and other informants reported that they were unaware of malnourished children in their communities that were not already covered by the program.

The quantitative and qualitative data described above were consistent with a program achieving moderate or high levels of coverage.

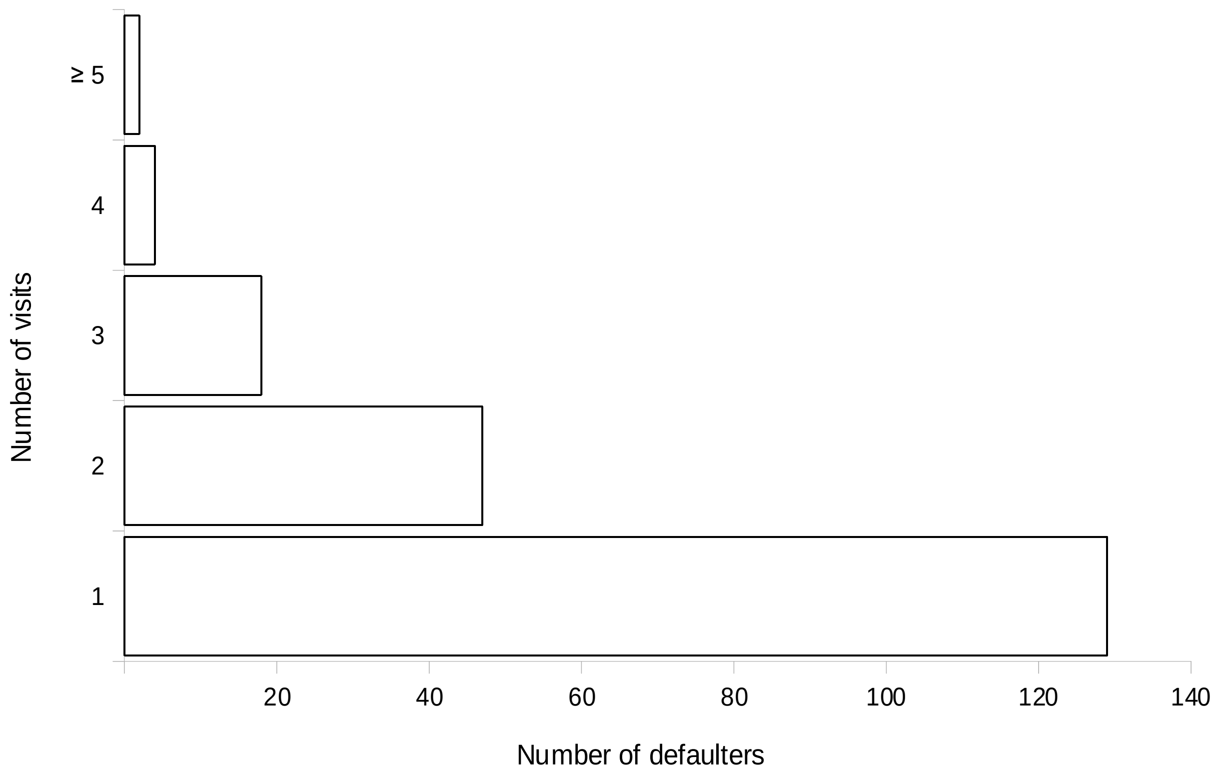
During mapping of home locations of beneficiaries using data from admission records, a considerable number of record cards with only one or two visits recorded were found. It was suspected, therefore, that there was likely to be considerably more defaulting than was recorded in the routine program monitoring data. Interviews with program staff revealed that program activity had focussed on delivering services to beneficiaries at clinics and that absences were **not** well recorded. This had led to an under-reporting of defaulters. These findings prompted an investigation focussed on defaulting.

Current and past beneficiary record cards were examined and discharges classified according to the program's own discharge criteria. This exercise resulted in a very different picture of the program:

Cured	:	40%
Default	:	49%
Transfers to hospital	:	9%
Deaths	:	2%

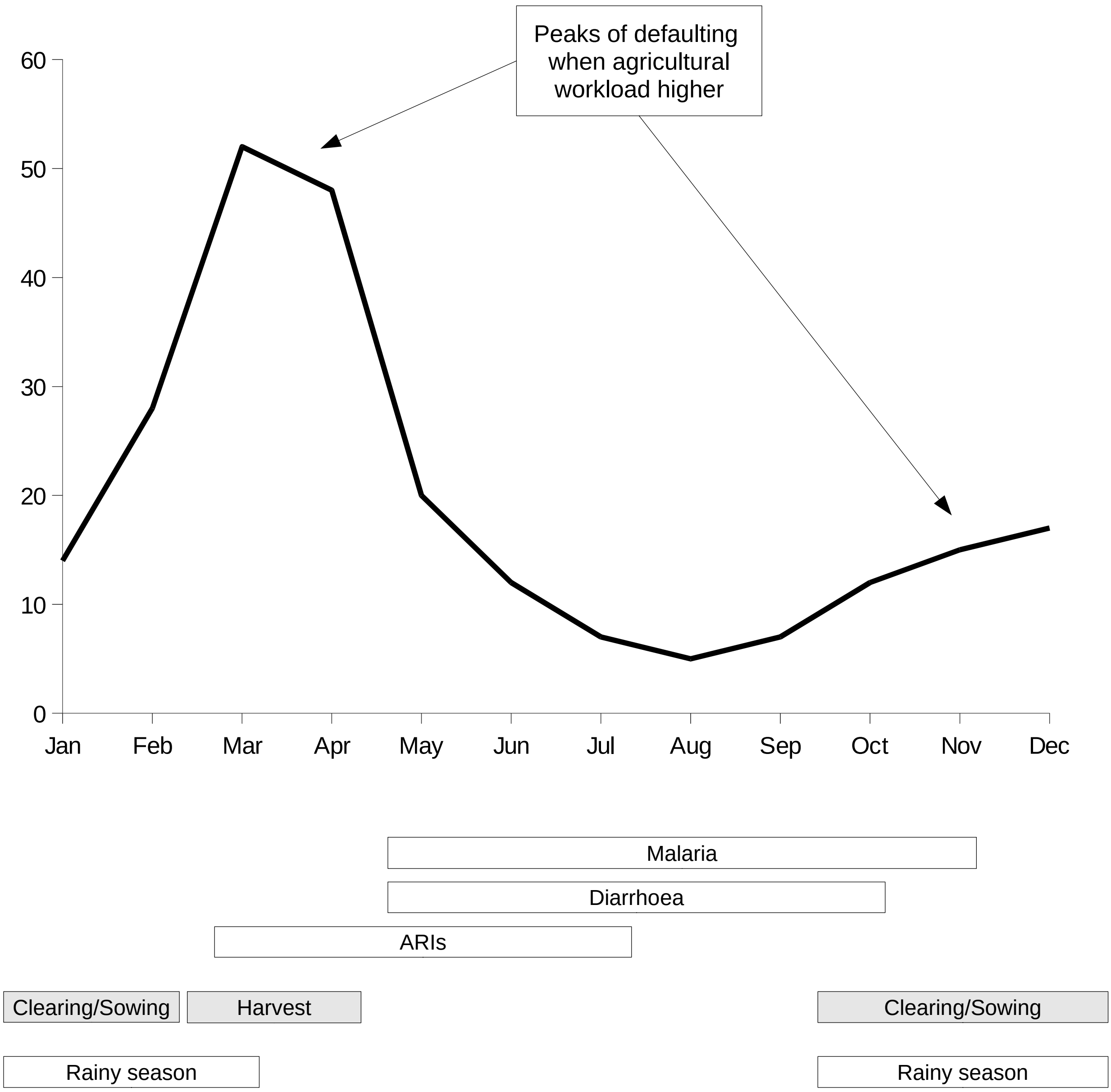
Further analysis revealed that a large majority (approximately 90%) of defaulters defaulted after only one or two visits to a program site (**Figure 100**). These were early defaulters and, therefore, probable current SAM cases at the time of defaulting.

Figure 100. Number of visits before defaulting



The trend of defaulting over time was analysed. This revealed that defaulting peaked during periods of higher agricultural labour demand (**Figure 101**).

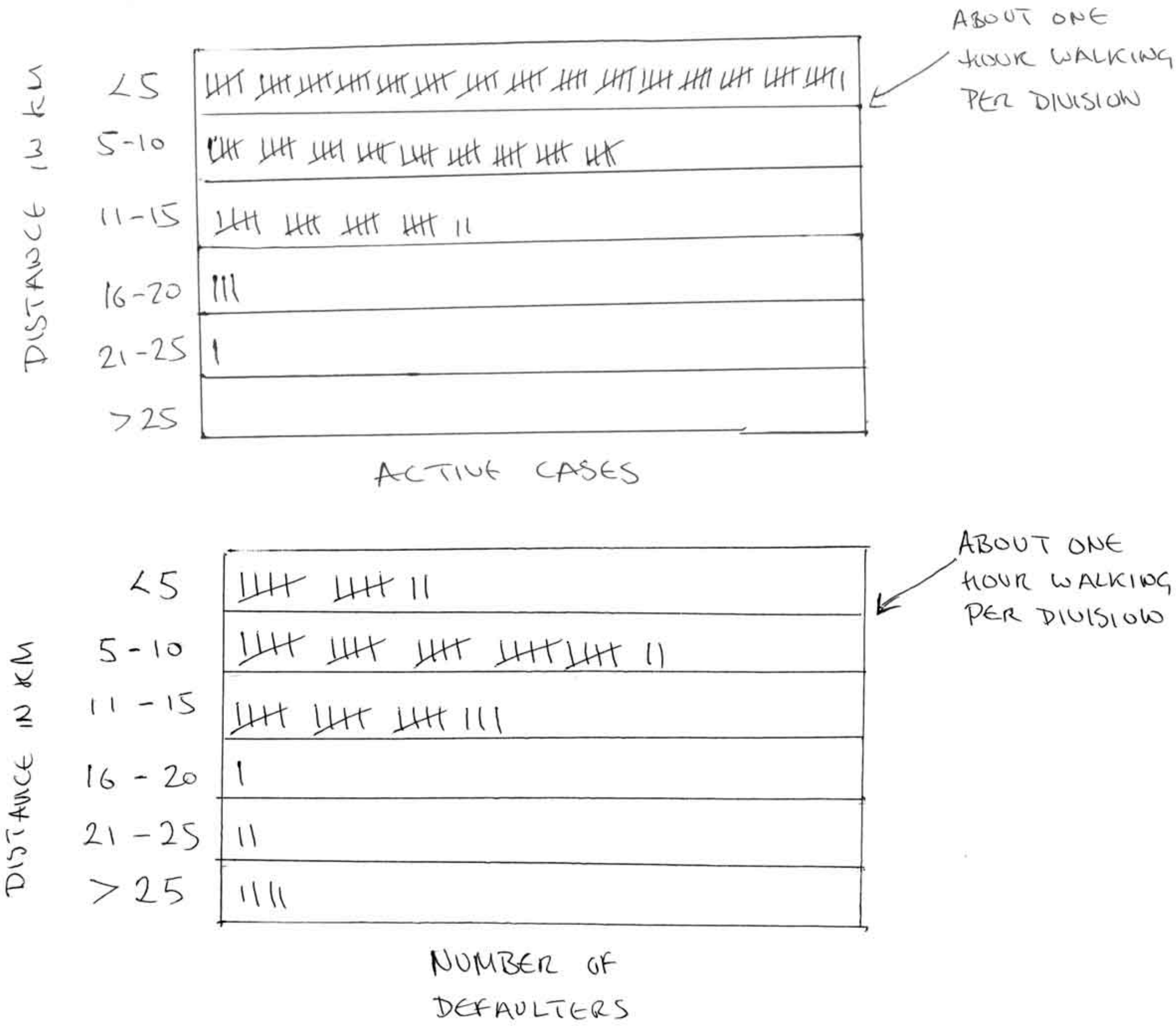
Figure 101. Trend of defaulting over time



Examination of the home locations of active cases and defaulters (**Figure 102**) indicated that:

- The majority of active cases came from villages within 5 km of program sites.
- The majority of defaulters came from villages farther than 5 km from program sites.

Figure 102. Distance from home to a CMAM program site for active cases and defaulters



These findings were supported by interviews with carers of defaulted patients. These key informants reported that the most important factors affecting their decision to default was the amount of agricultural work that they had to do (i.e., the higher the workload the more likely they were to default) and the distance between their homes and the program sites. It should be noted that these were **not** independent findings since time-to-travel is an *opportunity cost* (longer times to travel to the program sites mean less time for work).

These new findings caused the SQUEAC investigators to revise their initial belief of moderate to high program coverage and changed the focus of the investigation report and recommendations.

This case study highlights the importance of:

- Scepticism when working with routine program monitoring data. In this case, defaulting was grossly under-reported.
- Investigation and the triangulation process in ensuring the robustness of findings. In this case, the investigators were presented with conflicting data (i.e., routine program monitoring data showed low levels of defaulting but coverage mapping suggested high levels of defaulting). This prompted further investigation using a variety of sources and methods (i.e., triangulation by source and method).

Case Study: Applying SLEAC: Sierra Leone National Coverage Survey

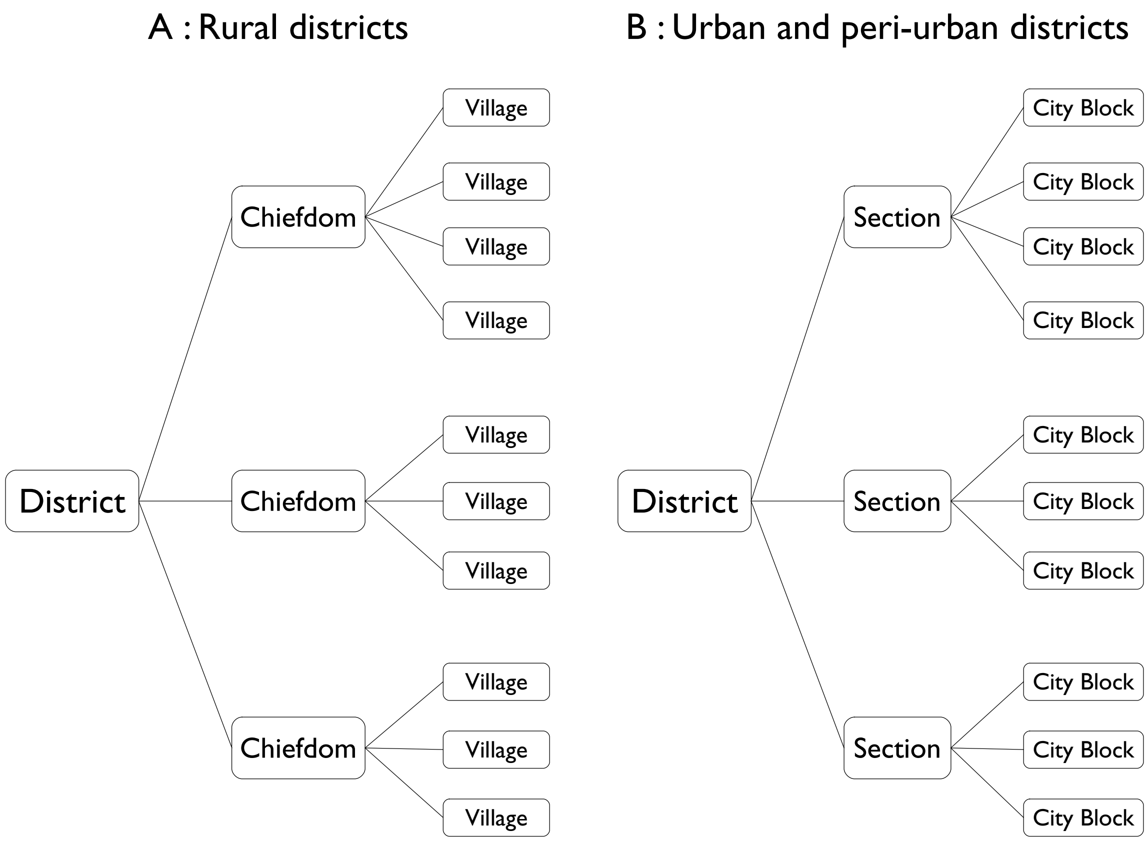
The CMAM approach to treating cases of SAM in government health facilities was piloted in four districts of Sierra Leone in 2008. The program was expanded to provide CMAM services in selected health centres in all 14 districts of the country in 2010. This case study describes the application of SLEAC to the assessment of the coverage of this national CMAM program.

SLEAC Sampling Design

SLEAC was used as a wide-area survey method to classify coverage at the district level. The district was selected as the unit of classification because service delivery of the national program was managed and implemented at the district level.

The PSUs used in the SLEAC surveys were census enumeration areas (EAs). In rural districts, EAs were individual villages and hamlets. In urban and peri-urban districts, EAs were city blocks. In rural districts, lists of potential PSUs were sorted by chiefdom. In urban and peri-urban districts, lists of potential PSUs were sorted by electoral ward (*sections*). This approach ensured a near-even spatial spread of the selected villages across rural districts and a near-even spatial spread of selected EAs across urban and per-urban districts. The structure of the district-level samples are shown in **Figure 103**.

Figure 103. Structure of samples in rural and peri-urban/urban districts



A target sample size of $n = 40$ current SAM cases was used in both rural and urban districts. This is the standard SLEAC sample size for large populations. A lower target sample size ($n = 33$) was used in the single peri-urban district because this district had a much lower population than the other districts.

The number of PSUs (n_{PSU}) needed to reach the target sample size in each district was calculated using estimates of average EA population and SAM prevalence using the following formula:

$$n_{PSU} = \left\lceil \frac{\text{target sample size } (n)}{\text{average EA population}_{\text{all ages}} \times \frac{\text{percentage of population}_{6-59\,\text{months}}}{100} \times \frac{\text{SAM prevalence}}{100}} \right\rceil$$

Average EA population was estimated as:

$$\text{Average EA population} = \frac{\text{District population}}{\text{Total number of EAs in the district}}$$

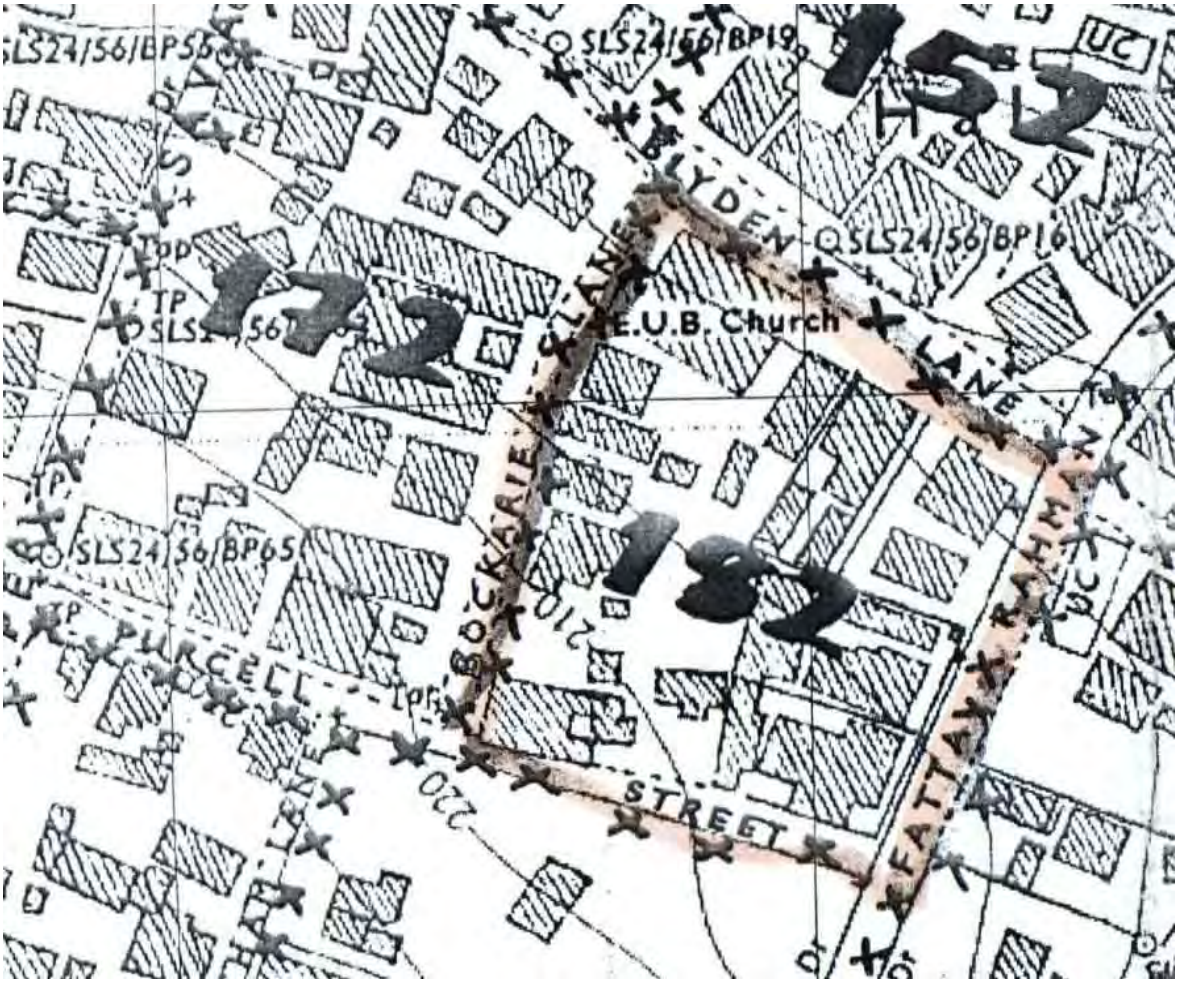
using data from the most recent (2004) Sierra Leone Population and Housing Census.

The percentage of the population aged between 6 and 59 months was estimated as 17.7%. This is a national average taken from the Sierra Leone 2004 Population and Housing Census. This estimate was used by Sierra Leone government departments, United Nations organisations, and NGOs.

SAM prevalences were taken from reports of SMART surveys of prevalence in each district that had been undertaken in the lean period of the previous year. The prevalence of SAM using MUAC and oedema was used since this matched program admission criteria.

The Sierra Leone Central Statistics Bureau provided information on the total district populations and total number of EAs in each district. The Sierra Leone Central Statistics Bureau also provided lists of EAs for the Western Area (urban and peri-urban) districts and large-scale maps (see **Figure 104**) of the EAs that were selected for sampling.

Figure 104. Example of a large-scale map showing enumeration area boundaries used when sampling in an urban district



Map courtesy of the Sierra Leone Central Statistics Bureau

PSUs were selected using the following *systematic sampling* procedure:

Step 1. The lists of EAs were sorted by chiefdom for rural districts and by section for urban and peri-urban districts.

Step 2. A sampling interval was calculated using the following formula:

$$Sampling\ interval = \left\lfloor \frac{Number\ of\ EAs\ in\ district}{n_{PSU}} \right\rfloor$$

Step 3. A random starting PSU from the top of the list was selected using a random number between 1 and the the sampling interval. The random number was generated by the coin-tossing method described under ‘A Note on Generating Random Numbers’ in the SQUEAC section of this document.

The PSUs selected by this procedure were sampled using a case-finding method tailored to the particular district:

- In rural districts, a district-specific case-finding question was developed from the base case-finding question:

  > *Where can we find children that are sick, thin, have swollen legs or feet, or have recently been sick and have not recovered fully, or are attending a feeding program?*

  This question was adapted and improved using information collected from TBAs, female elders, traditional health practitioners, carers of children in the program, and other key informants to include local terms (in all local languages) and local aetiological beliefs regarding wasting and oedema. This question was used as part of an active and adaptive case finding method (see Box 3, page 65).

- In urban and peri-urban districts, house-to-house and door-to-door case-finding was used. This was done because it was felt that active and adaptive case-finding would not work well in these districts. Sampling was aided by the use of large-scale maps showing EA boundaries provided by the Sierra Leone Central Statistics Bureau (see Figure 104).

After all selected PSUs in a district had been sampled, the survey team met at the district headquarters for data collation and analysis. The simplified LQAS classification technique was applied to the collated data.

The coverage standards:

Low coverage: Below 20%

Moderate coverage: Between 20% and 50%

High coverage: Above 50%

were decided centrally by MOH and UNICEF staff before the start of the surveys. These standards were used to create decision rules using the rule-of-thumb formulas:

$$d_1 = \lfloor n \times p_1 \rfloor = \left\lfloor n \times \frac{20}{100} \right\rfloor = \left\lfloor \frac{n}{5} \right\rfloor \text{ and } d_2 = \lfloor n \times p_2 \rfloor = \left\lfloor n \times \frac{50}{100} \right\rfloor = \left\lfloor \frac{n}{2} \right\rfloor$$

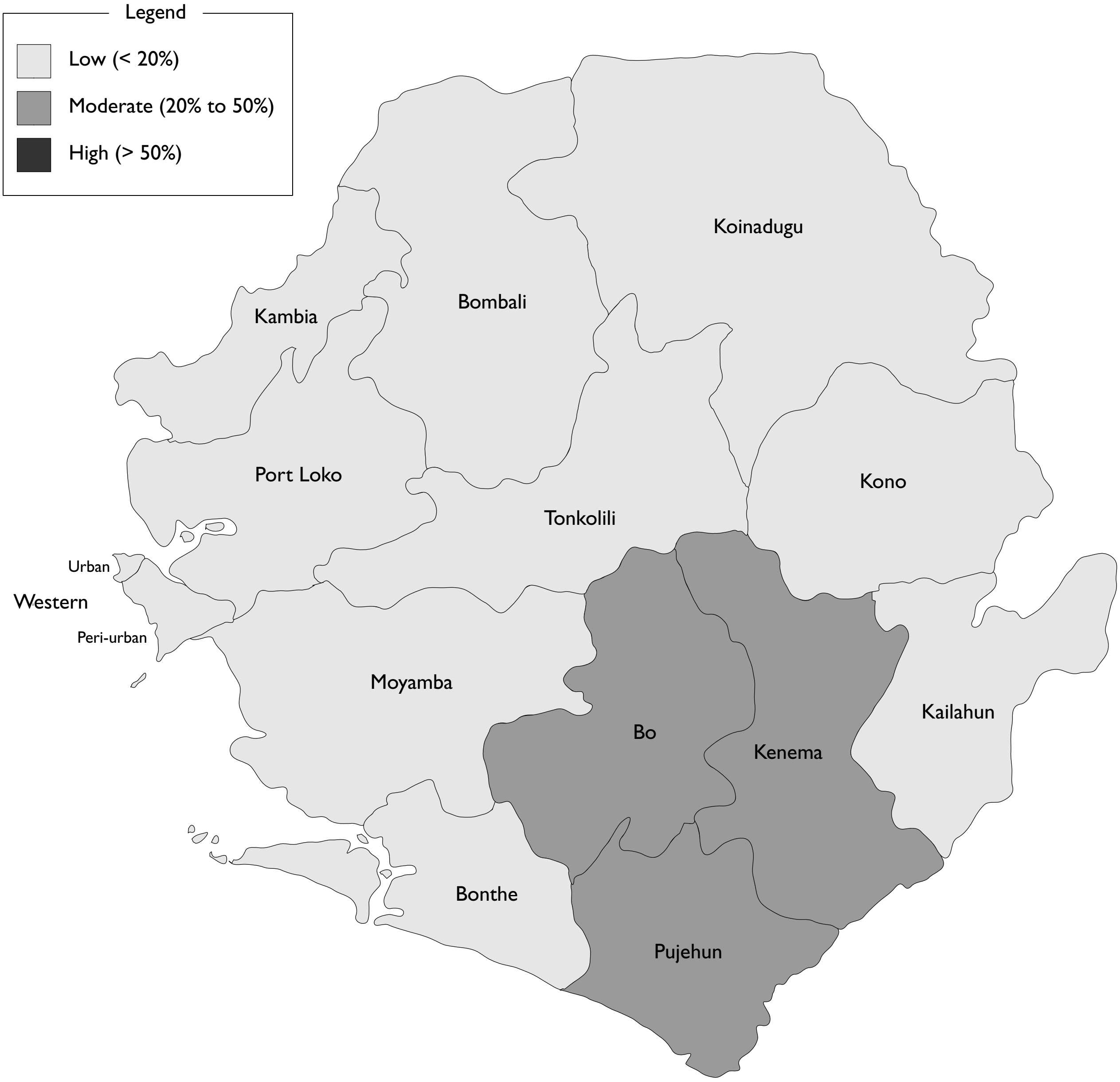
where n is the sample size achieved by the survey, p_1 is the lower coverage threshold (i.e., 20%), and p_2 is the upper coverage threshold (i.e., 50%).

Coverage in each district was classified using the algorithm presented in Figure 70. **Table 11** presents the results of the surveys. **Figure 105** presents the same results as a map of per-district coverage.

Table 11. Coverage classification by district

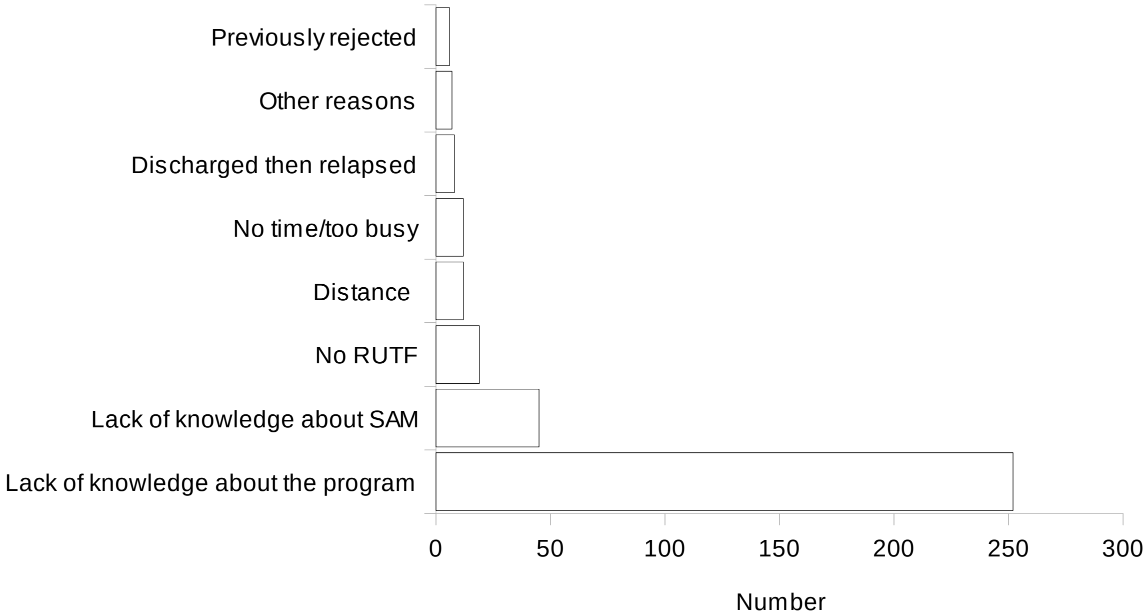
Province	District	SAM cases found (n)	Covered SAM cases (c)	Lower decision threshold $d_1 = \left\lfloor \frac{n}{5} \right\rfloor$	Is $c > d_1$?	Upper decision threshold $d_2 = \left\lfloor \frac{n}{2} \right\rfloor$	Is $c > d_2$?	Coverage classification
Northern	Bombali	30	4	6	No	15	No	LOW
	Koinadugu	32	0	6	No	16	No	LOW
	Kambia	28	0	5	No	14	No	LOW
	Port Loko	30	2	6	No	15	No	LOW
	Tonkolili	28	1	5	No	14	No	LOW
Eastern	Kono	16	2	3	No	8	No	LOW
	Kenema	34	8	6	Yes	17	No	MODERATE
	Kailahun	34	4	6	No	17	No	LOW
Southern	Bonthe	41	7	8	No	20	No	LOW
	Pujehun	27	6	5	Yes	13	No	MODERATE
	Bo	22	6	4	Yes	11	No	MODERATE
	Moyamba	40	6	8	No	20	No	LOW
Western	Rural	46	6	9	No	23	No	LOW
	Urban	20	2	4	No	10	No	LOW
National Total		**428**	**54**	**85**	**No**	**214**	**No**	**LOW**

Figure 105. Map of per-district coverage



A short questionnaire, similar to that shown in Box 2 (page 49) asking about barriers to coverage was administered to carers of non-covered cases found. Data were tabulated from the questionnaires using a tally sheet and presented as a Pareto chart (**Figure 106**).

Figure 106. Barriers to service uptake and access



SLEAC Implementation Process

The process as described above was completed in 8 weeks (44 working days) staffed by 15 mid-level health management staff and a principal surveyor provided by Valid International. Three survey teams with five members each were used. The teams were divided into two sub-teams. A survey team was headed by a 'captain' who was in charge of managing the sub-teams, organising travel and survey logistics, and co-ordinating survey activities with the principal surveyor.

Each district was divided into three segments. Segmentation was informed by logistics, with each segment being served by a road (when possible).

Each survey team was assigned to one of the three segments and provided with:

- A list of PSUs (sorted my chiefdom) to be sampled
- A list of the locations of CMAM program sites
- A list of the names and home villages of chiefs and chief's assistants for each PSU to be sampled

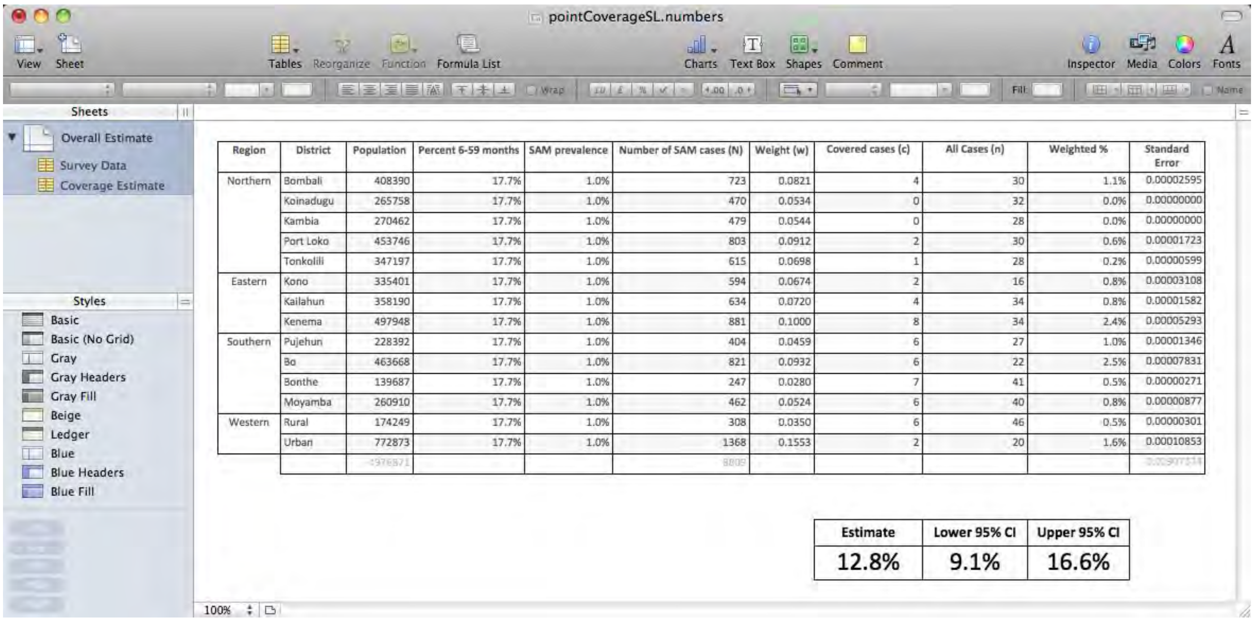
Each survey team started case-finding in the farthest PSU and then moved to the next-farthest PSU for case-finding and so-on. At the end of each day, the survey teams lodged in health centres, local guesthouses, or in villagers' homes. They restarted case-finding on the following day. This continued until all the PSUs had been sampled. The survey teams then came together at the district headquarters for data collation and analysis and results shared with district-level health management staff.

Upon completion, the survey team was able to:

- Classify coverage in each district (Table 11, page 185)
- Map coverage by district for the whole country (Figure 105)
- List barriers to coverage ranked by their relative importance (Figure 106)

An overall coverage estimate was calculated but not reported. **Figure 107** shows the calculation of a weighted point coverage estimator using spreadsheet software.

Figure 107. Calculation of a wide-area coverage estimate



Region	District	Population	Percent 6-59 months	SAM prevalence	Number of SAM cases (N)	Weight (w)	Covered cases (c)	All Cases (n)	Weighted %	Standard Error
Northern	Bombali	408390	17.7%	1.0%	723	0.0821	4	30	1.1%	0.00002595
	Koinadugu	265758	17.7%	1.0%	470	0.0534	0	32	0.0%	0.00000000
	Kambia	270462	17.7%	1.0%	479	0.0544	0	28	0.0%	0.00000000
	Port Loko	453746	17.7%	1.0%	803	0.0912	2	30	0.6%	0.00001723
	Tonkolili	347197	17.7%	1.0%	615	0.0698	1	28	0.2%	0.00000599
Eastern	Kono	335401	17.7%	1.0%	594	0.0674	2	16	0.8%	0.00003108
	Kailahun	358190	17.7%	1.0%	634	0.0720	4	34	0.8%	0.00001582
	Kenema	497948	17.7%	1.0%	881	0.1000	8	34	2.4%	0.00005293
Southern	Pujehun	228392	17.7%	1.0%	404	0.0459	6	27	1.0%	0.00001346
	Bo	463668	17.7%	1.0%	821	0.0932	6	22	2.5%	0.00007831
	Bonthe	139687	17.7%	1.0%	247	0.0280	7	41	0.5%	0.00000271
	Moyamba	260910	17.7%	1.0%	462	0.0524	6	40	0.8%	0.00000877
Western	Rural	174249	17.7%	1.0%	308	0.0350	6	46	0.5%	0.00000301
	Urban	772873	17.7%	1.0%	1368	0.1553	2	20	1.6%	0.00010853
		4976871			8809					[illegible]

Estimate	Lower 95% CI	Upper 95% CI
12.8%	9.1%	16.6%