Semi-Quantitative Evaluation of Access & Coverage
(SQUEAC)

Aweil East County
Northern Bahr-El-Ghazal State

Republic of South Sudan

November 2011

ACRONYMS

ACF   - Action Against Hunger
CMAM - Community management of acute malnutrition
CSAS   - Centric systematic area sampling
CNV   - Community nutrition volunteer
CNW   - Community nutrition worker
ECHO   - European Commission Humanitarian Organization
IYCF   - Infant and young child feeding
MUAC - Mid upper arm circumference
OTP   - Outpatient therapeutic program
PHCC   - Primary health care centre
SAM   - Severe acute malnutrition
SQUEAC – Semi quantitative evaluation of access and coverage
RUTF   - Ready to use therapeutic food
TFP   - Therapeutic feeding programme

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

The Aweil East County nutrition programme coverage investigation using SQUEAC methodology was conducted from 1st – 18th November 2011. The objectives of the investigation were:

1. Estimating the overall coverage of programme catchment areas in Aweil East.

2. Identifying barriers to access and uptake of the CMAM services provided by the Nutrition treatment programme in Aweil East

3. Giving recommendations to the nutrition treatment program based on the investigation findings to improve access to the IMAM services and increase programme coverage in the project areas

The evaluation used a simplified version of the standard, 3-stage; Bayesian beta-to-binomial conjugate analysis. CMAM coverage in Aweil East County was estimated to be:

Point Coverage   45.5% (35.0% - 56.2%)

The investigation in summary recommends:

- Creating mobile OTPs for some identified areas which are far from the existing OTPs and have high SAM children, increase the number of CNWs especially in those sites with high admissions to avoid continued use of casual labourers and having more outreach services during the peak of malnutrition to capture more children and reduce distance travelled by the beneficiaries.

- Improve community mobilization and defaulting follow-up. Mapping of villages per OTP catchment and planning accordingly for community mobilization

- Considering standardising and sustaining the motivation strategy for volunteers.

- The supply chain of the program has been experiencing breakages, there is need to ensure constant supply of the commodity.

- Increasing on-job training for CNWs by the OTP supervisor, increased contact with the program officer and manager. This is both motivational and has an impact of streamlining the short comings of the CNWs in manning of OTPs, handling of referrals and monthly reporting.

- In health seeking behaviour, the community seems to be first going to the traditional health practitioners who in most cases delay them before they can seek appropriate health care in the PHCC and OTP. There is need to educate the community and as well work with the traditional health practitioners to reduce delay in seeking health care and can be supportive in the referral to the PHCCs and OTPs for this purpose, uniform nutrition education messages for improving knowledge of community members on malnutrition.

- For improved coverage, more effort is needed on awareness creation on malnutrition and the CMAM service.

- More focus on Malualbai, as the number of acute malnourished children is very in this location, more focus of the nutrition program as well as integrated approach for WASH & food security could reduce suffering.

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1. BACKGROUND

ACF-USA has been working in Northern Bahr el Ghazal State since 2007 implementing integrated nutrition, food security & livelihoods and WASH activities in Aweil East County. The therapeutic feeding programs (TFP) admit and treat severely malnourished children in 7 OTPs and those with complications at SC level that is located in Malualkon, Baac payam.

Aweil East County is one of the five counties that make up the state of Northern Bahr el Ghazal in Southern Sudan. The county consists of seven administrative Payams of Malualbaai, Baac, Madhol, Mangartong, Mangok, Yargot and Wunlang running from north to south.

Northern Bahr el Ghazal is traditionally an agro-pastoralist region, and cattle ownership remains the primary determinant of wealth and status. Livestock are sold for cash, traded for other products, form marriage dowries and serve as a source of milk and meat.

During the fifth population census, the population of the county was estimated at 309,921. The SMART survey conducted by ACF - USA surveillance team in April 2011 showed that the GAM and SAM rates were 23.5 % (19.6 - 27.9 95% C.I.) 5.3 % (3.6 - 7.8 95% C.I) respectively and reported as per the WHO, 2006 standards. The presented facts can give a glimpse of the caseload expected in the County.

The Aweil East coverage investigation using SQUEAC methodology was conducted from 1st – 18th November 2011. This is the second coverage investigation conducted by ACF – USA South Sudan mission since it adopted the SQUEAC approach changing from its long time methodology - CSAS. The objectives of the investigation were:

🌱 Estimating the overall coverage of programme catchment areas in Aweil East

🌱 Identifying barriers to access and uptake of the CMAM services provided by the Nutrition treatment programme in Aweil East

🌱 Give recommendations to the nutrition treatment program based on the investigation findings to improve access to the IMAM services and increase programme coverage in the project areas

Briefly, the Semi-Quantitative Evaluation of Access and Coverage[1] (SQUEAC) tool was developed to provide an efficient and accurate method for identifying existing barriers to service access and evaluating coverage in a non-emergency context. The approach places a relatively low demand on logistical, financial and human resources to provide detailed information regarding overall coverage, areas of low and high coverage and the principle factors preventing higher coverage in a given target area. It is therefore possible to implement the method in a medium to long-term programme integrated with national Ministry of Health (MoH) operations rather than a short-lived, NGO funded programme not aiming to achieve long term sustainability. Methods previously available such as the Central Systematic Area Sampling (CSAS) approach create a far larger demand on resources and therefore cannot be viably integrated into MoH run programmes in the long-term.

This investigation was based on the principle of triangulation. This means that data was collected and validated by different sources and different methods. The exercise ended when there was redundancy; i.e. no new information was being gained from further investigation using different sources or methods.

The investigation achieved its efficiency by using a three stages approach: the development of the *Prior*, the development of the *Likelihood* and the generation of the *Posterior*. The first two stages aimed at identifying potential barriers and providing two individual estimations of coverage. During the *Prior* building process, existing routine data which had previously been collected and compiled

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[1] Mark Myatt, Daniel Jones, Ephrem Emru, Saul Guerrero, Lionella Fieschi. SQUEAC & SLEAC: Low resource methods for evaluating access and coverage in selective feeding programs.
http://www.brixtonhealth.com/SQUEAC.Article.pdf

was combined with qualitative data to produce a coverage "picture"; the "picture" was drawn by using the xMind software. Building the *Prior* provided a projection of coverage levels for both the entire target area and also on specific areas suspected of relatively high or low coverage within the programme's target zone.

The *Likelihood* was built with data collected during a wide area field survey in randomly selected villages. The *Active and adaptive Case Finding (AACF)* method was used to identify severely malnourished children as well as children enrolled in the programme who were still malnourished or recovering. During the wide area survey, additional qualitative data was collected in order to explain why some severely malnourished children were not enrolled in the OTP.

The last stage, the generation of the *Posterior,* combined the two initial stages and provided the overall coverage estimation, including Credibility Intervals[2] (C.I), by taking into account the "strength" of each component of the equation. The *Posterior* was calculated using the Bayesian calculator.

2. STAGE ONE

The first stage of SQUEAC investigations begun with an analysis of routine program monitoring data which included admissions, exits and data that is already collected on beneficiary record cards such as admission by MUAC beneficiary address (home villages) etc.

The objective of Stage One was to identify areas of low and high coverage and the reasons for coverage failure using routine programme data or easy-to-collect quantitative and qualitative data.

2.1 Programme Admissions

Among the ACF-USA nutrition programme operational areas, Aweil east has the highest number of admissions throughout the year. There are a lot of children that have been admitted and treated by the program since inception. For purposes of this investigation data analyzed covers a period that stretches from Jan – Oct 2011. In the period, the program admitted 6987 [3]children to its seven operational OTPs.
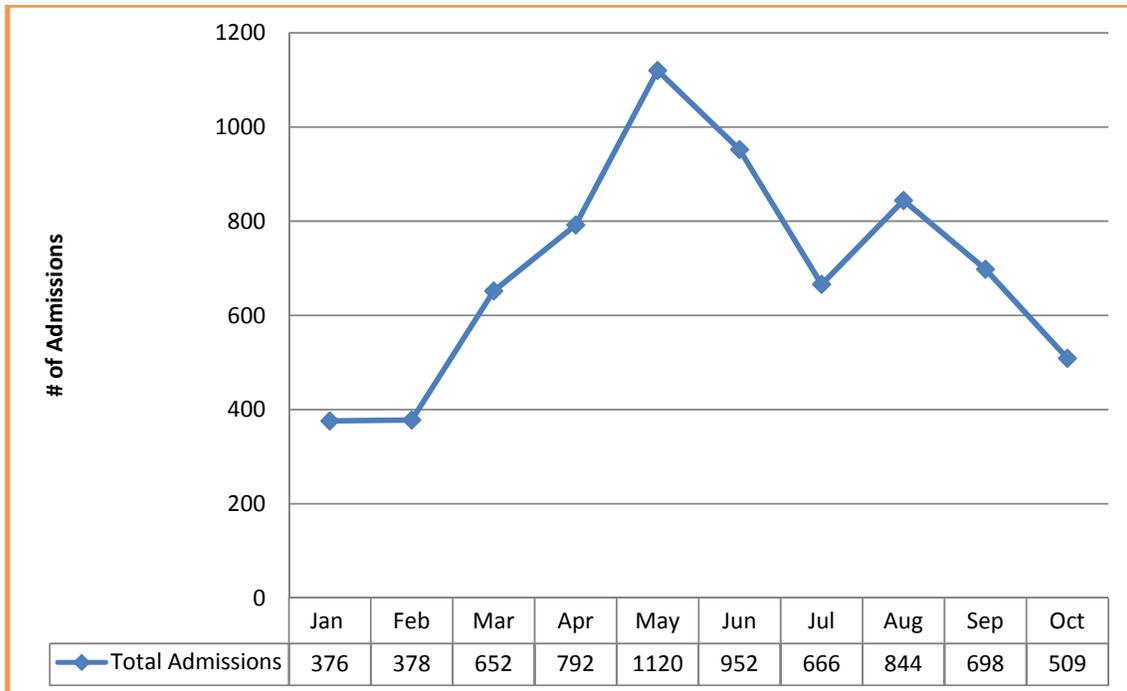
Evolution of overall admissions is illustrated in Figure 1. A glance at the trend reveals a steady increase in admissions from January up until its peak in May 2011 and a decrease thereafter with a slight come back in August. Admissions in January were low and were attributed to the referendum which had caused scale down of activities and at some point the activities were suspended for a period of two weeks and after that there is observed increase in trend. Pronounced peak in admissions in May 2011 was explained by the investigation as the period when the reserve stocks for the household are depleted and that there is migration to the big centres which increases the population in places like Malualbai, Malualkon and Warawar.

In addition, the period experienced a high number of returnees in Aweil East coupled by internally displaced persons from areas with conflicts. Locations like Malualbai are close to some of the areas served by Gogrial west programme e.g. Akon, mothers here prefer visiting Malualbai as instead of centres in Gogrial West. The July 2011 drop was partly attributed to RUTF stock-out which was for a period of 2 weeks. The drop is further explained by the investigation as caused by movements back to the cultivation areas.

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[2] The Bayesian approach is about beliefs and updating beliefs with data, the estimation interval is called the credible interval.
[3] The admission numbers exclude Aweil centre OTP which was not part of the survey

Figure 1**: OTP programme Admissions over Time, Jan - Oct 2011, Aweil East County**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
◆ Total Admissions	376	378	652	792	1120	952	666	844	698	509

2.2 Admission by service delivery unit (OTP)

Overall admissions to the programme were further analysed by service delivery unit in order to identify potential disparities in admissions across the different facilities.

Figure 2: Admissions by OTP, Jan - Oct 2011, Aweil East County

	Wargeng	Yargot	Omduruman	Malualbai	Lieth	Warawar	Malulakon
■ OTP	726	719	614	1740	831	1156	1201
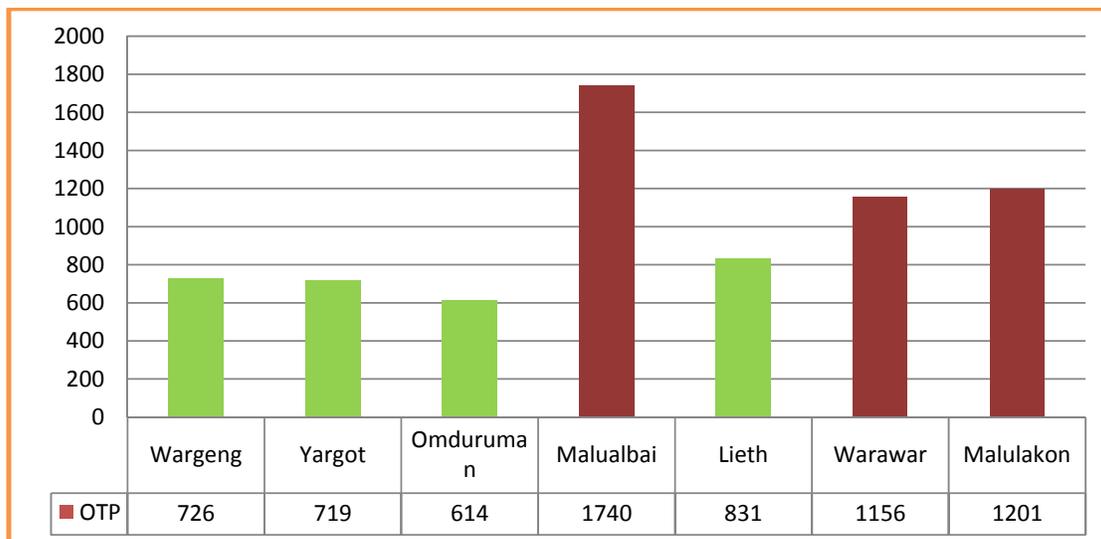
The analysis identified a clear difference between the sites whose series is light green and those in red as shown in figure 2 above. The investigation concluded this to be the result of the location of the facility near the primary road in the region connecting different centres and further because these are big centres in the region and they experience in-migration during the hunger gap and is also places with primary health care and so receives many cases as the beneficiaries seek medical care. Further as mentioned earlier, Malualbai has beneficiaries also coming from Gogrial west due to

proximity and as such has an IDP camp in one of the catchment areas. The admission trends over time per health facility are illustrated in Figure 3 below.

Figure 3: OTP admissions by health facility over time, Jan - Oct 2011, Aweil East County
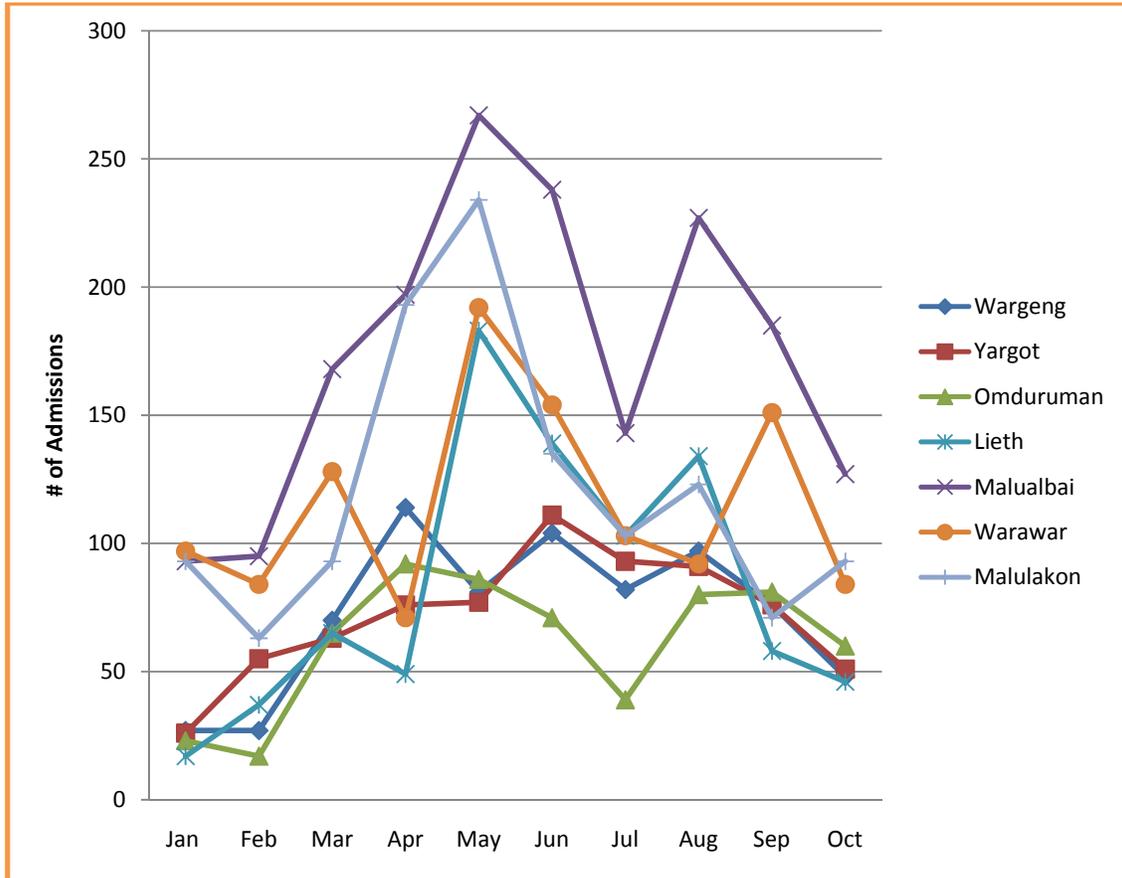
The OTP admissions indicate similar trends over time as compared to the overall program admission. All health facilities show an increase between Jan and May and the reasons are as explained above. Malualbai shows the highest in April because, the centre is big and populations move to the area during the dry season to put up with relatives till the season improves and cultivation begins then they move back to the rural and also because of proximity.

2.3 Admissions vs. Needs

Seasonal peaks are based on the local seasonal calendar and critical events, which highlights highest food insecurity (i.e. pre-harvest) and in-migration to big centres peak periods to be between March - May. In linking admission trends and the seasonal calendar one can see the trends correspond to needs as in Annex 1, though largely based on assumptions as the time frame is not long enough (over years) to illustrate this adequately.

The investigation has also ascertained that admissions drop with increasing agricultural responsibilities. This is twofold; first there is out-migration to the cultivation fields and second the labour intensive nature of cultivation and foreseen benefit does give little chance to seeking OTP services. There is more priority placed on cultivation by the caretakers and thus will require increased outreaches and mobile OTPs at this time to improve access.

2.4 Spatial coverage of Admissions

A geographical mapping exercise of admissions, defaulters and volunteers was used to assess the pattern of spatial coverage across the real catchment area of the programme. This was followed by a series of small area surveys to test hypotheses of heterogeneity of coverage. However, due to limitations on availability of good quality maps[4] , the spatial coverage assessment was modified. A pivot table was generated from the database to get villages with corresponding admissions, defaulters and volunteers

Following the overall admission trend analysis, the home locations of admissions were to indicate the spatial coverage of CMAM activities in the seven operational OTPs.

The analysis showed that admissions were higher in communities along the network of roads within the County and from the more densely populated areas. It is also clear that coverage is high with populations on short radius from the OTP, this corroborated by the fact that most villages far from the OTP had low admission purely because of distance. This was a key exercise towards guiding the investigation in the formulation of two different hypotheses on coverage for testing as part of Stage Two.

2.5 MUAC at admission

The measurement of the MUAC at admission is also part of the data available on the individual admission card and as well captured by the database. The compilation of data collected from each OTP site makes it possible to investigate the *timeliness of treatment seeking behaviours*.

In order to further understand whether the programme is reaching SAM children early, the MUAC at admission was plotted for all recorded admissions between Jan – Oct 2011. The results are as shown in the figure 4 below. The median MUAC at admission was 118mm and the mean MUAC was 117 mm. The slight discrepancy is influenced by the fact that the program admission uses weight for height z-score of -3 in addition to MUAC <115mm. This captures children earlier before they reach a MUAC of <115mm. However, despite use of W/H, quite a number of children are malnourished by MUAC definition. [5]

Overall, children appear to be arriving in a relatively timely manner for treatment, the median MUAC on admission can be used as an indicator of beneficiaries' treatment-seeking behaviour. More specifically, it reflects how early or late they seek care. The closer to the admission criteria the MUAC on admission the earlier they seek care and the lower the MUAC on admission the later they seek care. A median MUAC on admission of < 115 mm usually indicates late treatment-seeking behaviour. For the above analysis in the Aweil East IMAM programme, the admission median MUAC is 118 mm shows that the programme is able to capture SAM children early.

This early arrival seems to be positively influenced by use of W/H z-score as one of the admission criteria, the investigation found out that slightly above two thirds of admission are by W/H z-score. This implies that the children are admitted early before they reach the <11.5 mm which is the MUAC admission criteria.

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[4] The mapping exercise proved difficult because the available maps did not have villages or settlements on it. It was also difficult for the team to locate most of the villages on the map from the list provided by the programme.
[5] One point to note is that the people of this area are tall and may easily be considered to be having low W/H in reference to the standard height.

Figure 4: Graph of MUAC on Admissions
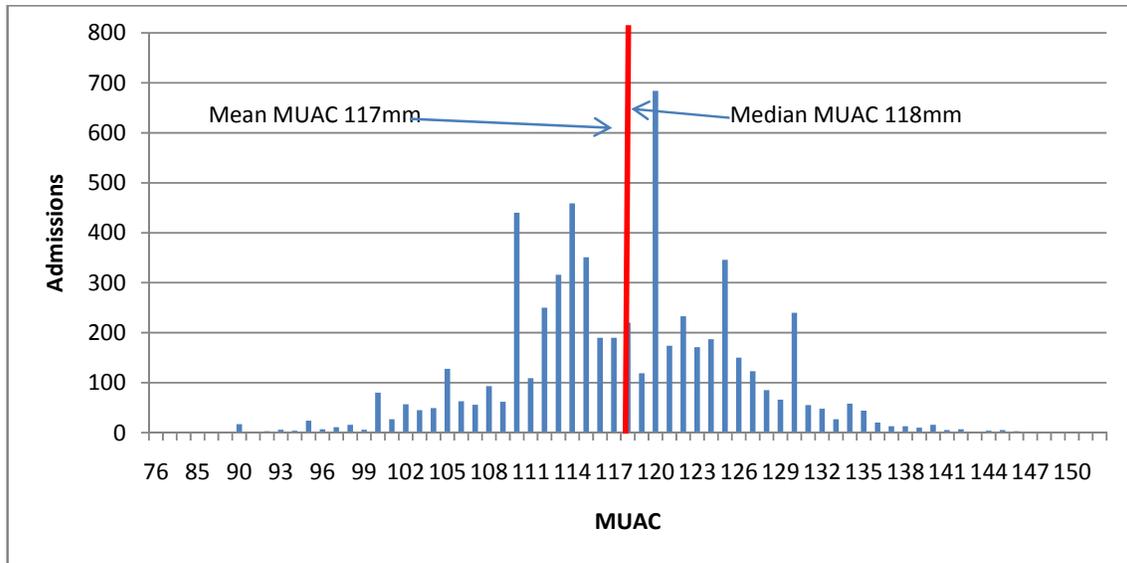
2.6 Programme Exits

Programme exits were meeting the SPHERE standards[6], the proportion of discharges from therapeutic care who have died is <10%, recovered is >75% and defaulted is <15%. The drop in June was due to increased number of defaulters which is as result of high admissions in the previous months and the program was experiencing some stock outs. Additionally as mentioned earlier, prioritization of cultivation as well has a bearing on defaulting.

The following graph presents cumulative programme performance indicators Jan – Oct 2011.

Figure 5: Graph of program performance over time

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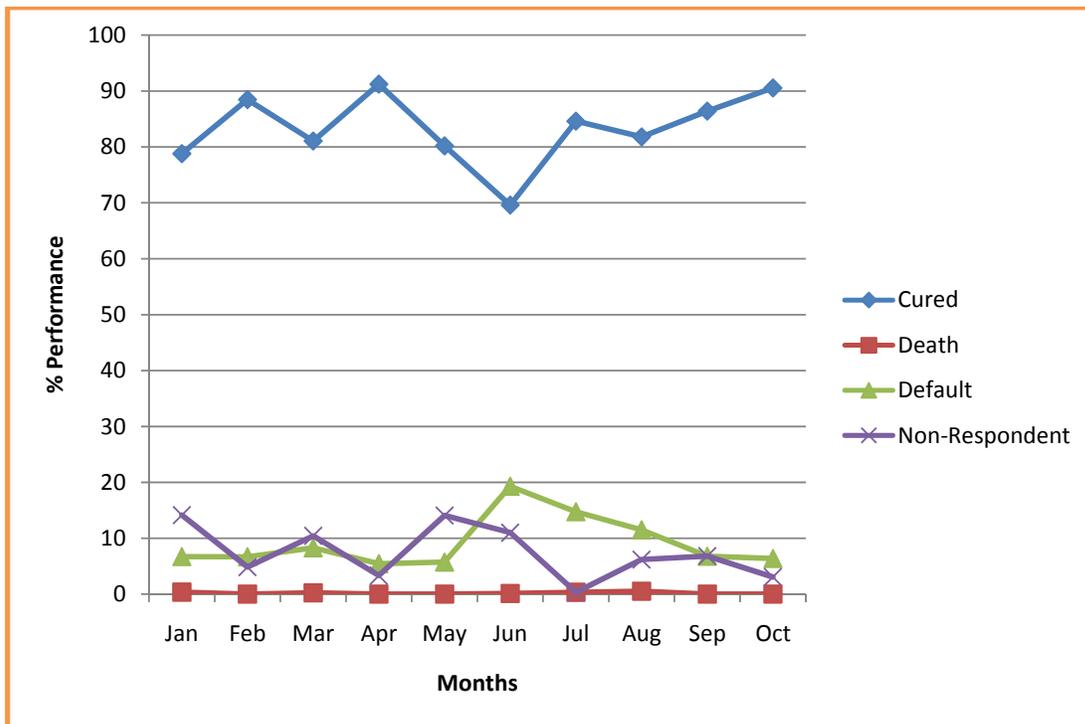
[6] SPHERE Standards Handbook 2011

2.7 Review of Defaulter Records

To better understand the factors effecting defaulting and potentially affecting coverage, various stages of analysis were conducted specific to defaulting. This was a key exercise towards guiding the investigation in the formulation of two different hypotheses on coverage for testing as part of Stage Two.

Defaulters were treated as uncovered cases; the number of defaulters was examined for signs of worryingly high trends over time.

2.7.1   Defaulter versus admission over Time

In bringing together admissions and defaulters per health facility it was possible to identify a few trends in the graph below.
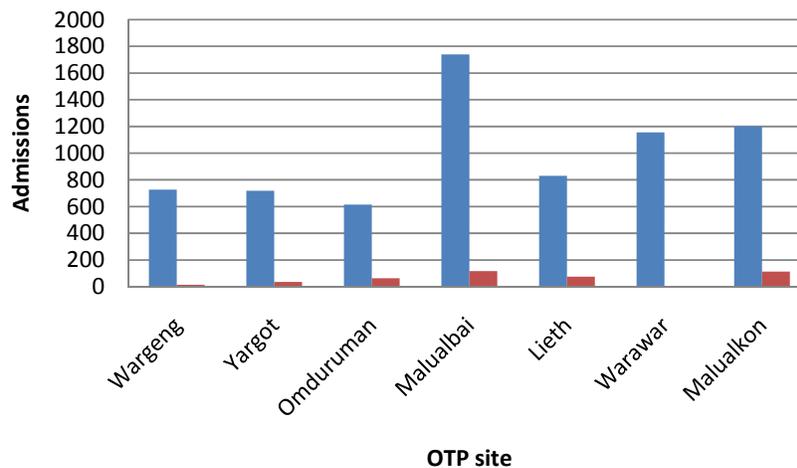
Figure 6: Defaulters versus Admissions per OTP, Jan - Oct 2011, Aweil East County

Health facilities with higher number of admissions also have a higher number of defaulters, such as Malualbai, Malualkon and Lieth with exception of Warawar which is attributed to the high awareness of the OTP services and close proximity to homes of most beneficiaries. On the same note, health facilities with lower admissions also have lower defaulting, such as Wargeng, Yargot and Omduruman. Such trends suggest a possible positive correlation between the levels of admissions and the levels of defaulting. The potential correlation seems to be corroborated by the trends in defaulting over time by health facility (Figure 7 below) which follows a similar pattern to that of admissions. The increase in defaulting in May and June could also be a result of out-migrations to the cultivation areas and increased farming activities.

Moreover, defaulting in Malualkon OTP which is more pronounced was due to the IDPs/returnees from Abyei who were admitted into the programme and returned shortly to Abyei while some moved to Manyiel- far from the OTP where they were admitted.

Omdurman has military barracks so when the army is transferred they moved with the family without informing the CNWs in that particular OTP. To take advantage of the rainfall, most of the mothers had gone to the low lands to cultivate and never returned to continue with treatment of their children.

Figure 7: Defaulter over time, Jan - Oct 2011, Aweil East County
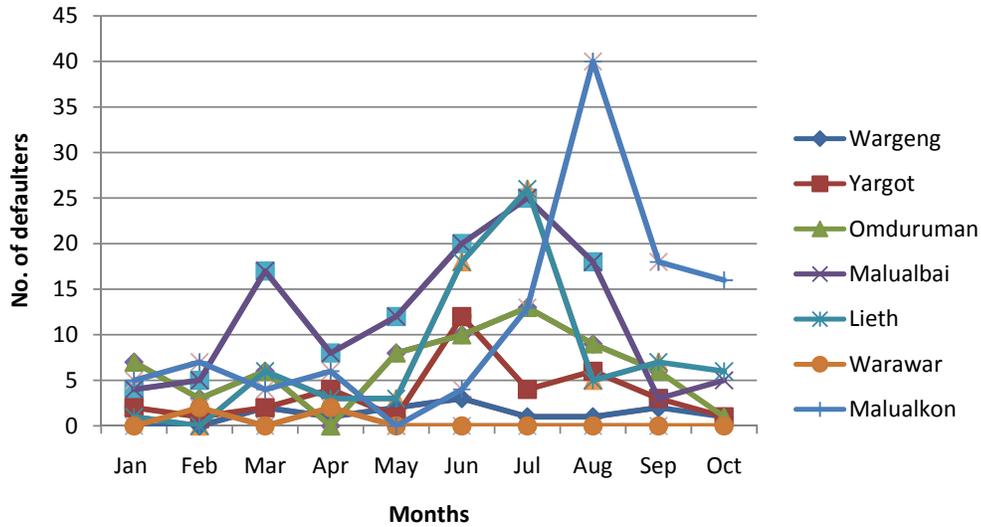
2.7.2 Early versus Late Defaulter

The investigation also analysed the timing of defaulting, in an effort to determine possible reasons behind it[7]. Discharged defaulter cards were gathered and separated into categories according to number of visits recorded (Figure 8). The analysis concluded that most defaulting is occurring early on, with most defaulters never returning after the 1st and 2nd visits. The trend line shows a clear picture of defaulting at early stages. The main reason has been sudden movement of populations especially IDPs, returnees and soldiers' barracks that were contributing high number of cases and finally some cases are due to the massive distances to the OTPs.

Figure 8: Time of defaulting, overall, Jan - Oct 2011, Aweil East County

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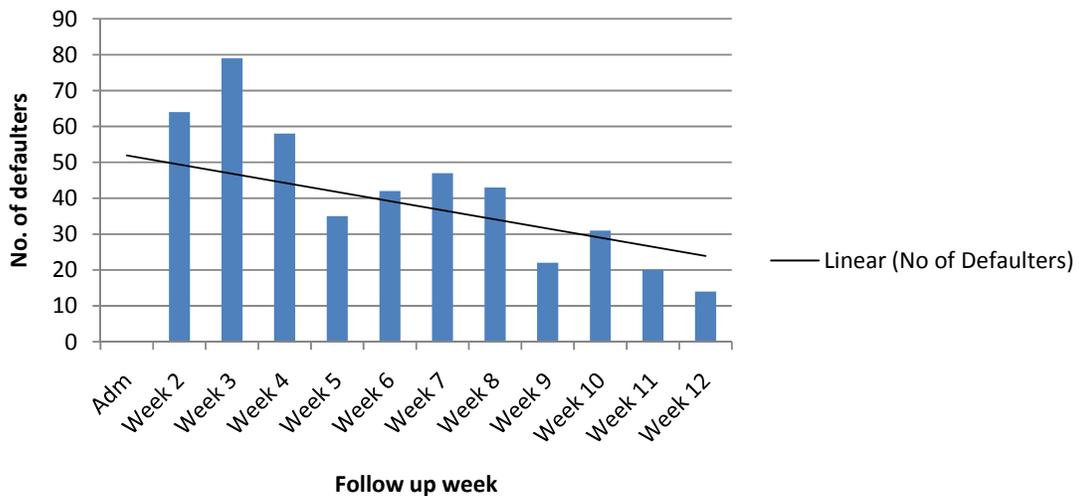
[7] Early defaulters generally suggests; 1) that the child did not recover on its own after (i.e. is affecting coverage) and; 2) it happened most likely for significant reasons. If it happened late it generally means that; 1) the child probably recovered on its own and; 2) it probably happened precisely because "sufficient" progress had been made and cost-benefit balance shifted.

2.7.3   Defaulters by Home Location

The investigation also considered the need for locating where the program has high defaulting by mapping the villages from which defaulters come from.

Generally defaulting was low in comparison to the admissions and most of the villages had 1 – 3 defaulters for the period Jan – Oct 2011. However some villages had high defaulting ranging between 11 - 32 defaulters, this is corroborated by the volumes of admissions and distance from some villages.

2.8 Review of Criteria Not Reached

A review of criteria not reached (CNR) showed a high number, 454 children were discharged Jan and Oct 2011. The investigation sought to understand what had caused the high numbers and especially in Malualbai OTP site where the figure was quite high (up to 55 cases/month) in comparison to the other OTPs. The finding was that high admissions coupled with RUTF stock supply shortages contributed. The process was two-way; first by giving fewer rations to the children and second by discharging those that had stayed longer in the program.

The graph below gives a pictorial view of the review.

Figure 9: Criteria not reached
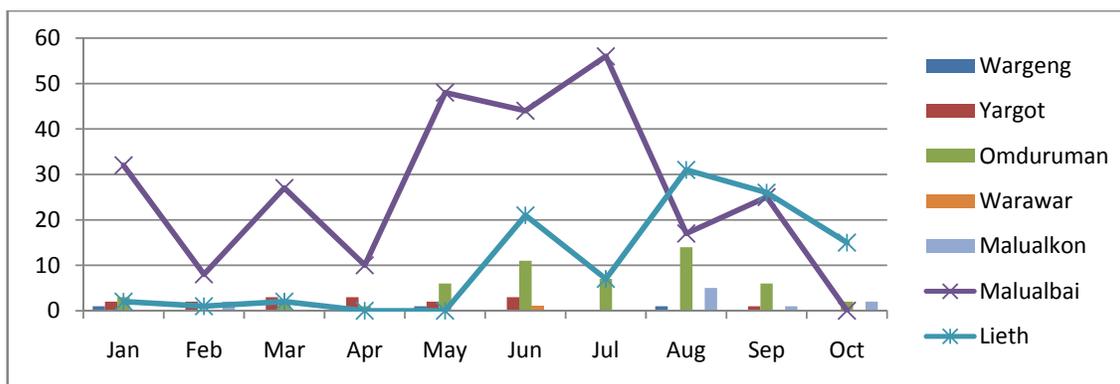
2.9 Qualitative Data

2.9.1   Synthesis of Quantitative and Qualitative Data

In this investigation, a mind mapping exercise was used to synthesise all quantitative data analysed and qualitative information gathered. The exercise allowed the investigation team to collate all the data in such a way to facilitate discussion and interpretation. The exercise was done by putting together pieces of flip chart paper to create a "wall" to write on. The theme or topic being investigated, which for this case was coverage, was put at the centre of the wall and then sub-topics based on the various sources of quantitative data and qualitative information were written down branching out from the central theme. Corresponding data and information were then written down per sub-theme or topic and the process was continued until all points of investigation were exhausted. The mind mapping exercise can also be facilitated and captured using XMind[8], a mind mapping software that allows for the recording of a mind map electronically.

2.9.2   Understanding of Malnutrition

Malnutrition is not recognized in Aweil East communities as a distinct and easily recognisable condition, which can affect early detection. The mothers do not at the first instance think of malnutrition when the child is unwell. In listing the common diseases in the community, malnutrition

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[8] XMind can be downloaded free at www.xmind.com.

was not mentioned as a disease. Disease mentioned and ranked according to occurance were: Diarrhoea, Malaria, Coughing and Fever. Malaria & Diarrhoea are said to be occurring frequently during the rainy season that is between May – Sept in 2011. The community described symptoms of Malnutrition as thin, loss of appetite, loss of weight, yellowish hair, baggy pants, face of an old man and big belly.

The terms used to refer to malnutrition are: *Dor* which means thin; *Thiang* which refers to a child who is thin, vomiting and has diarrhoea and *Chala* – thin and lacks appetite. The community recognizes that malnutrition is caused by: Lack of food/balanced diet, Poor care by mothers, Diseases, Poor Feeding and ignorance of good feeding practices.

2.9.3   Health Seeking Behaviour

During the community discussions, the respondents were asked what they do when their children are sick so as to assess their health or treatment seeking behaviour. Overall, these informal discussions revealed a strong traditional health seeking behaviour across the programme area.

The majority start by taking the child to the traditional healer and the practice seems quite strong since the healer has instructed people not to go to hospital before coming to him to find out and this advice is hid by the mothers. A number of things are performed depending on child sickness; for malnourished child, they give remains of a local brew mixed with some food stuff, however this is observed to be creating appetite for the child and that he will be able to begin eating. A child with diarrhoea has a different kind of performance for "treatment". The cost of a traditional healer is a number of *malua* of sorghum depending on clients' capacity.

When the situation becomes very serious the traditional healer can then advice the mother to take the child to the PHCC but still coming back to him to check on the progress, the child will then be taken to the PHCC, where they receive nutritional advice and medication for other identified illnesses. Some of the cases are brought to the health facility too late.

The factors considered before seeking treatment from PHCCs are: distance to the PHCC, permission from the household head and at times considering who will remain with other siblings. The community is also aware of drug shortages in the health facilities and in most cases they have always been referred to buy drugs from the shops and pharmacies in the market this has effect since they would prefer home remedies to coming to the PHCCs and the worse scenario is the belief that they must get injection because according to them that is what can cure.

2.9.4   Barriers to Access

In order to understand health seeking behaviours in Aweil East, a series of cultural and programmatic factors linked to malnutrition were reviewed. The table below summarizes key findings on possible reasons for defaulting and non-attendance.

Table 1: Reasons for Defaulting & Non-Attendance

Awareness on malnutrition & treatment available	Malnutrition is not recognized as a distinct disease by communities. Thus, when a child presents malnutrition signs and symptoms, caregivers begin home medication first and when it is not improving they go to the PHCC and from there is when they get to the OTP. There is still need for continued mobilization and awareness creation of malnutrition as well as the availability of CMAM services. The program is known and accepted, however this is the case for villages around the OTP; those distant are still having a challenge coming to the OTP and mobilization activities have not reached them
Supply shortages	Most OTPs reported shortages of supplies; this may have been caused by communication breakdown in the supply between the base and the OTPs. However, The team also experienced shortage that was occasioned by lack of PlumpyNut supply from UNICEF. The impact here is that when mothers travel long distances and are not able to get the supplies, they will go back telling others and as such will not return the next visit till they here of supply availability. This was also mentioned by CNWs in giving reasons for defaulting in some areas.

OTP service provision	The OTP services are well accepted and mothers are happy about it, however there is pronounced complaint of children turned away from the OTP since they do not reach the admission criteria, this is misinterpreted by mothers. This is caused by ignorance on the part of the mothers but may impact on the service negatively. There is need to have a way of educating the mothers both at the community and facility level on admission criteria, services provided and what it means to be rejected. The program as well need to be very careful on referring the children at the community level or else it may exacerbate the rejection.
Distance	Distance is highly pronounced in Aweil East. The catchment of OTPs is wider and some even have villages 8 hrs walk. This is having an impact especially on defaulting, mothers may bring the child the first time and fail to return back due to distance
Physical Barrier	During the rainy season, seasonal rivers become a main barrier to access. In addition, road networks also become worse, limiting access during the rainy season. In some sites flooding becomes the main barrier
Community Mobilization	Most of the villages visited away from the OTP reported having not seen someone doing the screening in their villages. This was further corroborated by the CNVs focus groups that complained of distance to the villages and were asking for transportation during mobilization days. The CNW also reported issues of follow up by the community mobilizer in confirming whether it is taking place
Rejection	This is evident in most OTPs; it has been caused by wrong referrals by the CNVs. The impact of this is that even when the child becomes malnourished the mother will not return since she was rejected.
RUTF Perceptions / Acceptance	RUTF is recognized and even has a local name muguak mieth Ado (food for malnourished child). Some community members refer to RUTF as food, which can have implication in that caregivers will attend the health facility without understanding the admission criteria/malnutrition treatment, be rejected and relay this information back to communities.

2.10   Areas of High and Low Coverage

Based on the information collected and analyzed in Stage One, there were observations of high and low coverage as seen in the admissions per home location. The investigation concluded that coverage is likely to be relatively low in distant areas from the OTP.

The hypothesis was therefore that:

- **Coverage is high** in areas around the program to a distance of 3 hour walk.

To test this hypothesis, six villages were selected, based on the investigation, as the most representative of the hypotheses. The second stage is then undertaken to confirm they hypothesis.

3.   STAGE TWO

The objective of Stage Two was to confirm the locations of areas of high and low coverage as well as the reasons for coverage failure identified in Stage One (above) using small area surveys.

Six villages were sampled where three were hypothesised as having high admission and the other low admissions. Four teams were formed for the small area survey which was conducted in two days.

3.1 Active and adaptive case finding

Active   = Target SAM cases instead of doing house to house screening

Adaptive   = Use key informants to help find SAM cases

= Key informants:

- Village headman/elder
- Traditional healer

-    Senior women and elders
-    Religious leaders
-    Beneficiaries

3.2 The definition of a Case

- MUAC less than 115 mm
- Bilateral oedema
- Aged 6-59 months
- <-3 Z-score; in this investigation, the criterion of Z-score was not considered to identify cases since it is a criterion generally used at the health facility level only and this measurement is not part of the community based approach[9].

The local terms used were as defined in section 1.8.1. Based on the information collected, coverage was classified against a threshold of 50%[10]. A decision rule (d) was calculated using the following formula:

$$d = n \times \frac{p}{100}$$

n = total number of cases found

p = coverage standard set for the area

Table 2: Stage Two – Small Area Survey (Findings)

In the test of hypothesis exercise for high coverage areas, the following results were found and calculations in order to classify coverage are as follows.

3.2.1 High coverage areas

Total SAM found = 5; IN program = 3; NOT in program = 2; D = 50/100*5=2.5=2

Since 3>2, then coverage is above 50% and the hypothesis was accepted.

3.2.2 Low coverage areas

Total SAM = 14; IN program = 0; NOT in program = 14; D = 50/100*14=7

Since 0<7, then the coverage is below 50%.

The actual numbers for each village are represented in the table below.

Table 3: Results of the small area survey

	Villages	SAM cases	Cases In Program	Cases Not in Program
High Coverage villages	Rum Manyiel	0	0	0
	Ameth Akok	1	1	0
	Riang Awei	4	2	2
Low Coverage villages	Akong	2	0	2
	Mathiang nintok	3	0	3
	Majok yinthou	9	0	9
Total		**19**	**3**	**16**

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[9] Duffield A, & Myatt M, 2007, Weight-for-height and MUAC for estimating the prevalence of acute under-nutrition: a review of survey data.

[10] Threshold was set at 50% based on the SPHERE minimum for rural areas.

The hypothesis that **Coverage is high** in areas around the program to a distance of 3 hour walk was proven, demonstrating that the actual coverage of the programme is limited to areas around 3 hours walk around programme sites, this implies that coverage across the programme area is patchy and NOT homogenous, and that far away areas are likely to have really low coverage.

4. STAGE THREE

The objective of Stage 3 was to provide an estimate of overall programme coverage using Bayesian techniques. To do this, the evaluation relied on the standards Bayesian beta to binomial conjugate analysis.

4.1 Developing a Prior

All the positive and negative factors identified affecting the coverage were listed, ranked and weighted according to their relative contribution to the overall coverage. Positive and negative factors ranked highest were automatically given a ±5% weight while lowest ranked factors were weighted ±1%. Factors ranked in between were given weights of ±3% according to their perceived positive or negative contribution to the coverage. The positive and negative weights for the factors were then added up.

All positive factors were added to the minimum possible coverage (0%) while all the negative factors were subtracted from the highest possible coverage (100%).

Table 4: Measuring Contributing Factors (Prior)

Positive Factors	Value		Negative Factors
Understanding of Malnutrition	5	5	Supplies
Free OTP service	5	3	Motivation of CNVs
Awareness of CMAM service	3	3	communication
Perception of RUTF	1	5	Distance
CMAM services	3		Work materials
Admission Vs Needs	3	1	Few number of staff at the OTP
Discharge outcomes	5		Lack of training for CNVs
Community mobilization	3	5	Health seeking behaviour
		1	Rejection
		3	Follow up/ Referral
		1	Defaulting
Added to Minimum Coverage (0%)	28	27	Subtracted from Maximum Coverage (100%)
Median	50.5		
α value	24.1	23.3	**β value**

The distribution of prior coverage estimate was determined through a beta distribution of the belief of perceived coverage estimates. This was done by using the Bayes SQUEAC calculator[11] to plot the mode and all the perceived other possible coverage proportions. An average was calculated and used as the median for a trial distribution curve (Prior) plotted using the Bayes SQUEAC Calculator. The final curve that was generated is as shown in figure 9.

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[11] Software specifically designed and developed for SQUEAC investigations and can be downloaded free at www.brixtonhealth.org

Figure 10: Prior of Programme Coverage
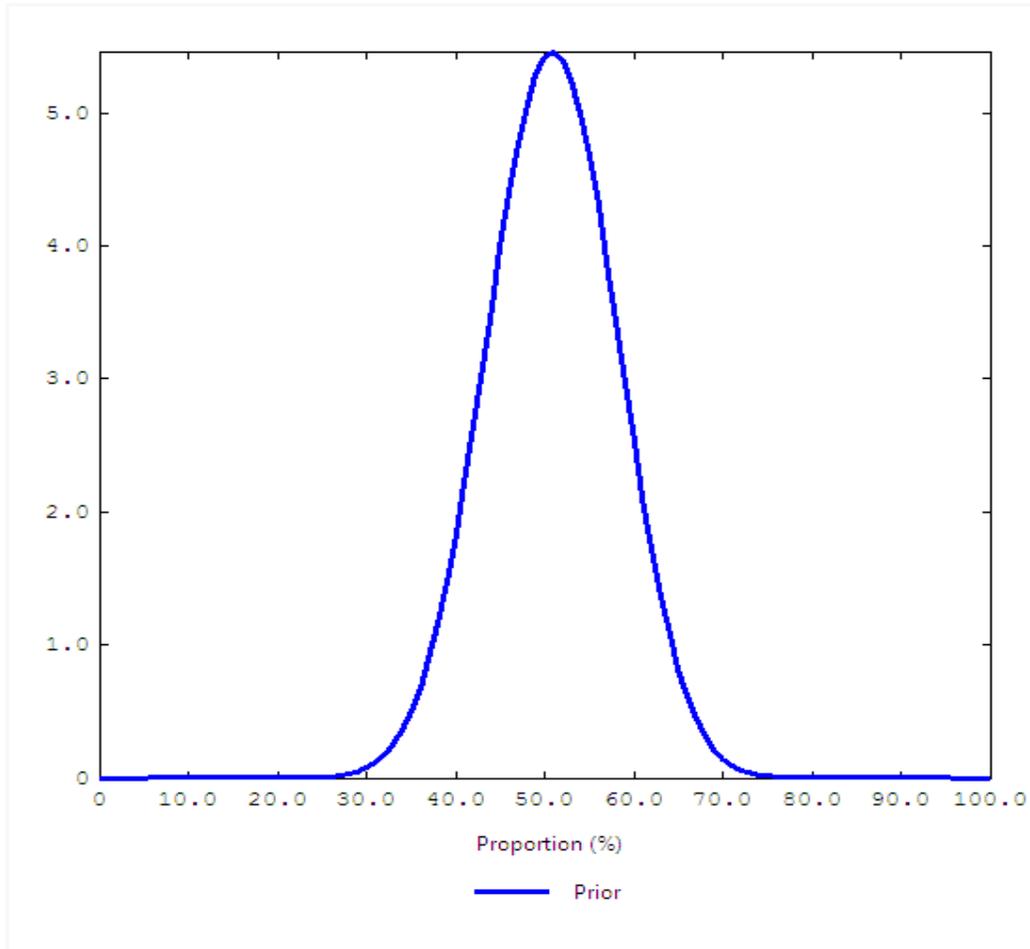
4.2 Sampling Methodology

4.2.1 Minimum Sample Size

To estimate the minimum number of cases (children) needed in the small area survey (n), the following formula is used:

$$n= \left| \frac{\text{mode x (1-mode)}}{(precision \text{ / } 1.96)^2} \quad - \quad (\alpha + \beta - 2) \right|$$

Using α (24.1) and β (23.3) values and a mode of 50.5% (*see section 3.1),* the following minimum sample is as follows:

n= [(0.505 x (1-0.505) / (0.11[12]/1.96)^2 – (24.1 + 23.3 – 2)]
n= (0.249975/0.00315) – 45.4
n= 79.68778 – 45.4
n= 33.96
n=34

In order to achieve a confidence of +/- of 10%, a minimum of 34 cases needs to be identified.

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[12] The precision was put at 11% instead of 10% since the sample size was hard to reach

4.2.2 Minimum number of villages

The minimum number of villages to be sampled was then calculated with the use of the following values.

Target Sample Size:	**34**
Average village population:	**427**
Prevalence of SAM:	**2.0%**
% Children aged 6-59 months:	**20%**

Values   were used in the following formula

$$n_{villages} = \frac{n}{\text{average village population}_{all\ ages} \times \dfrac{\text{percent of population}_{6\text{-}59\ months}}{100} \times \dfrac{\text{prevalence}}{100}}$$

$$n_{villages} = 34/\,(427 \times 0.2 \times 0.02)$$
$$n_{villages} = 34/3.416$$
$$n_{villages} = 9.95$$
$$\mathbf{n_{villages} = 10}$$

As a result, a minimum of 10 villages has to be sampled in order to reach the minimum sample size of children. However, in practice, the sample was not reached and the team had to increase the villages sampled to a total of 18 villages.

4.2.3 Spatial Representation

In order to achieve spatial representation, the Stage Three investigation involved a two-stage sampling:

1) Village selection: First, a list of all the villages in the catchment areas was generated, since the team wanted to have more villages at the sampling stage, 16 villages were randomly selected[13]. The simple random sampling approach was used in selecting the 16 required villages. However after the 16 villages were sampled, two more were selected to meet the sample size needs

2) Within-community sampling method: a combined active & adaptive case-finding & mass screening approach was used in Stage Three to ensure selected communities were sampled exhaustively. The wide area survey was carried out over four days (Nov 15th – 18th) by four teams of four people; each composed of three enumerators and was overseen by the surveillance and Nutrition program officers and Surveillance program manager.   Case definition used in Stage Two was reviewed with field teams and replicated in this stage of the process.

4.3 Wide Area Survey Results

Main results for the wide area survey are summarised in Table VI.

Table 5: Stage Three (wide area survey) Main Findings

Types of Cases	Number of cases
Number of current (SAM) cases	**34**
Number of current (SAM) cases attending the programme	**13**
Number of current (SAM) cases not attending the programme	**21**
Number of recovering cases attending the programme.	**33**

The main reasons for not attending CMAM services available are summarised.

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[13] Experience had shown that population figures were overestimated and also that SAM children were hard to find, the investigation considered it by increasing the number of villages.

Figure 11: Main reasons for Non-Attendance
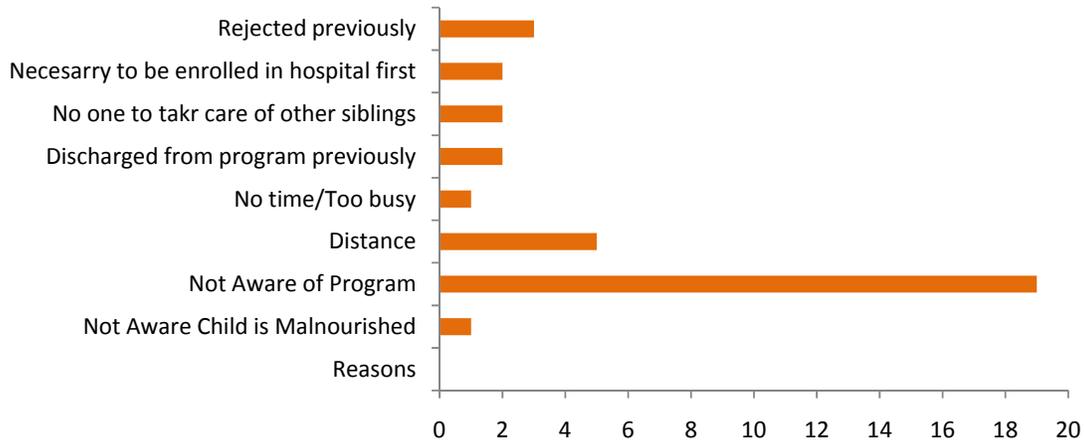
4.4 Overall Coverage Estimation

Point coverage is presented as it provides a more accurate picture of the actual coverage of SAM cases at the time the investigation was conducted. This is corroborated by the fact that distance is a massive issue, that case finding is weak. Period coverage[14] is as shown in the foot note 12.

Point Coverage
Point coverage provides a snapshot of programme performance and places strong emphasis on the coverage and timeliness of case-finding and recruitment. To calculate point coverage, the numerator and the denominator were selected from the results for the wide area survey using the formula

$$\frac{\text{No. of current (SAM) cases attending the programme}}{\text{No. of current (SAM) cases}}$$

Selected data was used as a denominator (34) and numerator (13) when inputted into the Bayes SQUEAC Calculator.

Figure 12: Graph of program coverage showing prior, likelihood and posterior curves
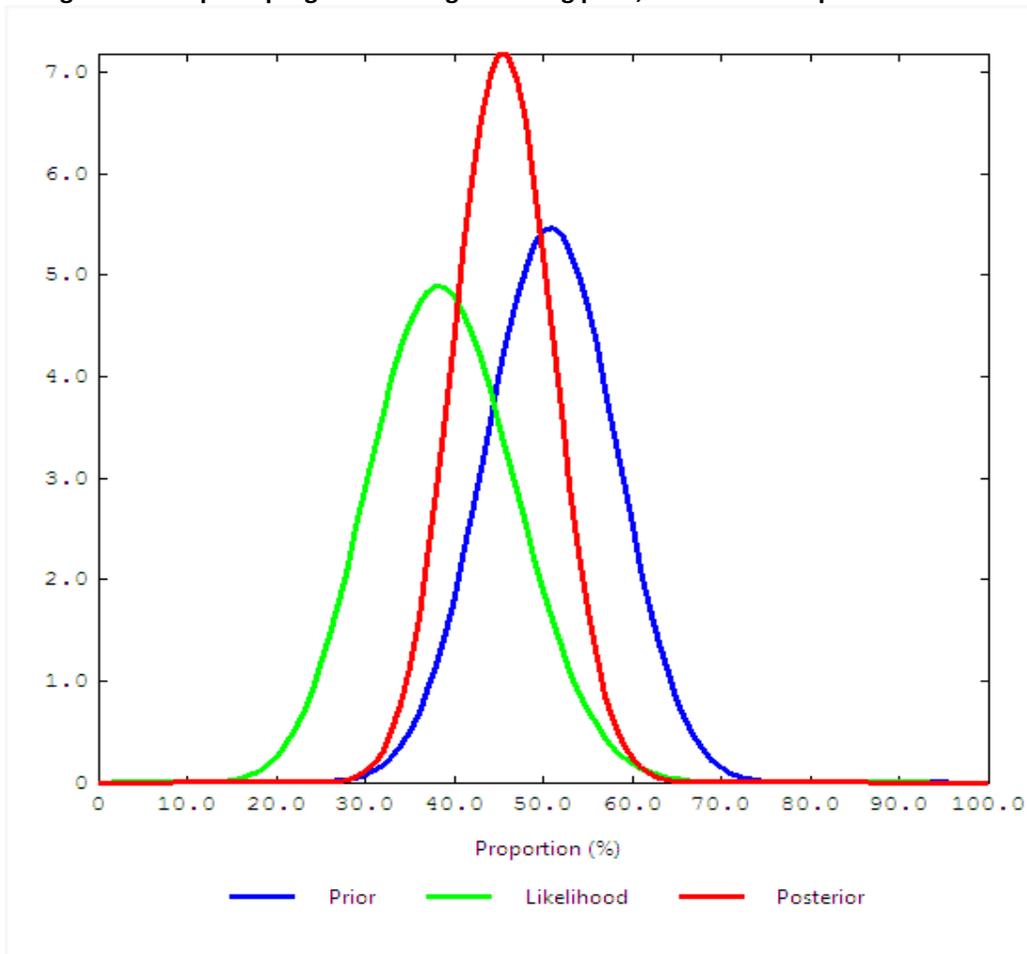
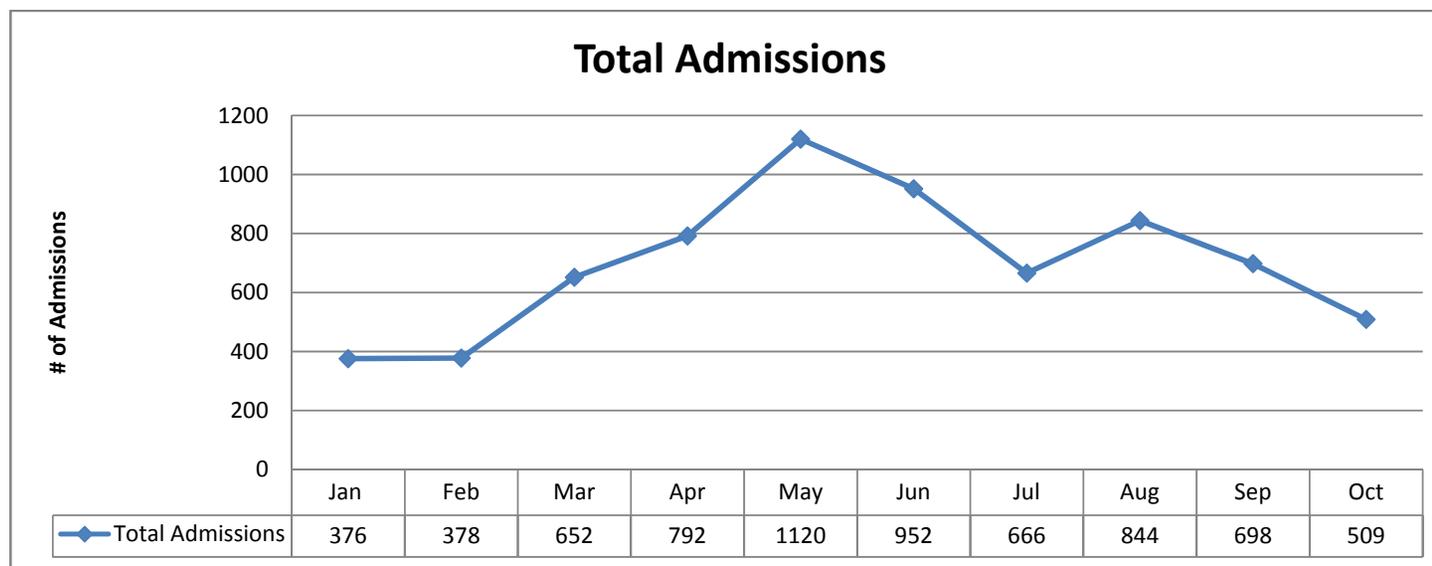Based on the existing prior and wide area survey (likelihood) **point coverage** was estimated to be **45.5% (35.0% - 56.2%)**[15]

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[15] All values were calculated using the Bayes SQUEAC calculator.

5. CONCLUSIONS & RECOMMENDATIONS

- Aweil East has a large number of admissions and the area covered by some OTPs is wide, There is therefore need to:
  - Create mobile OTPs for some identified areas which are far from the existing OTPs and have high SAM children, this will reduce defaulting and more importantly the distance travelled by the beneficiaries.
  - Increase the number of CNWs especially those sites with high admissions to avoid continued use of casual employees
  - Having more outreach services during the peak of malnutrition to capture more children and reduce distance travelled by the beneficiaries. The impact may be two-fold: first, access is improved and second, further decentralization can make caseload more manageable to overcrowded facilities.
- Improve community mobilization and defaulters' follow up.
  - Some CNWs need to be sensitised on need for follow up of defaulters as some of them categorical count number of absence and when reaching the third they record defaulted. There is need for synergy between CNWs and CNVs; this link needs strengthening.
  - Mapping of all villages per OTP catchment and plan for community mobilization, follow up and spot check to be conducted by the community mobilizer on areas that have been mobilized and identify villages that have not been visited and plan.
  - Volunteers' need to be spread across the catchment and thus selection of volunteers from villages near the OTP should be reviewed
- Consider standardising and sustaining the motivation strategy for volunteers through;
  - CNVs motivation and incentives being standard across all CNVs and OTPs
  - Refresher trainings
  - Provision of incentives e.g. t-shirts, caps, raincoats etc.
  - Transportation during mobilization days
- The supply chain to the program, especially that of RUTF has been experiencing breakages, there is need to ensure constant supply of the commodity. This is vividly pronounced in the program and was voiced by the beneficiaries as well as the OTP staff and further corroborated by the numbers of criteria not-reached and defaulters.
- Increased on-job training for CNWs by the OTP supervisor, increased contact with the program officer and manager. This is both motivational and has an impact of streamlining the short comings of the CNWs in manning of OTPs, handling of referrals and monthly reporting.
- In health seeking behaviour the community seems to be first consulting traditional health practitioners who in most cases delay them before they can seek appropriate health care in the PHCC and OTP. There is need to educate the community and as well work with the traditional health practitioners to reduce delay in seeking health care and can be supportive in the referral to the PHCCs and OTPs. Hence, uniform nutrition education messages for improving knowledge of community members on malnutrition.
- More focus on Malualbai, as the number of acute malnourished children is very high in this location, more focus of the nutrition program as well as integrated approach incorporating WASH & food security to address underlying causes of malnutrition.
- For improved coverage, more effort is needed on awareness creation on malnutrition and the CMAM programme.

Total Admissions

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Total Admissions	376	378	652	792	1120	952	666	844	698	509

# of Admissions (y-axis: 0–1200)

	Jan	Feb	March	April	May	June	July	August	Sept	Oct
Seasonal Illness						Malaria				
				Diarrhoea						
	ARI									
Food security					Hunger season					
					Cultivation					
						Weeding				
									Harvest	
						Rains				Rains
	Burning of Bushes									
		Fishing								
		Dry season								
Other Important seasonal events									Flooding	
	Migration									

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[16] Identified through FGD with community key informants and staff

Annex 2. List of villages sampled for the wide area survey

OTP Site	Villages Per OTP	Estimated distance by walk, Time (Hrs)	Sampling Number
Malualkon	Mabior	2	24
	PanAmei	2	27
Wargeng	Maper Piny Dong		x[17]
	Wunweel	¾	85
Warwar	Malou	3	120
	Akuach	1	x
	Uchien		153
	Kueth dit	40 mins	158
Lieth	Louonyacuol	1	179
	Malou	1	181
	Mabok Arien	1	187
	Pagai	2 & 45 min	211
Yargot	Hong Akon	3	275
Malualbai	Majak paluil	3	307
	Ameth wol Duang	4	308
	Biok Loc	4	314
	Rum Maloudit	2	319
	Marol Duer	3	345

The sampling of the 16 villages was by use of simple random sampling. The first stage was to assign all the villages numbers and secondly generating 16 numbers using the random number generator. The numbers generated are as shown in annex 2 referred to as sampling number.

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[17] Village chosen later to meet the sample size requirement