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Performance assessment of CMAM information system

Draft report

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Executive summary

This report presents the findings of a performance assessment of the Nigeria CMAM information system, which is intended to support lesson learning and ongoing improvement. Fieldwork was undertaken in Sokoto State, with analysis of secondary CMAM facility data from Sokoto, Bauchi, Gombe, Kaduna, and Kano states, as well as review of forms and documentation. Fieldwork methods included observation of the data system in nine sampled facilities in three LGAs in Sokoto; recounting of data for admissions, exits and RUTF utilisation; and interviews with health workers and government officials.

The Nigeria CMAM information system is based on weekly (SMS) and monthly (paper-based) collection of data. The two sub-systems are complementary. The SMS system enables rapid response to stock shortages and so facilitates smooth running of the programme. The data from the paper-based system are currently more complete, and the format is more compatible with other health service reporting systems. The information system is implemented by the Nigerian government, supported by UNICEF.

Main findings

- The **paper-based and SMS-based systems to monitor CMAM were operational** in all the visited facilities, and data were largely timely and complete. However, levels of accuracy and reliability varied.
- **Technical aspects of data transmission work well** for both the SMS- and paper-based systems, apart from occasional lack of network connectivity that affects the completeness and timeliness of the SMS data.
- **There is good motivation among staff at all levels.** Stakeholders recognise the importance of data for monitoring and developing the CMAM programme, and there is high motivation and therefore good potential to improve the system.
- **Where there are errors, these are primarily introduced at the stages of data collection and transmission by health workers.** The following challenges affect the accuracy of CMAM indicators:
  - The inadequate number of health workers, high workloads and capacity issues;
  - Although training includes sessions on how to complete forms and tally data, written guidance is not held at facilities;
  - Various versions of the forms are being used. Some health workers incorrectly use the 'outcome' categories (e.g. to indicate treatment rather than discharge) and admissions categories are not always recorded in the Outpatient Therapeutic Programme (OTP) form;
  - There are also challenges with the consistency of weekly data tallying. For example, values for the variable 'number of children in treatment' are carried over from the previous week or month, resulting in errors being carried forward in the data; and
  - There is limited or no quality assurance at the point of data entry.
- **UNICEF shares summary analysis of the data on request, but this could be more systematic.** At monthly state-level meetings there is some degree of feedback on performance and data quality, and findings from data analysis, to Local Government Area (LGA) and facility level. At some facilities and LGA offices there is interest in receiving summarised findings. Regular provision of hard copies of findings would likely stimulate use of the data at these lower levels, which in turn would promote improvement in data quality.
- **There is potential for greater data use**. Use of the CMAM data is more expansive at state and federal levels where they are used for monitoring, planning, reporting, tracking, and advocacy. At LGA and facility levels, CMAM data are used predominantly for forecasting, to ensure timely replenishment of ready-to-use therapeutic food (RUTF) supplies.
- **Some government stakeholders spoke of a need for written guidance on the interpretation and use of the SMS data**, so that they can more independently use the data. The user-friendliness of the both the weekly and monthly datasets could also be improved, and this would likely stimulate great use of the datasets.

Ratings for eight dimensions of data quality

Explanation of ratings		Source
	***Positive rating**: system generally working well*	*DA: Facility data analysis;* *I/O: Interviews/Observations;* *V: Verification;* *DR: Document review*
	***Intermediate rating**: Some improvements required. Recounted data varied with reported data by 10-19%*	
	***Negative rating**: Urgent improvements required. Recounted data varied with reported data by 20% or more*	
Completeness *(Without omissions)*		
	*I/O*	**Completeness is addressed** during supervision and state-level meetings
	*DA*	**Completeness is acceptable but there is room for improvement**. 7% weekly reports were missing in SMS data. No entire months were missing in paper data. Variables largely complete except RUTF in SMS data; and children in treatment at beginning/end of month in paper data
Accuracy *(Close to true value, with minimal errors)*		
	*V*	**Verification analysis suggests inaccuracies in data entered**. There are discrepancies between recounts, weekly tallies, registers and SMS data, that are particularly frequent and large for RUTF consumption and defaulters. Entry of monthly LGA reports into spreadsheets was largely accurate.
	*I/O*	**There are errors in completion of forms.** Fields are left blank in OTP card; sometimes incorrect categories are used; and there is a lack of quality control during tallying. Errors mostly introduced at data capture, not data transfer or analysis
	*DR*	**Layout and headings on OTP card and tally sheet need revision.**
Reliability *(Data are consistent internally and over time and are produced using common protocols)*		
	*I/O*	**Quality assurance protocols need strengthening, alongside development of consistent protocols** for data collection and tallying. A variety of paper forms are used, and there are inconsistencies between CMAM operations and national guidelines.
	*DA*	**There are inconsistencies in the data on some variables** including number of children in treatment, and RUTF stock balance. Performance indicators examined from the SMS system had only a small number of outliers.
Timeliness *(Data are reported and made accessible on a timely basis)*		
	*DA*	**Data are submitted through the paper-based system in a timely fashion. However, many weekly SMS reports are submitted late**. 76% of the SMS reports received were submitted two or more days after CMAM day (UNICEF uses a less strict measure of timeliness)
	*I/O*	There is **emphasis on timeliness in state CMAM meetings**. Late submission of SMS data is mostly due to connectivity issues. Monthly submission of paper records appears timely,
Integrity *(System used to generate data is protected from deliberate bias or manipulation)*		
	*I/O*	**Integrity is compromised by poor levels of protection rather than evidence of manipulation.** There is a lack of cross-checking of data entry, dissemination of data down to those responsible for data collection is lacking.
Confidentiality (*Data are collected, analysed, stored, and reported in a way that protects individual privacy*)		
	*I/O*	**Confidentiality of client CMAM information is compromised by poor practices and a lack of guidance on the storage of paper forms**. There is a lack of facilities for secure storage, and little awareness of the need for confidentiality.
Relevance (*the degree to which statistics meet user needs)*		
	*DR*	**Indicators reported are appropriate and have sufficient disaggregation**. Additional indicators are to be considered after analysis of utility and additional burden on CMAM staff.
Accessibility (*Data and metadata are easily available and assistance to users is adequate*)		
	*I/O; DR*	**There is limited access to data**. UNICEF, the FMoH and SMoH have routine access to data. Summarised data and assistance to users are provided to other stakeholders on request but this is dependent on a small number of UNICEF staff.
	*DR*	There is **insufficient documentation** specific to the CMAM information system that would help current and potential users to understand the data as well as limitations to data quality.

Recommendations

Actions to improve the quality of CMAM data

Training and guidance

- Strengthen guidance and training materials. These should establish clear protocols with respect to collection, transfer, aggregation, data management, and analysis processes. Highlight the importance of data quality and include practical exercises relating to data production and use.
- Expand the remit of the CMAM monthly meetings to include data accuracy and reliability.

Technical and process

- Improve and provide a single uniform set of forms for data aggregation and reporting.
- Review data needs for monitoring, planning, and advocacy to assess whether information collected on the OTP card can be simplified, and whether tally forms and SMS systems need revision. Take into account international guidelines, the Nigeria CMAM guidelines, and feedback from users.
- Once the content has been agreed, simplify the OTP form format to improve ease of use, and revise tally forms.
- Improve the software for data entry and aggregation (paper-based system): utilise automatic quality checks using Excel's data validation functionality.
- Develop a protocol to use child-level records to determine the number of children in treatment at the beginning of the week (SMS system) or month (paper-based system).
- Develop and continuously maintain a complete listing of facilities where CMAM is implemented, which can be used to cross-check for completeness against reports from facilities via the SMS and paper-based systems.
- Standardisation of reporting for SMS and paper-based systems should be considered to allow for comparison of data between the two systems. This would involve using the same full calendar weeks to aggregate from weeks to months for all facilities in the paper-based system, irrespective of the timing of the OTP day.

Supervision, feedback, and quality assurance

- Strengthen the supervisory system to emphasise data quality, with special focus on:
  - The correct use of admissions and outcome categories in the OTP form;
  - The processes of weekly data tallying (with recounts and cross-verification against the register) and data entry; and
  - The importance of correct storage of OTP forms.
- Consistently record feedback provided to facilities with respect to data quality issues. This should include whether and when the issue has been resolved, as well as feedback on weekly submissions from facilities (going beyond the current supervisory checklist). In the medium term, a paper form or spreadsheet could be used, moving later to an online solution. This would enable sharing of data quality issues across LGAs and at state and federal level.
- Develop quality criteria for data submitted via SMS, e.g. for range checks or missing values.
- Conduct periodic data verification exercises (with recounts) following a common methodology and share the results.

Actions to increase use of the CMAM data

Training and guidance

- Expand the remit of the CMAM monthly meetings to cover data interpretation and use.
- Develop written guidance on the interpretation and use of the SMS dataset, for users at the state and federal ministries of health, as well as UNICEF sub-national teams.
- Strengthen the capacity of Federal Ministry of Health (FMoH) counterparts in the Nutrition Unit to assess data quality and to interpret and use statistics. For example, UNICEF could work with a FMoH counterpart to apply quality checks on the dashboard dataset and provide feedback to lower levels. In the longer term, provide advanced training in the interpretation and use of statistics for these FMoH staff.

Technical and process

- Increase the user-friendliness of the data files produced from both the paper-based and SMS systems, e.g. by integrating automatically generated trends or graphs.
- Develop a system to automatically generate single-page paper reports for each LGA with a breakdown by facility (monthly) to be discussed and distributed at monthly CMAM meetings. LGA-level nutrition focal persons (LNFPs) could also share this with facility staff during regular supervisory visits.
- Provide convenient online access to the compiled SMS data, in addition to email, to users in the MoHs and UNICEF, and possibly other organisations (including civil society) in the future.

Supplementary actions to increase the quality and use of CMAM data

These are improvements which are desirable in the longer-term, but may be difficult to achieve in the current context given resource, skill and information technology constraints.

Staff resources, training and guidance

- Set up a system of mentoring among peers for health-workers. For this, first identify staff at facility level who have good skills and practices during training and supervision, and provide training to enable them to mentor staff at other facilities.
- Increase the LNFP's access to computer hardware and software, and provide training so they can access data for the LGA, calculate aggregated statistics, download reports, and enter and access data on supervisory visits.
- Increase staff resources, specifically by having an additional person in the SMoH state level office with data/statistics skills.

Technical and process

- Enable SMoH staff to interact regularly (e.g. annually) to exchange experiences and best practices.
- Create online forums for discussion and sharing information about data quality and use, to enable virtual interaction between state and LGA level staff, and with federal-level staff.

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List of abbreviations

ASNO	Assistant State Nutrition Officer
CIFF	Children's Investment Fund Foundation
CMAM	Community management of acute malnutrition
GAM	Global acute malnutrition
KII	Key informant interviews
LGA	Local Government Area
LNFP	LGA-level Nutrition Focal Person
OPM	Oxford Policy Management
OTP	Outpatient therapeutic programme
M&E	Monitoring and Evaluation
MoH	Ministry of Health
NFP	Nutrition Focal Person
NPHCDA	National Primary Health Care Development Agency
PHC	Primary Health Care
PRISM	Performance of Routine Information Systems Management
RUTF	Ready to use therapeutic food
SAM	Severe acute malnutrition
SMS	Short message service
SNO	State Nutrition Officer
SLEAC	Simplified Lot Quality Assurance Sampling Evaluation of Access and Coverage

1 Introduction

1.1 Scope and objectives of the assessment

CIFF have contracted Oxford Policy Management (OPM) to undertake a learning study of the CMAM programme in Nigeria, investigating (i) governance aspects, (ii) tracking longer-term outcomes for children, and (iii) establishing threats to the quality of data and indicators used to measure performance of the CMAM programme. This report focuses on the third component – the data information systems of the CMAM programme.

Following discussions with CIFF and UNICEF during the inception and design phase, it has been decided to re-frame this study as "Performance assessment of CMAM information system", encompassing an assessment of the quality of data produced by the CMAM programme as well as an assessment of the current and potential use of the data. The term "Data quality assessment" initially used implies too narrow a focus, since while data quality dimensions include "serviceability" and "accessibility" (revisions to methodology follow a regular and publicised procedure, data and metadata are easily available and assistance to users is adequate[1]), they do not include either assessment of the extent of usage of the data or constraints to potential usage. Moreover, the concept of a data quality assessment does not sufficiently reflect the qualitative components of the study, which informed recommendations and provides opportunities for learning. The component has therefore been renamed "Performance assessment of CMAM information system" during the design phase.

We define good performance of the information system as both the production of good quality data AND use of information for decision-making[2]. Our conceptual framework for the study (see Section 2) shows that poor CMAM data quality and poor use of information for evidence-based decision making can be due not only to technical issues, but also to organisational and behavioural barriers that hinder the collection of high quality data and the effective use of information. We explore these determinants in this component of the learning study.

The following objectives for this component are derived from OPM's technical proposal and the OPM-CIFF agreement as well as follow-up discussions with UNICEF and CIFF.

1. Assess the quality (with respect to accuracy; reliability; completeness; timeliness; integrity; confidentiality; relevance, and accessibility) of the data, which involves:
    a. Assess source data (on paper, in electronic form) and reported data
    b. Describe and assess the underlying systems of data collection, management, and reporting as well as quality assurance
    c. Identify contextual factors affecting the operation of these systems at the various levels of data collection and aggregation, and describe the impact of these factors on data quality.
2. Compare the new SMS system with the existing paper-based system, to identify the benefits and any potential challenges of the SMS system.
3. Assess government readiness to manage the system and make effective use of the data for oversight and planning at facility-level, LGA-level, state-level and federal level.
4. Identify means to enhance data quality and data use by government at the different levels.

[1] Definitions derived from: IMF (2003) Data Quality Assessment Framework. International Monetary Fund
[2] Data are defined here as simple measures or characteristics of people and things, and have little inherent meaning or value until aggregated. After analysis and interpretation of data, patterns can be identified, thereby creating information.

This section provides an overview of the objectives and the scope of the study and describes the data flow for CMAM monitoring data systems currently in operation. Section 2 summarises the study design and the methodology, and highlights any deviation from the design and study protocols previously submitted. Section 3 discusses the findings of the study with respect to the inputs, processes and data quality outcomes of the production of CMAM data. Section 4 presents the results and recommendations of the study with respect to use of CMAM data and potential to enhance use further in the future. Finally, Section 5 comments on the sustainability of the CMAM information system.

1.2 Country context

Nigeria is the largest country in Africa in population-terms (nearly 186 million in 2016). An estimated 88.4 million were living in multidimensional poverty in 2013, the greatest population of any single country globally[3]. Malnutrition prevalence rates estimated from the 2015 National Nutrition and Health Survey (NNHS) data were 32.2% stunted, 20.9% under-weight, 7.2% global acute malnutrition (GAM) and 1.8% severe acute malnutrition (SAM)[4]. These statistics hide large disparities between the geopolitical zones of Nigeria, whereby GAM was highest in the North-West (10.2%) and North-East (9.5%)[5]. The nutrition situation is particularly serious in Bauchi, Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, Yobe and Zamfara, where more than half of under 5-year-old children were found to be stunted in 2015 (ibid.). GAM is especially high in parts of Borno and Yobe states affected by insurgency and political violence, with an estimated GAM rate of 12.7% in North Yobe in November 2016[6].

Based on evidence that in many countries, most children with SAM are never brought to health facilities[7], over the past decade there has been a global initiative to shift from facility-based treatment approaches of acute malnutrition to a decentralized community-based approach. Such Community-based Management of Acute Malnutrition (CMAM) was introduced in Nigeria in 2009, with a pilot programme in Gombe and Kebbi states, with technical support from VALID and UNICEF. Now CMAM exists in twelve of the thirteen north-eastern and north-western states, and in 2014 an estimated 37% of SAM cases were being reached[8].

In 2012 CIFF approved the first phase of a five-year programme to treat up to 1 million children for SAM in Nigeria and to support the successful mainstreaming of the programme into the Nigerian health system. SAM treatment is currently provided in over 870 facilities in 146 LGAs[9]. UNICEF was closely involved in the initiation of all CMAM services in Nigeria, and funded by CIFF, UNICEF still directly supports the state public health sector systems to deliver CMAM in most of the sites where it is offered. The government of Nigeria pays the salaries of the health staff while UNICEF contributes light technical support and all the Ready-to-Use Therapeutic Foods (RUTF).

Attempts to mainstream CMAM services into the health system are countered by the weakness of the Nigerian Primary Health Care system. Most of the Primary Health Care (PHC) facilities in Nigeria lack the capacity to provide essential health-care services, related to issues including

[3] UNDP (2016). UNDP Human Development Report 2015. New York, UNDP, page 61.
[4] Nigeria Bureau of Statistics and UNICEF (2016) National Nutrition and Health Survey (NNHS) 2015.
[5] Five states (Borno, Jigawa, Katsina, Sokoto and Yobe) were above the warning threshold of 10% for GAM and six states (Borno, Delta, Katsina, Kebbi, Sokoto and Yobe) were above the WHO SAM crisis threshold of 2%.
[6] Nigeria Bureau of Statistics, CDC and UNICEF (2016) Summary Findings of Nutrition and Food Security Survey, North East Nigeria, November 2016
[7] WHO, WFP, the United Nations System Standing Committee on Nutrition and UNICEF (2007) Community-based management of acute malnutrition. A Joint Statement.
[8] Banda et al. (2014) SLEAC Survey of CMAM program Northern States of Nigeria.
[9] Calculated from dashboard data provided by UNICEF.

staffing levels, inadequate equipment and infrastructure, and lack of essential drug supply[10]. Human resource constraints relate both to numbers of health workers at facility level, and the lack of professional skills in PHC at the level of Local Government Area (LGA), where the post of Director may be a political appointee. Another constraint is the current configuration of health provision in Nigeria, whereby Primary Health Care is the responsibility of the local government administration, so health workers at facility and LGA level are accountable to the Ministry of Local Government, and the state nutrition officer (SNO), who is responsible to the Ministry of Health, has no authority over them. This issue is pertinent to the current study, whereby any proposed reforms to data production processes may be difficult to enforce.

The resources needed to treat the burden of SAM in the northern states are many times greater than current spending, so increased political support for CMAM services is essential to increase coverage and for sustainability. Thus, in addition to providing practical support for the programme, UNICEF has an important advocacy role, to increase awareness among senior political leaders of the health and economic benefits of effective treatment of SAM.

1.3 CMAM Monitoring data in Nigeria

This section provides a brief description of the CMAM monitoring data flow, system and quality assurance processes based on the discussions held and documents reviewed during the study.

Until 2016 monitoring of the CMAM programme had been managed predominantly using a paper-based system. Previous studies have identified some of the SAM management information and data as deficient[11], and the existence of bottlenecks at crucial levels of the data management system[12]. In collaboration with Columbia University, UNICEF introduced a system using smartphones to standardise and facilitate monitoring of the CMAM programme[13] and this system was rapidly integrated across the programme. Figure 1 summarises the data flows and processes, both for the paper-based system, on the right of the figure, and for the short message service (SMS) system on the left of the figure. The few numbers specified in some lower-level boxes refer to CMAM data collection forms included in Annex B. Data production processes are shown in rectangular boxes, and users are in ovals.

With the SMS system, weekly aggregated routine data are texted from facility level to federal level directly, whilst with the paper-based system, facility-level monthly aggregated data are transferred by hand to the LGA-level Nutrition Focal Person (LNFP), who in turn transfers the data to the State Nutrition Officer (SNO). Only at state level are the data entered into a spreadsheet, and in this form the data are transferred to other government users at state-level, and to UNICEF.

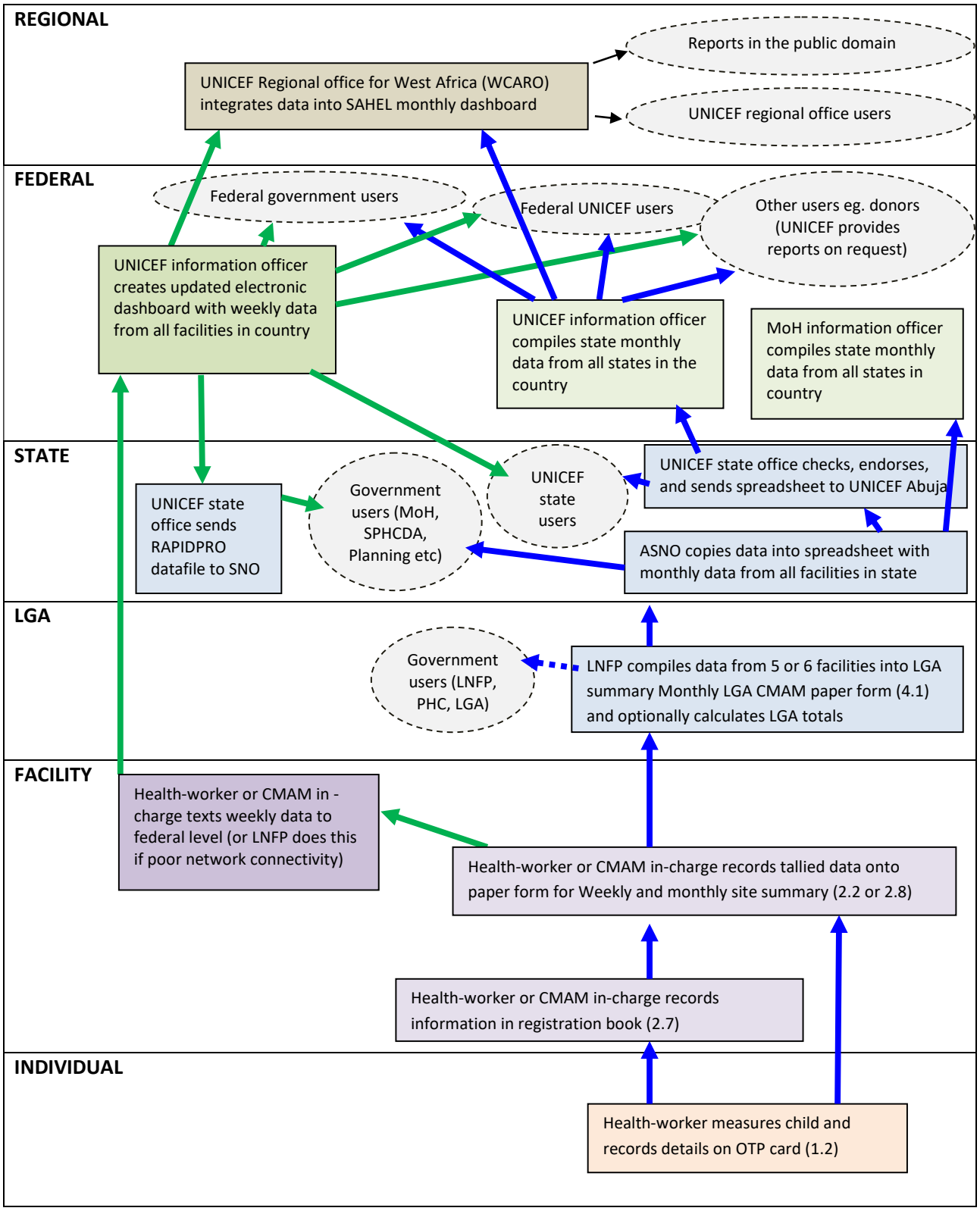
UNICEF sends the monthly data from their state-level to federal level office, where they are compiled together with the data from other states, and forwarded to the regional office for compilation into the SAHEL monthly dashboard. At this level, data are included in reports that are accessible in the public domain. Similarly, the Ministry of Health (MoH) separately sends the monthly data from their state-level to federal-level office.

With respect to data flow to users, on a weekly basis UNICEF provides the updated SMS data files to federal-level and state-level government offices, and to other institutions on request. On a monthly basis the SMoH provides the updated paper-based data files to UNICEF at state level and

[10] Aregbeshola and Khan (2017) Primary Health Care in Nigeria: 24 years after Olikoye Ransome-Kuti's Leadership. Frontiers in Public Health 5, 48. https://doi.org/10.3389/fpubh.2017.00048
[11] ACF (2015) Severe acute malnutrition management in Nigeria; challenges, lessons and the road ahead.
[12] Gill, H. et al. (2014) SMART management of malnutrition: Using smartphones to improve children's health in Nigeria.
[13] Ibid.

to federal-level and state-level government officers. Again, the data files are available on request to other institutions.

Figure 1: CMAM data flow



2 Study design and methods

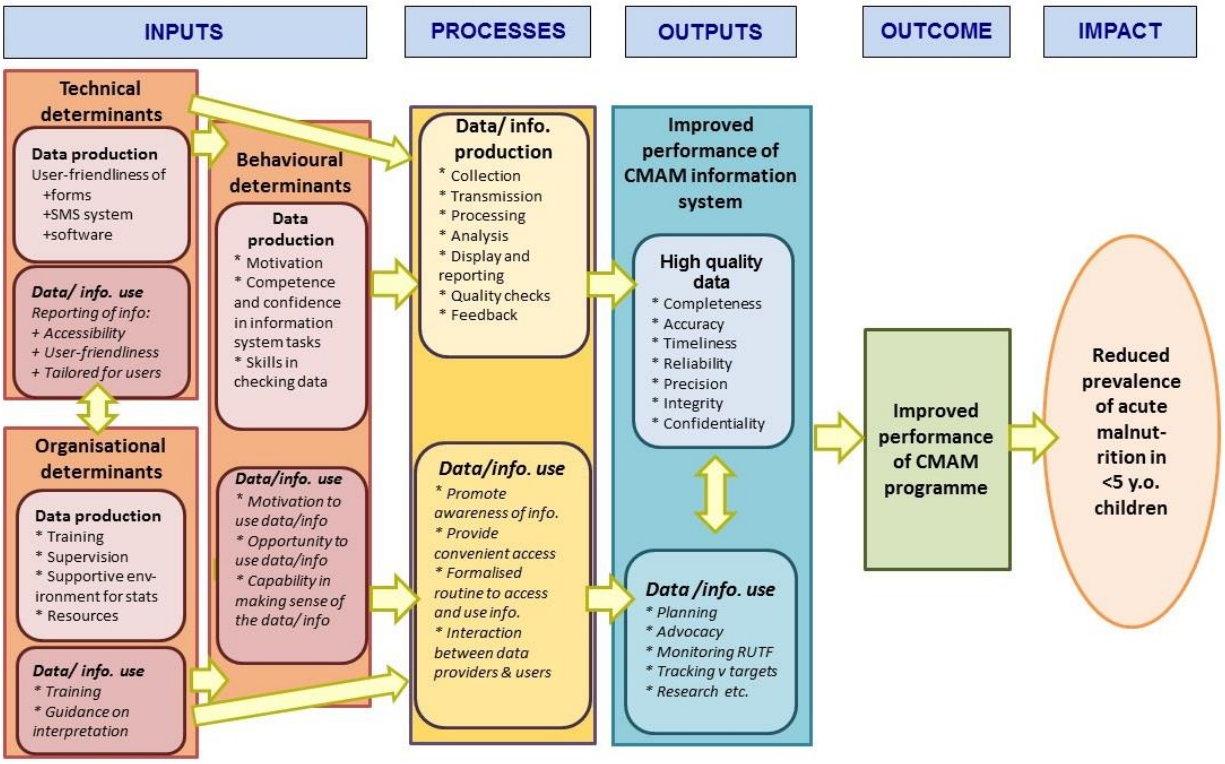
2.1 Conceptual framework

The conceptual framework adopted by the study and described in detail in the Design Document (v2, May 2017) determined the study design and is used to structure the discussion of findings in the following sections. The framework is based on the PRISM (Performance of Routine Information System Management) framework developed by the Measure Evaluation Project[14], which relates to the assessment of information systems including the institutional environment, their products and key data production processes.

The specific factors included in the boxes of Figure 2 have been tailored to CMAM in Nigeria. The framework assesses performance in terms of data quality and information use, and identifies underlying technical, organizational, and behavioural reasons for strengths and weaknesses in these two elements. Insights from recent research into using evidence in decision-making are incorporated, specifically that evidence use is dependent on the intermediary behavioural outcomes of capability, motivation, and opportunity.

The study assesses inputs, processes and output elements of CMAM monitoring data quality and use.

Figure 2: Conceptual framework for assessment of CMAM information system



[14] Measure Evaluation (2011) Tools for data demand and use in the health sector: PRISM Tools, p.5.

2.2 Study methodology

A combination of analysis approaches and tools has been employed to cover the components of data quality depicted in the conceptual framework (inputs, processes and outputs) for both paper and SMS systems; and to assess use of data and constraints to use:

- Fieldwork activities:
  - In Sokoto state, interviews with actors involved in collecting, processing, and analysing the data at each level depicted in the data flow diagram, as well as those involved in/responsible for quality assurance;
  - Interviews with actors involved in data production and use at federal level;
  - Observations of implementation of protocols at each level in the data flow;
  - Verification of records (OTP cards, weekly tallies, admission registers, RUTF consumption for a selected month and the day of the visit) at facility level;
  - Interviews with current and potential users of CMAM data.
- Desk-based activities:
  - Analysis of monthly facility-level data in terms of source data characteristics as well as key performance indicators;
  - Review of documentation (forms, guidelines, training material and protocols). A complete list of documents considered is included in Annex B.

As agreed during the design phase[15], the study places emphasis on qualitative approaches to assessing quality of processes and inputs, combined with a quantitative analysis of facility-level data. While the data produced by the verification exercise is quantitative in nature, the small sample of nine facilities in three LGAs in Sokoto does not allow for generalisation of findings to the CMAM programme in general. This said, weaknesses and patterns detected even in this relatively small sample and described in the findings are very likely to be common in the CMAM programme, as they relate to the way the system has been set up and is being operated.

This section describes the various preparatory and implementation activities and the protocols and tools employed by the OPM team.

2.3 Fieldwork preparation

2.3.1 Selection of state, LGAs, facilities

The OPM team adopted a purposive approach to the selection of fieldwork locations. The decision to conduct fieldwork in Sokoto was taken jointly with UNICEF. With 46 facilities providing CMAM OTP, Sokoto has a larger pool of facilities to select from than the other states considered (Bauchi, Gombe, Kaduna, and Kano), which allowed selection of a diverse set of facilities. In terms of nutritional outcomes such as stunting and wasting, it shows slightly worse outcomes than some of the other states. The choice also strengthened synergies with the other learning studies being conducted, as both the outcome and the governance studies include Sokoto for fieldwork.

[15] Two alternative study designs were developed and discussed during the design phase, the design adopted and a design including a larger-scale data verification, in several states and adopting a probabilistic rather than purposive approach to the selection of a larger sample of LGAs and facilities.

Available CMAM programme data from 2016 were then analysed to understand patterns of key variables (admissions and discharges as well as RUTF consumption) across LGAs and facilities and over time, in order to select a diverse set of facilities. Criteria considered included:

- Size (Average number of admissions per month)
- Performance (Average cure rate)
- Location variables: Distance from centre of LGA; rural / urban location

Moreover, the analysis took into account:

- Logistical considerations regarding the timing of CMAM days (which take place once per week) to allow for an effective and efficient organisation of fieldwork and travel by the OPM team.

2.3.2 Development of design and tools

In preparation of the fieldwork, the OPM team developed a range of protocols, questionnaires and checklists which were shared with CIFF and UNICEF and benefitted from comments received.

These included:

- **semi-structured interview guidelines for interviews** with the CMAM in-charge and health workers at facility level; with the LGA nutrition focal point (LNFP); with the State Nutrition Officer and the Assistant State Nutrition Officer at state level as well as UNICEF counterparts working in Sokoto state; and with MoH and UNICEF information officers as well as other potential users of CMAM data;

- **checklists** that supported capturing information about the processes of data collection, transfer, processing and analysis at facility, LGA, state and federal level, as well as technical and organisational inputs, as outlined in the conceptual framework;

- **a protocol and forms** for the data verification exercise at facility level. Protocols and forms describing the verification tasks in detail were shared separately with CIFF and UNICEF. In summary, the following verification checks were carried out:

    1. Recount of OTP cards of admissions in April, May and June 2017 to establish a total number of admissions for comparison against CMAM records;

    2. Recount of OTP cards from July 2017 with more detailed disaggregations by admission category and discharge criteria, where possible in line with reporting break-downs in CMAM records;

    3. For children discharged as recovered in July 2017, recount of the number of weeks they had received treatment, to provide an indication of treatment duration in the selected facilities in Sokoto.

    4. Recount of RUTF provided to children based on OTP cards for July 2017 for comparison with facility level data;

    5. In selected facilities: Count of RUTF stock in the beginning and the end of the day of the assessment visit as well as count of RUTF handed out over the as indicated on OTP cards for comparison with CMAM records on weekly tallies, stock cards and the SMS data.

Protocols, forms, guidelines and checklists were pre-tested during a visit to one facility and implemented during the main fieldwork after introducing adjustments to the forms, in particular reacting to the fact that details on admission criteria and discharge outcomes were often not recorded on OTP cards that were recounted by the team.. Moreover, Annex A contains a list of all tools used during fieldwork.

2.4 Fieldwork activities

The fieldwork in Sokoto took place from 13 November 2017 to 2 December 2017, starting with a visit to UNICEF Sokoto offices and the pre-test in one facility. The introduction of the study to and interviews with state-level government officials kicked off the main fieldwork phase. Before undertaking assessments in facilities, the team conducted interviews with the respective counterparts in selected LGAs.

2.4.1 Facility-level

LGA Nutrition Focal Persons assisted the team in facilitating facility visits by contacting CMAM in-charges and providing local guides (often their deputies) to accompany the OPM team to facilities. All facilities were visited on their respective CMAM OTP day. The assessment activities were organised in a fashion to ensure minimal interference with the provision of services and the usual workflow at the clinic. The team arrived at health facilities before the start of the clinic. Where possible, the team conducted interviews with the CMAM in-charges in the morning before the arrival of caregivers. In such cases, interviews with other facility workers were conducted after the clinic. Interviewees at health facilities included CMAM in-charges and at least one other CMAM staff. The CMAM in-charges also served as the facility in-charge in a third of facilities visited. While the team was accompanied by the local guides provided by the LGA focal person, they were not involved in the activities of the OPM team. Clients were observed as they went through clinic routines. In-charges were observed for tallying and reporting at the end of CMAM day.

Early arrival also allowed the team to count RUTF stock for the verification of RUTF consumption on the day of the visit, and to retrieve OTP cards for clients not attending that day (where sorted separately from current clients) and sort them for the data verification. Verification of records of current cases was mostly conducted at the end of the clinic, once OTP cards were no longer needed by the CMAM health workers. Moreover, the team recounted the remaining RUTF stock at the end of the day.

2.4.2 LGA-level

The State Nutrition officer facilitated OPM team visits to the LGA offices. Interviews and document reviews were scheduled through telephone calls. Upon arrival at LGA offices, LNFPs were first interviewed before conducting a review of available documents, such as summary records of CMAM data prepared at LGA level. No state level officer or UNICEF staff was present at LGA interviews.

2.4.3 State-level

During the visit to the state nutrition office, first the SNO (and ASNO were interviewed in the office of the SNO, and then the team conducted a further individual interview with the ASNO in his office, together with observations of hardware, data files on his laptop, and storage of paper records.

2.4.4 Interviews and regular debriefs were also conducted with the UNICEF office covering Sokoto state, Federal-level

Interviews at federal level were undertaken at UNICEF and at the Ministry of Health.

In addition, a survey tool was developed for email distribution, to investigate the extent to which data from the CMAM information system are used (and potentially would be used if the data were made available), and the functions the data are used for.

The OPM team sent the survey to individuals in three NGOs for which UNICEF provided contact details. The survey was completed both by the head of nutrition and an M&E officer from one NGO, and this response was followed up by a phone call with the head of nutrition while the consultant was still in Abuja. A meeting took place between the consultant and head of nutrition from the second NGO. No response to the request to complete the survey was forthcoming from the third NGO.

Also, the federal-level UNICEF information officer sent the survey to the nutrition sector coordinator for the operation in the north-east, and requested them to forward the survey to stakeholders involved in CMAM programming in the North-East. No responses were received.

While in Abuja, the CMAM programme officer in UNICEF made email contact with two potential interviewees, in the National Primary Health Care Development Agency (NPHCDA) and Ministry of Budget and National Planning, to facilitate arrangement of a meeting or phone conversation with the consultant. One responded, but was not available. Neither responded to requests to complete the email survey.

2.5 Desk-based activities

2.5.1 Document review

The OPM team requested and reviewed available documentation on the CMAM programme as implemented by UNICEF. These included the various forms used for recording information as source documents and to aggregate information for the paper-based system (see list in Annex B); the National Guidelines for CMAM, published by the Federal MoH; and the RapidPro training material. The OPM team had requested access to other training material or protocols and guidelines that may be in use, but understands that no further standard documentation exists. The findings from the document review feed into the analysis of technical and organisational inputs to data quality.

2.5.2 Analysis of data available in electronic form

UNICEF provided the assessment team with facility-level data from the paper-based system as well as the SMS system. All data were sent to OPM team by email and were analysed using the Stata software. The analysis focused on the period of January 2017 to July 2017.

Data from the two systems were analysed separately to assess quality indicators related to i) completeness ii) aspects of reliability and accuracy in terms of internal consistency checks, any outliers and other patterns looking at trends and relationships to examine consistency between performance variables and iii) timeliness.

Based on UNICEF's request, the study does not include the three north-eastern states of Borno, Yobe and Adamawa, due to the emergency context in these states and subsequent additional

programme support. Additionally, the study does not include the WINNN states of Kebbi, Katsina, Jigawa, Zamfara and Yobe. Thus, the five remaining states, that is, Bauchi and Gombe in the North-East Zone, and Kaduna, Kano and Sokoto in the North-West zone constitute the coverage for the separate analysis of SMS and paper-based data.

Moreover, the analysis also includes a comparison of key indicators from the paper-based and the SMS systems. The paper-based data are aggregated by calendar months at facility level, before being entered into spreadsheets at the state-level, while SMS data are captured and recorded by week. A comparison of the two databases therefore requires aggregation of the SMS data to monthly data. As CMAM OTP days fall on different week days depending on the facility, the paper-based system can include four or five weeks of data per month. To correctly aggregate the SMS data, it was therefore necessary to know the timing of the CMAM OTP day for each facility in a given week. This information was available to the OPM team for Sokoto state, and the comparative analysis is therefore limited to Sokoto.

2.5.3 Analysis of findings from the field

Following the fieldwork, information from interviews and observations was synthesised for the discussion of findings. Examples provided at facility-level are anonymised. Data collected on paper forms for the verification exercise were entered into excel, as well as data from forms seen and scanned by the assessment team (such as admission registers, weekly tally sheets, RUTF stock cards, and LGA summary reports) for subsequent analysis.

2.5.4 Scoring of data quality aspects and dimensions

Throughout the chapters presenting findings on data production and use, the overall assessment by the team is summarised using the following system of “smiley faces”. The ratings are accompanied by a summary of key findings that justify the rating as well as recommendations on how to address shortcomings.

Smiley face system to report the OPM team’s judgement on elements of CMAM information system performance	
	Positive rating: system generally working well
	Intermediate rating: Some improvements required to inputs, processes, or outputs, based on observations, interviews, or document/data review. Recounted data varied with reported data by 10-19%.
	Negative rating: Urgent improvements required to inputs, processes, or outputs. Recounted data varied with reported data by 20% or more.

To aid visualisation and standardisation of the results from the verification exercise, in the tables presented below in Section 3.5, cases where the recount by the OPM team differed by more than 10%, but less than 20% from the CMAM records are highlighted in yellow, and cases where the recount differed by 20% or more are highlighted in red. For instance, if the OPM team counted 60 defaulters compared to 50 defaulters in the CMAM records, this would be highlighted in red.

3 Findings on data production and data quality outputs

The discussion of findings is structured to mirror the elements of the conceptual framework guiding the assessment. This section reports on the performance of the information system with respect to data production and data quality outputs and is structured as follows: Firstly, findings concerning the processes of data production are described, followed by findings on the technical, behavioural and organisational factors that influence the processes, and then findings from the verification exercise and the desk-based analysis of facility-level data from both the paper-based and SMS systems. Summarised findings on the outputs in terms of the various elements of data quality, are presented and discussed, derived from the results reported in the previous sections.

3.1 Processes relating to data production

Summary findings of processes relating to data production

The process of **data collection** is given a negative rating, because there are several aspects of data collection being undertaken in a way that reduces the quality of the data collected. For example, incompletely filling out OTP cards (including recording source of admission, and code for outcome); incorrectly implementing parts of the CMAM protocol (identifying defaulters), inadequately performing medical checks (including that for oedema); and insufficiently restricting access to OTP cards and record forms so that patient confidentiality is compromised.

The process of **data transmission** is given a positive rating because the process is performed well, it is effective, and for the most part, data transmission meets the deadlines. For the SMS system, the health-workers feel that texting is easy and the only constraint is occasional poor connectivity. For the paper-based system, the data are also transmitted up levels effectively.

The process of **data processing and analysis** is given an intermediate rating as not much synthesis or analysis of the raw data is done of the paper-based data. In contrast, there is a reasonable amount undertaken automatically within the dashboard data file, so that users can obtain values of admissions and performance indicators, and some graphs to show time trends in these.

The process of **display and reporting** is given an intermediate rating as, apart from the RUTF alerts, there is little regular reporting occurring as an integral part of the information system. The RUTF stock alerts are very effective and valuable.

The process of **quality checking** is given an intermediate rating because improvements are needed in this aspect of data production. The study team rarely observed careful checks for accuracy during data entry, nor were such checks reported to occur. Quality checks of data in datafiles are done by eye and helped only by conditional formatting, and inconsistencies are not identified by examining patterns over time. The system for external supervision is generally strong, except for the variable quality and frequency of supervisory visits to facilities, and the inconsistent tracking of observations, actions and outcomes. The effectiveness of the system depends on a few key individuals.

The process of **feedback** is given an intermediate rating as only limited written feedback following supervisory visits is provided on the supervision checklist. Feedback after transmission of weekly or monthly data is not provided unless the data are late or incomplete. This happens face-to-face (at monthly meetings) or by phone.

Recommendations relating to processes

Information system processes are influenced by technical, organisational, and behavioural determinants, as shown in the conceptual framework (Figure 2). So, summaries of the recommendations proposed to improve processes are included below at the start of the appropriate sections about determinants (3.2, 3.3 and 3.4).

3.1.1 Data collection

The primary tool for recording data on the CMAM programme is the OTP card (card 1.2). The card is designed to capture data about the clients on entering the programme and provides room for tracking clients' progress while in treatment. A take home ration card is also issued to mothers/caregivers for subsequent visits to access weekly RUTF (card 1.3). CMAM staff also record basic information about new clients entering the programme on the admission register (2.6). The CMAM admission register is designed for recording the names, registration number, age, sex, admission criteria, admission date, discharge date and outcome. A few OTP sites also had a National Health Management Information System (NHMIS) register where similar information as captured on the CMAM register are entered. Other forms used at facility level are for aggregating weekly and monthly programme data. Forms used for this purpose include the tally sheets for clients and RUTF stock cards (2.1 and 2.4).

While based on the observations there does not seem to be any protocol ensuring a consistent sequence for completing the various forms across facilities, the most common practice observed is that facility staff record basic demographic information in the admission register for new clients before clinic starts. The basic information on the admission register is transferred to the OTP card by the facility record officer. The CMAM worker attending to clients completes other sections of the OTP cards while attending to them and in addition fills in the ration card. Tally sheets and other forms for aggregating data are completed at the end of CMAM day, in most cases by the CMAM in-charge.

Process of completing OTP cards

According to the observations, OTP cards are issued for all clients entering the CMAM programme. Issuing OTP cards for new clients is not a sole responsibility of the CMAM in-charge at OTP sites. Other CMAM workers were frequently assigned this role. However, information on the cards are reviewed by the CMAM in-charge while seeing clients.

Observations of admissions at facilities, and the verification exercise indicate that some aspects of the national CMAM protocol are not being correctly and consistently implemented, affecting both accuracy and reliability of the data. This may be due to a combination of lack of clear protocols, CMAM staff misunderstanding criteria, and time constraints during the CMAM day.

From observation, health workers are not always concerned about whether all the data entered in the cards are complete and correct. Ensuring that weight and MUAC values are recorded is

prioritised over other measurements and variables captured on the OTP cards. Information such as admission category, and code for discharge including defaulting, which are variables required for the tallying and reporting of CMAM data, are frequently not recorded (incomplete cards were observed as the norm in 7 out of the 9 facilities visited during the main fieldwork). The entries capturing relapses and returning defaulters were never observed to be ticked. Moreover, across the facilities visited, it appears there were differing criteria followed for classifying defaulters and recovered cases at the time of discharge. CMAM in-charges were observed to separate out cards of clients who did not attend the clinic for three consecutive visits while not recording them as defaulters in the hope that clients will return and continue their follow up.

A CMAM in-charge explained that: *"some clients come from remote villages which makes it difficult for them to keep weekly appointments, so they could default for a month, but that does not mean they won't come back again"*. However, the CMAM guidelines specify the criterium for defining a defaulter is three consecutive absences[16] so such clients should be recorded as having defaulted. While it is reasonable to be aware of the challenges clients face in keeping to weekly appointments, it is clear that In-charges are often not tracking and documenting absences appropriately, so these clients therefore remain in the system as "currently in treatment" and the number of documented default cases is likely to underrepresent true defaulting rates.

Moreover, in some cases admission categories were left blank, or filled in incorrectly. For instance, in one facility, the admissions category "referred from inpatient care" was also used for clients who were referred from the general out-patient centre of the PHC where the OTP clinic is held rather than being used exclusively to capture clients referred from the stabilization centre.

Other items on the OTP card were observed to be filled in without actually performing observations or measurements. For instance, more than half of the health workers observed record "normal" in the space for oedema without performing the check based on protocol, based on the lack of complaints from caregivers and if they fail to see any obvious swelling. Similarly, children's temperature was not always measured.

It was observed that facility workers are frequently pushed for time during the CMAM clinic, and this partly accounted for the failure to fill all details on OTP cards. They also showed variable levels of competence and experience, which impacted significantly on how well OTP cards were completed, as illustrated by the example in the box below.

Example of impact of experience and competence on completion of OTP cards

One CMAM in-charge was observed during OTP clinic to complete OTP cards with more attention to detail than other CMAM in-charges observed. During the interview, he reported significant experience working on routine immunization and previous participation in different training activities supported by other development partners including nutrition interventions supported by MSF. His participation in different donor-supported interventions possibly improved his awareness of the need for high quality data. He stated: "*I have worked with routine immunization where we always have to submit good data"*.

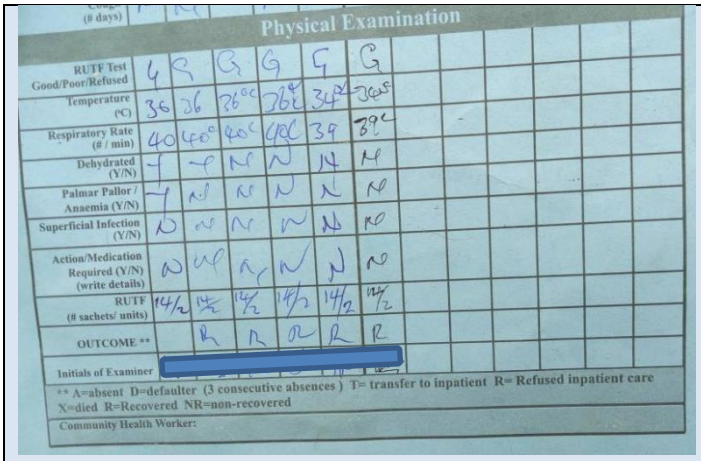
Omissions and errors introduced when completing OTP cards are likely to affect the accuracy of key performance indicators including the defaulting rate (underestimating defaulters). The item "OTP cards filled correctly" is already included in the supervisory checklist (Figure 12), and it is important to strengthen the system of supervision so that OTP cards are properly inspected for completeness of data recording.

[16] Federal MoH (2014) Operational guidelines for community management acute malnutrition (CMAM) in Nigeria.

Transfer of records from OTP cards to weekly tally sheets

The process of transferring records from OTP cards to tally sheet varies between facilities. The most common practice observed is that CMAM in-charges first sort OTP cards of clients seen on a CMAM day into different categories (new admission, discharge, revisits etc.). Cards in each category are counted and recorded in the tally sheet. The observation that admission types and treatment outcomes are not always recorded on the OTP cards indicates that this approach can be prone to errors as it relies on memory rather than checks of what has been recorded. If the tally is filled in a timely manner at the end of the day, the CMAM in-charge is likely to remember children who had come to the clinic that same day. Thus, tallies of new admissions and children discharged as recovered or transferred out on a given day will be less affected by recording errors, compared to records of other discharge types (defaulters, deaths) and the number of children in treatment at the beginning of the CMAM week. Also, while wrongly placed new admissions may be verifiable from the admission register, errors with other categories are more difficult to identify and correct. For instance, in one facility, three new admissions on their first visits were observed to be categorised as relapse cases. This was only resolved referring in addition to the CMAM admission register where new admissions were captured. In several other facilities, where discharge of some clients was not indicated on their OTP cards, the CMAM in-charge had problems to correctly record the number of discharges overall, and by exit type. Also, the OTP card was observed to contain conflicting outcome codes which could lead to wrong categorisation of a client, see box below.

On the tally sheet there is a cell to enter the number of children in treatment at the beginning of the CMAM week. It was observed that at the start of the tallying process, this value is copied from the value on the tally form for the number of children in treatment at the end of the previous week.



Example of incomplete details on OTP card

The code R at the base of the OTP card, indicates two outcomes: 'Recovered' and 'Refused inpatient care'. If the code R is used, to distinguish between the outcomes, a health-worker is expected to circle the relevant option below the grid. In the card on the right, the health-worker has not done this. Observations suggest this is a common error across facilities. In many cases the outcome cells were left entirely blank (in fact this code only needs to be entered for the week the child is discharged)

Completing CMAM registers

All OTP sites visited had a CMAM admission register for new clients. In most sites, this is the first form of documentation for new clients after they have been determined to be eligible for admission into the programme. How information is entered in the admission register varies depending on the mode of operation of the facility. In two of the facilities visited, all new clients are first attended to at the general outpatient clinic where preliminary documentations are done. Clients come to the OTP with a note from the general outpatient unit. In such cases, the admission register is completed using the information on the referral notes with some clarifications, if necessary. In other OTP sites, clients come to the programme directly, therefore the register is completed using information obtained from the client at the OTP centre. The admission register is used for recording the number of new admissions each CMAM day. It is a source document for reporting new admissions.

No particular issues were observed with completion of admissions in the admission register. However, it was observed that in the majority of facilities the columns for entering information about discharge of children were never filled and could therefore not be used for verification purposes.

National Health Management Information System (NHMIS) Register

A few health facilities maintain also a national health management information system register. This register contains more information than the CMAM admission register as facility workers are required to include the names of all clients seen at the clinic. Reports generated from the register are submitted to the LGA M&E officer. In the few facilities that maintain the NHMIS register, the CMAM in-charge reported that it constitutes additional workload for them to complete the register. Of the facilities maintaining NHMIS register, only one facility reported regularly submitting reports to the LGA based on the register. The purpose of keeping the NHMIS register at OTP centres is therefore not well defined.

Storage of cards and forms

OTP cards for old and current clients are generally stored at the facility, however storage facilities were mostly inadequate for ensuring confidentiality. About half of the facilities have lock-up facilities to keep clients' cards with only the CMAM in-charge having access to the key, while in the remaining facilities cards were accessible to other staff, which raises issues of record confidentiality. The common practice is to have cards stored in used RUTF cartons. In most cases, facilities sorted these cards according to month of discharge while others were using a sorting approach by month of admission. Cards from current and past patients were generally kept separately, but with apparently no defined system for distinguishing the two sets (for example cards were sometimes observed in the "current" box for children who had been admitted several months earlier). The observed age of the oldest cards stored at each facility varied from five years to ten months. There were varying explanations for the fact that cards were not available from the start of CMAM operations, including lack of formal handover systems for facility records when CMAM in-charges change. Other reasons included renovation of facilities during which many records went missing. It is apparent that storage systems in many health facilities are inadequate. Furthermore, nearly all health workers interviewed reported that they had not received any guidance or training on storage and general record-keeping. While it is recognised that in busy facilities, storage space may be a constraint, there is a clear need to improve storage systems for CMAM records across facilities. Programme staff would also benefit from provision of guidelines and training on proper record storage. These would include clarification of the purpose of keeping cards after discharge, as well as the length of time they are required to be kept, and the method of disposal.

RUTF data collection

Facility workers record RUTF handed out to individual clients on their OTP and ration cards. Based on the field observations, recording on both cards was in general performed correctly and consistently during the days of the assessment. Caregivers keep the ration cards for subsequent visits. However, new caregivers are often not effectively informed on how RUTF should be given to children. For instance, about 40% of caregivers of new admissions interviewed (out of a total of 49) were not properly informed about how much of RUTF they should give to their children. RUTF calculation for tallies is mainly done from the OTP cards at the end of CMAM day, which is also when the RUTF stock card is updated. In three out of the nine facilities visited, the OPM team observed that CMAM in-charges had difficulties with the tally of RUTF, relating to producing the correct sum as well as conversion between cartons and sachets. The consequences of challenges

with tallying are investigated further in Section 3.5, which presents findings from the data verification undertaken in facilities.

3.1.2 Data transmission

Transmission of data occurs weekly (from OTP site to federal level by SMS) and monthly (from OTP sites, to LGA and State level by paper, and from state to federal level by electronic transfer of data files). Figure 1 above shows the data flow via the two systems. In the case of the paper-based system, the large number of hands the data go through, with different aggregations and data manipulations performed at each stage, increase the risk of introducing errors in the data.

Paper reporting system

Facility level

Aggregated monthly reports from facilities, LGA and state are transmitted ultimately to federal-level via the "paper-based" system. At facility level, the monthly reports are aggregates of all weekly reports previously sent through the SMS system with some additional details, such as disaggregation of admissions by sex. The method by which the data are transferred from facility to LGA level varies - most Facility in-charges travel to the LGA to submit their paper reports by hand monthly, but sometimes the LGA nutrition focal point (LNFP) collects the forms from the facilities, particularly if they are present at a facility on a supervisory visit on the last CMAM day of the month. At one facility visited by the OPM team, the Facility-in-charge (who was not the CMAM in-charge) delivers the form.

Facility workers had varied perceptions of submission deadlines for monthly reports, from between the last CMAM day of the month, up until the 5th of the following month. Reports are often submitted earlier than the last day of the month by facilities holding their last CMAM clinic sessions before the last day of the month.

LGA level

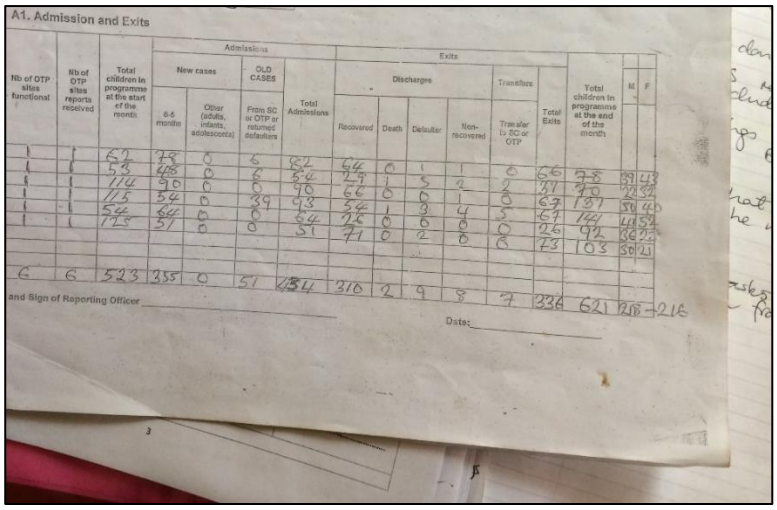
The LNFPs copy the data from the facility summaries onto their own reporting form, and the majority calculate aggregated summaries for the LGA as illustrated by the form below (the Sokoto ASNO reported that around six of the nine LNFPs in Sokoto do this).

The deadline for submission of LGA reports to state level was variously reported by LNFPs as between 3 – 5 days after the end of the month. Depending on proximity of the LGA to the state capital, different LGAs use different means to transmit their reports to the state nutrition office. For instance, Sokoto South (a metropolitan LGA) delivers reports to the State nutrition office[17] by hand, while other remote LGAs use public transport. It is not clear how confidentiality is ensured in the process.

There is the potential for errors to be introduced when data are copied from facility paper forms onto the forms for reporting the LGA aggregated data, and such errors are further investigated for a subset of selected facilities and LGAs in Section 3.5 on data verification. None of the LNFPs mentioned doing this task with another person in order to reduce the risk of errors.

[17] The State Nutrition Officer is employed by the MoH, and the LNFP is employed by the Primary Health Care PHC Department at LGA level

Figure 3: example of calculation of monthly totals



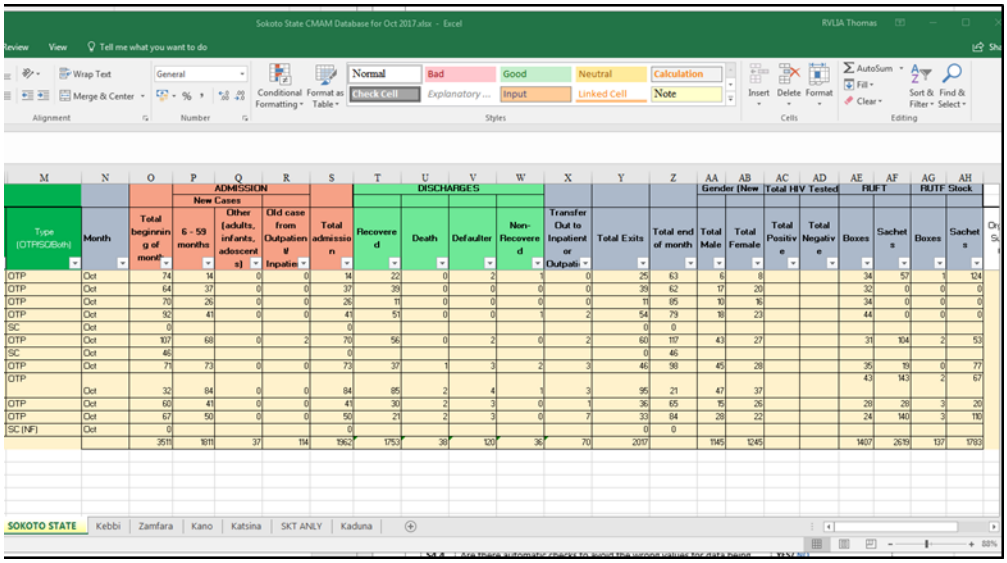
State level

At state level the data are entered into a spreadsheet, and in this form the monthly data are transferred to the Ministry of Health at federal level, and to the UNICEF office at state level (where the data are in turn checked, endorsed and transferred to the UNICEF office at federal level).

Entry of CMAM data

In Sokoto, the assistant State nutrition officer (ASNO) does the data entry. When the state UNICEF consultant is available he assists the ASNO with this task. When probed about whether they check for errors, the ASNO reported that they "*compare with the paper data and check it's been entered correctly*". Sometimes they check a sample, and sometimes all. The picture below shows the spreadsheet to which data are added each month.

Figure 4: Excerpt from spreadsheet used for entry of CMAM programme data at state level



Along the base are the names of all the states because at the start of the year, UNICEF at federal level provides the same spreadsheet to all state nutrition offices, including the data in columns A – M. Each month the SNOs edit only the sheet that is relevant for them. The SNO formats the new rows in a different colour from the previous month, to be able to easily distinguish the months from

each other, and amends the name of the file to specify the new month. That way, each month a new larger file is created.

Manual methods are not used to minimise data entry errors, such as double data entry on all or a sample of data. There are also no automatic checks to check for out-of-range values to reduce chance of the wrong values for data being entered – we were informed that the previous version of the spreadsheet had a system by which cells would turn red if the value was outside of the predicted range, or if the result of a calculation was negative. After data entry, the ASNO reported he checks by eye that it has all been done correctly, and that there is no need to just check a sample because the data set is not large. Clearly if one person is working on their own, there is the potential for errors introduced during the data entry process to be missed. It is recommended that in order to reduce this potential for errors, data should be entered twice on separate sheets and a comparison summary undertaken which would flag any discrepancies. If the ASNO is working with the UNICEF consultant, 100% quality control should be undertaken with one person reading the data from the form, and the second checking that the data entered matches those being read, and this has the additional advantage of reducing the likelihood of misinterpretation of poor handwriting.

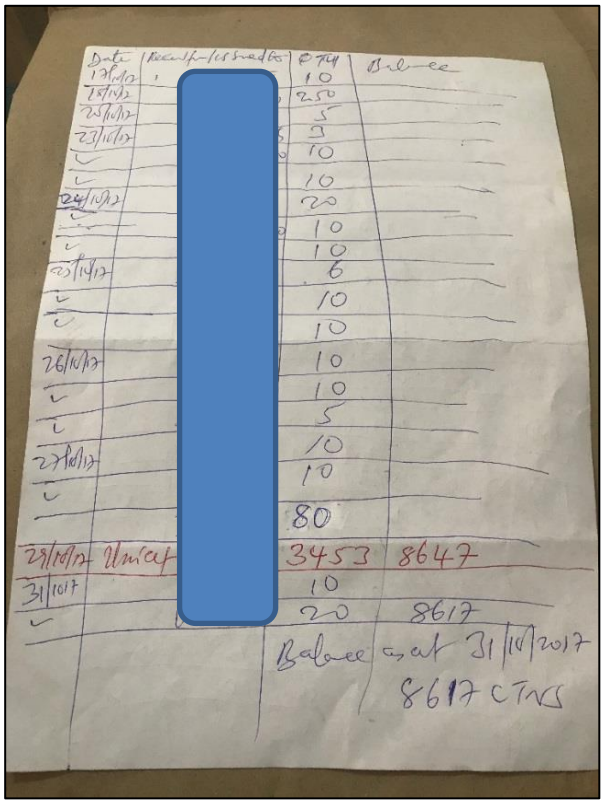
No constant value is used to indicate missing data[18], the cell simply remains blank. This could lead to misinterpretation of values of zeros in the datasets, because within Excel, embedded formulae return zeros from calculations of summations of blank cells. Thus a value of zero admissions calculated from cells with no data might be misinterpreted as having been derived from reported data. The ASNO uses colour to highlight cells with data he has identified as problematic and needing to be checked with the LNFP. Data quality issues identified during data entry are noted in an exercise book, but are not systematically filed and stored.

Collection and entry of RUTF data

The ASNO does the data entry for the RUTF data too. Figure 5 shows the data copied by hand from the store office at the MoH. It shows the amount of RUTF issued to each LGA, and the amount received at the store (in this case from Bauchi state store).

[18] It is good statistical practice to replace missing values in a dataset with a number that will not otherwise occur in the data set (e.g., -999; or in Stata use specific missing codes), and then to programme the software to recognise this value as the missing code.

Figure 5: Example of RUTF data copied from records held at the MoH store office



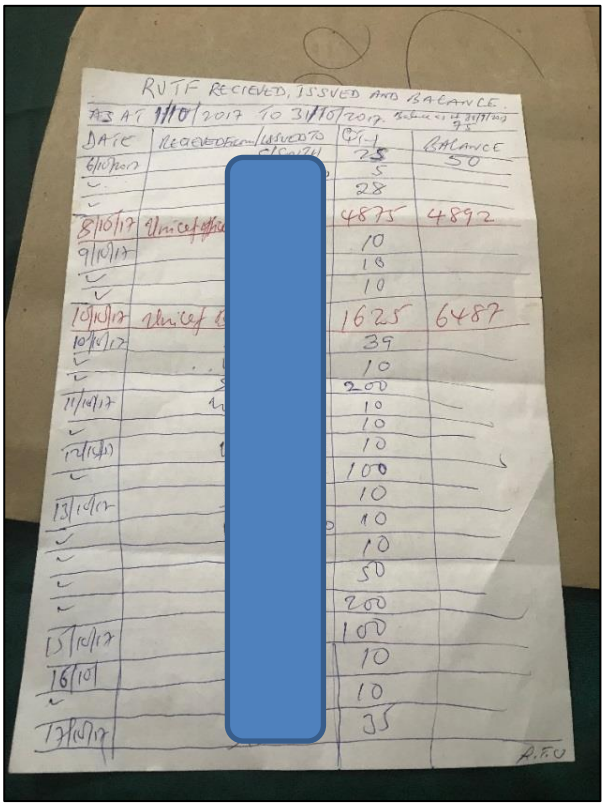
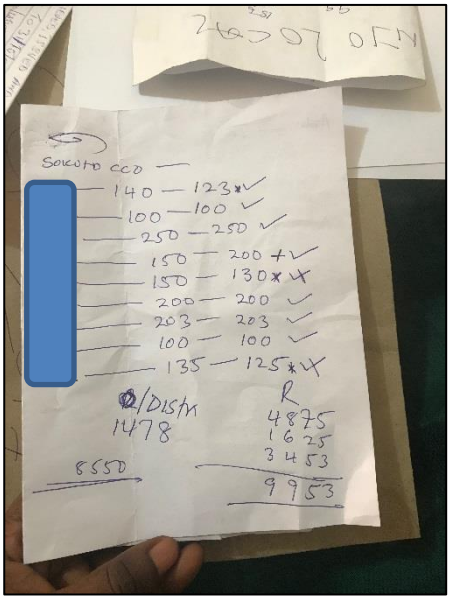
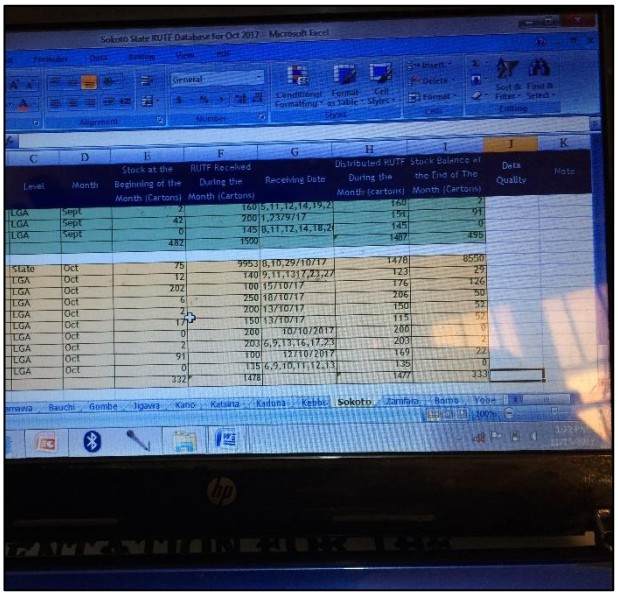


Figure 6 shows the comparisons by state done by hand by the ASNO before the data are entered into a spreadsheet. The data on the left are totals calculated using the data from the lists in Figure 5, and the data on the right are the totals submitted by the nine LNFPs as having been received at the facilities. Once the data have been rectified, they are entered into the spreadsheet shown in Figure 7.

Figure 6: (left) LGA RUTF stocks, comparing amounts distributed (calculated from MoH store office data), with values received (submitted by the LNFPs)

Figure 7: (right) Excerpt from spreadsheet used for entry of RUTF data at state level





Distribution from state office

The SNO is supposed to submit the data file to UNICEF state office by the 10th of the month, and UNICEF is supposed to submit the CMAM report, together with the RUTF and IYCF reports, to UNICEF at federal level by the 15th. As well as UNICEF, the SNO shares the monthly data with the Executive Secretary of the State Primary Health Care Development Agency and the M & E department in the Planning Ministry, at state level, and the nutrition information officer in the national PHC agency at federal level.

UNICEF at federal level reported that the data are generally received on time, if not, they call the SNO. They do not record the date the email is received from the state office. The compiled paper-based dataset is reportedly transmitted to the MoH at federal level by the SNO, so there is no need for UNICEF to do this, and this illustrates how the paper-based system is perceived as being government-owned, while the RapidPro system is perceived as being owned by UNICEF. A consequence of the distinction is that two different versions of the monthly datasets may exist, if UNICEF or the MoH discover errors and edit their datasets.

In Abuja, the monthly data from the 12 states are reportedly aggregated by UNICEF and sent to the UNICEF regional office for West Africa.

Timeliness and completeness for the paper-based system is encouraged by a system of “naming and shaming” facilities and LGAs at the state-level monthly (only for LNFPs) and quarterly (for CMAM in-charges too) CMAM meetings organised by the State Nutrition Officer. However, other data quality issues around the accuracy of the data submitted do not seem to be always considered in detail, based on notes reviewed from one of the meetings, though this might differ across time and states.

SMS system

Weekly transmission of facility data to the national CMAM programme office is done via the RapidPro SMS system directly from the facility-level. The number of health workers trained on the RapidPro SMS system per health facility ranges between two and four. Facility workers mostly agree that the SMS system is user-friendly. We observed that the system is usually started by sending the trigger word ‘SAM’ to a dedicated short code (72221) on MTN, 9mobile (formerly Etisalat) and Airtel telecommunication service providers. Subsequent steps follow an interactive prompt-response cycle in which the system requests for specific programme data. Senders have the opportunity to confirm data submitted before completing the submission process. The RapidPro SMS system requires designated health workers to register their mobile numbers to use the system. Only one number is registered per facility, when there is a need for someone other than the person assigned to carry out this role, the same phone number is accessed to do this. This requirement excludes other health workers from sending SMS reports if their mobile numbers are not registered and can be an effective way to check multiple reporting. The system also rejects double reporting from the same site by comparing unique site codes. The downside, however, is that reports may be delayed or not submitted at all if the only registered number is unavailable, for instance due to problems with the network. Currently the SMS system serves as a direct transmission of facility data to the federal UNICEF programme office, and LGA or state programme offices have no way of knowing what are the data being submitted, and of verifying the data. The LGA nutrition officers only become aware of submission if they request information about the status of submission from the facilities or when the facilities’ CMAM in-charge informs them.

The deadline for the facility to submit the text via the RapidPro SMS system is the Monday following the CMAM week in question. The automatic tracking on the computer starts on this day, and an alert is sent by text to the CMAM in-charge of any facility from which data have not been received[19]. After the data manipulation and checking, UNICEF at federal level send the updated weekly RapidPro dataset to the Head of Nutrition Unit, and chief information officer of the Nutrition Unit in the MoH, usually on Tuesdays. It is also distributed to the UNICEF nutrition officer, UNICEF head of field office and UNICEF state consultant. The head of UNICEF field office then sends the dataset to the SNO.

3.1.3 Data processing and analysis

Facility level

Other than aggregating data for data transfer purposes, there is practically no form of data processing occurring at facility and LGA levels. From observation, most facility workers appear to have good understanding of the various data collection tools, but don't know what else can be done to derive useful information from the data available to them at their level (for example, calculation the performance indicators of percent recovery and percent defaulting). While lack of capacity may be an immediate consideration, the CMAM programme does not appear to contemplate this at the beginning. CMAM staff at both facility and LGA levels did not report any form of training on data processing.

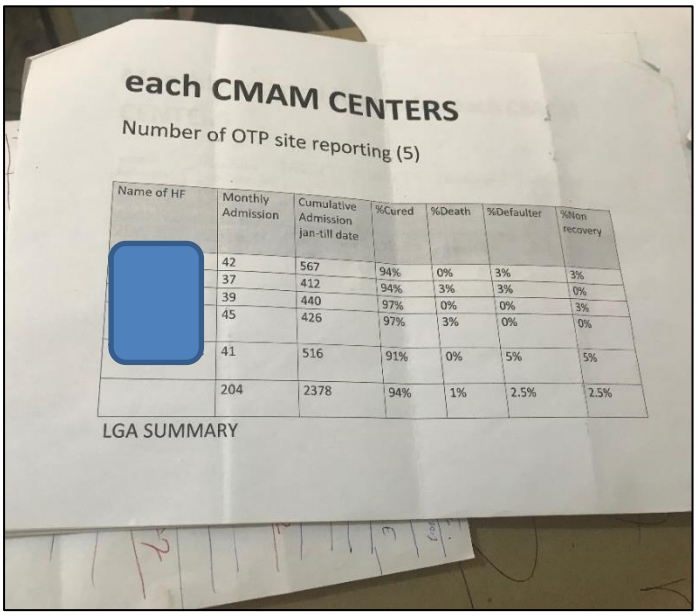
LGA level

In one LGA visited by the OPM team, a report used to be produced that included a tabulated summary of CMAM data for local use. This practice was initiated by the director of primary health of the LGA. Although it was reported that the report gets to the LGA chairman and other key management staff, it was not clear how the CMAM programme used this resource. This practice was however not sustained as it was discontinued after a new Director took over from the initiator. OPM team did not observe this practice in other LGAs.

In another LGA that the OPM team did not visit, the LNFP has a computer and he uses it to design forms and compile reports. The photographs shown in Figure 8 below were taken in the office of the ASNO, and indicate the potential of LNFPs to create reports electronically, which is untapped because they lack access to hardware and software.

[19] So those facilities offering CMAM services on Fridays are sent an alert sooner after their CMAM day than other facilities – it is on the following Monday for everyone.

Figure 8: Excerpts from summary report prepared by LNFP for submission to state-level



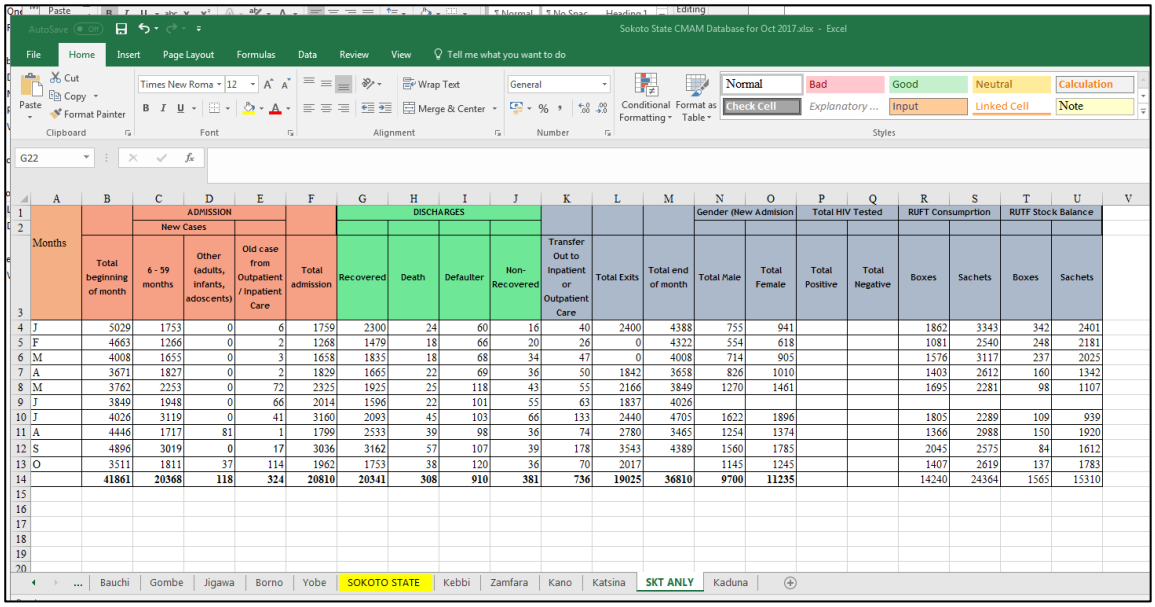
The OPM team did not observe any form of data processing effort in other LGAs visited. One LGA nutrition officer noted that, if he had tools such a computer at his disposal he would be able to explore the data more and perform some basic analysis and present the data for his LGA in tables.

State level

For the monthly data, as described above, the ASNO does the data entry with the state nutrition consultant whenever possible, and simple calculations are programmed into the excel sheet to derive facility values for total admissions and exits. A row at the base of the spreadsheet contains formulae for calculation of the state totals for that month, and the picture below shows the sheet “SKT ANLY” in the database that the ASNO created in which he compiles the monthly state totals.

The ASNO mentioned that the previous version of the spreadsheet enabled facility and LGA statistics to be calculated for user-specified periods using drop-down menus, but with the current version of the sheet he needs to manipulate the data to derive the statistics himself.

Figure 9: Monthly summary data from spreadsheet used for CMAM programme data entry at state level



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1			ADMISSION				DISCHARGES							Gender (New Admision		Total HIV Tested		RUFT Consumprtion		RUTF Stock Balance	
2			New Cases																		
3	Months	Total beginning of month	6 - 59 months	Other (adults, infants, adoscents)	Old case from Outpatient / Inpatient Care	Total admission	Recovered	Death	Defaulter	Non-Recovered	Transfer Out to Inpatient or Outpatient Care	Total Exits	Total end of month	Total Male	Total Female	Total Positive	Total Negative	Boxes	Sachets	Boxes	Sachets
4	J	5029	1753	0	6	1759	2300	24	60	16	40	2400	4388	755	941			1862	3343	342	2401
5	F	4663	1266	0	2	1268	1479	18	66	20	26	0	4322	554	618			1081	2540	248	2181
6	M	4008	1655	0	3	1658	1835	18	68	34	47	0	4008	714	905			1576	3117	237	2025
7	A	3671	1827	0	2	1829	1665	22	69	36	50	1842	3658	826	1010			1403	2612	160	1342
8	M	3762	2253	0	72	2325	1925	25	118	43	55	2166	3849	1270	1461			1695	2281	98	1107
9	J	3849	1948	0	66	2014	1596	22	101	55	63	1837	4026								
10	J	4026	3119	0	41	3160	2093	45	103	66	133	2440	4705	1622	1896			1805	2289	109	939
11	A	4446	1717	81	1	1799	2533	39	98	36	74	2780	3465	1254	1374			1366	2988	150	1920
12	S	4896	3019	0	17	3036	3162	57	107	39	178	3543	4389	1560	1785			2045	2575	84	1612
13	O	3511	1811	37	114	1962	1753	38	120	36	70	2017		1145	1245			1407	2619	137	1783
14		**41861**	**20368**	**118**	**324**	**20810**	**20341**	**308**	**910**	**381**	**736**	**19025**	**36810**	**9700**	**11235**			14240	24364	1565	15310
15																					
16																					
17																					
18																					
19																					
20																					

Bauchi | Gombe | Jigawa | Borno | Yobe | SOKOTO STATE | Kebbi | Zamfara | Kano | Katsina | SKT ANLY | Kaduna

Federal level

The UNICEF information officer or his assistant at federal level manipulates the data from the texts sent from facility level into a format that can be analysed. A series of Stata[20] commands are used to combine four excel files, to match the newly received data with the existing labels for facilities and LGAs, and some manipulation within excel creates one single excel file with the new weekly data which is then added to the existing composite file.

In the resulting dashboard data file, a series of sheets are included within which analysis is undertaken automatically, so that users can obtain values of admissions and performance indicators, and graphs to show time trends in these. Conditional formatting is used highlight cells falling outside certain criteria[21], for example

- Timeliness: The number of days the report arrived after the Monday of the following week, where yellow cell fill indicates a value between 7.1 - 14, and red greater than 14 days
- Cure rate: Yellow cell fill indicates a value between 50 - 75, and red between 0.1 – 50%
- Death rate: Red cell fill indicates a value greater than 10%
- Defaulting rate: Yellow cell fill indicates a value between 15 - 25, and red greater than 25%
- Non-recovered: Yellow cell fill indicates a value between 15 – 24.99, and red greater than 25%

Also, indicators are derived from combinations of variables[22], and conditional formatting is used to highlight low values of RUTF stock, and higher or lower consumption of RUTF than expected.

[20] Stata is a powerful general-purpose statistical software package that allows users to submit multiple commands via text files ("do-files") to perform data management, manipulation and analysis.
[21] Some are based on the Sphere CMAM standards i.e. recovery rate > 75%, death rate <10% and defaulting rate <15%
[22] for example, the average number of new admissions expressed as a percentage of the average number under treatment at beginning of the week, where the expected value is 12.5% (based on an assumption of each case spending 8 weeks in treatment), and red cell fill indicates % New Admissions / In Charge > 20%, while grey indicates a value less than 5%

3.1.4 Display and reporting

Facility level

Reporting seems to be only a minor feature of this information system. The exception is the alerts enabled by the rapid transmission of CMAM data using the SMS system. All stakeholders greatly appreciated how the alerts had greatly reduced the incidence of RUTF stockouts and simplified supervisors' work. The stock alerts are currently sent automatically to the UNICEF information officer at federal level, the SNO, the UNICEF State Office, and the LGA focal person.

Practical presentation of CMAM or other health-related data in the workplace (tables, graphs, and so on) was not observed in the facilities visited. With the exception of one health worker[23], CMAM in-charges interviewed did not attach any importance to visual display of CMAM data in their facilities[24]. However, during interviews, several CMAM in-charges expressed an interest to receive reports derived from the SMS data. One said he would like to receive findings of his facility and other LGAs to rank performance of the programme across the state. Another said "… *it would be good to compare our facility with others*". The benefits of appropriate reporting to lower levels seem self-evident (where "appropriate" means easily understood and using formats developed in collaboration with the staff) in that it should incentivise facility staff to produce better quality data for their own use.

LGA level

The ASNO reported that, with the exception of one LNFP, computers are not used at LGA level. The nutrition focal points do create their own paper reports for submission to the state office, but unsurprisingly do not display their data using graphs or figures since they would need to do this by hand.

State level

There is no regular production and distribution of data summaries at state level. The CMAM data are compiled into a spreadsheet, transmitted to UNICEF each month, and provided to other users on request (such as the Ministry of Planning).

The OPM team gained the impression that the monthly data would be used at state level more than is currently the case if the spreadsheet had better functionality (with respect to deriving summarised statistics, graphs and so on), however UNICEF's attention has recently been primarily focused on improving the dashboard. The ASNO reported that he used to display admissions data for the state by month from Jan-Dec, and such graphs were considered as insightful and taken by other staff for their use.

At the state-level monthly (only for LNFPs) and quarterly (for CMAM in-charges too) meetings organised by the SNO, the findings from the monthly paper-based data and weekly SMS data are projected and discussed.

Federal level

Similarly at federal level, there is no regular production and distribution of data summaries, neither from the monthly data nor RAPID PRO data. The CMAM data spreadsheets are provided to other

[23] One CMAM in-charge noted that if he had appropriate training on how to process and display their data in the facility, he would like to do this.
[24] it has been noted that in primary health care programmes, such as malaria and routine immunization, displaying data in visual formats is useful in identifying trends and can promote awareness and use of programme data

users on request, or analysis and reporting is undertaken in response to ad hoc requests from users.

The OPM team's view, reinforced by interviews with users in the nutrition unit of the Ministry of Health (see Section 4.2), is that the SMS dashboard is cumbersome, and does not inspire display and reporting. Although summary statistics are accessible by clicking on the separate sheets, there are few embedded summary graphs and tables to aid users' interrogation of the data, and users need to be familiar with the dataset to know where to look for these and how to access them. For this reason, potential users contact UNICEF to provide reports.

Clearly the information and programme officers at UNICEF are most familiar with the dataset, and presumably it is these few staff members who undertake the analysis necessary for reporting to CIFF or others.

3.1.5 Quality checks and feedback

Facility level at end of CMAM day

The team observed that CMAM in-charges frequently referred to the admission register as second source to cross-check admission numbers. Moreover, some CMAM in-charges recounted cards separated into different piles as described above. However, based on observations, there is no consistent verification protocol implemented when filling in weekly tally sheets at the end of the CMAM day, in particular with respect to cases of defaulters or deaths. The national CMAM guidelines do not provide any protocol in this respect.

Quality checking for data entry into the SMS system was observed to be limited. CMAM in-charges are prompted by the system to review their data before confirming submission of each value, but observations by the OPM team indicated that most CMAM in-charges only glance through their phone and confirm, without comparing the numbers on the screen of their phone with the values on the paper forms. Also any errors made during aggregation of data recorded on the paper forms are carried forward to the SMS report.

Facility level via monitoring / supervision system

To enable monitoring and supportive supervision of the CMAM programme, a system exists by which personnel from federal, state or LGA level undertake field visits to facilities to observe and discuss the implementation of the programme. Interviews with UNICEF and the state nutrition office indicate that someone from state level (SNO or ASNO) goes to visit a facility twice a month (this visit is supported by UNICEF). The Director of PHC at LGA level should visit each facility once a month, however records examined at facilities (see Annex D for examples from two facilities of dates of recorded visits) indicated this frequency lower in practice. The LGA nutrition focal person visits each facility twice a month; the UNICEF state consultant visits a minimum of 10 facilities a month, and the UNICEF field office nutrition specialist (UFONS) keeps an overview and occasionally also visits facilities.

Also there is a system of independent monitors sent from federal level, who according to UNICEF at federal level should visit each facility once a year minimum, on average every six months, and in Sokoto every 3 months. They use smartphones or tablets to note supplies used, number of admissions, (to be crosschecked with data reported to LGA level) as well as more qualitative indicators as included in the checklist described below, and send their findings to federal level.

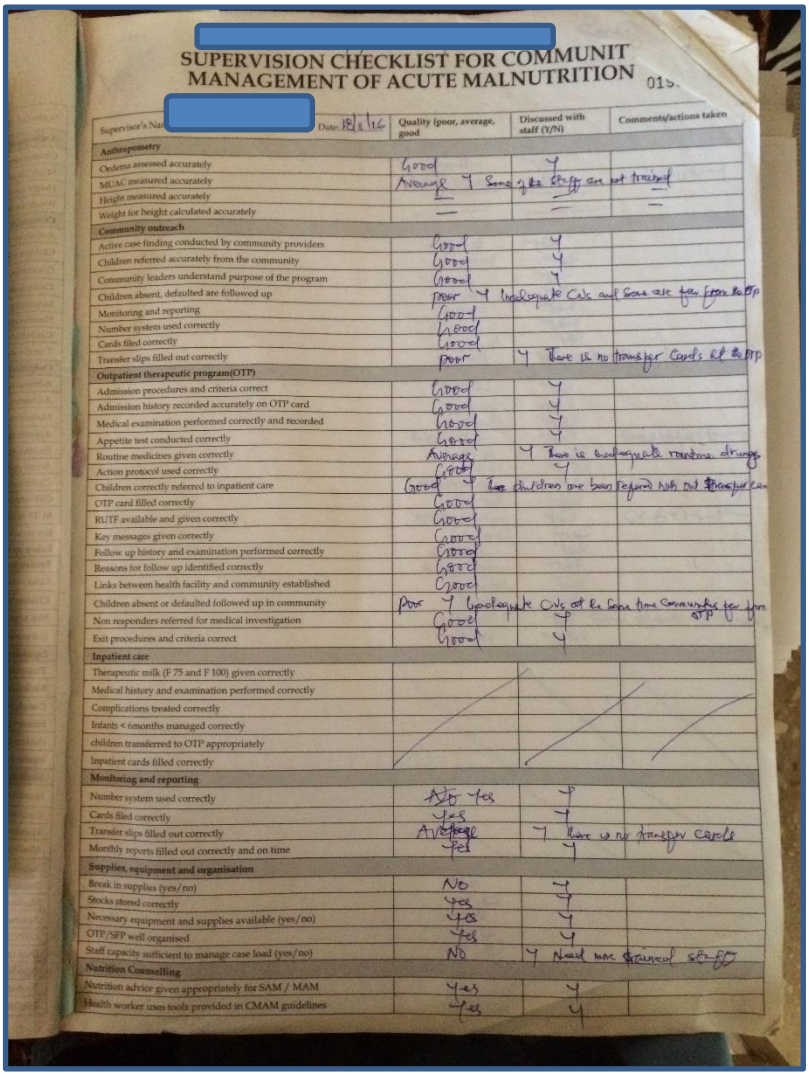
Annex 13 of the CMAM National Guidelines is a supervision checklist, and this is reproduced for use during supervisory visits in all the facilities (see Figure 10). The themes relate to accuracy of

anthropometric measurements, the community outreach component, processes of the CMAM day, monitoring and reporting, supplies and counselling. Copies of the completed checklists go to the UFONS, the SNO, LNFP and one is left at the facility. For each item, the quality is rated as poor, average or good, and supervisors also note if they have discussed the item with staff. There is also a small amount of space on the right of the form to record more detail or actions taken.

The items relating to monitoring and reporting are: number system used correctly (this refers to registration of clients); cards filed correctly; transfer slips filled out correctly; and monthly reports filled out correctly and on time. While the last item may be interpreted to include data tallying, the OPM team's impression from interviews and observations is that few supervisors other than the LNFP stay until the end of the CMAM day to observe and check the process of tallying and sending the texts. While the LNFP tends to stay until the end of the day, the focus is on checking that records are being transmitted, rather than providing quality assurance to the tallying and entry of the data.

The ASNO described that in Sokoto a system is implemented whereby on the day of a supervisory visit, the supervisor reports the number of children attending to the SNO. This process started in 2016 and is specific to Sokoto – he stated that "*We want to authenticate the data coming in*". The data are recorded in an exercise book and used by the ASNO to verify the data submitted by the LNFP at the start of the month.

Figure 10: Example of supervisory checklist for facility level visits



SUPERVISION CHECKLIST FOR COMMUNIT MANAGEMENT OF ACUTE MALNUTRITION

	Quality (poor, average, good)	Discussed with staff (Y/N)	Comments/actions taken
Anthropometry			
Oedema assessed accurately	Good	Y	
MUAC measured accurately	Average	Y Some of the staffs are not trained	
Height measured accurately	—	—	
Weight for height calculated accurately	—	—	
Community outreach			
Active case finding conducted by community providers	Good	Y	
Children referred accurately from the community	Good	Y	
Community leaders understand purpose of the program	Good	Y	
Children absent, defaulted are followed up	poor	Y Inadequate CVs and Some are far from the OTP	
Monitoring and reporting	Good		
Number system used correctly	Good		
Cards filed correctly	Good		
Transfer slips filled out correctly	poor	Y There is no transfer Cards at the OTP	
Outpatient therapeutic program(OTP)			
Admission procedures and criteria correct	Good	Y	
Admission history recorded accurately on OTP card	Good	Y	
Medical examination performed correctly and recorded	Good	Y	
Appetite test conducted correctly	Good	Y	
Routine medicines given correctly	Average	Y There is inadequate routine drugs	
Action protocol used correctly	Good	Y	
Children correctly referred to inpatient care	Good	Y Some children are been Referred with out Transfer Card	
OTP card filled correctly	Good		
RUTF available and given correctly	Good		
Key messages given correctly	Good		
Follow up history and examination performed correctly	Good		
Reasons for follow up identified correctly	Good		
Links between health facility and community established	Good		
Children absent or defaulted followed up in community	Poor	Y Inadequate CVs at the Some time Community far from OTP	
Non responders referred for medical investigation	Good	Y	
Exit procedures and criteria correct	Good	Y	
Inpatient care			
Therapeutic milk (F 75 and F 100) given correctly			
Medical history and examination performed correctly			
Complications treated correctly			
Infants < 6months managed correctly			
children transferred to OTP appropriately			
Inpatient cards filled correctly			
Monitoring and reporting			
Number system used correctly	Yes	Y	
Cards filed correctly	Yes	Y	
Transfer slips filled out correctly	Average	Y There is no transfer Cards	
Monthly reports filled out correctly and on time	Yes	Y	
Supplies, equipment and organisation			
Break in supplies (yes/no)	No	Y	
Stocks stored correctly	Yes	Y	
Necessary equipment and supplies available (yes/no)	Yes	Y	
OTP/SFP well organised	Yes	Y	
Staff capacity sufficient to manage case load (yes/no)	NO	Y Need more Trained staffs	
Nutrition Counselling			
Nutrition advice given appropriately for SAM / MAM	Yes	Y	
Health worker uses tools provided in CMAM guidelines	Yes	Y	

There was evidence that supervisors pay inadequate attention to checking data quality when they visit OTP sites. Only few CMAM in-charges reported any form of discussions around CMAM data with supervisors on their visits. Observation from available copies of previous checklist shows that impressions of most supervisors do not reflect the realities of programme performance at OTP site. This raises concern about the quality of supervisions from state and LGA levels and by extension the capacity of state and LGA level supervisors.

All facility workers interviewed reported that they do not receive written feedback following the supervisors' visits to their facilities. Supervisors provide immediate verbal feedback in form of correcting mistakes made by facility workers. No CMAM in-charge interviewed reported having a supervisor review their weekly or monthly reports with them. Only two CMAM in-charges reported ever receiving calls from their LGA focal person regarding their report, and the calls were to remind them to remind them of the deadline and did not extend to other data quality issues. In-charges reported only having opportunity to see their reporting mistakes at quarterly state level review meetings where programme dashboards are presented to them.

LGA level

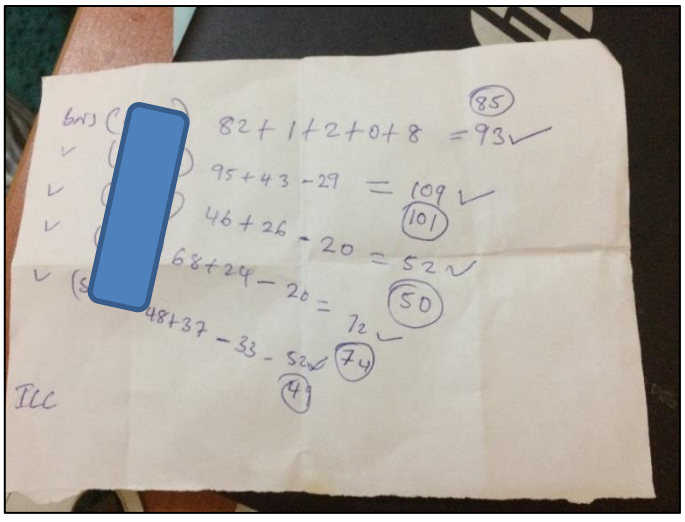
Monitoring for CMAM and other nutrition activities is not integrated with monitoring of other health programmes, which is undertaken by Monitoring and Evaluation staff. No mention was made of others being involved in checking data at LGA level before transmission to higher levels.

State level

CMAM data

1) Before entering the data submitted by the LNFP, the ASNO does simple arithmetic checks to ensure the derived data were correctly calculated (see Figure 11). The ASNO also checks data against reports sent in by monitors (see above). If any inconsistency is observed, he phones the LNFP to point out errors and ask them to follow up with facilities. Usually 3 or 4 calls are needed each month.

Figure 11: Calculations by hand done by ASNO on data from one LGA for October 2017



As described above, the UNICEF consultant reported he and the ASNO compare the dataset with the paper data and check it has been entered correctly. They do not do double data entry.

2) At the monthly meetings for LNFPs, during first week of every month, the LNFPs check the data that are being projected against the data that they submitted earlier.

The ASNO described how the previous version of the spreadsheet provided by UNICEF at federal level calculated the average number of cartons given out per child, and conditional formatting was used to highlight cells to show that the resulting value indicated the data were likely to be wrong. But the current version of the spreadsheet does not include these facilities.

Federal level

In the dashboard file, cells with data of questionable content are highlighted using conditional formatting, and checked by eye (see Section 3.1.3). Dashboard data are cross-checked by eye in comparison with monthly data but not systematically. The checks are done by UNICEF at federal level, and mainly by just by one person, the information officer, who, if he identifies a problem, then phones or emails the UNICEF Field officer, who passes on the task of follow up with LGAs and facilities to the UNICEF consultant. A consistent system does not exist to record that issues have been identified; that communication has taken place, or for the staff in the field to record their actions to address the issues.

The chief information officer in the nutrition unit at the Ministry of Health also sometimes notes data issues indicating poor performance or poor data quality, and may query these with UNICEF at federal level (who ensures the LGA nutrition focal point is contacted). It is notable that the query is routed through UNICEF at federal level – indicating the RapidPro system is perceived as owned 100% by UNICEF.

3.2 Inputs: Technical determinants relating to data production

The quality of data output from an information system is likely to be largely dependent on the layout, simplicity, and practicality of the tools used for data collection, entry, transmission and analysis. In this section, findings on these aspects are reported, together with the other technical determinant relating to data production in the Nigeria CMAM information system, that of the choice of indicators.

Summary findings of technical determinants of CMAM information system performance relating to data production

The technical determinant of **indicators** is given a positive rating as the selection of indicators for inclusion is broadly appropriate, and clarity of their definition is high (*except for new admissions, as it is not clear if this category should include returned defaulters)*

The technical determinant of **data collection forms** is given an intermediate rating because the user-friendliness of forms is varied. Also, there are inconsistencies between some forms.

The technical determinant of the **SMS system** is given an intermediate rating because it is both observed, and reported by the health-workers to be, user-friendly with respect to entering and sending data. However, connectivity issues are experienced, with impact of completeness of the consequent datasets.

The technical determinant of the **software** is given an intermediate rating because there are aspects that need improvement. Paper-based data are entered into a simple excel spreadsheet with no automatic quality checks. The routine for creating the dashboard file from the weekly SMS data is not complex, but only two individuals have the capacity to implement the routine, and both are UNICEF federal-level staff members.

Recommendations intended to improve the design and technical aspects of the CMAM information system relating to data production

1) Review data needs, to assess whether information collected on OTP card can be simplified. If so, improve formatting to increase ease of use, by
- using a larger and more user-friendly font, like Ariel rather than Times New Roman
- changing the coding for outcomes, and the variable for constant weight
- including space for recording actions taken by the community volunteers

2) Provide a single uniform set of forms for paper-based reporting, and (if deemed useful for programme management and tracking) within these
- include cells for gender statistics to be recorded
- add cells for collection of data on number of attendees
- amplify the headings to clarify the category in which returning defaulters should be included, or add a separate cell to capture these children

3) Include automatic quality checks within the software used for the paper-based data entry and aggregation.

3.2.1 Choice of indicators

The selection of indicators included in an information system should be driven only by the needs of users for planning and decision-making, and for reporting to funders.

The Sphere indicators (for recovery, default, death) are the globally accepted indicators used to monitor the performance of SAM programmes. These indicators can be calculated from the data collected on admissions, and the various categories of discharge in the Nigeria CMAM information system[25]. So, the inclusion of these variables is appropriate.

It is not clear whether the data on transfers in and out of the programme are being analysed and used. However, the internationally accepted mode of calculation of cured, death and defaulter rates assumes that transferred children are not included in the calculations, so for this reason alone it is also necessary to distinguish children transferred out of the OTP to SCs or other OTPs from “discharged” children. To be consistent with discharge data, it is also necessary to distinguish transfers into the OTP from SCs or other OTPs from new admissions. On some forms defaulters are also included with this category of children (see Form 2.1) and this is inconsistent with the categorisation of exits, see Section 3.2.2 below, and needs to be amended.

The number of children currently in treatment at the facility is necessary for allocating resources. Other variables mentioned in the National CMAM guidelines (p 48) as possibly being relevant are not included in the information system[26] and the OPM team concur with this, as collection of these data would need significant time, expertise and/or special surveys and are not essential for routine programme monitoring. The one exception is collection of data on admissions disaggregated by

[25] The Sphere indicator for coverage cannot be calculated from data collected during programme operation, specialist surveys are needed for this.
[26] Such as gender of new admissions; % of relapse among new admissions, causes of death, reasons for defaulting.

gender, which does not need specialist skills, and can be used to monitor the important issue of gender equality with respect to access to CMAM services. It is recommended that inclusion of this variable in the SMS data collection is reconsidered. This would enable gender disaggregated programme data to be calculated and any gender imbalance identified.

Inclusion of another variable could also be considered - at present the number of children attending in a given CMAM week is not recorded, and if added, this could be used to cross check the RUTF consumption data. Also, this number could be used to cross-check with the number of children reported as currently being in treatment. A big difference would indicate that the protocol for identifying children as defaulted is not being properly implemented.

3.2.2 Data collection forms

Forms referred to in this section are listed in Annex B.

Facility level – individual data

Three tools are used to collect information on CMAM clients - the facility admission register book (2.7), the OTP card (1.2), and the ration card (1.3). The OTP card contains identifying data of the patient, together with details of their diagnosis and checks as well as RUTF provided at all visits, and is kept at the facility. The ration card contains identifying data, anthropometric details from each visit and the quantity of RUTF distributed, and is kept by the caregiver while the child is in treatment. The facility register notes the admission of each client with basic identifying data, and the discharge should also be noted in the book, although as described in Section 3.1.1 on data collection processes, this action was not undertaken consistently across the facilities visited.

Although no health workers mentioned the OTP card (1.2) is not user-friendly, we observed that it is hard to read (because of the small font size, and choice of font) and its completion would not be intuitive for those unfamiliar with it. It would be easy for users to omit responses because they are not signposted as necessary, or to fill in the wrong box. An inconsistency noted is that the same code R is used to record two different outcomes[27]. There is potential to use the wrong response next to the heading “No change in weight”[28], and there is no space to record actions taken by community volunteers. In contrast, the ration card (1.3) and register form (2.7) are clearer and more user-friendly.

The OTP card has two functions – its primary function is to record clinical information. While it is not appropriate for the OPM team to comment on what information is needed to classify children, and to determine their treatment, the team recommends that the form be reviewed to ensure all variables included are being used for these purposes, and to remove any that are not. The secondary function of the OTP form is as the key document for recording information that enables programme monitoring. To reduce errors in the reporting derived from the form and thereby maximise the effectiveness of monitoring, the OPM team recommends the form be redesigned, to ensure the information needed for the tallying process is easier to identify and to enter correctly and completely.

[27] “Refused Inpatient care” and “Recovered”. It is also difficult to read these options because the shading is so dark.
[28] The direction of necessary change is not specified in the current footnote for this cell. Ideally this cell would be replaced with a box labelled “Weight gain”, with a footnote to explain “If no weight gain by the fourth visit, arrange home visit or refer to inpatient care”.

Facility level – aggregated data

A tally sheet for counting children admitted and discharged on each CMAM day exists in the national guidelines (2.1). There are some ambiguities associated with this form[29] and although it was not found to be used in practice, the ambiguities still pertain to the simpler forms[30] that are being used (2.2 and 2.3) of which one form has an essential category missing (2.2, that of new admissions that were old cases). As noted above in the description of processes, traditional tallying was not observed (using hash marks to count), so the forms are simply used to record aggregated data.

Form 3.1 from the CMAM national guidelines, for weekly reporting of facility data, is included in the annex, because although the OPM team did not observe its use in the field it includes cells for findings from calculation of the Key Programme Indicators. It could be argued that required use of this form (or preferably a simplified version) would encourage the CMAM in-charges to calculate the key performance indicators for their own facilities and help them develop an analytical approach to the data collection.

All CMAM in-charges interviewed felt the data forms used for recording weekly aggregated data are easy to use. We also observed that Form 2.3 is routinely used both to record data for the monthly paper-based reporting to LGA level, and in some facilities also to read off data for sending the weekly SMS data transfer to the federal level (in other facilities staff just made their own notes). The register book is also used to derive the gender statistics necessary for monthly reporting to LGA level, since gender is not included in Forms 2.2 or 2.3. Form 2.4 is used to record RUTF stock deliveries, utilisation and balances[31].

Since the SMS system was introduced, UNICEF created a new form to facilitate reporting via the SMS system (Form 3.2). We only observed one facility using this form (see 3.3), and this was found at state level so must have been submitted for the monthly reporting of data to LGA level for the paper-based system. The example seen was for weeks 31 – 36, so includes August plus one week in September. The ASNO would have needed to decide which weeks to include in the monthly summary, and to calculate the totals for the month using these selected weekly data. Form 3.2 was reportedly designed to facilitate reporting using the SMS system, however observations indicated it is not being used for this purpose, and form 2.2 is being used instead. It is potentially confusing for facility staff to have a choice of forms to use for monthly reporting, and it is recommended that a single uniform set of forms for paper-based reporting should be provided.

LGA level

At LGA level, it was observed that several forms are being used for transferring monthly facility data to state level, none of which exist in the CMAM national guidelines. CMAM data are reported using Form F4.1, and RUTF data using Form F4.3, with a summary from LGA stores using Forms F4.4 or F4.5[32]. These forms all appear to be clear and reasonably intuitive. The only issue is lack

[29] 1) Users are left to assume that row B2 “Other (adults, adolescents, infants)” are also “New” like the first row B1 “New 6 – 59 m SAM”;
2) Users are left to assume row C “From OTP/Inpatient care or returned defaulters” includes all ages.
3) Users are left to assume that Row G “TOTAL DISCHARGES” includes all rows E1, E2, E3, E4 and F above, because the next row H “Total end of week” is calculated as A + D – G. This is inconsistent with Form 3.1 which separates out “Discharges” (E1 to E4) from “Transfers” (F), and with Form 4.1 which specifies at the base that “Transfers (F) are excluded from national/ programme reporting as they are movements within the programme rather than entries and exits”
4) Gender statistics are labelled “New Admissions”. It is not clear if this includes those from OTP/Inpatient care and returned defaulters i.e. is it (B1 + B2 + C) or (B1 + B2)
[30] These do not include cells for collection of data with respect to gender or HIV testing
[31] Presumably the extra columns on the right for “Physical Balance” are included to enable any “Missing or extra” cartons or sachets noted in the centre columns to be taken into account, however in practice, it seems that the columns under Total are identical to the columns under Physical Balance (see 2.5).
[32] The label of the final row of Form 4.5 is “State Total” so the form was likely designed for aggregating state-level data.

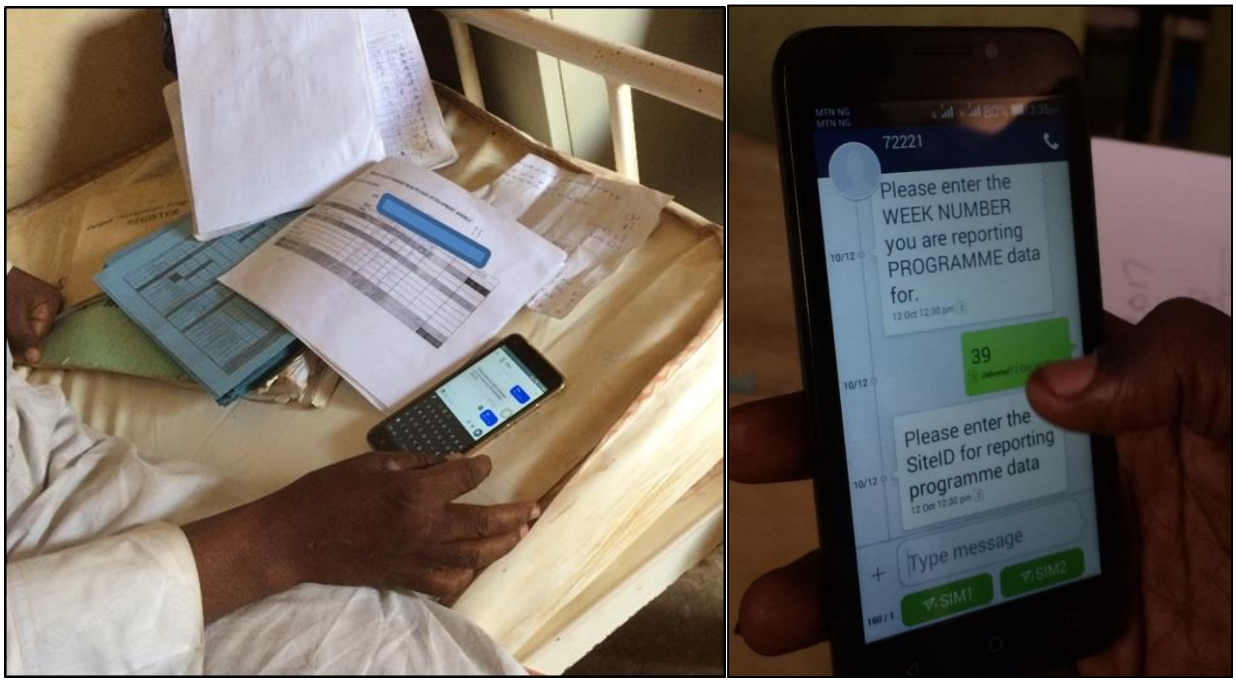
of clarity as to how returning defaulters should be recorded. On Form 4.1 defaulters are included as “OLD CASES” together with those transferred from another OTP or SC. This is consistent with the facility level forms F2.1 and F2.3, but inconsistent with the forms used for weekly reporting (3.1 from the CMAM guidelines and 3.2 which is used in practice) in which it is not specified in which admissions category returning defaulters should be included, so users are left to assume that they should be included as new admissions.

State level

A form exists in the CMAM national guidelines for reporting aggregated state level data to federal level (F5), but this is not used as the facility data are aggregated in a spreadsheet and electronically transferred to federal level[33].

3.2.3 SMS system for data transmission

Figure 12: CMAM in-charge enters data from weekly tally into smartphone



As described above in Section 3.1.2, UNICEF introduced a system using smartphones to standardise and facilitate monitoring of the CMAM programme, and weekly aggregated routine data are texted from facility level to federal level directly. The facility staff interviewed reported that it was easy to understand what was required, and to enter the data using the SMS system. The OPM team also observed the data entry process to be user-friendly. However, health-workers frequently mentioned problems with connectivity, and such staff sometimes spent a considerable amount of their free time trying to send the texts.

In interviews, facility workers explained they consider the SMS system offers some distinct advantages over the paper-based system of data transmission, for example the SMS system offers a faster means to transmit their data, and it is cheaper than the paper system. There is practically no cost associated with sending the SMS report, as health-workers are not charged by service providers, however registered users are required to have some credit on their network for the system to function. A key constraint mentioned by most CMAM in-charges is unreliability of

[33] At the base of the form, it states that “Non-recovered equals does not reach discharge criteria after four months (16 weeks) in outpatient care”. However, on Form 1.2, the OTP card, there is only space to record 12 visits.

network coverage for SMS. Remote facilities are particularly affected by poor network coverage. According to UNICEF at federal level, problems of connectivity are only very rarely due to the server not accepting data from texts, and when this happens it is quick to resolve – the cause is UNICEF having run out of "credits" with the company running the dashboard.

3.2.4 Software

Paper-based system:
As described in Section 3.1 facility-level monthly aggregated data are transferred by hand to the LGA Nutrition Focal Person (LNFP) at LGA-level, who in turn transfers the data to the State Nutrition Officer (SNO). Aggregated statistics for admissions, exits[34] and total in programme for each facility are automatically calculated, and aggregated statistics by state, but no aggregated statistics by LGA, are produced within the spreadsheet. The ASNO reportedly finds the current version of the spreadsheet easy to use, though not as user-friendly as the version in use last year which automatically produced graphics and was easier to search. It is not clear why the previous version of the excel spreadsheet was discontinued (the OPM team did not observe it).

As noted above in Section 3.1, the process of simple (single) data entry together with the lack of embedded validations in the spreadsheet means there is a high risk of errors introduced during data entry being undetected. We recommend that in order to reduce this potential for errors, data should ideally be entered twice on separate sheets and a comparison summary undertaken which would flag any discrepancies. We also recommend introduction of validations such as warnings linked to checks for out-of-range values, negative values, and numbers with decimal values (since all values entered should be positive integers), using Excels "data validation" options.

SMS system: The data manipulation needed to transform the data from the texts into a format that can be analysed was described above in section 3.1.3 and only two people know how to do this. This data manipulation is not complex, and command files exist so input is not required each week. However, the Nutrition Unit of the Ministry of Health does not use the statistical software Stata and staff members do not have the necessary skills to manipulate the command files and data[35]. The information officer at UNICEF explained that the dashboard system is perceived as "an intermediate system" before developing an interactive website to facilitate access to the SMS data, and therefore in their view it is not worth training anyone else to manipulate the data[36].

3.3 Inputs: Organisational determinants relating to data production

Staff work in an organizational context, which influences them through the rules, values and practices of the organisation. In this section, findings are described relating to the organisational determinants of the quality of data output from the Nigeria CMAM information system, specifically training, supervision and the supportiveness of the environment for statistics; and the availability of necessary resources with respect to finance, staff and equipment.

Summary findings of organisational determinants of CMAM information system performance relating to data production and data quality

The organisational determinant of the **training, supervision and supportive environment for statistics** is given an intermediate rating because there are aspects

[34] The sum of discharges and transfers
[35] In contrast, these skills are likely to exist in the Planning, Research and Statistics Division of the Ministry of Health.
[36] The respondent reported that data submitted via texts would be integrated directly into the datafile available for download from the website, so in future there would be no need to extract and consolidate the SMS data submitted.

that need improvement. A good system exists for external supervision except for the limited scope to record written feedback. After their transmission of weekly and monthly data, feedback is only provided to lower levels if a problem has been identified in their data. Priorities for health workers, reinforced by discussions at state-level meetings, are simple collection and reporting of data, i.e. completeness and timeliness. There is no incentive to maximise accuracy, because the use of data is very limited at facility level. The environment was not observed as "supportive" for statistics in that there is an absence of practical presentation of data in the workplace (posters with tables, graphs etc) at any level, so there is a lack of examples and potential inspiration for those who may have the capability to derive such material.

The organisational determinant of **resources** is given a negative rating, because significant constraints exist, particularly with respect to human resources. These are experienced in common with other health programmes being provided through the government health services.

Recommendations intended to strengthen the organisational rules, values and support practices aimed at building a culture of producing high quality data

1. Develop and include protocols for data aggregation and data transmission in the national CMAM guidelines
2. Document the processes used for gathering, entry, analysis and management of data, so that the practices are transparent and transferable
3. Develop and distribute guidelines for processes to assure data quality, in which roles and responsibilities are clearly defined. This includes
    - agreeing quality criteria that would provoke warnings to facilities
    - ascertaining MoH guidance concerning necessary storage duration and storage conditions of paper records; as well as storage and back-ups of electronic records
    - developing guidelines relating to data confidentiality of client-level information e.g.
        - storage of records in secure location such as a locked cupboard in locked room
        - control of permission to access records e.g. only to staff at a certain level
3. At federal-level, strengthen training materials for CMAM staff that can be adapted by states, that include theory and practical exercises relating to data production, quality and use.
4. Strengthen supervisory system to emphasise data quality, both for day-to-day supervision by the CMAM in-charge, and the periodic supervisions by the LNFP, state-level MoH and UNICEF staff, and independent supervisors. This would include
    - enabling more detailed notes to be recorded and left at the facility
    - developing standardized tools for informal and formal assessments of data quality
    - frequent random informal assessments of data quality
    - infrequent (e.g. alternate years) formal assessments of data quality
    - instigating a system to aid supervision and coordination between different levels. Federal- and state-level UNICEF and MoH staff, and LNFPs would record quality issues identified for each facility, and actions taken to follow-up. Supervision checks would be documented, together with notes left in the notebook, and any warnings given. In the medium term, a paper form or spreadsheet could be used, moving later to an online solution. This would enable sharing of data quality issues across LGAs and at state and federal level.

5. Set up a system of mentoring among peers for health-workers. For this, first identify staff at facility level who have good skills and practices during training and supervision, and provide training to enable them to mentor staff at other facilities.
6. Increase access to computer hardware and software by LNFPs, so they can analyse their facilities' data, calculate aggregated statistics, enter data about their supervisory visits, and access observations and recommendations made by other supervisors at facilities in their LGA
7. Increase staff resources at state level, by having an additional person in the state level office of the Ministry of Health (MoH) with data/ statistics skills.
8. Expand the remit of the CMAM monthly meetings to include data accuracy and reliability.
9. Create forums for discussion and sharing facts and ideas about data quality so that both state and LGA level staff can interact virtually, and state-level MoH staff meet regularly (e.g. annually) in person.

3.3.1 Planning/ Training/ Supervision/ Supportive environment for statistics

Observations and interviews at facility and LGA level indicate that guidelines for data production processes are lacking – even the existing national CMAM guidelines were not held at every location. In any case the CMAM guidelines do not include details about data tallying, required data to be transmitted, when, to whom, and in what format, nor of modes of storage of paper records with respect to the length of time health records should be kept, or their security and confidentiality. Our recommendation is that such guidelines should be written and distributed to all facilities and LGAs. Slides from strengthened or newly developed training materials could be held at facilities, in fact the existing slides from the SMS training could usefully be distributed to facilities immediately.

Facility level – training and guidelines:
Most CMAM in-charges hold the Junior CHEW (community health extension worker) certificate. One CMAM in-charge interviewed has a Diploma in health information management. It was not possible to observe materials used to train facility staff in data collection and transfer using paper forms. Interviews with UNICEF at federal level revealed that each state develops its own materials as it has the responsibility of training their own facility staff, and there is not a central stock of training material that can be adapted. In contrast, the SMS training is administered by UNICEF staff from federal level. Interviews with facility staff revealed that in addition to the two-day SMS training provided in 2016 (or one-to-one training with LNFPs on this), most had attended formal training in CMAM over the last two years[37]. Several CMAM in-charges expressed a desire for refresher training, and one identified that the monthly state-level meetings enable learning, describing how "*refreshers are given on CMAM*" at the quarterly state-level meetings she attends. During interviews at all levels it was frequently reported that staff experienced in CMAM are transferred away to sites that do not offer CMAM services, so the training is wasted, and the new staff may need to work without formal training for many months.

We recommend that at federal level training materials for CMAM staff be developed that can be adapted by states, and that include theory and practical exercises relating to data quality. These would ideally include guidance concerning necessary storage duration of paper records consistent with existing MoH policies, and guidelines concerning data confidentiality.

[37] This covers general CMAM operations (child assessment, admission criteria, follow up, criteria for discharge etc)

In addition to formal training sessions, and on-the-job training provided during supportive supervision (described below) another channel by which skills and knowledge are passed on are the State quarterly meetings. One CMAM in-charge recognised that at these meetings "…*refreshers are given on CMAM*"; another stated that these meetings are "*good for learning from others' experiences*", and another "*wants quarterly meetings to be held monthly, they learn from them*". It was described that at these meetings there are discussions on how to send data; how to use RUTF; how to do admissions and discharges; and how to track defaulters. In order to improve CMAM data quality, we recommend the remit of these monthly meetings should be expanded explicitly to include data accuracy and reliability, so that whenever practical aspects of CMAM programme implementation are discussed, there is always a focus on minimising errors during data collection and transfer.

One CMAM in-charge reported a wish that guidelines on data management be provided (of course this sentiment could be due to social desirability bias). Another wanted guidance on managing medical complications, two wanted more training on health education / preparing the health talk, and the remainder felt there were no tasks for which they needed more supervision, guidance or training.

Facility level – supervision:
As described in Section 3.1.5, external supervision arrangements for facilities are that the 3 key State-level officers (Director Public health, SNO and Assistant SNO) have 3 health facilities to visit every month. Supervisory visits are also done by the Director of the Primary Health Care (PHC) in the LGA, who is expected to visit OTP centres in their LGA twice a month (however, based on information received during interviews, there is some anecdotal evidence that they sometimes fail to visit the facilities despite receiving a small allowance and ask the LGA focal persons who work under them to get the information they need to complete the checklists for supervisory visits. The OPM team did not make any direct observations of such cases, and it could not be confirmed whether this practice is common across LGAs or whether it relates to an isolated case). The LGA nutrition focal person is expected to visit each OTP centre fortnightly, and the state nutrition consultant is expected to do 10 days monitoring a month too. They have different approaches, in that the LGA focal point systematically visits all facilities in their LGA, while state-level supervisory visits are targeted at facilities perceived as needing more support. Interviews at state-level indicate that monitoring and supervision at facilities relates more often foremost to logistics, to maintain the flow of the programme elements, rather than as a safeguard of data quality, which is hardly surprising given the constraints that the facilities work within (see below under "Resources").

There is also a system of independent monitoring by trained "resource people", administered at federal level, for which GPS data are collected on the location of the visits, and findings are sent back to federal level by text and are stored on a dashboard. This system is used to cross-check the findings of visits made by supervisors as part of the routine monitoring/ supervision system. The data provided by these independent monitors are reportedly under-analysed and the dashboard needs to be made more user-friendly (this is a comment from the UNICEF state nutrition officer – the data were not observed during the fieldwork).

There are two keys ways in which the external supervision system could be strengthened that would benefit data quality, first by enabling more detailed notes to be recorded and left at the facility than is currently possible on the checklist (Figure 12), and second by instigating a system to record supervisory checks, together with quality issues identified for each facility, and actions taken to follow-up. Initially, a paper form or spreadsheet could be used, later moving to a system by which the entries can be accessed online, to enable sharing of data quality issues across LGAs and at state and federal level.

LGA level – training and guidelines:

Two of the three LNFPs interviewed were trained as Senior Community Health Extension Workers (SCHEW) and the third had a diploma in Community Health. LNFPs are provided with training in CMAM together with the facility staff.

LGA level – supervision:
The nutrition focal point of one LGA explained that her manager was the Director of the PHC, and while she goes to see him if she has difficulties, he does not check her work and there is no formal system of supervision. The immediate manager of all LNFPs is the Director of the PHC department, which is often a political appointment. So, the Director may have no medical training, and is at best an experienced CHEW (community health extension worker).

State level – training and guidelines:
The most recent training attended by the Sokoto SNO was in 2016 and included general training including CMAM, and IYCF programme planning and coordination provided by UNICEF and the federal Ministry of Health. Also, both SNO and ASNO attended the training in the RapidPro reporting system for facility staff in 2016 mentioned above. With respect to supervision, the head of the nutrition unit in the MoH at federal level emails the SNOs when necessary, and they interact with him when they need guidance, but there is no established system to interact with them on a regular basis. Rather than providing formal training, the perception expressed by UNICEF staff at federal-level is that the UNICEF field consultant will provide support to state-level MoH staff. Ideally state-level MoH staff would meet regularly in person, and also be able to discuss data quality at other times, for example via an online forum. There are reportedly no standards or guides being used at state level apart from the CMAM national guidelines.

The UNICEF Sokoto field office nutrition specialist (UFONS) has a Bachelor's degree while the UNICEF Sokoto State Nutrition Consultant (USNC) has a Masters degree in Statistics. Interviews at federal level indicated that training of UNICEF staff at state level does not occur at regular intervals but is undertaken on an ad-hoc basis. For example, in 2017 UNICEF state consultants and field office heads from four states came to Abuja and discussed their roles and activities including reporting with federal-level UNICEF staff. State-level UNICEF staff in other states were visited by the federal-level UNICEF information officer and he conducted on-the-job training. Our impression, gained from interviews, is that support is available when such staff request it, but there is no formal process for simultaneously disseminating information from federal level to state level, nor a forum for sharing experiences of challenges and good practices between those working at the same level.

Federal level – training:
The head of the Nutrition Unit of the MoH is trained as a medical doctor. The chief information Officer in the Nutrition unit has a degree in Cooperative and Rural Development and a Masters degree in Social Work. The UNICEF information staff are all educated to Masters level.

Example of the influence of organisational factors affecting data quality – Application of the protocol around defaulting

If defaulters are not properly identified and recorded, the accuracy of the key performance indicators of recovered%, death% and defaulter% is affected, so comparison with Sphere standards would be distorted. This data quality issue arguably relates primarily to organizational factors rather than data collection errors for the following reasons:

- Although there is a clear definition of a defaulter in the national CMAM guidelines, there is no defined protocol in the guidelines for identifying defaulters each week by looking at the OTP cards of children who have not attended. Nor is this task included in the

supervision checklist (Figure 12), and so it can be inferred that it is also not checked during the routine external supervision process.

- As far as we are aware, the protocol for identifying and reporting defaulters is not included in the training of staff responsible for data collection and reporting.
- The data collection tools are inconsistent with respect to recording defaulters, in that the forms 2.1 and 4.1 include returned defaulters in the same admissions category as transfers from OTP or inpatient care, while forms 3.1 and 3.2 do not mention returned defaulters in the sections for new admissions. (In the latter two forms, intelligent users would assume that returning defaulters should be categorised together with new cases, as this would be consistent with the specification of defaulters as a separate category of discharge in these forms.)
- Due to lack of incentives available to compensate community volunteers, most facilities do not have a functioning system of tracking defaulters. So, there is little motivation for health workers to identify defaulters quickly in order that volunteers can encourage caregivers to bring the child back to be treated.

3.3.2 Resources: Finance, staff, equipment

Facility level: Many constraints on the effective operation of the CMAM programme were observed at facility level that are likely to impact on data quality, not just those obviously relating to data, such as lack of computers or paper forms. Interviews with staff indicated that staff salaries are not paid regularly, and the number of staff working was rarely as great as all those appointed to be in-post for reasons including death, illness, non-replacement of transferred staff, and absence due to educational commitments. As mentioned in the box above, the shortage of financial resources available to motivate and retain community volunteers leads to a lack in most facilities of a system by which absentees from the CMAM programme are followed up. Only those facilities supported by external agencies have well-functioning systems for this process. The most important consequence is increased risk of death in defaulters, because caregivers are not followed up after absences and encouraged to rejoin the CMAM programme. With respect to data quality, not tracking defaulters has consequences for accuracy of key performance indicators, because one is unable to distinguish between defaulting and death[38].

Running water and electricity supply are often lacking. Essential drugs now need to be purchased on prescription. Around half of the facilities visited did not hold a copy of the CMAM national guidelines, and even fewer had copies of the “JobAids” (summarised guidance). Additional resources mentioned most frequently by the CMAM in-charges that would help them do their job related to CMAM better, were supplies of forms, tally sheets and referral cards. In-Charges reported that reporting forms are not regularly supplied to them. The OPM team was informed that In-Charges only got one copy of most of the forms at the inception of the programme and they have since been responsible for making more copies from these original versions. Facility workers resort to making their own notes when they are not able to produce copies of forms.

LGA level: None of the three LNFPs interviewed by the OPM team had a computer. Their office space was observed to be shared and cramped, and lack of office space was also mentioned by two of the three as a constraint on their effectiveness. Insufficient space is the reason why two of the LNFPs had adopted the practice of storing data forms elsewhere, one kept them in their car and the other at their home.

[38] The second component of the CMAM learning study, that of tracking longer-term outcomes for children, will generate further evidence with respect to the approaches to following up absent children and the role of community volunteers in this respect.

The lack of access to portable electronic devices at LGA level is a major constraint on both data quality and data use in the Nigeria CMAM information system. The LNFPs have a pivotal role in both enabling data flow, and influencing the quality of those data via supervision and on-the-job training. Access to computer hardware and software would enable the LNFPs to analyse their facilities' data, calculate aggregated statistics, enter data about their supervisory visits, and access observations and recommendations made by other supervisors at facilities in their LGA.

State level: The SNO has a computer and the ASNO uses his own personal laptop. The ASNO, who does most of the data entry work, identified his main constraint as a poorly functioning modem which limits internet access, and his printer also does not work well. The ASNO needs cupboards to store the records received from LGA level, because already many papers have been damaged by water flowing down the walls from higher floors, and the cause of the problem has not been eliminated.

Federal level: It is only at federal level that there are staff whose sole responsibility is data production and management (both in UNICEF and MoH) – for all others it is a task that needs fitting in around other tasks. In UNICEF there are highly trained staff with access to international experts such as academics for support, and also support is available from the company that provides the RapidPro system (Nyaruka) and from UNICEF in New York.

There may be some staff in the state MoH Monitoring and Evaluation (M&E) department whose only role is data collection and management, but they are not currently involved with the CMAM information system. This is because apart from a small number of nutrition indicators, nutrition data are not yet a routine data requirement of the national health information management system.

The existence of government staff serving the M&E function at LGA and state level is encouraging (apparently this is relatively recent). The potential for collaboration between the nutrition staff and the M & E staff at these levels should be explored as currently the planning department are not at all involved with M&E of the CMAM programme, and it is conceivable that CMAM could benefit from their expertise, and even share access to computers. At federal level, the potential for collaboration with the Planning, Research and Statistics Department of the MoH is similarly desirable and potentially beneficial to the CMAM programme. The Planning, Research and Statistics Department would seem to be the obvious future custodian of the RapidPro system, given it is the custodian of the Nigerian Health Management Information System (HMIS), and given the lack of expertise in data management in the MoH Nutrition Unit. This issue is discussed further in Section 5.

3.4 Inputs: Behavioural determinants relating to data production

Performance of health information systems via the processes described in Section 3.1 (data collection, data integration, transmission, analysis and presentation) are likely to be directly affected by the actual and perceived competencies of the stakeholders in the system. This section describes the findings relating to the competencies that impact on the quality of data output from the Nigeria CMAM information system, together with the other important behavioural determinant of data quality, that of motivation.

Summary findings of behavioural determinants of CMAM information system performance relating to data production and data quality

The behavioural determinant of **competence and confidence in information system tasks** is given an intermediate rating because competencies with respect to

checking data quality, analysis and use of information are limited in the MoH, it is mainly staff in UNICEF who undertake these tasks.

The behavioural determinant of **motivation** is given an intermediate rating because staff are stimulated to submit timely and complete data via "naming and shaming" at monthly meetings, but other aspects of quality are not prioritised.

Recommendations intended to enhance the motivation and competence of personnel to collect high quality data

1. At federal level strengthen training materials for CMAM staff that can be adapted by states, and that includes theory and practical exercises relating to data quality (*already noted above under organisational determinants)*
2. Implement informal on-the-job training in assessment of data quality for federal-level staff who are responsible for information management
3. Provide advanced training in interpretation and use of statistics including assessment of data quality, for federal-level staff who are responsible for information management
4. Develop a system to automatically generate single-page paper reports for each LGA, with breakdown by facility, to be discussed and distributed at monthly state-level meetings. These reports could also be shared by LNFPs with facilities during regular supervisory visits.
5. Develop a users' guide to the interpretation and use of the dashboard dataset, including a checklist of which features and data should be examined.

3.4.1 Competence and confidence in information system tasks

Facility level: Information system tasks at facility level are collecting and tallying CMAM admission and discharge records, keeping and tallying stock records, and using Rapid Pro to send data. These tasks are undertaken by the facility staff whose confidence and capability appear to be quite variable. The collection of accurate and reliable individual-level data is particularly compromised by the time pressures faced by the staff on CMAM day, and by the lack of a functioning system of community volunteers to follow up absent clients. The fact that many of the CMAM in-charges wished for refresher training in CMAM operations indicates they are aware of their limitations. With respect to data quality, interviews revealed they are more concerned with completeness and timeliness than accuracy or reliability because they know if they submit data late or they are incomplete, it will be displayed at the next LGA or state level meeting in front of all their peers from other facilities or LGAs.

LGA level: At LGA level our impressions were that staff could acquire information management skills using computers if given the opportunity. While they do not currently have expertise in electronic data management, they are confident with use of mobile phones to key and send data. It was observed that one LNFP already submits their reports to state level that were compiled using computers. Increasing the LNFPs' access to computer hardware and software would enable them to calculate aggregated statistics, store their data electronically, enter data about their supervisory visits, and access observations and recommendations made by other supervisors at facilities in their LGA (if the web-based system we are proposing is implemented)

State level: In Sokoto the ASNO has information management skills. Each month he enters the data submitted from LGA level as described above in Section 3.1.2. and can manipulate it to obtain summarised data by location and time period. He expressed enthusiasm to have more training. The OPM team agree that it would be valuable for him to receive training in summarising and reporting data in a user-friendly way, and in critical interpretation of findings.

Federal level: The chief information officer in the federal level MoH nutrition unit expressed a need for training in data analysis and management. He felt he and his team "…*don't have the knowledge about how to analyse the data*" and that "*We've had no training on interpreting the dataset*". He would welcome a manual on data use. The Federal-level UNICEF nutrition information officer agreed that a users' guide to the dashboard dataset, including a checklist of which features and data should be examined, might be good idea.

3.4.2 Motivation

Data are not used much at lower levels. As a consequence, there is little incentive to ensure their own data are completely accurate, and as mentioned above, timeliness and completeness are of higher priority.

Interviews with health workers revealed they were generally very motivated to improve the programme, especially at their own facility, but such improvement was not perceived to be linked with data quality issues, it related more to following up defaulters or being able to provide routine drugs gratis rather than through prescriptions. Three of the interviewed CMAM in-charges mentioned that the SMS system has increased their workload as texting is an extra task to fit in at the end of a busy day. One stated they were happy to do it, but two perceived it as multiple (duplicate) reporting. Interviews also indicated that health-workers are motivated to text their data via the SMS system as they appreciate how the SMS system facilitates rapid programme decision-making. RUTF stock alerts are generated and sent out automatically when the system senses low level of stock at any facility (definition of "low" is a constant value across all facilities, it does not vary according to reported client loads). Facility workers also voiced the opinion that the SMS system potentially reduces the risk of data loss that may arise from loss of paper forms (however loss of forms during transfer was not observed as a major problem across the facilities and LGAs).

The SMS system has increased workload at LGA level because in addition to following up the completion and submission of the monthly paper reports, the LNFPs check whether the texts have been sent at the end of each CMAM day, and follow up if not. These staff do not benefit directly from this task as, except for presentations at the state-level monthly meetings, they do not see the resulting dataset. One LNFP seemed to slightly resent the focus on data at the expense of logistical aspects of services: "*The first priority is to ensure that services are delivered, because good quality data should come from services delivered*"

The head of the federal level MoH nutrition unit expressed the view that reports derived from the SMS data in the form of paper summaries would be useful at facility level, and could motivate the health workers, and the OPM team share this perception. Regular provision of hard copies of findings would likely stimulate use of the data, and in turn promote improvement in data quality.

3.5 Findings from the data verification exercise

The data verification exercise provides evidence of the extent of mistakes introduced during data collection, transfer and entry in a selected number of facilities. It is therefore complementary to the analysis of inputs and processes described in previous sections, which focus on the possible reasons for threats to data quality. As was the case for all fieldwork-based activities for this study, the verification took place in nine facilities in three selected LGAs in Sokoto. One facility was visited to pretest the tools. This facility is included in the analysis of admissions presented in the following section, but excluded from all subsequent analysis of the verification data, as protocols for capturing exits and RUTF were slightly modified following the pre-test and data collected were not comparable.

Summary findings from the verification conducted in selected facilities in Sokoto

Accuracy is given an overall negative rating because of the extent of discrepancies between recounted admission, exit and RUTF numbers from OTP cards and the data reported through the CMAM system.

This said, accuracy of entry into the spreadsheets from LGA-level reports is good, and the verification found no discrepancies between RUTF handed out to caregivers and RUTF recorded on ration cards and OTP cards.

Recommendations on improved processes and inputs to increase accuracy were provided in the previous sections

3.5.1 Recount of admissions

Admissions April to June 2017

The number of new admissions of children 6-59 months was recounted based on OTP cards at the above selected facilities over the months of April to June 2017, i.e. covering 13 weeks from calendar week 14 to week 26. Recounted numbers have been compared to the admissions register, weekly tally and the weekly SMS data reported for each facility. The aim is to assess accuracy of records in the selected facilities and months and the quality of record-keeping. Differences can point to evidence that OTP cards in facilities are not consistently kept and may have disappeared between the date they were issued and the day the verification took place.

Some weekly tallies were missing. An assumption that the weekly SMS data is equivalent to the weekly tally has been taken for those facilities where the weekly tallies could not be found. A total of 1,111 OTP cards were recounted covering 130 weeks of CMAM treatment (for all the visited facilities).

The recounted weekly number of new admissions from the OTP cards was matching the reported number in the weekly tally in only 27% of the weeks reviewed. Of the 73% of the weeks where the recounted number did not match the weekly tally, the difference exceeded 5 children in 11 weeks (see Table 1). In some cases, the weekly tally of newly admitted children did not match the admission register. For weeks where zero cards were recounted, it is likely that the difference is due to OTP cards going missing. There are, however, also cases where the recount is closer to the records provided by the admission register, which points towards inaccuracies in the weekly tallies.

Table 1: Weeks in which the weekly tally exceeds the recounted cards by 5 children or more

LGA	Facility	Week Number	Weekly Tally	Register	Recounted cards	Difference (Tally - Recounts)	Difference (Register - Recounts)
1	A	22	19	15	12	7	3
1	B	18	12	6	6	6	0
1	C	17	8	8	0	8	8
1	C	20	11	11	0	11	11
1	C	24	16	16	9	7	7
2	B	16	12	6	4	8	2
2	C	24	18	N/A	9	9	N/A
3	A	19	15	17	6	9	11
3	A	20	15	15	5	10	10

LGA	Facility	Week Number	Weekly Tally	Register	Recounted cards	Difference (Tally - Recounts)	Difference (Register - Recounts)
3	A	21	17	16	0	17	16
3	A	25	13	N/A	5	8	N/A

Note: N/A: Complete set of CMAM admission registers not available to OPM team

Table 2 shows total admissions (new admissions and transfers) for the three months from April to June 2017 from the weekly tallies, SMS data, and recounts of OTP cards by the OPM team during visits. Differences between tallies and recounts exceeded 10% of the figures provided by the weekly tally in half of the visited facilities. In the remainder of the facilities, discrepancies were between 6%-9%. Differences were particularly large in facilities 1C and 3A. Except for facilities 2A and 3B, admission numbers reported by the facilities through weekly tallies were higher than those recounted by the OPM team. Across all the facilities visited, this difference amounts to 173 admissions.

The comparison between weekly tallies and the SMS data also indicates that these two data sources do not always match perfectly. These cases are further explored in the following table.

Table 2: Total admissions, April – June 2017

LGA/Facility	Total Weekly tally	Total SMS data	Total recounted OTP cards	Difference (Weekly tally -SMS)	Difference (Weekly tally – recount)	Difference recounted in % of weekly tally
LGA1	**457**	**464**	**377**	**-7**	**80**	**18%**
A	253	260	231	-7	22	9%
B	106	106	96	0	10	9%
C	98	98	50	0	48	49%
LGA2	**427**	**426**	**373**	**1**	**54**	**13%**
A	85	85	90	0	-5	-6%
B	101	99	77	2	24	24%
C	132	132	103	0	29	22%
D	109	110	103	-1	6	6%
LGA3	**400**	**384**	**361**	**16**	**39**	**10%**
A	132	116	82	16	50	38%
B	107	108	128	-1	-21	-20%
C	161	160	151	1	10	6%
Grand Total	**1,284**	**1,274**	**1,111**	**10**	**173**	**13%**

Notes: differences of >=10% and <20% are highlighted in yellow; differences of >=20% are highlighted in red.

Overall, in 16% of the weeks reviewed, data in the weekly tally differs from that reported in the SMS system, indicating errors when SMS are keyed if we assume that the weekly tally is the source data used. In about half of the cases, the weekly tally numbers are larger than the SMS data numbers. Weeks and facilities with differences are shown in Table 3.

Table 3: Difference between weekly tally and SMS data: Admissions April – June 2016

LGA	Facility	Week Number	Weekly tally	SMS data	Difference (Weekly tally - SMS)
1	A	25	23	30	-7
2	B	15	6	12	-6
2	B	19	7	8	-1
2	B	16	12	6	6
2	B	17	9	6	3
2	D	22	11	12	-1
3	A	16	7	13	-6
3	A	17	4	15	-11
3	A	18	12	13	-1
3	A	14	7	0*	7
3	A	15	8	6	2
3	A	20	15	9	6
3	A	21	17	7	10
3	A	22	10	7	3
3	A	23	6	0*	6
3	B	19	13	15	-2
3	B	21	7	10	-3
3	B	20	9	5	4
3	C	25	14	15	-1
3	C	15	14	13	1
3	C	23	16	15	1

Note: *no reporting for these weeks in the SMS system

3.5.1.1 Admissions in July 2017

The recount of OTP cards for April, May and June 2017 considered all OTP cards with first visits during those months, without distinguishing by admission criteria. A series of more in-depth recounts was performed for July 2017. Children 6-59 months old are admitted into the CMAM program from either the community or self-referrals, from outpatient care (other centre) and from inpatient care (inpatient). OTP cards for children admitted were recounted in 10 facilities (including facility 2C where the pre-test took place) and analysed for four weeks (week 27 to week 30) in July 2017, disaggregated according to admission categories listed above. A total of 542 admissions were recounted. In approximately one third of the cards (31%), the admission category was not recorded and could therefore not be identified by the OPM team as either new admissions or transfers.

The comparison of the total number of recounted admissions with those reported in the weekly tally and SMS system is shown in Table 4. In half of the visited OTPs, differences between the weekly tally and recounted admission OTP cards exceeded 10% of the number of children admitted according to the weekly tally. As with the recounts for April, May and June, large discrepancies were observed in facilities 1C and 3B. Facilities with relatively consistent reporting in both recounts included 2A, 2D, and 3C.

It is also worth noting that in some facilities, such as 1A, not all children in the admission register were transferred to the weekly tally and in a few cases such as facility 2B, the number of children

admitted in the weekly tally is higher than that in the admission register. The difference between the SMS and weekly tally in facility 1A is likely due to a data entry error when sending the SMS, where in week 28 new admissions were recorded as 0.1 in the SMS system instead of 10.

Table 4: Total admissions from weekly tally, register, SMS data, and recount; July 2017 (weeks 27-30)

LGA/Facility	Total Weekly tally	Total Register	Total SMS	Total recount	Diff. (Tally - recounted cards)	Diff. in % of tally	Difference (Tally - Register)	Difference (Weekly tally - SMS)
LGA1	**211**	**219**	**201.1**	**144**	**67**	32%	**-8**	**9.9**
A	129	139	119.1	88	41	32%	-10	9.9
B	37	39	37	33	4	11%	-2	0
C	45	41	45	23	22	49%	4	0
LGA2	**273**	**282**	**273**	**264**	**9**	3%	**-9**	**0**
A	64	64	64	61	3	5%	0	0
B	54	46	54	48	6	11%	8	0
C	90	100	90	90	0	0%	-10	0
D	65	72	65	65	0	0%	-7	0
LGA3	**156**	N/A	**157**	**134**	**22**	14%	N/A	**-1**
A	63	N/A	63	62	1	2%	N/A	0
B	41	N/A	42	21	20	49%	N/A	-1
C	52	52	52	51	1	2%	0	0
Grand Total	**640**	N/A	**631.1**	**542**	**98**	15%	N/A	**8.9**

Notes: differences of >=10% and <20% are highlighted in yellow; differences of >=20% are highlighted in red; N/A: Complete CMAM admission register not available to OPM team.

In two of the three LGAs visited, forms showing facility data aggregated by LNFPs at the LGA level, for transfer for data entry to the state, were also scanned. These were analysed in comparison with the weekly tallies collected at health facilities, as well as the facility-level data in the datafile from the paper-based system and the recounts from OTP cards performed during the OPM visit to facilities. This allows to assess whether any discrepancies are introduced once data are aggregated in LGA offices, or entered into the spreadsheets at the level of the state.[39]

The findings show that except for the case of facility 2B, LGA reports and the paper-based data are consistent, which indicates that data entry at state-level was performed correctly for the facilities analysed. In two facilities, discrepancies between the weekly tallies and the LGA reports were observed, which carried over into the paper-based datafile. Differences between the weekly tally and the recount by the OPM team are in line with results discussed for Table 4.

Table 5: Total admissions from weekly tally, LGA report, paper-based data, and recount; July 2017

LGA/Facility	Weekly tally	LGA report	Paper data	Recounted	Diff (weekly tally-LGA report)	Diff (LGA report - paper)	Diff (weekly tally-paper)	Diff (weekly tally-recounted)

[39] In order to achieve comparability with the monthly paper-based data, weekly tallies and recounts were aggregated to calendar months accounting for the timing of the OTP day of visited, which is why some of the figures in Table 5 differ from the figures in Table 4, which considered specific calendar weeks.

LGA1	**211**	**N/A**	**113**	**144**	**N/A**	**N/A**	**98**	**67**
A	129	N/A	47	88	N/A	N/A	82	41
B	37	N/A	28	33	N/A	N/A	9	4
C	45	N/A	38	23	N/A	N/A	7	22
LGA2	**197**	**169**	**163**	**187**	**28**	**6**	**34**	**10**
A	64	64	64	61	0	0	0	3
B	54	54	48	48	0	6	6	6
D	79	51	51	78	28	0	28	1
LGA3	**178**	**183**	**183**	**155**	**-5**	**0**	**-5**	**23**
A	63	63	63	62	0	0	0	1
B	41	46	46	21	-5	0	-5	20
C	74	74	74	72	0	0	0	2
Grand Total	**586**	**N/A**	**459**	**486**	**N/A**	**N/A**	**127**	**100**

Note: summation is by calendar year, so 2D and 3C summations include the last week of July 2017.

3.5.2 Exits based on OTP cards

Exits July 2017

The objective of recounting OTP cards for children who exited the CMAM program in July 2017 was to assess any discrepancies in the disaggregation of children who exited the programme as presented in the CMAM records of the SMS and paper systems. The exercise took place in the 9 facilities visited within in the three LGAs as described in the section about recounting admissions. The period covered by the analysis corresponds to the four calendar weeks 27 to 30. As a result, there are 36 weeks under study in this subsection of the report in which 327 OTP cards were recounted as discharges.

Exits are categorized in the CMAM monitoring system as either recovered, dead, defaulted, non-recovered or transferred to inpatient care. Overall, for 64% of cards recounted the outcome category was not filled in in the OTP card and could therefore not be recounted as foreseen by the team's initial fieldwork protocol. One option was to only provide an aggregate analysis across all exits. The team attempted to improve on this option by considering additional information on the cards – MUAC, weight and RUTF – to determine a "likely" discharge reason. Results from the analysis have to therefore be considered keeping these challenges in mind. Using this approach, children were categorised as "assumed recovered" in 42% of the cards recounted. The OPM team classified these as likely recovered since they appeared to meet most of the recovery criteria. Furthermore, children were classified as "assumed defaulters" for 19% of the recounted OTP cards. For 3% of the OTP cards recounted, it was not possible to decide on a most likely discharge reason. This raises a question as to how facilities disaggregate, tally and report the number of children discharged if some of the discharge information is not completely filled on the OTP cards. It also highlights the challenges to this and future verification exercises.

Table 6 shows and compares the total recounted number of children who exited by facility (without distinguishing by exit reason) to that reported in the weekly tally and SMS data. Except for facilities 2D, 3B and 3C, the recounted number of children was always below the reported number of children. The table also illustrates that there are some discrepancies between paper weekly tallies and the SMS data.

Table 6: Total exits July 2017 (weeks 27 to 30)

LGA/Facility	Total weekly tally	Total SMS data	Total recounted OTP Cards	Difference (Weekly tally - SMS)	Difference (Weekly tally - Recounted cards)	Diff. based on recount in % of weekly tally
LGA1	**163**	**155**	**98**	**8**	**65**	**40%**
A	83	83	54	0	29	35%
B	33	31	28	2	5	15%
C	47	41	16	6	31	66%
LGA2	**112**	**119**	**106**	**-7**	**6**	**5%**
A	26	28	21	-2	5	19%
B	37	37	31	0	6	16%
D	49	54	54	-5	-5	-10%
LGA3	**168**	**169**	**123**	**-1**	**45**	**27%**
A	80	79	27	1	53	66%
B	40	42	46	-2	-6	-15%
C	48	48	50	0	-2	-4%
Grand Total	**443**	**443**	**327**	**0**	**116**	**26%**

Notes: differences of >=10% and <20% are highlighted in yellow; differences of >=20% are highlighted in red.

Similarly to the admissions analysis, the team also collected records from LGA offices showing aggregations of facility-level data on exits from the programme for the LGA. Table 7 compares LGA reports for the calendar month of July 2017 with weekly tallies, paper-based data and verification recounts from OTP cards. The records from the LGA reports were all consistently entered into the spreadsheets for the paper-based system, but some small discrepancies were found between weekly tallies and LGA reports. The differences with respect to OTP cards recounted reflect the discussion for Table 6.

Table 7: Total exits from weekly tally, LGA report, paper-based data, and recount; July 2017 (calendar month)

LGA/Facility	Weekly tally	LGA report	Paper data	Recounted	Diff (weekly tally- LGA report)	Diff (LGA report- paper	Diff (weekly tally- paper)	Diff (weekly tally- recounted)
LGA1	**163**	**N/A**	**169**	**98**	**N/A**	**N/A**	**-6**	**65**
A	83	N/A	84	54	N/A	N/A	-1	29
B	33	N/A	38	28	N/A	N/A	-5	5
C	47	N/A	47	16	N/A	N/A	0	31
LGA2	**128**	**136**	**136**	**119**	**-8**	**0**	**-8**	**9**
A	26	26	26	21	0	0	0	5
B	37	37	37	31	0	0	0	6
D	65	73	73	67	-8	0	-8	-2
LGA3	**181**	**183**	**183**	**135**	**-2**	**0**	**-2**	**46**
A	80	82	82	27	-2	0	-2	53
B	40	40	40	46	0	0	0	-6
C	61	61	61	62	0	0	0	-1

Grand Total	**472**	**N/A**	**488**	**352**	**N/A**	**N/A**	**-16**	**120**

Note: summation is by calendar year, so summations for facilities 2D and 3C include the last week of July 2017.

Table 8 compares numbers of defaulters recorded in weekly tallies, the SMS data, and recounts. As explained above, the OPM team had to make assumptions when allocating cases to an "assumed defaulter" category when information on treatment outcome was missing on the OTP card. The figures suggest that reported figures through the CMAM information system may underestimate the number of children who defaulted, with consequences for the accuracy of default rates as well as other performance indicators.

Table 8: Weekly tally number defaulters vs recounted assumed number of defaulters, July 2017 (weeks 27-30)

LGA/Facility	Defaulters, weekly tally	Defaulters, SMS	Recounted defaulters	Recounted assumed defaulters	Difference (Weekly tally - Recounted (defaulters + assumed defaulters))	Diff. in % of tally
LGA1	**4**	**4**	**0**	**8**	**-4**	**-100%**
A	2	2	0	2	0	
B	0	0	0	5	-5	
C	2	2	0	1	1	
LGA2	**4**	**4**	**5**	**26**	**-27**	**-675%**
A	0	0	0	0	0	
B	3	3	0	26	-23	
D	1	1	5	0	-4	
LGA3	**13**	**13**	**0**	**28**	**-15**	**-115%**
A	13	13	0	6	7	
B	0	0	0	22	-22	
C	0	0	0	0	0	
Grand Total	**21**	**21**	**5**	**62**	**-46**	**-219%**

Notes: differences of >=10% and <20% are highlighted in yellow; differences of >=20% are highlighted in red.

Given the challenges the team faced when attempting to tally the disaggregated discharge reasons, the number of "assumed defaulters" in the verification recount by the OPM team may be overstated, if children are in fact deceased, rather than defaulters, as these two categories cannot be distinguished from OTP cards where discharge reasons were left blank. Table 9 provides a similar analysis as above, but aggregating deaths and defaulters both for the weekly tallies and the recounts. A similar picture emerges regarding the likely under-reporting of either defaulting or deaths, highlighting the importance of a) an effective community volunteer system to track cases of children with longer absences, and b) the importance of recording outcomes where known. Otherwise, rates calculated for the different exit categories (cured, death, defaulting rates) are likely to be inaccurate. Using the total number of exits shown in Table 6 for calendar weeks 27-30, the percentage of deaths or defaulters based on the CMAM system would be 6.5% of all exits, compared to 22% based on the recount. The difference is due to the larger number of defaulters/deaths in the recount, as well as the lower number of total exits in the recount. This calculation should be seen as indicative only, given that it relates to one month's worth of data in 9 facilities in one state, and considering the challenges encountered by the OPM team during data verification in terms of identifying exits by category.

Table 9: Tallies of defaulters or dead vs. recounts of defaulters or dead (weeks 27-30)

LGA/Facility	Defaulters and dead, Weekly tally (1)	Defaulters, assumed defaulters and dead, Recounted (2)	Difference (Weekly tally - Recounts) (3)	Difference in % of column (1)
LGA1	**11**	**13**	**-2**	**-18%**
A	7	7	0	
B	0	5	-5	
C	4	1	3	
LGA2	**5**	**31**	**-26**	**-520%**
A	0	0	0	
B	4	26	-22	
D	1	5	-4	
LGA3	**13**	**28**	**-15**	**-115%**
A	13	6	7	
B	0	22	-22	
C	0	0	0	
Grand Total	**29**	**72**	**-43**	**-148%**

3.5.3 RUTF consumption and utilization

RUTF consumption July 2017

Weekly RUTF utilization during the month of July 2017 was recounted from OTP cards for all weeks reviewed in all 9 facilities. These numbers are then compared to those reported in the tally provided by the CMAM stock card/OTP weekly statistics form and the SMS data. In facility 1A, the RUTF stock card including weeks 29 and 30 was not available and the card including week 27 was not available for facility 1B. For these weeks, it was assumed that the stock card figure is equal to the figure reported in the SMS data. Table 10 shows that the recount of RUTF cartons consumed during July 2017 was below the stock card tally in all facilities except for facility 2D. This may imply that facilities report fewer RUTF sachets compared to what they actually give out, and/or that CMAM in-charges face problems tallying RUTF consumption correctly from the OTP cards, a challenge observed during the visits. Another explanation is that some of the OTP cards of children treated in July 2017 were lost.

Table 10: Total RUTF utilisation July 2017 (weeks 27-30)

LGA/Facility	Weekly tally/stock card RUTF cartons Utilised	SMS data RUTF Cartons consumed	Recounted RUTF Cartons from OTP cards	Difference (Weekly Tally – SMS data)	Difference (Weekly Tally – Recounted RUTF Cartons)	Difference Tally-recount in % of tally
LGA1	**115**	**115**	**85**	**0**	**30**	**26%**
A	56	56	50	0	6	11%
B	27	27	18	0	9	33%
C	32	32	17	0	15	47%
LGA2	**86**	**86**	**72**	**0**	**15**	**17%**
A	31	31	28	0	3	10%
B	27	27	13	0	14	52%
D	29	29	31	0	-3	-10%
LGA3	**124**	**123**	**91**	**1**	**32**	**26%**
A	41	40	25	1	16	39%
B	37	37	22	0	15	41%
C	46	46	44	0	1	2%
Grand Total	**325**	**324**	**248**	**1**	**77**	**24%**

Notes: differences of >=10% and <20% are highlighted in yellow; differences of >=20% are highlighted in red.

LGA-level reports with aggregated data on RUTF consumption for the calendar month of July 2017 were only retrieved for LGA3. As for admissions and exit data, the data summarised in Table 11 suggests that entry of data from the LGA reports into spreadsheets is implemented without mistake. Some differences are found for the transfer of data from the tally/stock card to the LGA report.

Table 11: RUTF consumed, LGA3 (July 2017)

LGA/Facility	Tally/Stock card	LGA report	Paper data	Recounted	Diff (stock card - paper data)	Diff (stock card- recounted)
LGA3	**138**	**141**	**141**	**104**	**-3**	**34**

A	41	38	38	25	3	16
B	37	41	41	22	-4	15
C	60	62	62	58	-2	2

Note: Facility 3C includes last week of July 2017

The OPM team also counted RUTF stock at the beginning and end of the OTP day the facility was visited. The difference can provide another measure of RUTF consumption to be compared against the stock card, as well as the OPM team's recount of RUTF handed out based on OTP cards on that day. Findings are summarised in Table 12.

Analysis of the recounted RUTF cartons and sachets on the morning and evening of the verification day of each facility shows one case where consumption reported based on stock cards was considerably higher than consumption observed based on recounts (facility 2D), while the opposite was the case in facility 1B. There was therefore no clear pattern with respect to the direction of discrepancies on the day of the visit.

Table 12: RUTF utilisation on the verification day (November/ December 2017)

LGA	Facility	Recounted morning RUTF cartons on day of visit	Recounted evening RUTF cartons on day of visit	Expected RUTF utilised on the day (Morning - Evening)	Recounted RUFT cartons utilised on the day of visit from OTP cards	RUFT cartons Utilised on the day of visit (RUTF stock card)	Difference (stock card - Expected utilization)	Difference in % of amount on stock card	Difference (stock card – Recounted from OTP cards)	Difference in % of amount on stock card
1	A	12.2	5.1	7.1	7.2	7.1	0.0	0%	-0.1	-1%
1	B	8.4	5.4	3.1	3.4	2.6	-0.5	-19%	-0.8	-31%
1	C	5.4	2.3	3.1	3.5	3.4	0.3	9%	-0.1	-3%
2	A	7.8	2.3	5.5	5.4	5.3	-0.2	-4%	-0.1	-2%
2	B	9.0	2.5	6.5	5.9	6.4	-0.1	-2%	0.5	8%
2	D	13.0	8.3	4.7	4.0	8.9	4.2	47%	4.9	55%
3	A	7.4	1.3	6.1	3.8	6.1	0.0	0%	2.3	38%
3	B	7.0	0.8	6.2	6.0	6.0	-0.2	-3%	0.0	0%
3	C	-	-	-	7.3	7.3	-	-	0.0	0%

Notes: given the timing of the arrival of the start of the CMAM day, no stock recount was performed in C; differences of >=10% and <20% are highlighted in yellow; differences of >=20% are highlighted in red.

Finally, the number of RUTF sachets handed out to caregivers was compared against numbers recorded on OTP cards and RUTF ration cards in a subset of facilities for 5-6 children per facility. Sachets handed out and recorded on ration cards and OTP cards all matched. This could have been influenced by the presence of the OPM team, but as the caregivers were approached and asked about sachets received outside of the facility, this effect should be limited.

Table 13: Comparison of sachets handed out to caregivers and sachets recorded

Child number	Facility	Sachets received	Sachets on ration card	Sachets on OTP card
1	2C	14	14	14
2	2C	18	18	18
3	2C	14	14	14
4	2C	18	18	18
5	2C	18	18	18
6	3C	14	14	14
7	3C	7	7	7
8	3C	21	21	21
9	3C	21	21	21
10	3C	18	18	18
11	3A	18	18	18
12	3A	14	14	14
13	3A	14	14	14
14	3A	14	14	14
15	3A	22	22	22
16	3B	14	NR	14
17	3B	18	18	18
18	3B	14	14	14
19	3B	14	14	14
20	3B	21	21	21
21	2A	7	7	7
22	2A	14	14	14
23	2A	14	14	14
24	2A	18	18	18
25	2A	21	21	21
26	1C	7	7	7
27	1C	11	NR	11
28	1C	14	14	14
29	1C	18	18	18
30	1C	25	NR	25
31	1C	25	25	25
	Matching	**100%**		

Notes: NR=not recorded

3.5.4 Weeks in treatment

Weeks in treatment (disregarding periods of absences) were recorded for children who were discharged as recovered in July 2017 based on their OTP cards and for those children who likely recovered from the program as indicated by the MUAC and weight indicators on children's OTP cards. Almost half of the children (N=115, or 46%) recovered during the 8th week as shown in Figure 13, in line with the CMAM guidelines for treatment duration. Table 14 shows that, on average, children get discharged after 7 weeks of treatment, with shorter treatment periods in LGA2 than in the other two LGAs. This is driven by the average duration of only four weeks in treatment before children are discharged as recovered in facility 2B.

Figure 13: Number of weeks in treatment (for recovered and assumed recovered children)

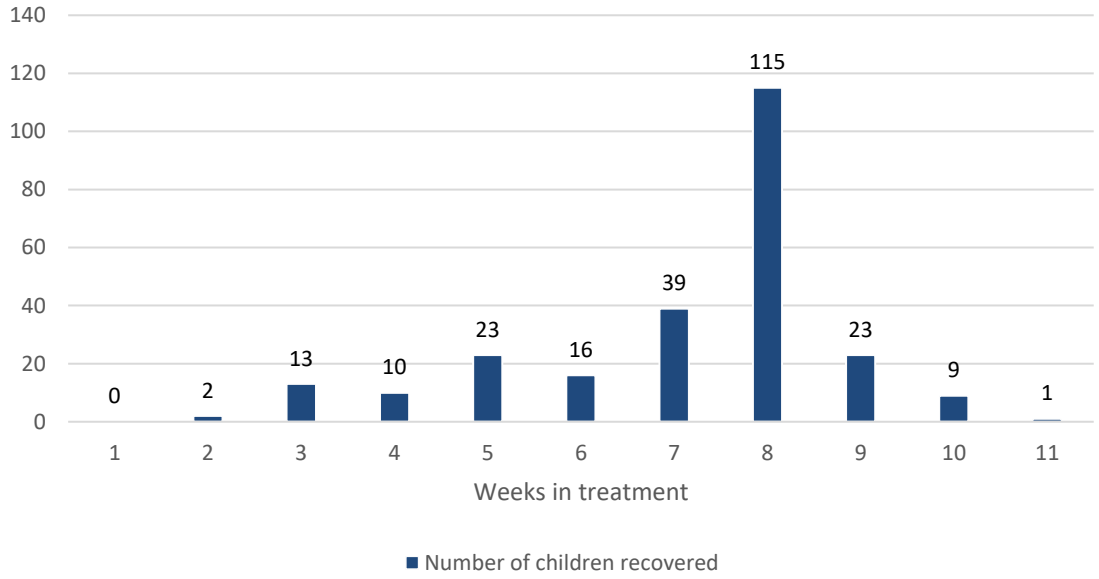


Table 14: Average number of weeks in treatment by facility and LGA

LGA/State	Average weeks in treatment
LGA1	**8**
A	7
B	7
C	8
LGA2	**6**
A	8
B	4
D	6
LGA3	**7**
A	6
B	8
C	8
Grand Total	**7**

3.6 Findings from the desk-based analysis of facility-level data

This section covers the analysis and comparison of the weekly SMS and monthly paper systems. It intends to assess quality indicators related to i) completeness with respect to completeness of facility records (weekly, monthly) as well as the number of missing observations for particular variables, ii) aspects of accuracy and reliability in terms of internal consistency checks, any outliers and other patterns looking at trends and relationships to examine consistency between performance variables and iii) timeliness.

Summary findings from desk-based analysis of facility-level data

Completeness is given an intermediate rating, because some facilities/LGAs appear to be only covered in one of the systems. Also, 7% of observations (complete weeks) were missing from the SMS data for the 30-week reference period examined. Completeness of reporting on certain variables (RUTF stocks in the SMS data and children in treatment in the paper-based data) should be further improved. The rating is not negative, as completeness of reporting achieved for other variables was good, and there were no complete months missing from the paper-based data for the 7-month period examined.

Reliability is given an intermediate rating, because inconsistencies in the variables analysed have been detected, e.g. variables for children in treatment at the end of the week/month and the beginning of the following month; or RUTF stock balance given stock at the beginning of the period, receipt and consumption. Positively, only very few outliers (implausibly high or low numbers) were found for the main indicators of interest.

Timeliness is given an intermediate rating, as more than half of the weekly reports come in late in the SMS system when using UNICEF's definition of late submission. The proportion of late reporting increases to three out of four facilities when one standardises late reporting to 2 or more days after the OTP day took place. No "date of receipt" variable is included in the data that would allow to analyse timeliness of the paper-based system.

Recommendations intended to improve completeness, reliability and timeliness
(only those not captured in previous sections on inputs and processes)

1. A listing of all facilities where CMAM is implemented, separate from the datafiles with data reported from facilities, should be developed in order to allow for analysis of coverage of the data.
2. Given the inconsistencies found in the variable capturing children in treatment at the beginning/end of the period, it is recommended that recording of children in treatment at beginning of period (week/month) should be verified at facility-level as part of the end-of-day tallying process based on child-level records rather than carried over from previous period; otherwise mistakes made in one week/month will remain in the data.
3. Standardisation of reporting for SMS and paper-based systems should be considered. This would involve using the same full calendar weeks to aggregate to months for all facilities in the paper-based system, irrespective of the timing of the OTP day. Standardised reference periods would allow for easier comparison between the two systems.

3.6.1 Coverage of available SMS and paper data, 2017

The OTP data received for 2017 for the paper-based and SMS systems are summarised in Table 15 and Table 16 respectively. Coverage in terms of facilities and LGAs is not (yet) fully identical. Bauchi included 6 additional facilities in 6 LGAs in the paper-based data (that started reporting in August 2017), which did not appear in the SMS system. Furthermore, the paper-based system also included one additional LGA in Gombe, with three facilities, and one additional LGA in Kaduna, with 7 facilities.

We also find that for one LGA in Kaduna, the SMS system provides data for four OTPs, while only one facility appears in the paper-based system – though with missing data on all CMAM indicators.

While discrepancies in terms of additional facilities in the paper-based data might be due to the fact that the SMS system has not yet been fully rolled out, reasons for additional facilities in the SMS data are less clear. A complete and up-to-date listing of all facilities where CMAM is implemented, with an indicator what system(s) facilities use for reporting, as well as other facility-level information such as size or the day of the week the OTP is held should be developed and maintained. A listing would allow to assess whether facilities are completely missing with respect to expected reporting patterns and facilitate periodic as well as ad hoc review activities such as this study.

Which data is included in the subsequent analysis is explained in the respective sub-sections. Generally data analysed covers the period January to July 2017, to avoid effects of late reporting towards the period for which data were provided.

Table 15: Paper-based number of OTPs and LGAs, January – October 2017

State	No. OTP/Paper	No. LGA/Paper
Bauchi	21	9
Gombe	18	4
Kaduna	24	8
Kano	30	6
Sokoto	46	9
Total	**139**	**36**

Note: In one LGA in Kaduna, only one OTP facility reporting, with no data on admissions, exits and RUTF.

Table 16: SMS number of OTPs and LGAs, January – November 2017

State	No. OTP/SMS	No. LGA/SMS
Bauchi	15	3
Gombe	15	3
Kaduna	20	7
Kano	30	6
Sokoto	46	9
Total	**126**	**28**

3.6.2 The weekly SMS data system

The dataset has 26 variables, all of which have been included in the study. These are id (a generic number, increasing with the number of observations, that is all weeks reported by facilities), State (CMAM State), LGA, SiteName (name of the OTP facility), SiteID (OTP unique identification number), Type (Type of the facility that is OTP or SC), Year, WeekNum (week number), reporte_date (the reporting date), AgeGroup (age group of children admitted), Beg(total number of children under treatment at the beginning of the week), Amar(weekly number of children newly admitted), Tin(weekly number of children transferred in from outpatient or inpatient care), Dcur(weekly number of children recovered), Dead(weekly number of children dead), Defu(weekly number of defaulted children), Dmed (weekly number of non-recovered children, Tout(weekly number of children transferred out to inpatient or outpatient care), End(Total number of children under treatment at the end of the week), stockcode, RUTF_beg(cartons of RUTF at the beginning of the week), RUTF_in(RUTF cartons received a week), RUTF_out(RUTF cartons signed out a week), RUTF_bal(closing stock balance of RUTF cartons at the end of the week).

Completeness, missing values and miscoding

This section assesses the completeness of the dataset in terms of coverage of all facilities and completeness of records. Missing refers to when an OTP facility failed to report in any particular variable in a given week. As a result, facilities reporting zero values are not considered as missing. Zero reporting is further analysed below. The team considered 30 weeks of reporting covering the months of January to July 2017.

Overall, there are 126 OTP facilities and **Error! Reference source not found.**6 shows the number of OTP facilities and LGAs by state.

With data analysis limited to 126 OTP health facilities and 30 weeks, there was a theoretical maximum of 3,780 observations in the dataset (30 weeks x 126 facilities). The number of actual observations in the SMS dataset was 3,509.

Completeness of weekly records

Table 17 shows that not all health facilities reported every week of the reference period, and data were missing for 7% of weeks. Of the 126 OTPs expected to report each week, on average 94% of the weeks were reported between week 1 and 14, dropping to 84% of weeks reported between week 15 and 17 on average, and increasing back to 94% from week 18 up to week 30. Kaduna state has the largest number of facilities underreporting with respect to weekly data, mainly from facilities located in LGAs 2, 3 and 6 (Table A-1 in Annex C).

Table 17: Proportion of OTP facilities reporting every week in each state

Week Number	State					Overall % reporting
	Bauchi	Gombe	Kaduna	Kano	Sokoto	
1	93%	87%	95%	90%	96%	93%
2	93%	93%	95%	90%	96%	94%
3	93%	100%	90%	93%	96%	94%
4	93%	100%	90%	90%	93%	93%
5	100%	100%	85%	93%	93%	94%

Week Number	State					Overall % reporting
	Bauchi	Gombe	Kaduna	Kano	Sokoto	
6	100%	100%	90%	93%	96%	95%
7	93%	100%	90%	93%	96%	94%
8	93%	100%	85%	93%	93%	93%
9	100%	93%	90%	93%	96%	94%
10	100%	100%	90%	93%	93%	94%
11	100%	93%	90%	97%	96%	95%
12	100%	93%	90%	97%	96%	95%
13	93%	93%	85%	97%	96%	94%
14	80%	93%	80%	100%	96%	92%
15	87%	93%	80%	63%	89%	82%
16	93%	87%	75%	63%	93%	83%
17	93%	87%	70%	83%	96%	87%
18	93%	87%	90%	97%	98%	94%
19	93%	87%	80%	97%	98%	93%
20	100%	87%	80%	100%	98%	94%
21	100%	87%	80%	97%	98%	94%
22	100%	87%	80%	100%	98%	94%
23	100%	87%	80%	97%	93%	92%
24	100%	93%	85%	100%	96%	95%
25	100%	87%	85%	100%	96%	94%
26	93%	80%	85%	100%	96%	93%
27	93%	80%	85%	100%	96%	93%
28	100%	80%	80%	100%	96%	93%
29	100%	87%	85%	100%	93%	94%
30	100%	87%	85%	100%	96%	94%
Total	**96%**	**91%**	**85%**	**94%**	**95%**	**93%**

Notes: Population corresponds to all weeks with expected reporting by OTPs in Bauchi, Gombe, Kano, Kaduna, and Sokoto.

Missing values in specific variables

Missing values in specific variables only affect a very small percentage of observations, e.g. key reporting variables (admission, discharges/exits) are missing for 6 weeks (0.1%). Weeks with missing key reporting variables were dropped from the data. Furthermore, there are 206 weeks (5.9%) with no RUTF stock reported at the beginning of the week, 34 weeks (1%) where no RUTF receipt is reported and 34 weeks (1%) for which RUTF consumption is missing. Week 1 has the highest proportion of facilities (92%) with missing RUTF stock at the beginning of the week which may be explained as the commencement of CMAM activities and thus no RUTF stocks at facilities.

Furthermore, for 18 weeks (0.5%), no RUTF variable is reported although there were children in treatment (see Table A-2 in Annex C). The case of missing RUTF stocks is most common in facility 2A in Bauchi.

Likely data entry errors

Table A-2 in Annex C indicates that the same figure was erroneously entered for the total number of children under treatment at the beginning of the week and new admissions in facility 2A. Furthermore, there are 4 weeks (0.1%) where figures between 0 and 1 were

entered for the number of children under treatment at the beginning of the week, number of newly admitted children, number of children recovered and number of deceased children, as shown in Table 18. These show possible data entry errors and appear to be mostly driven by data submissions from facility 3C in Sokoto.

Table 18: Weeks in which facilities report the number of children between 0 and 1

State	LGA	Facility	Week Number	Total at beginning of week	New admissions	Cured	Dead
Sokoto	3	C	1				0.1
Sokoto	3	C	14			0.11	
Bauchi	1	A	26	0.144			
Sokoto	3	C	28		0.1		

In 3 weeks (0.1%), health facilities reported a negative number of children under treatment at the end of the week, due to likely data entry errors in other variables (Table A-3 in Annex C).

Overall, while the systems do not fully prevent data entry errors, only few cases seem to be affected.

Internal consistency

This section examines how consistently variables within the SMS system are calculated. The total number of children under treatment at the end of week is verified as to whether it is equal to the difference between total admissions and exits. Other variables checked for internal consistency are the total number of children at the end of the week against the total number of children at the beginning of the following week; and RUTF stock balances at the end of the week and whether these are equal to the opening RUTF balances at the beginning of the following week.

Total number of children under treatment at the end of the week (January – July 2017)

The total number of children under treatment at the end of the week was recalculated from the data by taking the difference between admissions (including transfers in) and exits (including transfers out). The variable is accurately computed by all OTP facilities within the SMS system as there were no differences identified.

For facilities that reported each week from January through to July 2017, the total number of children at the end of the week differed from the total number of children at the beginning of the following week in 28% of all weeks reported (Table 19). This was mainly driven by inconsistent records for facilities in Kaduna (45% of all inconsistencies).

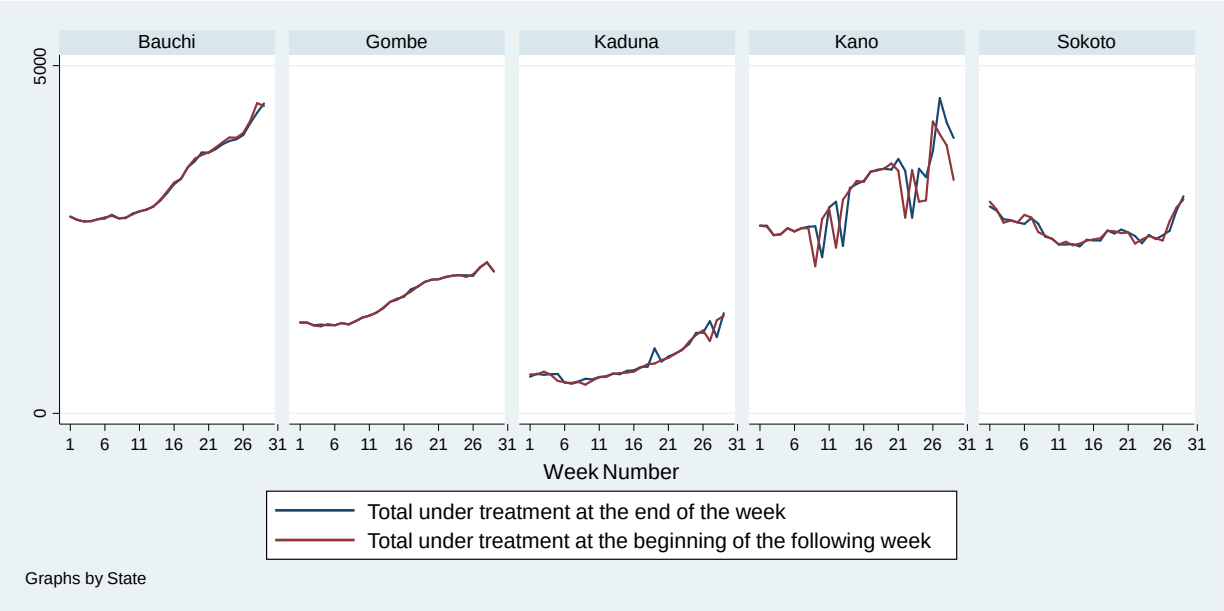
However, while discrepancies in the data are common, the absolute differences are relatively small and would change figures in most cases by only 1-2% across all weeks (see Table A-5 in Annex C and Figure 14 below).

Table 19: Proportion of OTP facilities reporting different number of children under treatment at the end and beginning of the following week

State	Total

	Bauchi	Gombe	Kaduna	Kano	Sokoto	
Total	**24%**	**13%**	**45%**	**19%**	**30%**	**28%**

Figure 14: Total under treatment at the end of the week vs total under treatment at the beginning of the following week



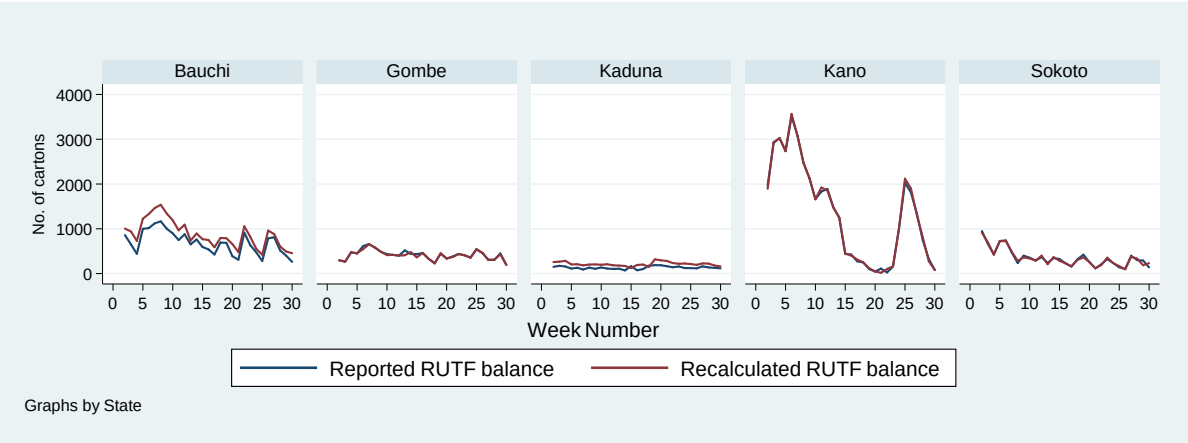
RUTF stock balance at the end of the week (January – July 2017)

Stock balances at the end of the week were not correctly calculated and reported in 54% of the weeks, with a larger proportion of discrepancies observed for Kaduna and Bauchi (Table 20 and Figure 15). These are mainly driven by discrepancies reported from LGA1 in Bauchi LGA7 in Kaduna.

Table 20: Proportion of OTP facilities reporting incorrect RUTF balances at the end of the week.

	State					% reporting incorrect RUFT balances
	Bauchi	Gombe	Kaduna	Kano	Sokoto	
Total	**63%**	**47%**	**79%**	**37%**	**55%**	**54%**

Figure 15: Reported RUTF balances vs recalculated RUTF balances per week



In this case, discrepancies were observed to be relatively large in some of the LGAs. For instance, when considering stock balances across all weeks in each of the LGAs, some recalculated end-of-period stocks were almost twice as large as the reported figures (Table 21).

Table 21: Difference in reported RUTF stock balances and the recalculated RUTF stock balances for every LGA in every state across all weeks

State	LGA	Reported RUTF balance (1)	Recalculated RUTF (2)	Difference (2-1)	Difference in % of (1)
Bauchi	1	7465	13162	5697	76%
	2	5027	5062	35	1%
	3	7424	7311	-114	-2%
Gombe	1	3220	3221	2	0%
	2	3164	3106	-58	-2%
	3	5734	5535	-199	-3%
Kaduna	1	480	508	28	6%
	2	194	377	183	94%
	3	239	471	232	97%
	4	247	248	0	0%
	5	851	1558	706	83%
	6	432	487	56	13%
	7	1402	2544	1142	81%
Kano	1	8238	8295	57	1%
	2	5688	5681	-7	0%
	3	6057	6132	75	1%
	4	8921	9025	104	1%
	5	5238	5234	-5	0%
	6	4985	4995	10	0%
Sokoto	1	1611	1263	-348	-22%

State	LGA	Reported RUTF balance (1)	Recalculated RUTF (2)	Difference (2-1)	Difference in % of (1)
	2	1501	1514	13	1%
	3	1564	1584	21	1%
	4	1590	1641	51	3%
	5	884	866	-18	-2%
	6	739	909	170	23%
	7	897	893	-4	0%
	8	377	428	51	14%
	9	1016	1028	12	1%

On the other hand, when the stock balances at the end of the week were compared with RUTF opening stocks at the beginning of the following week for all those facilities that reported every week of the reference period, 97% of the weeks were accurately calculated and reported.

Outliers (January – July 2017)

This section examines possible outlier values in selected variables. Outlier points can point towards mistakes in the data and underlying procedures, and worth further investigation, especially when overall averages or rates are strongly affected. A standard rule of values lying in and outside 1.5 times the interquartile range from the median was applied to determine possible extreme values.

New admissions

Extreme values of new admissions were reported in 0.7% of the weeks reported – a very small percentage of observations overall. The weekly median number of new admissions by state was 23 children in Bauchi, 18 in Gombe, 12 in Kaduna, 28 in Kano and 9 in Sokoto. Figure 16 shows that some facilities within states reported a considerably higher number of admissions compared to the state average in a given week - for example, in Bauchi, three facilities reported over 200 new admissions compared to the average of 23. In Kaduna, two facilities reported over 180 new admissions as compared to the state average of 12 while in Kano, two facilities reported over 300 admissions compared to the state average of 28.

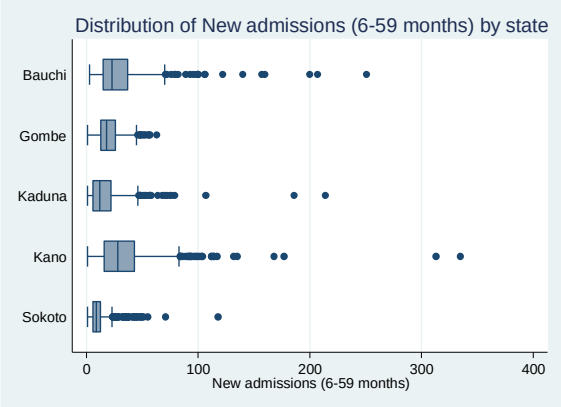


Figure 16: Distribution of new admissions by state

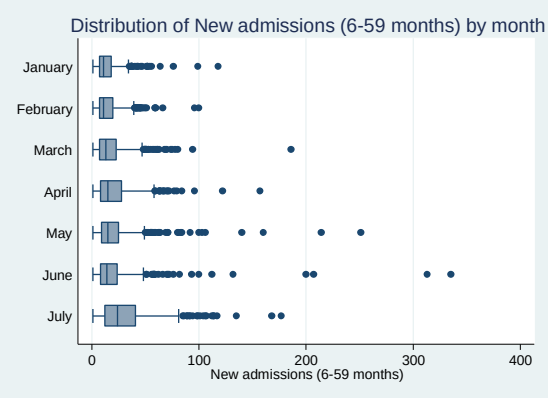


Figure 17: Distribution of new admissions by month

Figure 18 presents the weekly patterns for selected facilities with outlier values, indicating clear spikes for some of the facilities, which are not in line with the general trends.

Figure 18: Weekly trends for selected facilities with outliers in the variable of new admissions of children aged 6-59 months

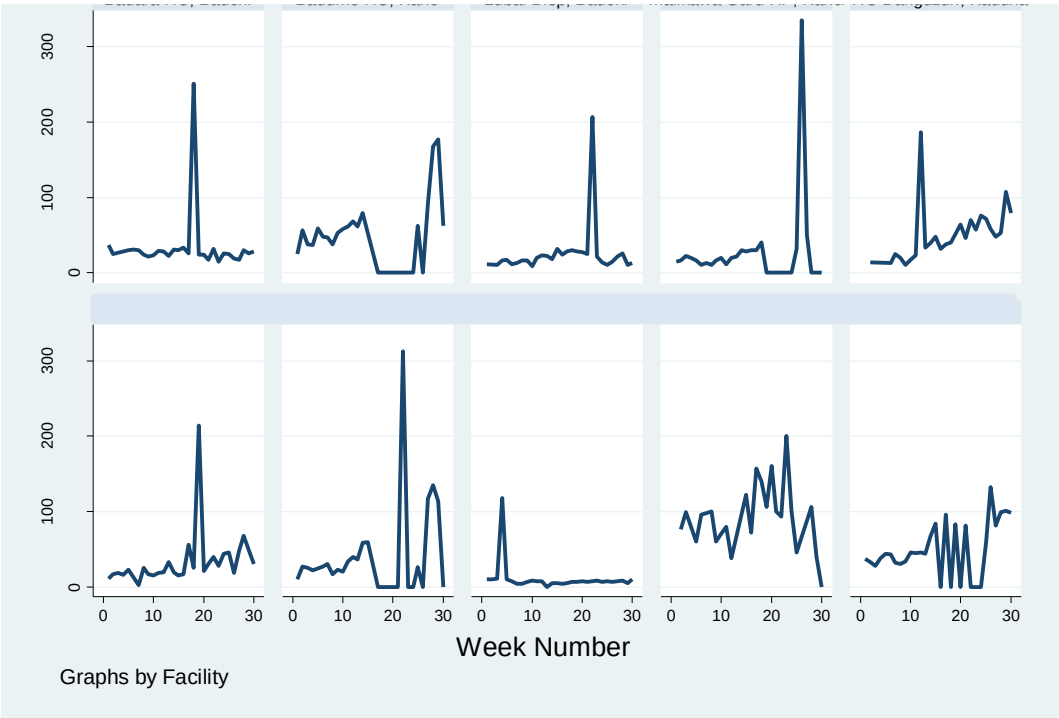


Table 22 shows mean and median values of new admissions by state, including and excluding the outlier observations. The outliers have no impact on the median and limited impact on the mean. This said, facility-level averages will be affected.

Table 22: Mean and median values of new admissions (6-59 months), with and without outliers

State	With outliers	Without outliers

	Median	Mean	Min	Max	Median	Mean	Min	Max	% change in median	% change in mean
Bauchi	23	30.1	3	251	23	27.6	3	106	0%	-8%
Gombe	18	20.5	1	63	18	20.5	1	63	0%	0%
Kaduna	12	17.0	1	214	12	16.2	1	107	0%	-5%
Kano	28	34.2	1	335	28	31.7	1	104	0%	-7%
Sokoto	9	10.3	1	118	9	10.2	1	71	0%	-1%
Total	**14**	**19.9**	**1**	**335**	**14**	**18.9**	**1**	**107**	**0%**	**-5%**

Recovered children

On average, 11 children per facility recovered weekly across the five states. With the same rule of identifying outliers as with new admissions, relatively high recovery numbers were reported in 1.1% of the weeks reported. However, weekly trends of these facilities show week to week fluctuations in the number of children recovered as opposed to extreme values except for two facilities where numbers go from 0 children recovered to over 100 and 50 respectively in week 13 and then drop to zero between week 17 and 25. It seems as if these two facilities were not operating CMAM services in those weeks.

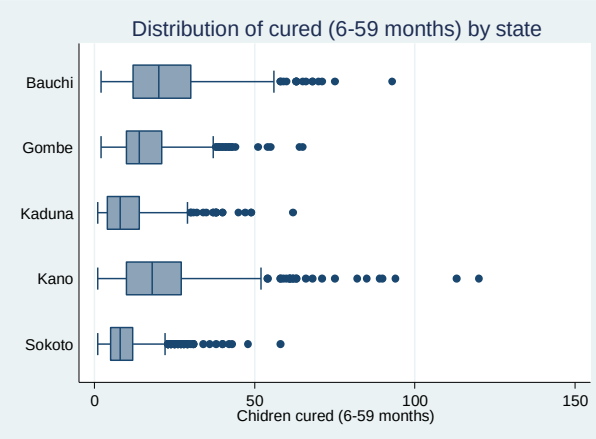


Figure 19: Distribution of the weekly number of children recovered by state

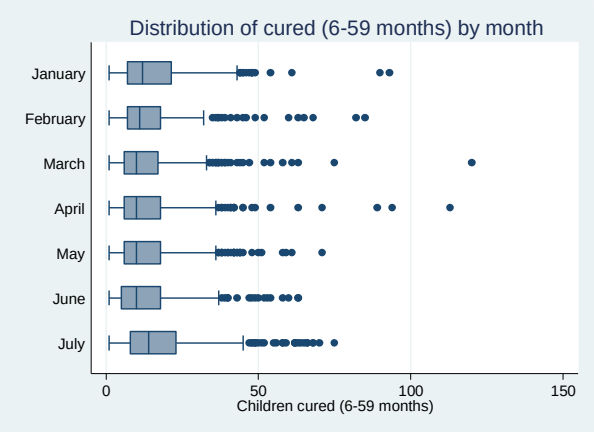
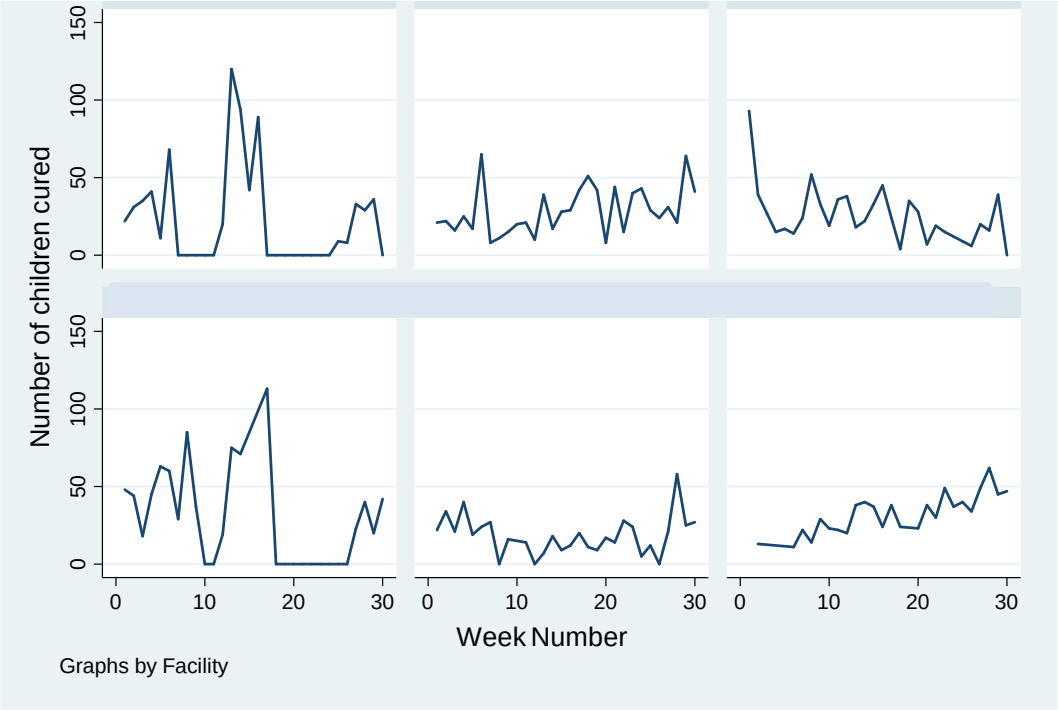


Figure 20: Distribution of the weekly number of children recovered by month

Figure 21: Weekly trends of selected facilities with outliers in the number of children recovered



Similarly to admissions, the outliers do not affect much conclusions based on medians across states and there are only small changes to the means (Table 23).

Table 23: Mean and median values of recovered children, with and without outliers

State	With outliers				Without outliers				% change in median	% change in mean
	Median	Mean	Min	Max	Median	Mean	Min	Max		
Bauchi	20	22.6	2	93	20	21.2	2	60	0%	-6%
Gombe	14	16.5	2	65	14	16.3	2	55	0%	-1%
Kaduna	8	10.4	1	62	8	10.3	1	49	0%	-1%
Kano	18	20.9	1	120	17	19.1	1	60	-6%	-9%
Sokoto	8	9.5	1	58	8	9.5	1	58	0%	0%
Total	**11**	**14.5**	**1**	**120**	**11**	**13.9**	**1**	**60**	**0%**	**-4%**

RUTF Stock

The monthly average RUTF stock per facility is 13 cartons across the five states. For 0.9% of the weeks, 200 RUTF cartons and above were reported, mainly in Kano state. Some facilities report RUTF stocks considerably above their respective states averages. For example in January, two facilities in Kano report over 300 RUTF cartons as compared to the state average of 50 cartons. Other facilities also report RUTF stocks considerably above monthly averages. The weekly trends of selected facilities with a number of RUTF cartons that exceeds state average are presented in Figure 24. For facilities in Kano, outlier values correspond to opening stocks that were supplied to these facilities in the early weeks of CMAM services. Between weeks 18 and 25, some of these facilities seem to be closed as

they report zero RUTF stocks. Analysis also shows that during these weeks of zero RUTF stocks, there were no new admissions and discharges reported.

Figure 22: Distribution of weekly RUTF stocks by state

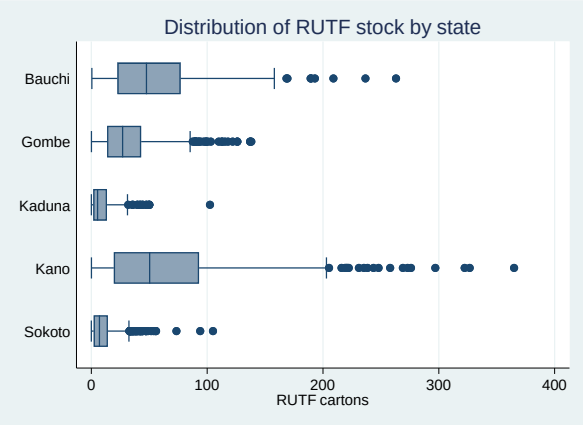


Figure 23: Distribution of RUTF stocks by month

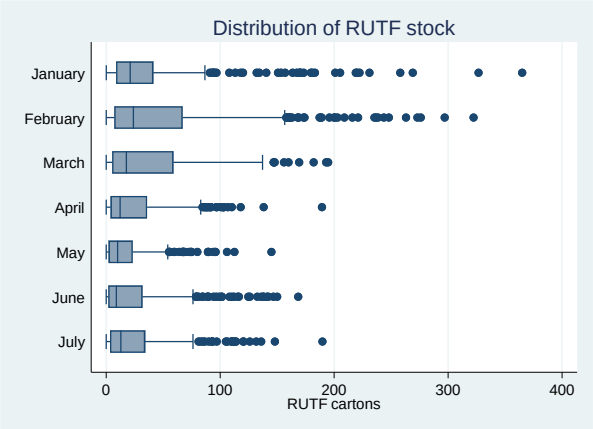
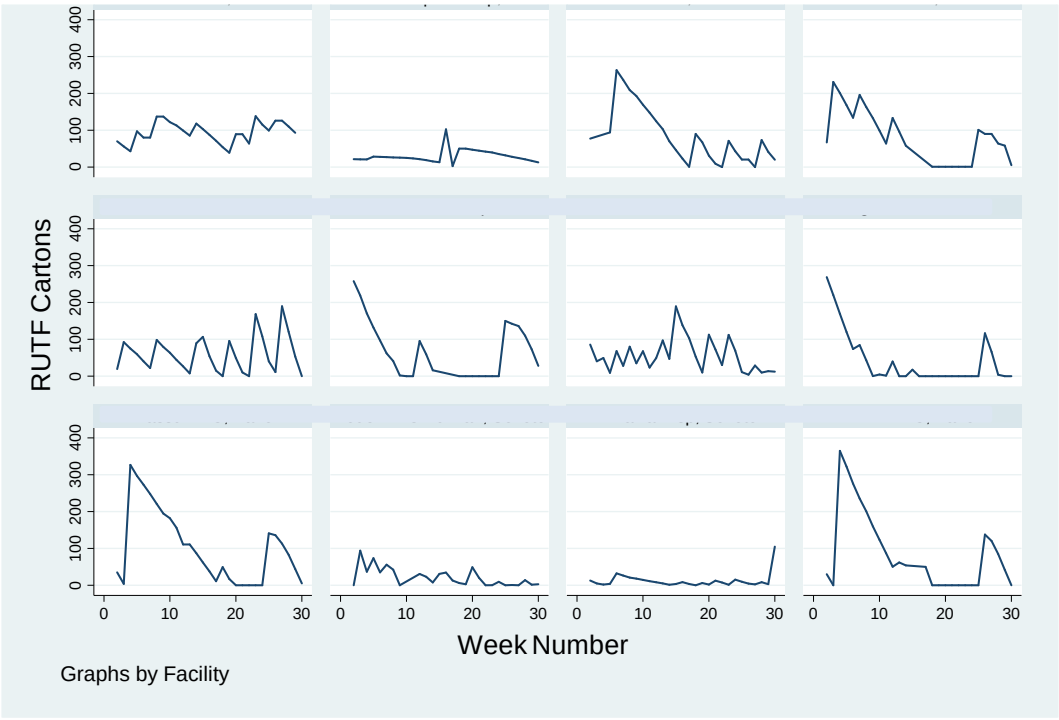


Figure 24: Weekly trends of selected facilities with outliers in the RUTF stock variable



In the case of RUTF consumption, excluding the outliers again has a limited effect on average values by state, except for Kano where mean RUTF would be around 10% lower than reported (Table 24).

Table 24: Mean and median values of RUTF consumption, with and without outliers

State	With outliers	Without outliers

	Median	Mean	Min	Max	Median	Mean	Min	Max	% change in median	% change in mean
Bauchi	47.6	54.5	0.5	263.1	47.0	53.1	0.5	193.0	-1%	-3%
Gombe	27.0	32.3	0.1	138.1	27.0	32.3	0.1	138.1	0%	0%
Kaduna	5.4	9.2	0.0	102.4	5.4	9.2	0.0	102.4	0%	0%
Kano	50.3	65.6	0.1	365.0	49.2	58.9	0.1	199.9	-2%	-10%
Sokoto	7.0	10.2	0.0	105.0	7.0	10.2	0.0	105.0	0%	0%
Total	**14.5**	**30.8**	**0.0**	**365.0**	**14.3**	**28.9**	**0.0**	**199.9**	**-2%**	**-6%**

Reporting of zeros

This section examines the number of weeks in which key variables were reported as zero.

In 388 (11%) of the weeks analysed, health facilities reported zero admissions of children age 6-59 months. Zero admissions mainly occurred in Kano state and these were clustered in the months of May and June. Also, Table 25 shows that between week 17 and 24, over half of the health facilities in Kano, were reporting zero new admissions.

Figure 25: No. of weekly records with zero new admissions of children 6-59 months old, by states

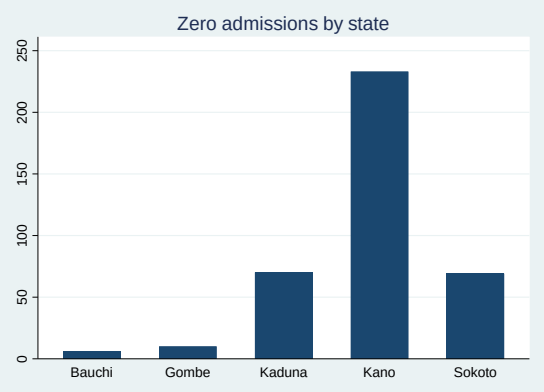


Figure 26: Number of weekly records with zero admissions of children 6-59 months old, by month

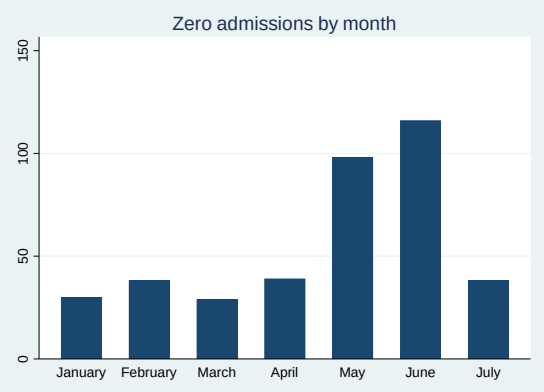


Table 25: Proportion of OTP facilities reporting zero new admissions of children 6-59 months old for every week in each state

Week Number	State					%
	Bauchi	Gombe	Kaduna	Kano	Sokoto	
1	0%	0%	42%	0%	7%	9%
2	0%	0%	26%	0%	0%	4%
3	0%	0%	22%	7%	2%	6%
4	0%	0%	22%	4%	5%	6%
5	0%	0%	24%	0%	0%	3%
6	0%	7%	17%	0%	5%	5%
7	0%	7%	11%	0%	7%	5%
8	0%	13%	6%	4%	42%	19%
9	0%	0%	6%	4%	9%	5%
10	0%	0%	6%	7%	5%	4%
11	0%	0%	17%	0%	2%	3%
12	0%	0%	17%	0%	5%	4%
13	0%	0%	24%	7%	7%	8%
14	0%	0%	13%	0%	2%	3%
15	0%	0%	13%	16%	2%	6%
16	0%	8%	13%	42%	2%	12%
17	0%	0%	21%	52%	5%	16%
18	0%	8%	17%	52%	7%	18%
19	0%	0%	13%	55%	0%	15%
20	0%	8%	6%	87%	2%	24%
21	7%	0%	6%	90%	2%	25%
22	0%	0%	6%	93%	4%	26%
23	0%	8%	6%	90%	5%	26%
24	0%	0%	6%	73%	0%	19%
25	7%	0%	6%	13%	0%	5%
26	7%	17%	6%	33%	27%	22%
27	0%	0%	12%	3%	0%	3%
28	0%	0%	6%	3%	0%	2%
29	0%	0%	12%	23%	0%	8%
30	20%	0%	6%	60%	5%	20%
Total	**1%**	**2%**	**14%**	**28%**	**5%**	**11%**

An analysis of the reported number of zero children recovered per week shows similar findings. The number of children recovered was reported as zero in 464 weeks (13%), 57% of which originate from facilities in Kano. As with new admissions, a majority of these cases occurred in May and June when more than half of the health facilities in Kano reported zero number of children recovered (mainly between weeks 20 and 26). Similar trends are observed for zero RUTF stocks reported. Table 26 further confirms that Kano state has the highest number of health facilities reporting zeros in the three variables.

Table 26: Proportion of OTP facilities reporting zero values in the three variables

State	New admissions	Cures	RUTF Stock

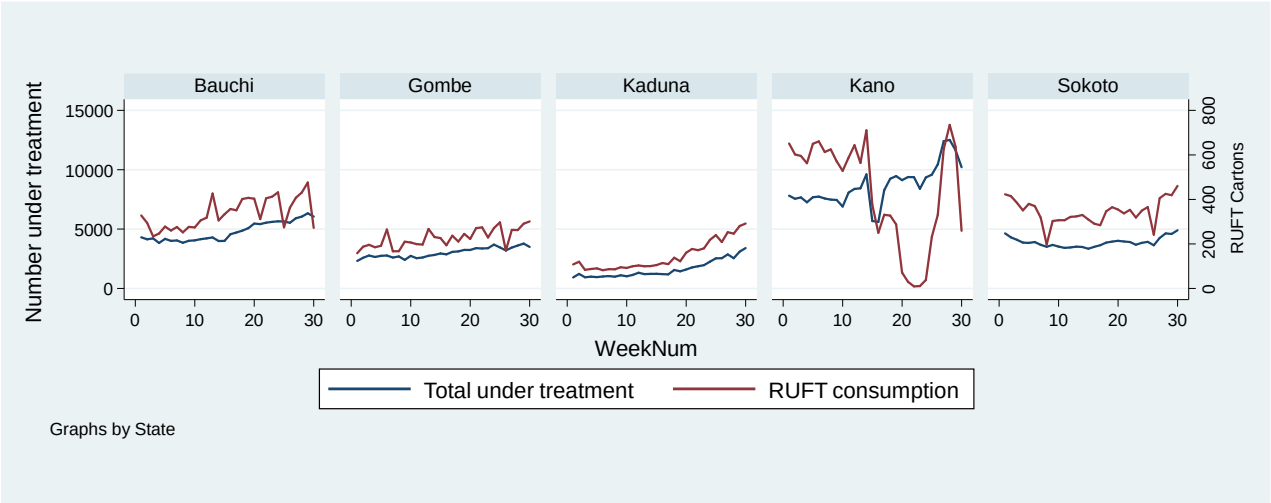
	% of OTP with zero new admissions in at least one week	% of OTP with zero new admissions in at least one month[40]	% of OTP with zero children recovered in at least one week	% of OTP with zero children recovered in at least one month	% of OTP with zero RUTF stocks in at least one week	% of OTP with zero RUTF In at least one month
Bauchi	33%	0%	27%	0%	47%	0%
Gombe	13%	0%	13%	0%	20%	0%
Kaduna	45%	15%	65%	25%	45%	10%
Kano	100%	47%	100%	60%	87%	27%
Sokoto	72%	0%	72%	0%	72%	11%
Total	**63%**	**13%**	**65%**	**18%**	**62%**	**12%**

Relationships and trends

Total under treatment vs RUTF consumption

Figure 29 shows trends in the total number of children under treatment (i.e. children in treatment at the beginning of a week plus admissions) and RUTF consumption. These two variables should be closely correlated. The graphs show that in all states except Kano, RUTF stocks are to some extent correlated with the total under treatment, though there are variations in RUTF consumption which are not fully mirroring children in treatment. In Kano, there is an inverse relationship between weeks 20 to 25 where the number of children under treatment is high with almost zero RUTF consumption. In a situation of RUTF stock-outs one would expect that children under treatment also go to zero. The fact that this is not observed indicates that the variable of "children in treatment at the beginning of the week", which tends to be carried over from the previous week, does not correctly capture how many children are actually being treated at any point in time.

Figure 27: Weekly trends in the total number of children under treatment and RUTF consumption

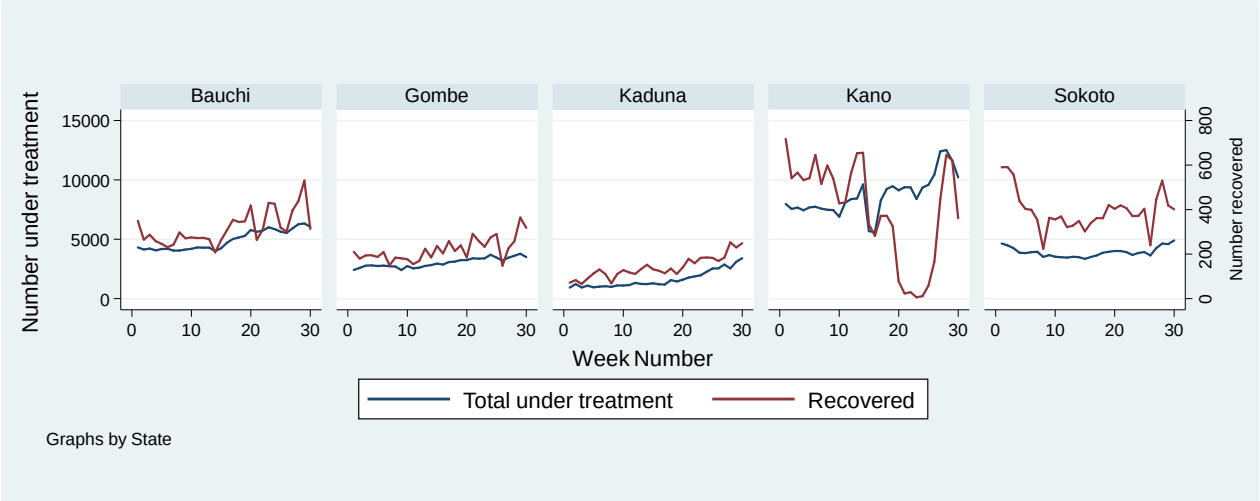


[40] Month refers to where all weeks in a given month have zero values.

Total under treatment vs recovered

Figure 28 shows that the number of children under treatment was also correlated with the number of children recovered for all the states except Kano, though with fluctuations across weeks. In Kano, most health facilities between week 20 and 25 reported zero number of children recovered, though the number under treatment was high. During these weeks, new admissions were also zero, so the number under treatment includes children under treatment carried over from previous weeks.

Figure 28: Weekly trends in the total number of children under treatment and the number of children recovered



Timeliness (January-July 2017)

Timeliness of SMS data was assessed in two ways: (i) using timeliness indicators produced within the UNICEF dashboard, which allows facilities to report until the Monday following the OTP day; and (ii) based on whether a facility reported on the OTP day or the day after. This definition allows for a comparable measure of timeliness across all facilities, as otherwise the acceptable delay depends on the timing of the OTP day in a given week.

According to UNICEF's measure (Table 27), data for slightly more than half of the weeks reported came in late for the period of weeks 1 to 30 (January to July) 2017. Late reporting was considerably more common in Kaduna than in other states, with Bauchi performing the best in terms of timeliness.

Table 27: Proportion of facilities reporting late by state, between January and July 2017 (UNICEF definition of late reporting)

	State					
	Bauchi	Gombe	Kaduna	Kano	Sokoto	%
Total	**33%**	**61%**	**84%**	**49%**	**53%**	**55%**

Using the second definition of timeliness, the assumption taken is that the first reporting day in the month is the CMAM day for that facility and therefore the facility is expected to be reporting on the

same day of every week. Facilities that did not operate in January are excluded from this section of the analysis.

Given these assumptions, facilities reported late in three quarters of the weeks reported (76%). Table 28 shows the proportion of health facilities that reported late by week in each of the five states. Most facilities tried to report on time in week 1, after which more than half of the facilities reported late in the weeks that followed.

Table 28: Proportion of facilities reporting late every week in each state

Week Number	State					%
	Bauchi	Gombe	Kaduna	Kano	Sokoto	
1	7%	8%	74%	0%	7%	16%
2	62%	83%	94%	50%	80%	73%
3	69%	85%	94%	59%	77%	76%
4	57%	85%	94%	58%	79%	75%
5	57%	77%	94%	48%	81%	72%
6	64%	92%	94%	56%	77%	75%
7	57%	92%	94%	63%	73%	74%
8	62%	92%	88%	56%	86%	77%
9	57%	69%	88%	59%	82%	73%
10	71%	77%	88%	67%	81%	77%
11	57%	77%	94%	67%	77%	75%
12	71%	77%	94%	59%	80%	76%
13	57%	77%	88%	65%	75%	73%
14	58%	77%	87%	63%	70%	70%
15	50%	100%	93%	76%	98%	88%
16	46%	83%	93%	65%	81%	76%
17	54%	92%	100%	55%	72%	72%
18	54%	75%	100%	81%	82%	80%
19	62%	75%	94%	85%	77%	79%
20	50%	75%	100%	100%	75%	81%
21	64%	83%	93%	96%	77%	83%
22	79%	67%	93%	81%	80%	80%
23	64%	83%	93%	100%	79%	85%
24	64%	92%	94%	89%	81%	84%
25	64%	83%	100%	89%	79%	83%
26	57%	82%	100%	100%	81%	85%
27	57%	91%	94%	100%	81%	85%
28	43%	73%	93%	93%	76%	78%
29	50%	83%	94%	96%	71%	79%
30	71%	73%	94%	100%	79%	85%
Total	**58%**	**79%**	**93%**	**73%**	**76%**	**76%**

3.6.3 Paper-based system (January – July 2017)

There are 24 variables in the paper data, namely state, lga, hf (OTP facility), month, tbeg (total number of children under treatment at the beginning of the month), newadmin (monthly number of new admissions of children 6-59 months old), other (monthly number of new admissions of other infants, adolescents and adults), transin (monthly number of old cases transferred from outpatient or in patient care), tadmin (monthly total number of admissions that is new admissions and transfers in), cured (monthly number of children recovered), dead (monthly number of children dead), default (monthly number of children who defaulted), nonrecov (monthly number of non-recovered children), transout (monthly number of children transferred out to inpatient or outpatient care), texits(monthly total exits, i.e. discharges and transfers out), tend (total number of children under treatment at the end of the month), male (monthly number of male children, for new admissions only), female (monthly number of female children, for new admissions only), pos (monthly number of children tested HIV positive), neg (monthly number of children tested HIV negative), RUTF_consbox (monthly number of RUTF boxes consumed), RUTF_conssach (monthly number of RUFT sachets consumed), RUTF_stockbox (monthly number of RUTF boxes in stock) and RUTF_stocksach (monthly number of RUTF sachets in stock)

In comparison to the SMS data, paper-based data for Bauchi includes six additional LGAs which all started reporting from August 2017. These LGA's are not in the SMS data for the same months. Also, Gombe and Kaduna have an extra LGA covered (LGA4 with five facilities) and LGA8 (with seven facilities), respectively. These extra LGAs together with their facilities have been excluded from the analysis for a better comparison between the SMS and the paper system. Another exclusion in the paper system is LGA2 in Kaduna which has only one OTP facility and reporting no data for any of the variables during the reference period.

As with the SMS data, the analysis focuses on OTP sites between the months of January and July 2017. In total, there are 854 observations (i.e. number of months reported by all the facilities). Table 16 shows the number of health facilities and LGAs in each state as compared to the SMS data.

Table 29: Number of OTP's in the paper systems analysed as compared to SMS system

State	No. OTP/Paper	No. LGA/Paper	No. OTP/SMS	LGA/SMs
Bauchi	15	3	15	3
Gombe	15	3	15	3
Kaduna	16	6	20	7
Kano	30	6	30	6
Sokoto	46	9	46	9
Total	**122**	**27**	**126**	**28**

Missing values

In the paper system, all facilities reported throughout the reference period, i.e. data are complete in terms of months with valid observations.

Analysing specific variables, one finds that the total number of children under treatment at the beginning and end of the month is missing for 11% and 12% of the observations respectively. These originate from Bauchi state where none of the health facilities reports the total number of

children under treatment at the beginning and end of the month during the months of February to July 2017. The number of children being tested for HIV has a high proportion of missing observations too (64%) though this variable is not covered under the SMS system. Variables such as state, LGA, health facility and month are complete.

Table 30: Percentage of missing values by variables in the paper system

Variable	Missing observations	Total observations	% missing
tbeg	95	854	11%
newadmin	2	854	0%
other	2	854	0%
transin	2	854	0%
tadmin	0	854	0%
cured	4	854	0%
Dead	5	854	1%
Default	4	854	0%
nonrecov	4	854	0%
transout	4	854	0%
texits	0	854	0%
tend	100	854	12%
male	34	854	4%
female	34	854	4%
pos	539	854	63%
neg	539	854	63%
RUFT_consbox	16	854	2%
RUFT_conssach	18	854	2%
RUFT_stockbox	17	854	2%
RUFT_stocksach	17	854	2%

Internal consistency

Compared to the SMS system, there are a larger number of aggregations performed in the paper system.

Total admissions

Total admissions reported in the data were recalculated as the sum of new admissions (admissions of 6-59 months and other age) and transfers in. Dropping all missing observations in these variables, the recalculated sum was compared to the reported sum and less than one percent (0.8%) of the total admissions were inaccurately computed. These inaccuracies were reported by 6 health facilities all from Gombe state.

Total exits

The total number of children exiting the facility in a given month was recalculated as the sum of the number of children cured, number of children deceased, number of defaulters, number of non-recovered children and children transferred out to inpatient or outpatient care. Comparing the recalculated sum to the reported sum, 4% of reported exits were inaccurately calculated. These were reported during different months by 30 health facilities (25%) of which 18 were from Sokoto, 8 from Gombe and 4 from Kano.

Total number of children under treatment at the end of the month

14% of the observations for the indicator of children under treatment at the end of the month were incorrectly computed, with errors in the calculation spread over 32 facilities during different months of the reference period. 47% of these facilities were from Gombe state and 31% from Bauchi state.

Sex disaggregation

The number of new children admitted that is to say new admissions of children 6-59 months old and other age groups was disaggregated by sex, male and female. 21% of the reported disaggregation in sex did not match the total number of new admissions. 76 facilities (62%) reported incorrect disaggregations during different months. Of these, 46% were from Sokoto and 18% from Kano and 17% from Bauchi. Table 31 lists the health facilities in Sokoto state where incorrect sex disaggregation was reported. Large differences are identified in Goronyo and Sabon Birni LGA's.

Table 31: Sex disaggregation in Sokoto state

LGA	OTP Facility	Month	New admissions (6-59 months) and other age groups	Male	Female	Difference
1	A	February	19	8	4	7
1	B	June	96	31	34	31
1	C	April	24	12	13	-1
1	D	June	74	40	37	-3
1	E	January	53	20	32	1
2	B	July	44	21	33	-10
2	D	July	40	17	22	1
2	E	February	48	16	20	12
3	A	April	53	18	24	11
2	B	February	22	23	44	-45
3	C	July	47	58	81	-92
3	D	April	29	27	41	-39
3	E	May	24	19	30	-25
4	A	February	37	21	10	6
4	B	May	13	23	21	-31
4	C	July	22	10	14	-2
4	D	March	25	14	17	-6
4	E	March	37	15	20	2
5	B	January	30	13	14	3
5	D	February	12	5	4	3
5	E	June	45	20	22	3
6	A	July	25	48	54	-77
6	B	May	67	41	44	-18
6	C	June	42	33	28	-19
6	D	June	37	23	46	-32
6	E	June	50	62	56	-68
7	A	July	78	39	43	-4
7	C	July	48	22	32	-6
7	D	April	18	9	10	-1
8	A	June	25	12	12	1
8	B	March	41	14	23	4
8	E	July	46	18	23	5
9	A	March	30	14	15	1
9	D	February	24	13	10	1
9	E	July	126	57	72	-3

Total number of children under treatment at the end of the month vs total number of children under treatment at the beginning of the following month

Only health facilities that reported throughout the seven months are considered under this subsection. Bauchi state is excluded since almost none of the facilities report the total number of children under treatment at the beginning of the month. The total number of children under treatment at the end of the month was different from the total number children under treatment at the beginning of the following month in 29% of all the months reported. Table 32 shows that Gombe has the largest number of health facilities reporting inconsistent totals while in the SMS data it is Kaduna state (Table 19). Also, January and April registered the highest proportion of OTP facilities reporting these inconsistencies i.e. 40% and 38% respectively.

Table 32: Proportion of OTPs where the total number of children under treatment differs between the end and beginning of the following month for every month by state

Month	State				Overall %
	Gombe	Kaduna	Kano	Sokoto	
January	93%	13%	0%	59%	40%
February	100%	6%	3%	30%	29%
March	93%	13%	13%	2%	20%
April	53%	6%	0%	70%	38%
May	87%	13%	0%	0%	14%
June	100%	19%	50%	0%	31%
Total	**88%**	**11%**	**11%**	**27%**	**29%**

Reporting of zeros

Paper-based data shows a small proportion of zero admissions of children 6-59 months (2%) and zero number of children recovered (3%) was driven by zero reporting in Kano state, especially in the months of May and June. This finding is consistent with the SMS data. However, for the RUTF consumption variable, the findings differ between the two systems, as in the paper system, 100% of the facilities in Gombe state report zero RUTF boxes and sachets consumed during all months. This accounts for 88% of the zero RUTF consumption reported. The remaining 12% was reported from Kano state.

Table 33: Proportion of OTP's reporting zero values in at least a month

State	% of OTP with zero new admissions in at least a month	% of OTP with zero children recovered in at least a month	% of OTP with zero RUTF cartons consumed in at least a month
Bauchi	0%	0%	0%
Gombe	0%	7%	100%
Kaduna	0%	13%	0%
Kano	53%	67%	50%
Sokoto	0%	0%	0%
Total	**13%**	**19%**	**28%**

3.6.4 Comparison: Paper-based vs SMS system.

The SMS system and the paper-based system use different reference-periods – full calendar weeks for the SMS system and calendar months for the paper-based system. As calendar weeks can span two months and timing of the OTP day in the week will determine in which week a report is captured in the paper-based system, the data from the two systems cannot be easily aggregated and compared. This is illustrated by the analysis of performance indicators for each of the two systems. For the SMS system, weeks 1 to 30 are considered for January to July, while the analysis for the paper-based system is based on calendar months January to July.

Outcome performance January to July 2017

The outcome indicators used to evaluate performance are based on discharges, and include the number of cured children, number of children who died, number of children who defaulted and non-recovered, all as a proportion of all children discharged. Table 34 shows that Bauchi, Sokoto and Gombe have high recovery rates. Figure 29 pictures weekly trends for performance rates and it appears as if these rates have had little seasonal variation, but also highlight some unusual patterns. In week 29, the recovery rates in Gombe fell from 91% to 81% while defaulter rates increased from 6% to 17%. In Kaduna, the average recovery rates between week 1 and 4 are 56% with a relatively high defaulting rate of 35% on average. Kano reports an average defaulting rate of 16% between weeks 1 and 15. Also, Kano reported that 60% of the children who exited the program had died in week 23. This is also because the total number of children exiting the program dropped from 400 in week 19 to an average of 40 children between week 20 and 25 and in week 23, 9 out of 15 children who exited the program had died. Furthermore, in week 28 a high defaulting rate of 53% is reported in Kano. Overall Kano reports the highest proportion of children who do not recover from the program.

Table 34: Performance rates by state, SMS system

State	Dashboard				SMS data				Verification factors			
	Cures	**Defaulted**	**Dead**	**Non recovered**	**Cures**	**Defaulted**	**Dead**	**Non recovered**	**Cures**	**Defaulted**	**Dead**	**Non recovered**
Bauchi	91.7%	4.7%	0.9%	2.8%	91.7%	4.7%	0.9%	2.8%	1.00	1.00	1.00	1.00
Gombe	91.2%	6.3%	1.0%	1.5%	91.2%	6.3%	1.0%	1.5%	1.00	1.00	1.00	1.00
Kaduna	83.7%	12.1%	1.7%	2.5%	83.7%	12.1%	1.7%	2.5%	1.00	1.00	1.00	1.00
Kano	76.0%	17.4%	1.0%	5.6%	76.0%	17.4%	1.0%	5.6%	1.00	1.00	1.00	1.00
Sokoto	91.4%	4.6%	1.7%	2.3%	91.4%	4.6%	1.7%	2.3%	1.00	1.00	1.00	1.00
Total	**85.9%**	**9.6%**	**1.2%**	**3.3%**	**85.9%**	**9.6%**	**1.2%**	**3.3%**	1.00	1.00	1.00	1.00

Notes: Verification factors[41] are used in Table 34 above to compare performance rates with those reported in the SMS data dashboards. Overall, all performance rates are correctly computed and reported.

[41] A verification factor is a number generated to reflect if reported data are accurate or precise. Data are considered accurate if the verification factor is between 0.95 and 1.05, over-reported if the verification factor is < 0.95 and under-reported if the verification factor is > 1.05.

Figure 29: Weekly performance rates by state

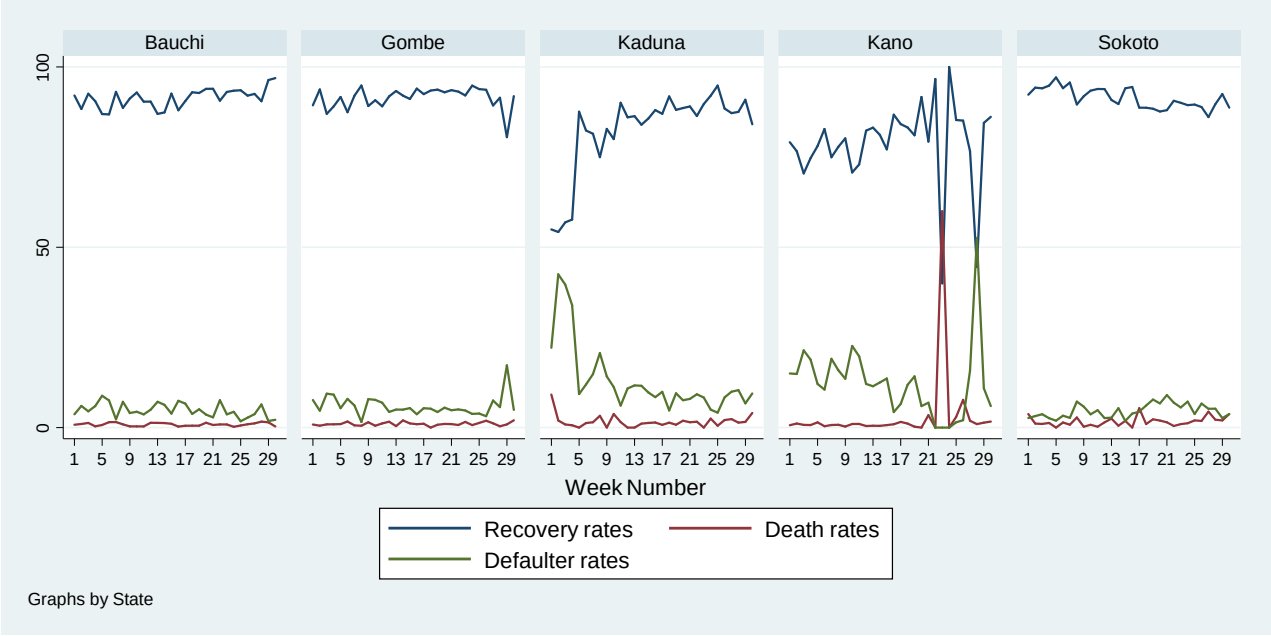


Table 35 provides the summary statistics from the paper-based system. While values are similar, the systems give different rankings to the five states in terms of recovery rates. While Bauchi had the highest recovery rates according to the SMS data, it ranks third in the paper data. Differences can be due to errors in the data that affect the two systems differently, but can also simply be due to the different reference periods.

Table 35: Performance rates by state, paper-based system

State	Performance rates			
	Recovered	Defaulted	Dead	Non recovered
Bauchi	91.8%	4.9%	0.9%	2.4%
Gombe	92.2%	5.2%	1.0%	1.5%
Kaduna	85.9%	10.6%	1.5%	2.0%
Kano	79.8%	13.8%	0.9%	5.5%
Sokoto	92.6%	4.2%	1.2%	1.9%
Total	**87.8%**	**8.1%**	**1.1%**	**3.1%**

To disentangle these two reasons for discrepancies, the following table examines whether the SMS and paper system report exactly the same values for performance variables when the reference periods are standardised. Comparison is limited to Sokoto state where prior knowledge about timing of CMAM OTP days was available for all the 46 OTP facilities in the 9 LGAs. Months in which facilities did not report in the SMS system (be it one week in a month) have been excluded from the comparison to have a consistent comparison between the two systems. The SMS data are aggregated based on the calendar months, as they would be aggregated by the paper-based system. Monthly aggregated data are then compared for both systems. Table 36 shows the proportion of months in which facilities in Sokoto report identical data in both the paper-based and SMS system. There are 299 months in study between January and July 2017. The number of children who exit the program as defaulters and those who die are more consistently reported

between both systems than the new admissions, cured children and RUTF consumption. Absolute differences between the paper-based and SMS system for admissions and RUTF consumption and discharges respectively are shown in Tables A-7 and A-8 in Annex C. For instance, differences in new admissions (6-59m) differed by more than 10% in 11 out of 46 facilities over the 7 months analysed, and differences in numbers of recovered children differed by more than 10% in 8 out of 46 facilities.

Table 36: Proportion of months where facilities in Sokoto state report identical numbers in both systems for selected performance variables

	New admissions of 6-59 months	Cures	Defaulters	Dead	RUTF consumed
Proportion of months where Paper == SMS	65.9%	58.2%	77.6%	87.3%	35.8%

3.7 Summary of Outputs relating to data production: Quality of data/ information

This section summarises quality of data/information according to different dimensions of data quality. The rating follows the same system as in previous sections. As different sources of information contribute to the assessment, findings from interviews and observations, data analysis, verification, and document review are summarised separately, where applicable.

Dimension	Rating	Source	Comment
Completeness *(Without omissions)*		Interview or observation	**Completeness is addressed** during supervision and state-level meetings.
		Data analysis	**Completeness is acceptable, but there is room for improvement**: 7% of weekly reports missing in SMS data for Jan-July 2017; no entire months missing for paper data; where data are reported, variables are largely complete except for RUTF in SMS system (4% with no data on RUTF stock at beginning of the week) and children in treatment at the beginning/end of the month (11%/12% missing data) in the paper-system.
Accuracy *(Close to true value/with minimal errors)*		Verification	**Verification analysis suggests inaccuracies in data entered**, with discrepancies between recounts, weekly tallies, registers and SMS data. Discrepancies were particularly common for RUTF consumption and defaulters. Entry of monthly LGA reports into spreadsheets was largely accurate.
		Interview or observation	**Challenges to completion of forms:** Fields are left blank in OTP card (e.g. discharge, or admission details) or filled without measurements (e.g. oedema, temperature); in some cases there is incorrect use of codes and absences are not recorded; tally process more appropriate for admissions than exits. Health workers did not report any challenges with forms, except for lack of copies; however, observations suggest that cards are hard to read. Observations suggest that errors are mostly introduced at the point of data capture, rather than data transfer or analysis.

		Document Review	**Layout and headings on OTP card and tally sheet need revision**: codes for treatment outcomes are unclear, and font and formatting make cards difficult to read; tally sheets do not capture more detailed categories of children to aid verification against OTP cards.
Reliability (*Data are consistent internally and over time and are produced using common protocols)*		Interview or observation	**Quality assurance protocols at all levels require strengthening**, together with development of consistent protocols for data collection and tallying; a variety of forms are used for monthly aggregates in the paper-based system; inconsistencies exist between CMAM operations and national CMAM guidelines with respect to identification of defaulters.
		Data analysis	**Inconsistencies in the data exist in some variables**: in children in treatment variable (28% of SMS observations) and RUTF stock balance (54% of SMS observations); moreover, 14% of observations for children in treatment at the end of a month were inconsistent in the paper data; for performance indicators examined in SMS data (new admissions, number of children recovered, and RUTF) there was only a small percentage of outliers.
Timeliness *(Data reported and made accessible on a timely basis)*		Data analysis	**Data are submitted through the paper-based system in a timely fashion, but many weekly SMS reports are submitted late.** 76% SMS reports were submitted 2 or more days after OTP day; more than half were late when applying UNICEF definition *(reporting until the Monday following the OTP day, which is less stringent, but is not comparable across facilities*); paper data was submitted in a timely fashion, but may not provide information with the required periodicity.
		Interview or observation	**There is emphasis on timeliness in state meetings.** Monthly submission of paper records appears timely. The late submission of SMS data is mostly due to connectivity issues.
Confidentiality (*Data collected, analysed, stored and reported in a way that protects individuals' privacy*)		Interview or observation	**Confidentiality of client CMAM information is compromised by poor practices and lack of guidance in national guidelines** with respect to storage of paper forms; staff interviewed showed little awareness of the need for confidentiality; there is lack of facilities for secure storage.
Integrity *(System used to generate data is protected from deliberate bias or manipulation)*		Interview or observation	**Integrity is compromised by poor levels of protection rather than evidence of manipulation.** There is insufficient cross-checking of data entry; dissemination of data down to those responsible for its collection is lacking.
Relevance (*The degree to which statistics meet user needs)*		Document Review	**Indicators reported appropriate** and with sufficient disaggregation; additional indicators suggested by national guidelines (e.g. sex, age disaggregation; capture of old cases returning) to be considered following analysis of utility and additional burden on CMAM staff.
Accessibility (*Data and metadata are easily available and assistance to users is adequate*)		Interview or observation	**Limited/on-demand access to data:** UNICEF and the MoH have routine access to the data, at state and federal levels. Summarised data and assistance to users are provided to other stakeholders on request, and this is dependent on a small number of UNICEF staff members. There is appetite among other CMAM stakeholders (NGOs) for routine access to the SMS dataset.
		Document Review	**Insufficient documentation**: There is insufficient documentation specific to CMAM information system that would enable users to understand the data as well as limitations to data quality.

4 Findings relating to data/information use

An objective of the study is to assess government readiness to make effective use of the information system data for oversight and planning at facility-level, LGA-level, state-level and federal level. This section therefore reports findings with respect to processes relating to data use, the factors that influence these processes, and the outputs in terms of the current and potential use of the data.

4.1 Processes relating to data/ information use

Summary findings of processes relating to data use

The process of **promoting awareness of the information** is given a negative rating because activities to build awareness of the information system and develop positive attitudes towards uptake of the data were not observed.

The process of **provision of convenient access** is given an intermediate rating because UNICEF and the MoH have routine access to the SMS data, at state and federal levels. However, the data are provided to other stakeholders only on request, and the SMS dashboard files are large, “cumbersome”, not easy to use, and distributed by email.

The process of **formalised routine to access and use information** is given an intermediate rating because for facility and LGA level users, data are presented and discussed at state-level meetings. On the other hand, hard copies of summarised data are rarely made available at these meetings, and within levels, only *ad hoc* meetings are held at which data are discussed and harnessed for programme management.

The process of **interaction between data providers and users** is given an intermediate rating because actions are quite limited. At federal level, there is potential for more interaction via online networks, as well as face-to-face mentoring and meetings. The lack of computer resources at lower levels constrains interaction between data providers and users, nevertheless users at lower levels do interact with data providers at the state-level meetings.

Recommendations on processes relating to data use

Information system processes are influenced by technical, organisational, and behavioural determinants, as shown in the conceptual framework (Figure 2). So, recommendations proposed to improve processes are included below in the appropriate sections about determinants (4.2, 4.3 and 4.4).

4.1.1 Promotion of awareness of information

No actions to build awareness of the information system, and to develop positive attitudes towards uptake of the data, either within the government or more generally, were observed or reported. (During the study, it was not ascertained if potential users of the data exist outside of the MoH and UNICEF who are unaware of the information system, but this seems likely.) Production of outputs

at regular intervals would increase the visibility of the information system, and encourage engagement with potential users.

4.1.2 Provision of convenient access

From interviews it was established that only UNICEF and MoH have direct access to the compiled monthly and weekly data, and only at state and higher levels. (As discussed below, this provides a good case for maintaining the paper-based system because at least the data exist at LGA and facility levels in paper form). The SMS data files are large (9 MB), so not convenient for those with low connectivity. The OPM team's view, reinforced by interviews with users in the federal level MoH nutrition unit, is that the SMS dashboard is cumbersome. While summary statistics are accessible by clicking on the separate sheets, the fact they are buried within a huge dataset does not make searching for them particularly inviting. Finally, it seems that no regular reports are being derived from the CMAM data at any level (except apparently by the regional UNICEF office, see flow diagram). Consequently, the compiled weekly and monthly data are apparently only used for programme planning and advocacy by UNICEF and the MoH at state and federal level.

We were not made aware of any system at LGA level enabling potential users to have access to the paper copies of the monthly data, stored by the LNFPs after transmission to state level for data entry.

4.1.3 Formalised routine to access and use information

We observed or heard of no evidence of systems existing by which information derived from the paper-based data or SMS data at federal level is made available for users at facility or LGA level to keep and refer to. The monthly meetings at state-level provide the only mechanism by which these potential users are enabled to have access to the data. The UFONS explained that initially CMAM in-charges came to all the meetings, but now so many facilities are offering CMAM services that it is only possible to hold quarterly meetings for the CMAM in-charges and monthly for LNFPs. The meeting is chaired by the SNO, and attended by the state Director of PHC. Data from the information system are presented to the attendees and quality issues pointed out by UNICEF, then following the meeting the LNFP or UNICEF state consultant follows up the issues with the relevant facility. CMAM in-charges described how evidence is provided to indicate which facilities submitted paper reports late, or texts were late. They also "*compare numbers across LGAs e.g. rates of defaulters, and try to find reasons and solutions*". These meetings are discussed more below in Section 4.4.2.

With respect to the weekly SMS data, for about a year, UNICEF distributed the weekly updated dashboard datafile to certain NGOs, but since February 2017 this access stopped and now the datafile is only available to MoH and UNICEF at federal and state levels. The federal-level UNICEF information officer explained that NGOs had noted inconsistencies between the data collected by SMS and the internal data collected by the NGOs, and it was preferable to discontinue the access to external stakeholders until the RAPID PRO data system had been strengthened.

4.1.4 Interaction between data providers and users

It was revealed in interviews that interaction between potential users at facility and LGA levels, and data providers (UNICEF and MoH at state and federal level), currently occurs at the monthly state-

level meetings. There is no regular forum for such interaction between actual or potential users at state and federal level other than UNICEF or the Ministry of Health – the providers simply provide summarised data when requested, for example to donors or other government ministries.

There is also no forum by which users at the lower levels can interact with data providers at federal level. Considering the future, engagement with users with respect to any proposed changes to the information system is key. Given the lack of computer resources at LGA and facility level, feedback from the lower levels on proposed changes (for example with respect to design of forms or of monthly / quarterly summaries) could be invited using a mobile phone survey as well as via the monthly CMAM meetings.

4.2 Inputs: Technical determinants relating to data use

The ultimate objective of a health information system is not the production of information, but its use. Therefore, such systems should present and disseminate data and information derived from it in modes that are appropriate for its various audiences, both with respect to the presentation format, and the dissemination method(s) used. The extent that products from information systems are used is likely to be closely linked both with accessibility of the data and derived information, and by the user-friendliness of the means used for display and reporting. This section reports findings on these aspects of the Nigeria CMAM information system.

Summary findings of technical determinants of CMAM information system performance relating to data use

Technical determinants of data use are given an intermediate rating because of their varied nature. The spreadsheets of data collected via the paper-based system are fairly user-friendly, while the spreadsheets of data collected via the SMS system are less so. Updated datasets are distributed monthly (paper-based system) and weekly (SMS system) by email, fortunately UNICEF is developing an interactive website to facilitate access to the SMS data. UNICEF produces reports of summarised findings for users only on request.

Recommendations intended to improve the design and technical aspects of the CMAM information system relating to data use

1. Increase the functionality of the data file produced from the paper-based system by
   - Including more tables and figures that are automatically produced, and for which parameters can be adjusted e.g. state/ senatorial zone/ LGA/ facility, age group, and period of analysis
   - Locking row and column headings to facilitate navigation
2. Increase the functionality of the dashboard data file produced from the SMS system by
   - Including more guidance for interpretation of the conditional formatting
   - Including more tables and figures that are automatically produced, and for which parameters can be adjusted e.g. state/ senatorial zone/ LGA/ facility, age group, and period of analysis
   - Locking row and column headings to facilitate navigation
   - Creating written guidelines for the interpretation of the dataset
3. Provide convenient access to the compiled monthly data online in addition to via email
4. Enable convenient access to the compiled SMS data:

An interactive website is being developed, meanwhile
- Provide online access to the dataset online in addition to via email
- provide guidance on use of the dataset *(noted in Section 3.4)*

5. Initiate a system to automatically generate single-page summary paper reports for each LGA with breakdown of data by facility, to coincide with state-level monthly meetings (*noted in Section 3.4*).

User-friendliness of paper-based data files: Increased use of the data files by those who have access to them would be encouraged by increased functionality of the data files. For example (as was described by the ASNO to have been the case for a previous version of the spreadsheet) it should be possible to easily obtain summaries of data by state, LGA, and facility by specified time periods. Also, calculation of key performance indicators, and derived statistics (such as mean number of RUTF cartons distributed by child, with conditional formatting to highlight indicators derived from potentially erroneous data) could be built into the sheet as is the case for the SMS data files.

User-friendliness of SMS data files: As for the paper-based data files, increased use by those who have access to the dashboard files would be encouraged by increased functionality. As discussed above in Section 3, the OPM team perceive that the dashboard file is not user-friendly for a non-expert. There are built-in indications of potentially erroneous data using conditional formatting, but these indicators are not clearly explained in each sheet. Furthermore, there are very few embedded summary figures and tables to aid users' interrogation of the data, and column and row headings are not locked, which would aid users to navigate the sheets without getting lost. Written guidance to aid users of the data file would be valuable. For example, at federal level, the head of the MoH nutrition unit contacts the information officer at UNICEF when he needs data for meetings, since he "… *can't understand the spreadsheet*" and "…*I have not been able to use it.. This is raw data but I need a summary*". UNICEF mentioned that an interactive website is being developed, but since the new system may be some time in the making, it would still be valuable in the meantime to develop and distribute a user-guide to the dashboard file.

Means of access to data from the paper-based system: The updated files with compiled data are distributed as email attachments each month by the SNO's office to the UNICEF state-level office and government stakeholders at state and federal level (see Figure 1). An alternative more convenient system would be to use an internet storage system such as Google Drive, or Dropbox, so that stakeholders could download spreadsheets only when required.

Means of access to data from the SMS system: The dashboard file, which includes all the data compiled since the onset of the SMS system, is distributed by UNICEF as an email attachment (9 MB). This is a particularly user-unfriendly method to enable access to the dataset for those with connectivity issues. Again ideally access would be provided via an internet storage system such as Google Drive, or Dropbox, from which users could download only the data they need rather than the complete dataset.

While the dashboard data file itself is not shared with LGA level staff (most do not have computers) the dashboard data are displayed and discussed at the monthly state-level meetings which the LGA nutrition officers attend and the quarterly state-level meetings that the CMAM in-charges attend. During interviews with facility staff, many expressed an interest and desire to have information fed back down from the federal level. While disseminating information to facility and LGA levels using paper reports would be logistically challenging, most of these stakeholders are

without access to information technology apart from phones so paper reports are the only option for enabling their access to summarised data. The effective network for data collection and transmission upwards, already described, could be harnessed for data sharing in the reverse direction, thus, paper reports relating to individual facilities could be distributed to LGA nutrition focal points via the monthly state-level meetings, and these staff could distribute the reports when they undertake supervisory visits to facilities or collect monthly data.

4.3 Inputs: Organisational determinants relating to data use

As remarked on above with respect to data quality, the use of data and information is affected by the rules, values and practices of the organisation within which stakeholders are situated. The two main organisational contexts associated with the Nigeria CMAM information system could hardly be more different – firstly that of a large UN agency with an international reputation for providing statistics to help identify needs, to support advocacy, and to assess progress, and secondly that of a government ministry of a lower-middle income country with concomitant lack of human resources and technical background. This section of the findings describes the impact of these contexts on the use of data and information in the CMAM information system.

Summary findings of organisational determinants of CMAM information system performance with respect to data use

The organisational determinants of data use are given an intermediate rating because there are several weak aspects that could relatively easily be improved. The rating reflects both the apparent lack of effort on the side of UNICEF to pass on its expertise to help develop a culture of data use in the MoH (for example, there minimal on-the-job training of MoH staff by UNICEF experts at federal level, and a lack of guidance to aid interpretation of reported data) and also the low priority in the MoH given to development of this culture (for example, there have been no gatherings of state level CMAM-related staff in the last year, and data use is not included in training of health workers).

Recommendations intended to strengthen the organisational rules, values, and support practices aimed at building a culture of data use

1. Create forums for information use – it would be especially valuable (and feasible) to bring together state-level MoH staff so they can interact both virtually and in person (*already noted in Section 3.3)*
2. Continue and develop the system of monthly and quarterly state-level meetings
   - Use these meetings to discuss the quality of monitoring data produced, and data interpretation and use
   - Develop guidelines to strengthen and facilitate these review meetings
3. As well as interaction via the monthly meetings, involve users in any proposed changes to the systems e.g. design of monthly / quarterly summaries, and enable them to feedback to state level after the system is established, via mobile phone.
4. At federal level, develop training materials for CMAM staff that can be adapted by states, and that includes theory and practical exercises relating to information use
5. At federal level, introduce regular sessions in which UNICEF staff work with a MoH counterpart to pass on skills and expertise e.g. in interpretation of dashboard dataset *(noted in Section 3.4)*

6. Identify individuals at facility level who have good skills and practices who can mentor others at the same level (*noted in Section 3.3)*
7. Increase access to computer hardware and software by LGA nutrition focal points, so they can access data for their LGA, calculate aggregated statistics, and download reports (*noted in Section 3.3).*
8. Develop a users' guide to the interpretation of the data sets, and advice on practical use of the data, including checklists of which features and data should be examined *(noted in Section 3.4).*
9. In addition to users in the MoH and UNICEF, provide convenient online access to the compiled SMS data to other organisations including civil society.

Governance of the CMAM information system is characterised by an imbalance in power between UNICEF and the MoH with respect to finance and expertise on one side, and "ownership" of the CMAM programme on the other. The CMAM information system is situated between these two sides, whereby the MoH is dependent on the expertise of UNICEF to maintain the RAPID PRO system and interpret its outputs, while the MoH is the agency actually responsible for keeping records and monitoring the programme. To help redress the imbalance, and enable more benefit to be gained from the CMAM data, UNICEF needs to sensitively provide resources and assistance to the MoH to gain meaning from the information system's outputs.

There are many ways that a culture of data use could be promoted. For example, the Head of the Nutrition Unit of the Ministry of Health reported there had been no gatherings of state level CMAM-related staff in the last year. Such gatherings would enable experience to be shared and increase capacity in data quality assurance and use of CMAM data. Also, there is reportedly minimal on-the-job training of MoH staff by UNICEF experts at federal level, and a lack of guidelines both to aid interpretation of reported data, and data use. Such documentation would be valuable, as would CMAM training materials which integrated data interpretation and use. The current system of monthly state-level meetings bring people together working at the same level and offer a good forum in which to foster information use.

4.4 Inputs: Behavioural determinants relating to data use

The use of data produced by information systems, and of information derived from those data, is likely to be directly affected by behavioural factors including both motivation and opportunity to use the data/ information, and aptitude in data interpretation. This section reports the findings relating to knowledge, attitudes, motivation and opportunity that stimulate and deter use of data from the Nigeria CMAM information system.

Summary findings of behavioural determinants of CMAM information system performance relating to data use

☻ The behavioural determinant of **motivation** is given a positive rating because it is so high at federal level, both in UNICEF staff who work within the wider context of international targets, and in NGO staff who do not have access, and would like to use the CMAM data for gap analysis, monitoring achievements, planning and advocacy. Motivation to use data and information is variable at facility and LGA levels.

The behavioural determinant of **opportunity** is rated as intermediate because while the data are freely available for use by UNICEF and government at state and federal levels, the opportunity to use data derived from the information system is limited at lower levels. Data are presented at state-level meetings but apart from paper copies of their own local data that has already been submitted to state-level, the CMAM in-charges and LGA focal points do not have access to reports of summarised data, and therefore cannot compile them and compare over time and space.

The behavioural determinant of **capability in making sense of data/ information** is given an intermediate rating because the data are being used to good effect on a day-to-day basis to aid planning. However, capability with respect to advanced interpretation of data appears to be weak, as except for UNICEF at federal level, the accuracy of data was unquestioned, despite the existence of unrealistically high or low values for some performance indicators. At facility level, respondents had limited knowledge of what the data are used for, or could be used for, and so capabilities are undetermined.

Recommendations intended to enhance the motivation and competence of personnel to extract and use data effectively

1. Develop a system to automatically generate single-page summary paper reports for each LGA, with breakdown by facility, to be discussed and distributed at monthly state-level meetings. These reports could also be shared by LNFPs with facilities during regular supervisory visits. (*noted in Sections 3.4 and 4.2*).
2. Create written guidelines for the interpretation of the dashboard dataset (*noted in Sections 3.4, 4.2 and 4.3)*
3. At federal level develop guidelines and training materials for CMAM staff at facility and LGA level, that can be adapted by states, and that include theory and practical exercises relating to information use (*noted in Section 4.3)*
4. Implement informal on-the job training in interpretation and use of statistics, for federal-level staff who are responsible for information management (*noted in Sections 3.4 and 4.3)*
5. Implement advanced training in interpretation and use of statistics, for federal-level staff who are responsible for information management (*noted in Section 3.4)*

4.4.1 Motivation to use data/information

Despite the negative organisational and technical determinants of data use outlined in the sections above (including absence of data use in training, and of physical examples of data use displayed in the working environment), in some facilities and LGAs, there is high motivation to obtain summarised data derived from the CMAM information system (see examples below).

Example of stakeholder at facility-level wanting greater access to data[42]

Monica is the CMAM in-charge of Namabi facility, and over 80% of her time is spent on CMAM. She is trained as a Senior Community Health Extension Worker. Two health workers work with her on the CMAM programme, and two others are currently on study leave. She does not

[42] The names of the staff and facility have been changed

get help from other health workers in the facility, but the Facility in-charge sometimes comes on the CMAM day, mainly to supervise activities.

If she had more time, Monica would use it to train community volunteers to perform their roles better. She feels that the SMS system has increased her workload, and that the system is "multiple reporting". When probed as to whether his colleagues and management feel it's important to have good systems to collect and transmit CMAM data, she said they did, and this is because "CMAM is the main service provided that brings people to the health facility".

Ad hoc meetings are held at the facility to review CMAM programme, and also general management review meetings, and that she is always invited to such meetings. No official records of the meetings are kept. The most common way the facility has uses CMAM data is to monitor the number of admissions, and when high numbers of admissions are recorded, "they send CVs to educate the communities". They also use the data to determine RUTF need. She does not participate in meetings at LGA level relating to CMAM. She would like to use CMAM data "to make case for government support for the programme" but says he is "discouraged by the government's slow response to such efforts".

Findings from analysis of CMAM data done at state or federal level are shared with Monica at the quarterly meeting of facility in-charge held at state level, and she would also like to receive paper reports with "findings about my facility and other LGAs, to rank performance of the programme across the state."

Example of stakeholder at LGA-level wanting greater access to data[43]

Frank is an LGA nutrition focal point with five facilities under his charge. He spends more than half his time on the CMAM programme. He visits each facility at least twice a month which means that two weeks out of four are spent only on supportive supervision. In the other two weeks, he is still in touch by phone with the facilities to check the CMAM operations are running smoothly and that the SMS texts have been successfully sent.

If he had more time, Frank would use it for the IYCF programme as "this is preventative". But if the time had to be allocated to the CMAM programme he would use it for more food demonstrations and WASH education (water and sanitation). He feels the SMS system has increased his workload because he needs to check facilities have sent their SMS. However he is happy doing that as LGA data are now sent promptly.

When probed as to whether his colleagues and management feel it's important to have good systems to collect and transmit CMAM data, he said he feels he is the only one that thinks it's really important, and that his manager didn't realise he spent so long on data-related tasks. Frank does not share any tasks with others working in M&E at LGA level.

He organises ad hoc LGA-level meetings - when needed he calls the 5 facility-in-charges together to review the CMAM programme and discuss issues. No notes are kept. There used

[43] Names of staff and LGA have been changed

to be monthly meetings at LGA-level at which all units presented their situation, but the current Director of PHC discontinued this practice.

When asked to describe how the LGA uses CMAM data, Frank said he is the only one who uses them. “Nobody else in the building is interested”. He described that “Data helps you understand if you have issues or complications - It make me understand if we have issues or complications. Also, it makes me understand if we have underweight children that we need to transfer to SC[44]. I ask, did you transfer this kid? We have to go through their cards and find address. We used to go and meet them in their houses. Also we use data to understand if they come once or twice and stop. If their place is not far I can go there and ask why do you not come?” He and his staff can see how many children have defaulted and follow them up if necessary. Frank described how the community volunteers are sometimes not active as “no one is supporting them, there is no help with transport. Despite that we still have a few who are still coming, they do help us.”

When asked if he would you like to use the CMAM data more than he does, he said yes and that he would “would like to understand better, and have guidelines as to what to look out for in the data”. If he has any problems with this he calls the ASNO, who is always very helpful.

He would like to have data from the complete programme sent back down to him from federal level, “so that I can check it”. Once it was reported at a monthly meeting that he had requested RUTF, but he hadn’t, because the LGA still had some stock. He found it annoying that his data had not been accurately recorded. He is also interested to have data to compare his LGA with other LGAs, and Sokoto with other states.

Motivation to use data is high in UNICEF at the state and federal levels who already have access to the data, and work within the wider context of organisational and international targets. Interviews with NGO staff at federal level indicate motivation is also very high in NGOs who at present do not have access to the datasets. Agencies working in the north-east of the country perceive the SMS data would be helpful to judge how their programme compares with others, and where there is a need for new activities (see examples below). One M & E officer commented that the SMS data collection process was not clear, and that it would be helpful for partners to be informed about this so partners could maximise the quality of data submitted by facilities supported by their agency.

Example of NGOs wanting access to data[45]

Sara is head of nutrition at the NGO “Help” which is supporting CMAM operations in over a hundred facilities in three north-eastern states. They no longer receive the weekly excel CMAM dashboard data (UNICEF stopped providing it in February) and are very keen that this access should be resumed so they can use the data for advocacy, achievement, gap analysis, and planning. They would like access to the data, not simply summaries, so they could do their own analysis.

[44] Stabilisation centre, for in-patient treatment of acute malnutrition
[45] Names of agencies and staff have been changed

Sara feels "..it is very necessary to have information" so that "Development partners can see if targets are being reached". "Having data brings people together to analyse it and look at which actions are necessary". "There's no discussion about to be had about the need for the dashboard data to be made available" – "new partners need to know who is doing what and where there are gaps". "It should be open" and "No-one has a clue what is happening where" (this refers to the north-east). She summarised that "data are needed for planning and programming decision-making" and that because her NGO doesn't work in all the facilities in an LGA, "it would be helpful to have the data to look at trends, and to compare facilities. That can help you see if any changes are due to the programme or to things that are affecting everyone". Also, she said the data are necessary for advocacy. Sara described a recent experience of attending a meeting in Lagos about Essential Medicines where the inclusion of RUTF and F75 was being discussed. She quickly needed figures on numbers of acutely malnourished treated, and this figure would have been at her fingertips if the dashboard had been open access.

Michael is the head of nutrition at the NGO "Serve" which is supporting CMAM operations in three states. They used to receive the dashboard data each week, but he didn't use the information because he didn't have time. In future he doesn't feel the need for direct access to the dashboard, instead it would be useful for Serve to have monthly summary reports distributed by email. He said someone like him who doesn't need to use the data day-to-day would not bother to log onto an interactive website. However, if a summary report appeared in his email in-box, he would look at it, and possibly see something interesting that might then lead him to log on and look at the website.

He would like the emailed summary reports to provide statistics on new admissions over a defined period together with performance indicators, and which are disaggregated by LGA, state and partners supporting. The information would be used to

- *"Confirm that our internal reports and those from government to the dashboard match;*
- *Understand trends of admissions in different locations and use this as a starting point to analyse need for further support;*
- *Have a better view of performance indicators in other locations or by other partners. For example, if we are experiencing high defaulting in X LGA, would other LGAs in the State have the same issue? Or would other partners in the same LGA or surrounding LGAs have the same problem?"*

Abigail is the M & E officer at the NGO "Nourish" which is supporting CMAM programmes in North – Eastern states. They used to receive the dashboard data each week, but she didn't use the information because she didn't trust it. She said "*The data collection process was not quite clear. I compared the information in the dashboard with information generated by another programme in same location and there were a lot of differences across the months I used as reference. I did not see the information produced by the dashboard as complete especially when I did the data quality assessment (using source documents at facility level) of my programme and I compared with the dashboard."*

Abigail would like to have direct access to the dashboard data resumed, and would be happy with monthly summary reports as an alternative. She would prefer to be sent the reports by email rather than needing to access a webpage. The information would *"complement information generated by my programme in similar locations*" and she would use it "*to inform*

decision-making during proposal development" and *"estimating caseloads during CMAM facility assessments*". She would like indicators to be disaggregated by LGA and state, and also by sex. She specified that "…*the data collection process needs to clear to all actors. Thereafter, other actors can build a system of support to ensure that information sent to the dashboard is complete*".

4.4.2 Opportunity to use data / information

Use of the data aggregated to federal level is restricted and not available to users at LGA and facility levels, thus stakeholders do not have the opportunity to provide feedback and to use the information to improve their programs.

Even the data relating to one's "own" facility- and LGA, stored on paper at one's one level, are apparently little used – the perception exists that they are collected for transmission to higher level but not for one's own use. There were few formalised "opportunities" to use data reported. Most CMAM in-charges stated that their management only hold infrequent meetings on an ad hoc basis at which the CMAM programme is discussed (see example in box above). However, at one facility the CMAM in-charge described that facility meetings at which CMAM data were presented and discussed were held monthly, and also WDC (Ward Development Committee) CMAM meetings were held quarterly from at which notes were recorded. Another CMAM in-charge reported that in his ward, WDC meetings are held monthly (he is secretary) and CMAM is one of the topics discussed, and this was corroborated by the OPM team by observing notes made at the meeting.

Only one of the ten CMAM in-charges interviewed reported attending meetings at LGA level (these were organised by the LNFP), and only one of the three LNFPs reported attending meetings at LGA level organised by their managers in the LGA.

As described above, respondents reported that at the state-level meetings, presentations of the CMAM data are viewed together and discussed with the CMAM in-charges and LNFPs. The impression gained by the OPM team is that discussions at these meetings are currently primarily about ensuring the data are complete and submitted on time, about comparing performance indicators between LGAs and facilities (making the assumption that the indicators reflect the true situation, see below) and about practical issues related to operation of the CMAM programme. According to two CMAM in-charges "*At quarterly meetings it's shown who submitted reports late. Also if texts were late*."; *they "discuss the numbers discharged, and amount of RUTF distributed*".

Thus CMAM in-charges and LNGPs only have access to their own paper records of local data compiled for transmission to the higher levels of the information system, and temporary viewing of data at state-level meetings. So, they do not have the opportunity to easily compare their performance over time and with other facilities – this would become possible if they were provided with summary reports that they could compile.

Also, the system of regular state-level meetings could provide an effective mechanism to increase skills in data interpretation of stakeholders at the two lower levels, and their awareness of how the data could potentially be used.

Stakeholders at state and federal levels reported greater opportunity to use data. The SNO described how at state level in Sokoto, there are quarterly meetings convened by the State Primary

Health Care Development Agency (SPHCDA)[46]. All the health departments come together and present data in turn, followed by budget discussions, and annual reports are issued by the PHC. Also the State Committee for Food and Nutrition, coordinated by the Ministry of Planning, meets annually and involves UNICEF and line ministries, and CMAM data are used to facilitate discussions. Unfortunately, no opportunities are provided for SNOs to come together and use the CMAM data to facilitate discussion of the programme.

At the federal level, interviews revealed there are internal meetings within UNICEF and the MoH about the CMAM programme, and more general meetings at which CMAM is one of a number of items on the agenda (see box below). However there does not appear to be a regular mechanism any inter-institutional meetings apart from those relating to the emergency in the north-east. The box below includes details of meetings and reports described by the Head of the Nutrition Unit.

Federal level government meetings and reports for which CMAM data are drawn on:

- CMAM task force: Members are MoH officials, donors (including DFID and CIFF), NGOs and bilateral organisations, and the private sector (including Nutriset and Dangote)[47]
- MoH planning meetings, for all heads of units. These occur twice or three times annually but the most important one is at the end of the year when budgets need to be agreed.
- Nutrition in emergencies working group (NiEWG) meetings; notes taken are shared via a weblink so people on the mailing list can access them.
- National Council of Nutrition (NCN, launched in November 2017), the highest decision-making body on nutrition. It is chaired by the Vice-President, and hosted by the Planning Commission, so the Minister of Planning is the Secretary.
- The National Food and Nutrition Committee, the technical committee supporting NCN
- Annual Ministry of Health report

4.4.3 Capability in making sense of data/ information

It is difficult to assess of capability in making sense of data/ information without using some kind of test questions, and this study did not include these kinds of tools. However, from comments made during interviews, at LGA and state level the most significant deficit appeared to be a critical approach – some stakeholders in both the MoH and UNICEF seemed unaware of the potential unreliability of the performance indicators (defaulting rates, recovery rates etc) and this is also likely to be an issue at facility level.

A major challenge both to improving data quality and to increasing the effective use of data in the CMAM information system, is the everyday use of the word “quality” refers both to the “correctness” of the data, and to the effectiveness of the programme. This issue was apparent during interviews - when queried on challenges to data quality, respondents often understood that one was referring to improvements in programme performance, for example, by reducing defaulting rates, or increasing recovery rates.

[46] The SPHCDA is responsible for all primary health care activities, while the SMoH is responsible for policies.
[47] The list of members was obtained from the document “*Ready to Use Therapeutic Food (RUTF) and the WHO Essential Medicines List*” CMAM Forum, 2016

As described above in Section 3.6.2, interviews revealed that facility staff were generally eager to improve the programme, especially at their own facility, but such improvement was linked with logistical issues of programme performance, not data quality issues. Also, as far as the OPM team are aware, the discussion of key performance indicators at monthly state-level meetings does not involve questioning the reliability of the values. So, if one facility has a higher defaulting rate than others, this is interpreted as resulting from a higher proportion of children defaulting at this facility, rather than from application of a more rigorous approach to identifying and counting defaulters using the OTP cards at this facility. Thus, it seems that data quality, apart from timeliness and completeness, is currently not prioritised as an issue needing action.

The OPM team considers that raising awareness of the two separate influences (true programme performance, and correctness of procedures used to capture the performance) on the values of reported statistics is an essential first stage in any attempt to improve and increase data use in the CMAM information system. If data production processes are improved, leading to improved data quality, the reported statistics will become closer to the likely true values, and it will appear that programme performance is declining[48]. So, it is important that CMAM in-charges are supported and reassured rather than penalised at this stage. Changing the culture so that, for example, a 98% cure rate is perceived as a bad thing rather than a good thing, because such a high rate must be unreal (and is probably due to no-one taking the decision to discharge children) will need leadership and time.

4.5 Outputs: Use of data/ information

In this section, the findings relating to actual data use are described. As a consequence of the weak data use processes described above (particularly the fact that the data are only minimally distributed, and summarised information derived from the data is not reported at all) it seems that the data are not used anywhere near their potential. However, with respect to facilitation of planning to meet needs for RUTF and reduce stockouts, the information system appears to be well used and is serving this purpose effectively.

At facility level use of the data from the information system is low. Respondents did not readily provide examples of data use, but when prompted most mentioned planning for RUTF needs. Other applications were examining the performance of the programme, monitoring the number of admissions, and monitoring the number of defaulters. As described above in section 4.4.2, no formal scheduled meetings were reported to occur, nor reports written. One CMAM in-charge described how the meetings are held at times that depend on when the staff are available – since two colleagues go to *"school*". When they meet they "…*sit together and see how we can fix problems. For example if we notice admissions have gone up and recovery rates are low, we have a campaign to "scare" caregivers to give RUTF.*"

At LGA level, use of the data is similarly low. Interviews with the LNFPs revealed that there are few formal scheduled meetings - only one of the three LNFPs described attending meetings at LGA level organised by their managers. Also the PHC does not issue reports containing CMAM data/ information. With respect to use of the data by LNFPs, one described using data to "*to make a case for support from the LGA*". The second said that they were the only one using the CMAM data at LGA level, and it was useful to help understand how the programme

[48] This may cause a problem with donors if key performance indicators do not meet the Sphere Standards (greater than 75% recovered, and less than 15% defaulted)

is running and if there are issues. The third LNFP said CMAM data are not used at LGA level other than for reporting to state level.

At state level there is much greater use of the data. There are formal meetings as described in Section 4.4.2, convened by the PHC and the Ministry of Planning, and annual reports are issued by the PHC. The SNO described how CMAM data are compared to annual targets, and are used to help develop the state-level nutrition action plan. Also they are used to support advocacy - "*..Among the data, these are the numbers of defaulters, we can make case to the governor for funding to community volunteers. We need to go to the governor and take his wife to community level"*

The UNICEF nutrition field specialist and consultant reported using the CMAM data to help make decisions on where supportive supervision is most needed, and on where training needs are most urgent. Also they are used for advocacy, for example to motivate state governments to fund RUTF; to forecast the need for supplies including RUTF, and for budgetary planning.

It is at **federal level** that the data are mainly used.

In government, as well as the meetings and reports described above in Section 4.4.2, the Nutrition unit uses the data to respond to issues that arise, and for advocacy. The head of the nutrition unit described how he uses data provided by UNICEF *"to make a case for what we want"*., for example the estimate he quotes at meetings, of 2.5 million children under the age of five in Nigeria suffering from Severe Acute Malnutrition every year, is based on data collected through Rapid Pro and calculated using recently developed approaches[49]. Other government ministries were mentioned as being important users of CMAM data, including the NPHCDA, and Budget and Planning, but it was not possible for the OPTM team to collect data from them (see methods section)

UNICEF use the data for

- *Monitoring*: The Nutrition Manager described that she examines patterns of use of RUTF, and if there are strange patterns, she contacts the state-level UNICEF office to alert them. Also data are tracked against SPHERE standards e.g. for mortality to be < 2%. If death rates are high, again she would follow this up with people on the ground. Trends in admissions data are scrutinised, as a sharp increase in children admitted indicates those facilities need more support.

- *Planning*: The Nutrition Manager explained how needs for RUTF are forecast, interestingly the monthly P+P data are considered to be more useful for this as they are more complete than the weekly SMS Data. She uses number of children in programme plus 10% to estimate needs for next month and quarter[50]

- *Tracking* against international targets and accountability*:* UNICEF has made public commitments to reach a certain number of children, and so needs to report against these.

[49] Bulti et al. (2017) Improving estimates of the burden of severe acute malnutrition and predictions of caseload for programs treating severe acute malnutrition: experiences from Nigeria Archives of Public Health 75:66

[50] A proposed recommendation is regular collection of data on the number of children attending each CMAM session (in addition to new admissions and discharges). The data will enable examination of the assumptions underlying planning calculations. The difference between the number of children theoretically in the programme and the number who attend will indicate the extent of departure from the ideal pattern of eight weeks' treatment followed by discharge as cured.

- *Advocacy*: UNICEF attempts to leverage resources from government. This activity is described in detail in reports of the OPM study component on governance.
- *Research* with practical applications: The data have been used for research to test the existing assumptions used to estimate caseloads, and also to estimate lives saved, and papers have been published on these studies in the public domain including a peer reviewed journal[51]

Other potential users are academic institutions; NGOs who support CMAM operations in Nigeria (see example above) and the World Health Organisation.

[51] See reference in footnote above; also, Bulti et al. (2015). How many lives do our CMAM programmes save? A sampling-based approach to estimating the number of deaths averted by the Nigerian CMAM programme. Field Exchange 50, August 2015. p38.

5 Sustainability of the CMAM information system

In this final section, findings from the sections above are pulled together to address the question of the extent to which the Nigerian government is ready to manage the CMAM information system and make effective use of the data and information.

There are several external factors that make it difficult for the government to manage the system. These constraints are common to all health programmes, and include:

- The current configuration of health provision in Nigeria, whereby different levels are administered separately. With respect to the CMAM programme specifically, it means that health workers at LGA level are accountable only to the Ministry of Local Government, so the SNO, who is responsible to the Ministry of Health, has no authority over them.
- The MoH lacks spare human resource capacity. With respect to the CMAM information system, this is a constraint because at state-level in Sokoto there is currently task-sharing with UNICEF staff, so if UNICEF were to withdraw support, governmental human resources would need to be increased by at least an equivalent number of staff members.
- The MoH lacks specialist technical expertise at federal level. With respect to the CMAM information system, such expertise is necessary for taking over the SMS system and it would be difficult to acquire this without secondment of staff.
- The technical capacity of government staff at state and LGA level is most likely modest[52]. With respect to the CMAM programme higher levels of expertise are particularly needed to improve data quality.
- Resources relating to equipment and workplace environment are lacking. For the CMAM programme this factor particularly constrains the activities of the LNFPs, who have vital roles in supervision and transmission of data. Their effectiveness is limited by their lack of access to computers and dedicated office-space.
- Financial resources are lacking at facility level. For the CMAM programme, this means routine drugs are not provided, and also makes it difficult to strengthen the component of the programme by which community volunteers follow up absentees, with implications for data quality.

Other factors hindering government readiness to manage the information system are internal, and so could potentially be addressed, including:

- UNICEF's currently central role in supervision and quality assurance. Their presence and high levels of expertise reduce the incentive for the government to increase its responsibilities in this area.
- The Nutrition Unit does not collaborate closely with other units in the MoH[53] or other ministries which are likely to have staff with complementary technical expertise
- The findings from supportive supervision are inconsistently recorded and shared, and the criteria used to identify which facilities have greatest need for visits and support, including training, are unclear.

On the positive side, there are factors that bolster government readiness to manage the system

[52] The OPM team only visited Sokoto state, where the capacities of key government staff responsible for undertaking and managing data production tasks (SNO, ASNO and LNFPs) are reasonably good (although of course would benefit from further coaching and training). It is unclear whether this finding holds true in other states.
[53] It is important to ascertain relevant expertise in the Planning, Research and Statistics Division of the MoH.

- Government staff at all levels are generally highly motivated to improve their programme, and to gain more skills
- There exists an excellent system of regular state-level meetings for LNFPs and directors of PHC, and for CMAM in-charges. With respect to data quality, these forums already focus on timeliness and completeness, and there is potential for them to focus on the additional aspects of accuracy, reliability and confidentiality, and to cover data interpretation and use

Current governance

In order for the Nigeria CMAM information system to be managed by the government in the future, data governance issues must be addressed in the short term, where data governance is here defined[54] as “the exercise of authority, control and shared decision making (planning, monitoring and enforcement) over the management of data assets”. The principal feature of the current governance of the information system is the power imbalance between UNICEF and MoH with respect to finance and expertise on the one hand, and "ownership” of the source of the data on the other. This situation appeared less overt at state level where strong collaborative relationships exist and there is effective sharing of tasks and information relating to the programme, and support. At federal level there appears to be less direct collaboration and the power relationship is more visibly in favour of UNICEF, probably because they control the SMS system, both with respect to data production and access to the resulting data. Recommendations proposed above that would help redress this balance, include

- the production of a guide to interpreting and using the output of the dashboard
- on-the-job training of MoH staff in data interpretation
- advanced training in interpretation and use of statistics, for federal-level MoH staff who are responsible for information management
- creation of an online system for sharing information about facilities with respect to supervisory visits, and to data quality issues identified via checks of datasets. This way the system would be less dependent on the knowledge of a few key individuals

An additional governance issue (identified by the UNICEF federal-level information officer) is a lack of clear accountability for things not done within the CMAM programme. For example, it is not clear whose responsibility it is to follow up questionable RUTF statistics. Also, currently there is no clear demarcation of how bad indicators must be before action is taken such as intensive supervision or additional training, or ultimately closure of a facility. So, sometimes nothing is done. Recommendations proposed above that would address this issue, include

- development of quality criteria (using scores) for indicators included in SMS dataset, to enable a transparent system of warnings and incentives to be implemented. The effectiveness of this system would be dependent on:
- creation of an online system for sharing information about facilities with respect to supervisory visits, and to data quality issues identified via checks of datasets, as specified above.

Integration with HMIS

The transmission of the CMAM data to higher levels occurs in parallel to the system for other health services provided at the health facilities. State- and federal level stakeholders interviewed nearly unanimously considered that only integration of the CMAM information system into the country’s Health Management Information System (HMIS) would ensure sustainability.

[54] From: Data Management Association (2009) The DAMA Guide to the Data Management Body of Knowledge (DAMA-DMBOK), p.19

Such integration would not be straightforward. Currently the Nigerian HMIS only captures a few nutrition-related indicators, and none related to CMAM. The timeliness of the HMIS does not fit well with the reporting requirements of CMAM – as was expressed by the federal-level MoH information officer "*RapidPro is for programmatic data which needs speedy attention. HMIS data are not urgent."* So, the HMIS would need to be capable of incorporating weekly data before the CMAM information data can be incorporated into it (presumably in theory the monthly data could already be incorporated if there was a will to do so). Another issue is the quantity of indicators that the CMAM information system collects - for the CMAM data to be integrated into this system, the data collected would presumably need to be simplified even more than it has been already.

Location of government ownership

As mentioned above in the section on organisational determinants of data production, the Planning, Research and Statistics Department seems to be the obvious future custodian of the SMS system, given this department has expertise in data management (it is the custodian of the HMIS), and the MoH Nutrition Unit does not. The MoH Nutrition Information Officer at federal level informed us that the Nutrition Unit and Planning Departments are accustomed to working together, for example they are currently collaborating to decide which indicators should be included in the new iteration of DHIS2[55]. The Planning Department is reportedly considering introducing a system similar to RAPID PRO for data transfer, so this provides an added incentive to work in partnership.

While the Planning Department does not have the subject-matter specialism required to take over all tasks that UNICEF currently perform, it would presumably be straightforward for them to adopt the mechanical tasks of maintaining the RAPID PRO system, and of extracting and consolidating the SMS data submitted by the facilities. They could then either assimilate the updated data into the website if the proposed system comes to fruition, or simply forward the dashboard data to the information team of the Nutrition Unit to interpret, summarise, report, distribute and act on.

The OPM team understand that staff in the FMoH Planning, Research and Statistics Department have received a number of training sessions with the goal they should lead integration of the CMAM SMS data into the DHIS.

Can the paper-based system be phased out?

The paper-based system and SMS system provide complementary data, in that the weekly RUTF data sent by SMS greatly helps the CMAM programme to run smoothly, and the paper-based system provides data that corresponds to the reporting intervals for other types of health services data.

In theory, the SMS system could eventually replace the paper-system if the issue of low completeness due to occasional poor connectivity was resolved, and software was developed that could automatically derive monthly data from the weekly data. Other conditions that need to be met before phasing out the paper-based system, mentioned during interviews, were

- A strengthened role for LGA nutrition focal points, including development of their computer literacy, and access to computers

[55] District Health Information Software (DHIS) is a web-based system for reporting, analysis and dissemination of district-level data from health programs. It is supported by the WHO and used in many countries globally.

- A strengthened role for the government staff at state level, including increased human resources within the MoH
- Increased human resources dedicated to the information system at government level, including one full-time person in the MoH dedicated to work on the information system
- Integration of the RapidPro system into the routine HMIS (see above)
- Increased use by the MoH of the data, as only this would provide sufficient motivation to maintain and own the SMS system

Long-term prospects for government ownership

If implemented, the measures described above will have the benefit both of improving data quality, and of increasing government readiness to manage the system. However, with respect to the long-term evolution of the information system, it is hard to escape the conclusion that the information system will only be managed and owned by the government when use of the data yielded by the system is essential to them, and the data will only be essential when the government is responsible for the financial support of the CMAM programme. Currently the government only pays staff salaries, and with a few exceptions, does not provide funding to programmes, although this situation shows signs of improvement[56]. Sustained provision of those factors needed for the government to manage the CMAM information system, especially increased human resources, correspond to those needed for the CMAM programme as a whole.

[56] See learning study on Governance for further detail.