UNIVERSITÀ DEGLI STUDI DI TRIESTE

XXXI CICLO DEL DOTTORATO DI RICERCA IN
SCIENZE DELLA RIPRODUZIONE E DELLO SVILUPPO
Indirizzo Clinico Epidemiologico

Supportive Supervision as an approach to improve the quality of care for children with acute malnutrition in Arua district, Uganda: Baseline systematic assessment, Cluster Randomised Controlled Trial and Cost-Effectiveness Analysis

Department of Medicine, Surgery and Health Sciences
Field: General and Specialized Pediatrics

DOTTORANDO	Humphrey. Wanzira
COORDINATORE	Prof. Paolo Gasparini
SUPERVISORE DI TESI	Dott. Marzia Lazzerini
CO - SUPERVISORE DI TESI	Prof. Egidio Barbi

ANNO ACCADEMICO 2017/2018

Abstract

INTRODUCTION

Moderate and severe acute malnutrition estimates among children in the West Nile region, in Uganda, are higher than the national level (10.4% and 5.6%, respectively *versus* 3.6 % and 1.3 %). Additionally, the WHO estimates that in 2016, 6.6 million children and young adolescents died from causes attributed to the poor quality of care in such similar settings. Supportive supervision (SS) has been proposed as one of the approaches to improve quality of care. The main objectives of this project were; to determine the baseline status of the quality of care of nutrition services and health outcomes among malnourished children at health facility level; to test the effectiveness of supportive supervision to improve health outcomes and quality of care; and to estimate its cost effectiveness.

METHODS

Phase one: Six health centers with the highest burden of malnutrition in Arua district, West Nile region, were selected. Information on health outcomes (cured, defaulters, non responders, transferred and died) and quality of case management were extracted from official records. Quality of care was assessed using the national Nutrition Service Delivery Assessment (NSDA) tool, with ten key areas scored as poor, fair, good or excellent.

Phase two: The six facilities were randomized to receive either SS or to control. SS was delivered for ten months in two equal five months' periods; to heath center (HC) staff only (first period), and later extended to community health workers (CHWs) (second period). SS was delivered biweekly for the first three months and later monthly. The package included: monitoring progress, provision of technical support, facilitating good team dynamics and problem solving attitude. The control facilities were assigned to receive the national routine quarterly supervisory visits. Main outcomes included health outcomes, quality of case management, quality of nutrition service delivery and access to care.

Phase three: The Incremental Cost Effectiveness Ratios (ICER) for the first and second period were estimated.

RESULTS

Phase one: A total of 1020 children were assessed at baseline. The cured and defaulter's rates were 52.9% (95% CI: 49.7 – 56.1) and 38.3% (95%CI: 35.2 – 41.4) respectively. The NSDA revealed 33/60 (55%) areas scored poorly, 25/60 (41%) as fair, 2/60 (3.3%) were good and none were excellent. Main gaps included: lack of trained staff; disorganized patient flow; poor case management; stock out of essential nutrition supplies and weak community linkage. *Phase two*: 737 children were enrolled, 430 in the intervention and 307 in the control. Significant findings of the intervention *versus* control included: higher cure rate [83.8% (95%CI: 79.4 – 86.7) *versus* [44.9% (95%CI: 37.8 – 49.1), p=0.010)], lower defaulting rate [1.4% (95%CI 1.1% to 1.8%) *versus* 47.2% (95%CI 37.3% to 57.1 %), p=0.001], higher correct complementary treatment (94.0% *versus* 58.8%, p=0.001) and more NSDA areas scored as either good or excellent [24/30 (80%) *versus* 14/30 (46.6%), OR = 4.6 (1.3 – 17.4), p=0.007]. Access to care was significantly higher during the second period as compared to the first period [proportion difference = 28.4%, OR = 1.7 (1.3 – 2.3), p = 0.001].*Phase three*: the ICER of € 9.7 (95%CI:7.4 – 14.9) and € 6.8 (95% CI:4.8 – 9.5) were estimated in the first and second periods respectively.

CONCLUSION

At baseline, the quality of care provided to children with malnutrition at health center level was greatly substandard. The delivery of SS to HC staff and CHWs significantly improved the cure rate, the quality of case management, the overall quality of care and access to care. SS, especially that delivered to CHWs, was very cost effective.

Key words: Supportive supervision, Malnutrition, children under 5 years, quality of care, randomized controlled trial

Table of Contents

List of Tables

List of Figures

List of acronyms

ART	Anti Retro-viral Therapy
BF	Breast Feeding
CEA	Cost Effectiveness Analysis
CHEERS	Consolidated Health Economic Evaluation Reporting Standards
CHWs	Community Health Workers
CI	Confidence Interval
CONSORT	Consolidated Standards of Reporting Trials
DALY	Disability Adjusted Life Years
DHT	District Health Team
HC	Health Center
HIV	Human Immune-deficiency Virus
HMIS	Health Management and Information System
ICC	Intra-cluster Correlation Coefficient
ICER	Incremental Cost Effectiveness Ratio
IMAM	Integrated Management of Acute Malnutrition
IMCI	Integrated Management of Childhood Illnesses
INR	Integrated Nutrition Register
IRCCS	Instituti di Ricovero e Cura a Carattere Scientifico
ITC	In-patient Therapeutic Care
LMIC	Low and Middle Income Countries
MAM	Moderate Acute Malnutrition
MD	Mean Difference
MDG	Millennium Development Goals
MoH	Ministry of Health
MUAC	Mid Upper Arm Circumference
NSDA	Nutritional Service Delivery Assessment
OPD	Out Patient Department
OR	Odds Ratio
OTC	Out-patient Therapeutic Care
PDSA	Plan-Do-Study-Act cycle
PHC	Public Health Care
RCT	Randomized Controlled Trial
RUTF	Ready to Use Therapeutic Foods
SAM	Severe Acute Malnutrition
SD	Standard Deviation
SDG	Sustainable Development Goals

SOP	Standard Operating Procedures
SS	Supportive supervision
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
SUN	Scaling Up of Nutrition
TB	Tuberculosis
UN	United Nations
UNCST	Uganda National Council for Science and Technology
UNICEF	United Nations International Children's Emergency Fund
WHA	World Health Assembly
WHO	World Health Organization
WHO-CHOICE	World Health Organization - CHOosing Interventions that are Cost Effective
YLD	Years of Lived with Disability
YLL	Years of Life Lost

Chapter One

1. Introduction

Under-nutrition is a major cause of morbidity in children under 5 years [1]. The most recent estimates indicate that 50.5 million children under 5 years are diagnosed with wasting and 17 million with severe wasting and of these, 26.9% occur in Sub-Saharan Africa [1]. In Uganda, acute under-nutrition is considered a condition of public health importance [2]. National estimates report that 3.6% children suffer from moderate acute malnutrition (MAM) while 1.3% have severe acute malnutrition (SAM) [3]. However, this prevalence is heterogeneous across regions. For instance, the West Nile region, currently considered as a humanitarian setting and hosting refuges from South Sudan and Congo [4,5] has the highest reported prevalence of MAM and SAM in the country at 10.4% and 5.6% respectively [3]. This is far above the target identified by the World Health Assembly which adopted the goal of reducing and maintaining the prevalence of wasting in children to under 5% by 2025 [6,7].

In an effort to reduce this burden and improve on patient management of children with malnutrition, the Ministry of Health (MoH) developed the Integrated Management of Acute Malnutrition (IMAM) guidelines in 2006 and updated them in 2011 [8] and 2016 [2], in line with the WHO recommendations. The guidelines provide details for the management of children with both MAM and SAM at health facility level and include recommendations for screening and follow up at community level. Support has been provided from both international and local stakeholders especially the procurement and distribution of therapeutic foods and basic nutritional equipment [10], [12]. However, several studies have shown that developing guidelines, providing training and basic equipment *per se* do not actually ensure that care is delivered according to the standards [11–15]. This is supported by previous assessments of the quality of nutritional service in low and middle income countries (LMIC) that highlighted that poor adherence to guidelines and poor quality of care are common findings [12,13,16,17]. However, the magnitude of this under performance is not adequately known, especially in a

refuge setting. Supportive supervision (SS) has been suggested as a promising intervention for achieving higher adherence to guidelines and better quality of care in LMIC such as South Africa, India and Bangladesh [18–20]. Yet, there is currently limited evidence of its impact particularly on health outcomes, especially among children with malnutrition [21].

The first aim of this project was to systematically determining the baseline status of quality of care of nutrition services at out-patient therapeutic centers (OTC) as described under **chapter four.** The second aim was to test the effectiveness of SS to improve health outcomes and quality of care of nutrition services among children admitted at these heath facilities as described **under chapter five**. The intervention was delivered in two study periods reflecting two approaches: SS was first delivered to staff at health center (HC) level (study period one) and later extended to community health workers (CHWs) attached to each HC (study period two). The third aim of this project was to estimate the costs of delivering the intervention during both study periods in one year, and cost effectiveness for the two approaches. Details of which are described **under chapter six**

Before commencement of this project, it was submitted to IRBs including the School of Public health Makerere University Ethical committee, Uganda National Council of Science and Technology, and the Ethical Committee of the IRCCS Burlo Garofolo. The study protocol was registered in ClinicalTrials.gov (NCT03044548). During study implementation, all relevant regulations for ethical consideration in human research were followed, including the Nuremberg Code [22], the Helsinki declaration latest version 2013 [23], and all relevant procedures of Good Clinical Practice and International Conference of Harmonization[24]. Health authorities were informed of the authorization received to conduct the study. At the facility level, staff were informed on the objectives and methods of the study, and their written consent was obtained. At the individual level, the parents/guardians of children were informed and provided written consent to participate in the study **(Appendix 1 & 2).** Consent was administered in the most appropriate language, that was either English or the local language of Lugbara.

2. Background

2.1. Acute under nutrition: Global Perspective

The 2017 malnutrition status joint report by UNICEF/WHO and World Bank entitled "*Levels and Trends in Child Malnutrition"* reveals that globally 50.5 million children are diagnosed as having acute under nutrition (wasting) and 16.4 million are severely wasted [25]. Over 90 percent of children with wasting are either from the South and Southeast Asia or Sub-Saharan Africa. In Africa, 14.0 million children under 5 years are wasted, of which 4.1 million are severely wasted. In reality, this burden could possibly be an underestimate because the surveys, from which these estimates are based, are impacted upon by the timing and duration of data collection, only capturing a snap shot of the burden at a specified point in time [7,26].

Under nutrition is as a result of deficiency of protein, energy as well as micronutrients including vitamins and minerals [27,28]. The causes are varied and include; poor access to appropriate, timely and affordable health care; inadequate caring and feeding practices (e.g. exclusive breastfeeding or low quantity and quality of complementary food); poor food security; and a lack of a sanitary environment, including access to safe water, sanitation and hygiene services [28]. Under nutrition can either be acute (wasting) or chronic malnutrition (stunting) [7,25,28] and diagnosis is mainly through anthropometry (body measurements of height, weight and mid –upper arm circumference) including clinical parameters such as presence of edema [27]. These are then compared to standard reference nutrition indices such as the WHO reference growth standards[29]. Moderate acute malnutrition (MAM) is defined as moderate wasting between −3.0 and −2.0 Z-scores below the median and/or MUAC ≥115 mm and <125 mm. Severe acute malnutrition (SAM) is defined as severe wasting with a weight-for-height −3.0 Z-score below the median ,and/or mid-upper arm circumference (MUAC) <115 mm and/or bilateral pitting edema. [27,28].

The focus of this project is on children diagnosed with acute malnutrition. Consequences of this condition can be both short-term and long-term, with children under 5 years as the most

affected [1,27,28]. In the short-term, acute malnutrition is indirectly linked to 45% of all deaths in children under 5 years every year [30]. Most of these deaths are due to SAM, which has been reported to be associated with a ten-fold risk of mortality when compared to a healthy child [30]. The long-term consequences can extend into adulthood and include events such as growth retardation and developmental delays, poor cognitive ability and weaknesses in overall bodily functions such as weakened immune system [28].

Reducing malnutrition has been recognized at both the global and national levels as an important driver of positive progress for any community [31]. Malnutrition negatively impacts on the economic development of a country, through losses in productivity due to poor physical status, impaired cognitive development and, most importantly, through increased health costs associated with treatment [30,32]. In the last two decades, there has been increasing global attention and investment in the reduction of malnutrition. For instance, in 2000, the United Nations (UN) adopted eight Millennium Development Goals (MDGs) with several MDGS addressing malnutrition indirectly or directly such as the MDG 1 that aimed at eradicating extreme poverty and hunger by 2015 [33]. Additionally, efforts by the World Health Organization (WHO) and UNICEF [28] have led to the Scaling up of Nutrition (SUN) movements, networks and partners to improve nutrition especially among children and women. A number of activities that have been achieved through this movement include a multi-sectoral approach involving relevant stakeholders, establishment of coherent policy and legal frameworks, alignment of programs with common objectives and results frameworks, and mobilization of resources to support nutrition actions. WHO has developed and disseminated nutrition management guidelines to standardize the treatment of MAM and SAM at facility levels while the SPHERE project has set reference standards for emergency settings [34–36]. Furthermore, in 2012, the World Health Assembly (WHA) set targets to reduce and maintain the level of acute malnutrition to less than 5% by 2020 [6,7] with the purpose of increasing attention, investment and actions for cost-effective nutrition related interventions and policies. In 2015, the United Nations (UN) replaced the eight MDGs with 17 Sustainable Development Goals (SDGs), with the acknowledgement that nutrition is a core component of the achievement of all

these goals [31]. Specifically, the second SDG aims to end all forms of hunger and malnutrition by 2030, making sure all people, especially children and the more vulnerable, have access to sufficient and nutritious food all year round.

Despite all these efforts, there is clear evidence of slow and unequal progress to achievements of these goals and targets especially in developing countries [25,27,28] where acute malnutrition continues to significantly contribute to the high rates of mortality, especially among children under 5 years [25,27,30].

2.2. Acute under nutrition in Uganda

Uganda is one of the low and middle income (LMIC) countries where acute malnutrition is considered a condition of public health importance [2]. The prevalence of MAM among children under 5 years is 3.5% and SAM at 1.3% [3] from an estimated population of 6.6 million children in the similar age bracket (18% of the 35 million estimated total population) [37]. Additionally, in areas currently considered as humanitarian settings, these prevalence estimates are three-folds higher than the national estimates. For instance, the West Nile region, which hosts refugees from the war torn neighboring countries of South Sudan and DR Congo [4,5] has an estimated prevalence of MAM at 10.4% and SAM at 5.6% [3]. This situation is also exacerbated by the high prevalence of infectious diseases such as HIV and TB, which are both known to be major risk factors for under nutrition [30,38–40]. There is evidence that 15 percent of acutely malnourished children presenting to the in-patient facilities are HIV-positive [2]. In Uganda, malnutrition has also been shown to be associated with between 35 – 55 % of all childhood deaths and is one of the main contributors to the high infant and under-five mortality rate at 43.8 and 66.1 per 1000 live births respectively [41].

There is strong commitment from the government to reduce this burden. Over the last two decades, improvement of nutritional status of the population has become a priority. This effort is led by the Office of the Prime Minister which has brought together ministries such as Health,

Education and Agriculture, in dialogue with UN agencies such as UNICEF [9], and development partners. Reducing malnutrition is recognized as a key part of the country's strategy for becoming a middle-income country by 2040 [42]. Actions to address malnutrition were included in the National Development Plan 2015/2016 – 2019/20 [43] and in the Uganda Nutrition Action Plan 2011-2016 for multi-sectoral support [9]. Specific to the Ministry of Health, there has been development of standards, policies and guidelines in line with the WHO recommendations. The Ministry developed the first Integrated Management of Acute Malnutrition (IMAM) guidelines in 2006 which were later updated in 2011 [8] and most recently in 2016 [2]. The guidelines provide a reference standard for ensuring appropriate preventive interventions, early identification and treatment of the acutely malnourished individuals. They are a comprehensive document combining management of in-patients (SAM with complications), out-patients (SAM without complications), supplementary feeding (MAM) and community mobilization and involvement.

There has also been strong partner support from stakeholders such as UNICEF, who have been instrumental in the procurement and distribution of therapeutic foods and basic nutritional equipment [9,10].

2.3. Quality of Care at health facility level in Low and Middle Income Countries

According to the WHO, quality of care is defined as "the extent to which health care services provided to individuals and patient populations improve desired health outcomes. In order to achieve this, health care must be safe, effective, timely, efficient, equitable and people-centred" [44]. The details of these six dimensions are described in box 1.

Box 1: Dimensions of quality of care

Health care provision should be:

1. **Safe.** Delivering health care that minimizes risks and harm to service users, including avoiding preventable injuries and reducing medical errors.
2. **Effective.** Providing services based on scientific knowledge and evidence-based guidelines.
3. **Timely.** Reducing delays in providing and receiving health care.
4. **Efficient.** Delivering health care in a manner that maximizes resource use and avoids waste.
5. **Equitable.** Delivering health care that does not differ in quality according to personal characteristics such as gender, race, ethnicity, geographical location or socioeconomic status.
6. **People-centred.** Providing care that takes into account the preferences and aspirations of individual service users and the culture of their community.

Source: WHO Quality of care: A process for making strategic choices in health systems[44]

Despite the increasing coverage of interventions for malnutrition, there is evidence that the quality of care of children with malnutrition in LMIC is still sub-standard [44,45] and is linked to the alarmingly high mortality rate in children under 5 years[46]. There are several documented reasons that contribute to this sub-standard quality of care in LMIC. *Baily et al* broadly listed them as the lack of human resources, infrastructure, equipment and supplies, in addition to poor case management, service delivery [21], insufficient financial support and health service delivery fragmentation [44].

In Uganda, Primary Health Care (PHC) is the predominant service delivery system with the government accounting for over 60% of PHCs facilities under the National Minimum Health Care Package while the rest are privately owned [47]. Even though the cost of funding this package is estimated at US$ 28 per capita, only US$ 8.2 is actually available, highlighting a huge financial gap needed for optimal service delivery.

Furthermore, most PHC workers who are responsible for health delivery to the largest population are stationed in remote and rural settings. They are mainly clinical officers, nurses and community health workers (CHWs) who face frequent challenges such as inadequate resources, minimal training and remuneration [48], all contributing to the to the sub-standard delivery of quality of health care services. This situation is further exacerbated in areas experiencing a refugee crisis such as the West Nile region. The influx of a large number of individuals into this region with inadequate resources like food leads to food insecurity, and ultimately malnutrition especially among refugee children [48]. This results into a higher burden of malnutrition in the area, with most of these children ending up at the nearest health facility for treatment. The increasing number of children at these facilities is most times beyond the planned scope of health service provision, an occurrence that is always associated with worsening quality of care, service provision and ultimately poorer health outcomes.

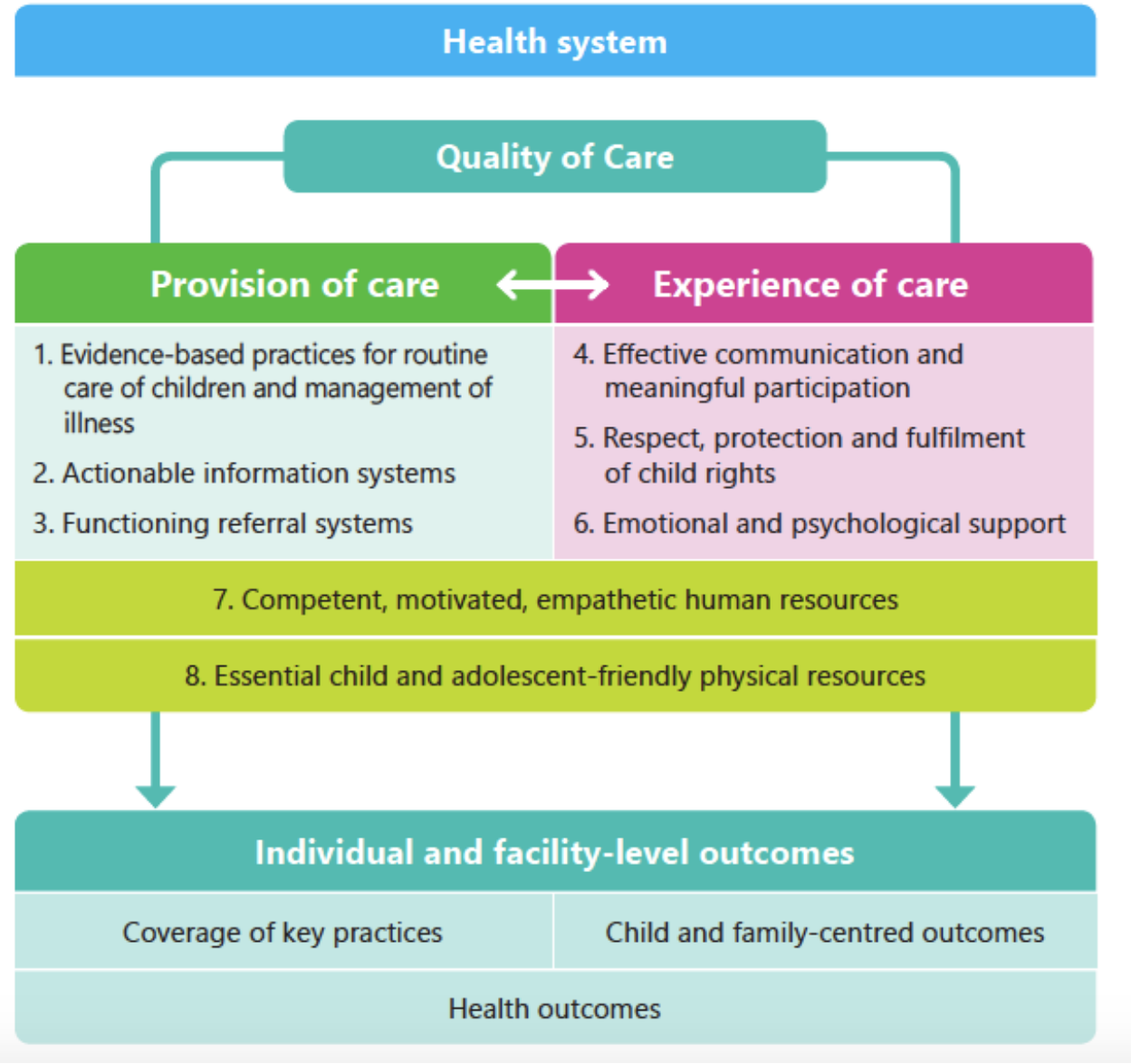
There is consensus among stakeholders that scaling up of interventions and increased resource allocation will not directly translate into better health outcomes, if attention is not given to the the quality of care provided at the facility level. According to the 2016 WHO statistics, 6.6 million children and young adolescents (5.6 million children under 5 years and 1 million aged 5 – 14 years) died, mostly from preventable causes, attributed to the poor quality of service delivery at the health facility level [45,46]. Sub-standard quality of care reduces the effectiveness of interventions while increasing the risks for morbidity complications and mortality [49] which could partly explain the alarmingly high mortality rates attributable to malnutrition, despite the increasing coverage of interventions, as documented in the recent joint WHO/UNICEF and the World Bank reports [25].

The importance of quality of health care in services delivery and its potential impact on child and maternal survival is progressively being recognized in a number of scientific publications [50–52] and policy documents [45,53,54] as an important additional component to improvement of health and well being.

Riding on this momentum, the WHO, in 2006, launched the "Quality of care: A process for making strategic choices in health systems" as a guide and standard for systematic decision making processes for managers at country levels for the design and implementation of effective interventions to promote quality of health care [44]. This has been followed by two series on the standards of improvement of quality of care, first for maternal and new born care [55] and most recently among children and young adolescents [45]. Quality of care Standard One in the WHO series for children and young adolescents which states that *"Every child receives evidence-based care and management of illness according to WHO guidelines"* directly addresses malnutrition care in the health facility level. This is under the quality statements 1.6 "*All infants and young children are assessed for growth, breastfeeding and nutrition, and their carers receive appropriate support and counselling, according to WHO guidelines*" and 1.7"*All children at risk for acute malnutrition and anaemia are correctly assessed and classified and receive appropriate care according to WHO guidelines*".

Furthermore, the WHO document [45] recommends a specific framework for improvement of quality of pediatric care (Figure 1). The Framework comprises of eight domains; evidence-based practices for routine care of children and management of illness; actionable information systems; functioning referral systems; effective communication and meaningful participation; respect, protection and fulfilment of children's rights; emotional and psychological support; competent, motivated, empathetic human resources; and essential child- and adolescent-friendly physical resources.

Figure 1: Framework for improving the quality of pediatric care



Source: WHO Standards for improving the quality of care for children and young adolescents in health facilities [45]

2.4. Supportive supervision as an approach to improve Quality of Care

For decades, the most common approach used for improving the case management of common children's diseases has included the adoption and dissemination of evidence-based guidelines, usually combined with training of staff [56–58]. This was because of the general belief that the lack of knowledge and skills among health facility staff was the reason for their underperformance [59]

However, there is substantial evidence that this approach has largely been ineffective in improvement of health facility staff performance and overall quality of care at facility level, especially among LMIC [12,13,16,48]. Specifically, assessments of the quality of nutritional services in different settings, after training, have highlighted poor adherence to guidelines leading to substandard quality of care and subsequently poor health outcomes for malnourished children [12,13,16]. These findings demonstrate the need for other innovative interventions, most especially those that focus on mentorship and building relationships in the whole workforce.

Supportive supervision (SS) has been suggested as a promising and sustainable intervention to achieve higher adherence to guidelines [60–62]. Ensuring adequate SS may be one of the best interventions to improve the quality of care provided by health facility staff, and therefore the health outcomes of children suffering from malnutrition.

3. Problem statement: Inadequate Supportive Supervision

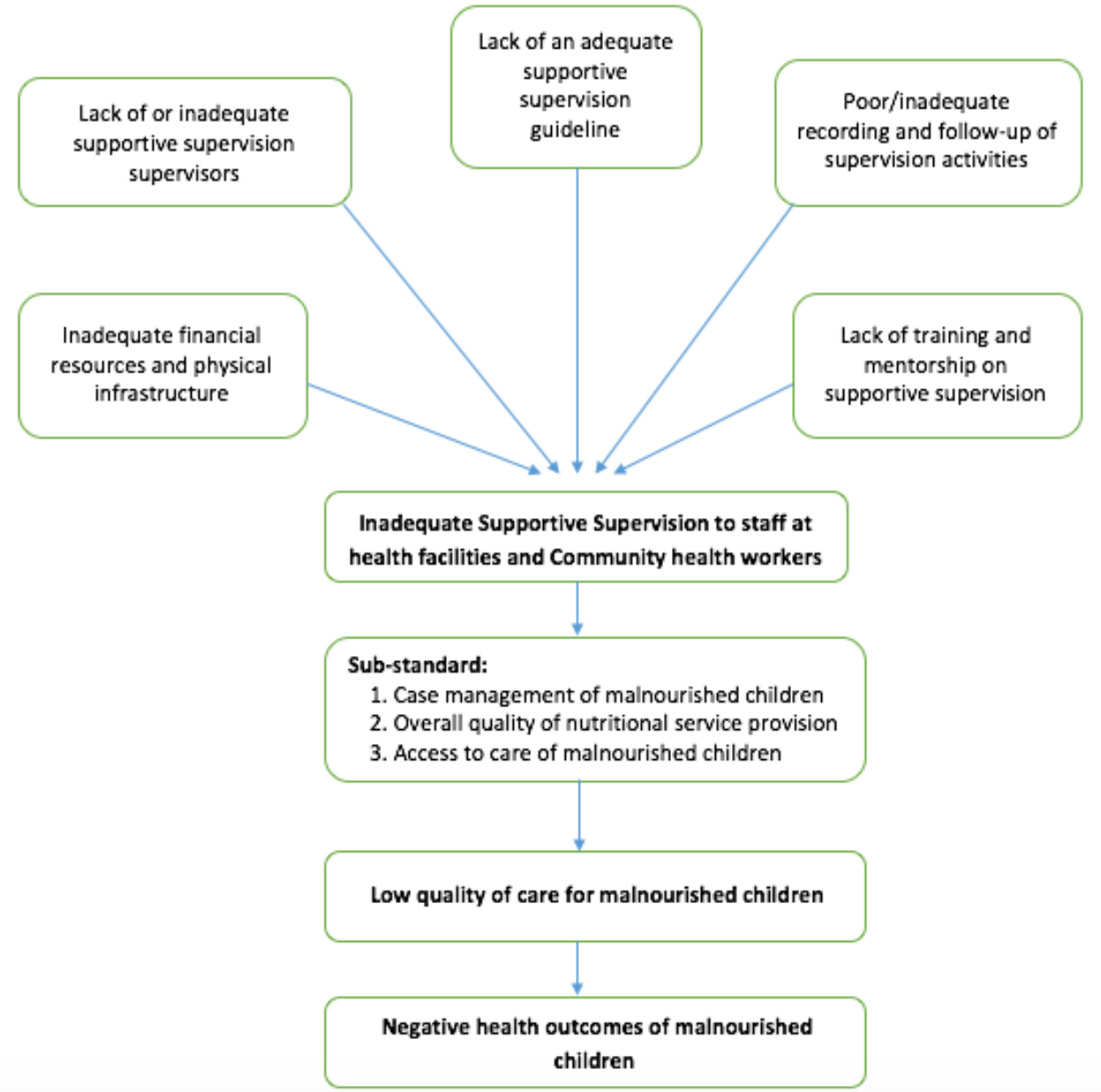
Identifying areas of substandard quality of care is an important step towards improvement of health services [16,63–67] because such findings focus intervention activities such as SS towards areas of weaknesses. Yet, in Uganda, there is currently limited published literature that adequately describes the quality of care of malnourished children admitted to health facilities in the context of these challenges, more so those located in a humanitarian setting. Additionally, just like several other LMIC which have SS included in their national guidelines,

Uganda continues to be plagued by challenges during its implementation. Although the health facility staff receive an initial training at the time of guideline dissemination, there is evidence of no record of supervisory health facility field visits and in instances where they are, the supervisors receive no specific training on how to conduct an effective SS [17,68]. This is exacerbated in areas of humanitarian crisis, like the West Nile region, where the mass arrival of refugees places enormous strain on existing public services and local health care infrastructure [69]. Furthermore, even though there is evidence of benefit of SS on health care worker's knowledge, attitudes and practices and improvement of quality of care, there is no clear evidence on its impact on patient health outcomes [21] especially coming from LMIC settings. As such, evidence from published high quality studies on impact of SS on health outcomes such as that provided by randomized controlled trials (RCTs) is limited, if any. A recent search of the PubMed database for systematic reviews and studies evaluating SS in the health service delivery system (search terms included SS, health systems, under nutrition, developing countries, RCT, Systematic reviews) did not reveal any published study on its impact on improvement of health outcomes of children with malnutrition. Only two studies, evaluating quality improvement for children with malnutrition, used an RCT design [11,70] but were evaluating SS as a minor component of a more complex multifaceted intervention. Also, even though the current IMAM guidelines have SS included, there is no clarity on how this would be done especially the activities involved, making the current process prone to varying interpretations and implementation approach [2].

There is also limited, if any, published literature on the cost effectiveness of this approach when conducted in health facilities admitting children with malnutrition. Cost effectiveness analysis provides specific information regarding the financial resources need against the effectiveness of SS which can be used to promote the approach or for financial advocacy purposes. Evaluating the cost-effectiveness of interventions, in particular in contexts with limited resources such as Uganda, is crucial. For instance, the IMAM guidelines [2] recommends SS to be conducted on a quarterly basis, and yet this is not regularly done due to a number of reasons that include the lack of financial resources [71].

The conceptual framework in figure 2 below summarizes the most important issues identified, that affect supportive supervision and its link to quality of care and overall impact on health outcomes.

Figure 2: Problem statement conceptual framework



Chapter Two

4. Literature review

4.1. Supervision of health care workers in Low and Middle Income Countries

Supervision is an English word derived from two Latin words *"super"* which means *"above"* and *"videre"* which means *"see"* or *"observe". Kilmister et al* defined supervision in medicine as the provision of monitoring, guidance and feedback on matters of personal, professional and educational development in the context of the doctor's care of patients [72].

Supervision of health care staff in LMIC countries gained momentum at the time of the PHC movement following the Alma-Ata Declaration [73,74]. In 1978, the WHO adopted PHC as a core concept for achieving universal access to health care services [75] with the aim of equitable access and cost effective health care service delivery, especially in LMCI. The adoption of PHC was subsequently followed by extensive expansion of health care facilities to reach the lower administrative levels. In an effort to try and maintain the standards of the new facility set up, that were distant from the center of authority, PHC guidelines also included a component of supervision [73,74].

At that time, the supervision approach was mainly a top-down model which mainly involved higher level staff passing instructions to their lower level colleagues, sometimes followed with punitive measures to the lower level staff [73,76]. *Clements et al,* further describes this supervision approach as a remnant of colonialism characterized by inspection and control with the purpose of finding fault while offering little guidance on improvement [76]. The main activities focused on facility inspection, availability and use of resources, logistics and supply chain, records review and passing down communications and directives [73] while the burden of finding solutions to any issues was solely left to the health facility staff [21,74,77].

Over the last two decades, there was a realization that this “traditional” approach was not effective [73,78] partly because health care workers perceived supervisors as monitors/inspectors who were more concerned with control, criticism and finding fault. Other challenges to this approach included infrequent health facility visits [48] and problem solving was more or less reactive with inadequate feedback or guidance for improvement provided [74,76]. Due to these challenges, the concept of SS started to gain prominence and has gradually been replacing the traditional approach as a best practice in health care [73,74,78].

Marquez et al defined SS as “a process that promotes quality at all levels of the health system by strengthening the relationships within that system, with an emphasis on identifying and solving problems and contributing to the optimization of the allocation of resources – promotion of high standards, teamwork and better communication in both directions “[78].
Whereas the traditional supervision approach tended to focus on formative and normative aspects of quality improvement such as increasing knowledge, skills, accountability and quality assurance, SS also included the re-orientation towards the restorative aspects such as enhancing work place relations, building trust, empathy and responding to emotional needs for a broader performance improvement [79]. *Marquez et al* summarizes the differences between the traditional supervision approach as compared to SS [78] in Table 1 below.

Table 1: Comparison of traditional and Supportive supervision approaches

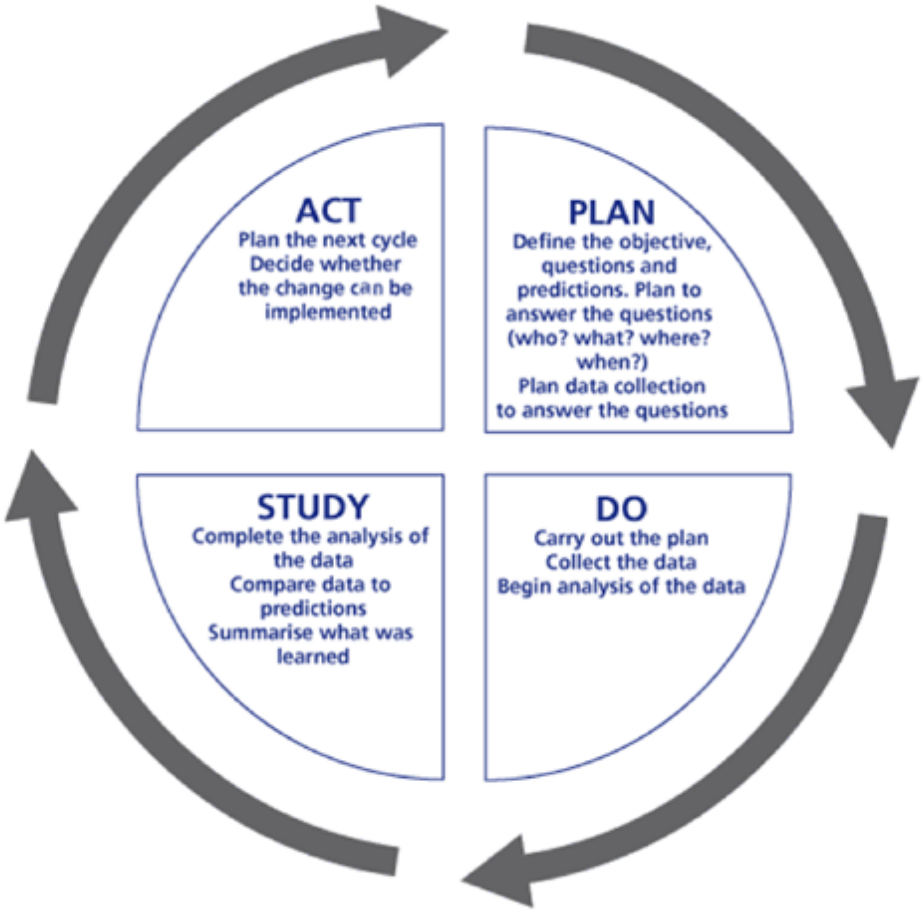
Action	**Traditional supervision**	**Supportive Supervision**
Who performs supervision	External supervisors designated by the service delivery organization	External supervisors designated by the service delivery organization; staff from other facilities; colleagues from the same facility (internal supervision); community health committees; staff themselves through self-assessment
When supervision happens	During periodic visits by external supervisors	Continuously: during routine work; team meetings; and visits by external supervisors
What happens during supervision encounters	Inspection of facility; review of records and supplies; supervisor makes most of the decisions; reactive problem-solving by supervisor; little feedback or discussion of supervisor observations	Observation of performance and comparison to standards; provision of corrective and supportive feedback on performance; discussion with clients; provision of technical updates or guidelines; onsite training; use of data and client input to identify opportunities for improvement; joint problem solving; follow-up on previously identified problems
What happens after supervision encounters	No or irregular follow-up	Actions and decisions recorded; ongoing monitoring of weak areas and improvements; follow-up on prior visits and problems

Source: *Marquez & Kean, 2002 [78]*

Kilmister et al described the relationship between the supervisor and the health facility staff receiving supervision as the single most influential determinant of the quality of supervision and therefore the cornerstone of the SS approach[72]. This approach is a two-way communication focused on the quality of relationships [21,72] and meeting staff needs through on-job transfer of knowledge and skills [80] and usually contains elements such as: on site problem identification and solving, to improve quality and meet patient needs; quality improvement of case management process; empowerment of health providers to monitor and improve their own performance; external supervisor acting as a facilitator, trainer and coach, participation of health providers in supervising themselves and one another; participatory decision making involving the whole team; and peer assessment, self-assessment and community input consideration [21,59,78].

According to this model, the supervisory visits are non-authoritarian and an opportunity for participatory peer-to-peer interaction and open communication between the supervisor and staff members, aiming at listening to the voice of the health facility staff, and clarifying any doubt in relation to the implement of the national guidelines, and at developing solutions together, in the form of "quality improvement teams" [76,78]. The attitude is very much "problem solving". Identified problems are analyzed as a team as soon as they are encountered and solved following the widely accepted Plan-Do-Study-Act cycle (PDSA cycle) method for quality improvement in health care [81]. In brief, this cycle (Figure 3) involves making a Plan for an identified problem, stating the expected change, person responsible for the achievement of the change and the timeline for implementation. The plan is then tested (Do) through implementation and later verified that the planned change tested is according to plan (Study). The final step (Act) summarizes the findings and the lessons learned from the previous steps.

Figure 3: The Plan-Do-Study-Act cycle



Source: Taylor et al, [81]

The benefits of SS of health care workers to improving health care service delivery and quality of care are known [59,68,82,83]. For example, in an earlier study conducted in Senegal by *Suh et al* entitled "Improving quality of reproductive health care in Senegal through formative supervision" the authors found that formative supervision improved the quality of reproductive health services, especially in facilities with on-site skills building and refresher training [84]. Evidence from a recent systematic review of SS as a strategy to improve primary healthcare services in Sub-Saharan Africa conducted by *Bailey et al* found that SS models based on a problem solving approach were more strongly linked to increased health worker motivation,

job performance, provider confidence, job satisfaction and morale [21]. More recently in Uganda, a study by *Henry et al* on the competency in SS on public sector medicines management supervisors in Uganda found that medicines management supervisor's SS competency was positively related to the improvement in medicines management at the facilities [85]. Specific to pediatric hospital care *Hoque et al* found that Integrated Management of Childhood Illnesses (IMCI) training combined with regular supervision improved the quality of child health care at facility level even among health workers who had received minimal pre-service training [70]. Most recently *Lazzerini et al* also found that periodic SS after a training course improved both adherence to WHO guidelines on hospital care for children and the overall quality of pediatric care[86].

Based on this evidence, there is growing interest to adopt the SS approach as part of national human resources management manuals. WHO developed manuals for SS training such as the SS training for mid-level managers under the vaccination program [79,87]. Some LMIC countries for example South Africa, India and Bangladesh have guidelines and are implementing some form of it [20,70,77]. In Uganda, the concept of SS was mentioned as early as 2000, in the first Ministry of Health National Health Policy aligned to the 1996 constitution [88]. Under the human resource development section, the Ministry determined to establish and maintain mechanisms for assuring relevant continuing education for, and SS of all health personnel. This was also included in the subsequent revised versions of 2010 [89] and was also adopted in the National Quality Improvement framework and strategic plans and Manuals [71,90]. For the management of children with malnutrition, the most recent 2016 IMAM guidelines have a section on SS and the relevant data collection sources and tools [2]. One of the most commonly quoted tools is the National Service Delivery Assessment (NSDA) tool that assess 10 capacity areas of health service delivery at the out-patient therapeutic care (OTC) facilities including quality improvement activities, and monitoring and evaluation.

In a more recent strategic document “Strategy for Improving Health Service Delivery 2016-2021” [91] the Ministry of Health is in the process of moving towards harmonizing all the SS guidelines and standards into one document based on the health systems building blocks including; Service delivery, Human resources for Health, Pharmaceutical products (Medicines and health supplies), Governance and leadership, Financing and Health information systems. The proposal includes the development of tools to cover the six areas and SS will be carried out in an integrated and comprehensive manner.

4.2. Cost-effectiveness of interventions in Low and Middle Income Countries

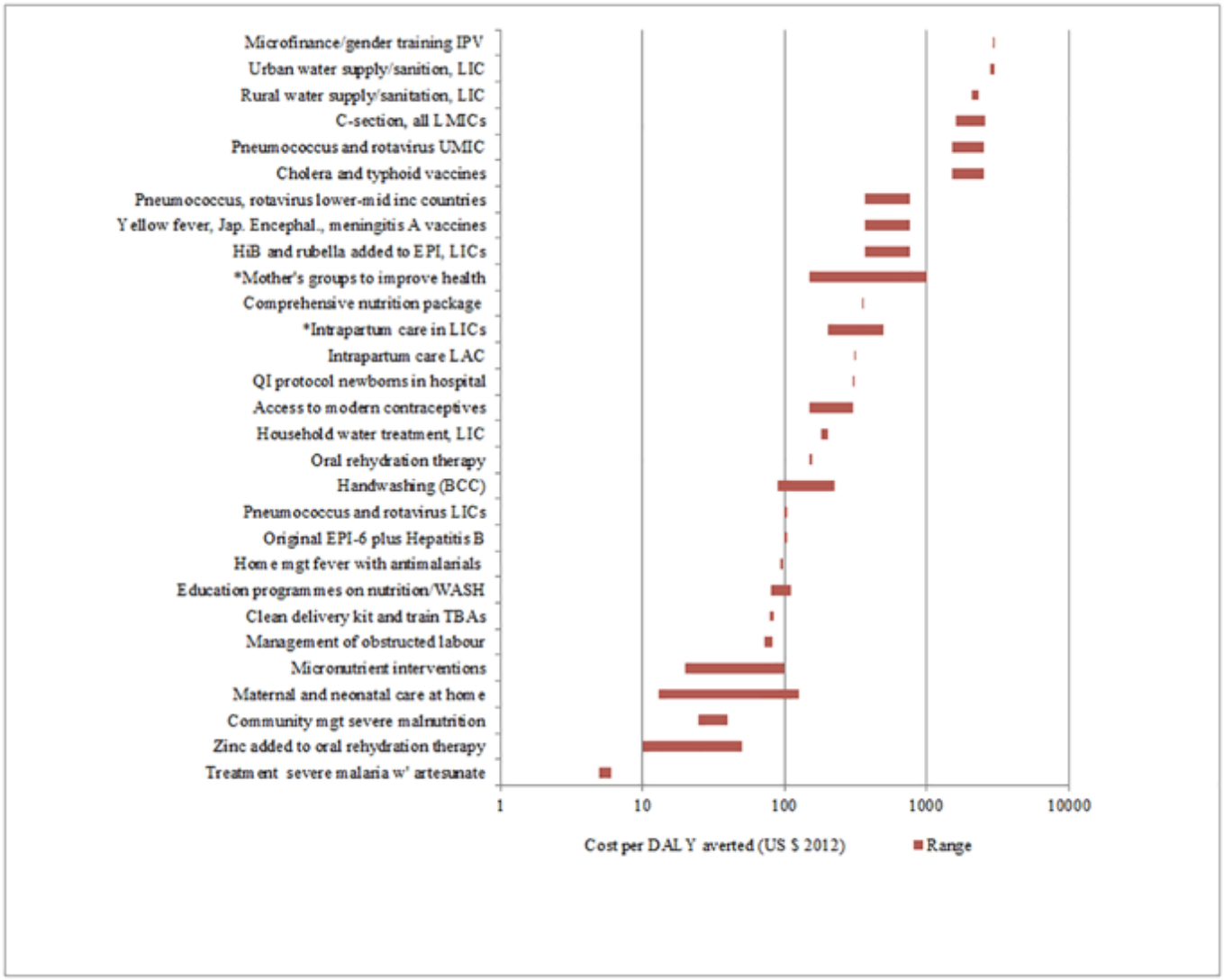
The limited resources for health care means that only effective interventions that are considered to be “value for money” are likely to be considered for scale up. Therefore the need to demonstrate the cost–effectiveness of health care interventions, a type of economic evaluation, is increasingly becoming a priority especially in such settings [92]. In general, economic evaluations play an important role especially during the prioritization and allocation of resources in the decision making process. They can guide decisions regarding the most appropriate mix of strategies and the best way to allocate scarce resources. The awareness that cost effective interventions have a greater possibility for adoption, due to the additional value for money they offer for similar effectiveness and higher possibility of sustainability, has boosted the inclusion of cost effectiveness analysis (CEA) as part of new health care intervention assessments.

CEA considers the costs and outcomes of a health care intervention designed to improve health and well being of a population[93]. The main health outcomes considered in CEAs include; natural units such as cured, death, defaulters etc and Disability Adjusted Life Years (DALYs). The cost estimations are influenced by the perspective selected which include; societal perspective, the provider’s perspective, or the private (patient or household) perspective. The perspective is determined by considering the end user of the generated information and the feasibility of collecting the cost data. A societal perspective includes all costs, regardless of who incurs them

whereas a provider or private perspective considers the view point of a specific service provider or private entity. CEA provides information about the relative efficiency of alternative interventions (two or more interventions) with the same goal [94]. The CEA is usually expressed as a ratio of costs in relation to effects called the "incremental cost –effectiveness ratio (ICER)" [95]. It is the difference in costs between the new and the old intervention and divided by the difference in effects between the new and old intervention. It is interpreted as the additional cost per additional "health outcome" achieved, such as the cost per children cured or cost per DALY averted.

The WHO and partner experts, have provided several guidelines on the standards for reference during the conduct of a CEA [92,93,96]. Furthermore, the WHO CHOosing Interventions that are Cost Effective (CHOICE) group has also suggested cut-offs for costs per DALY averted, as a guide in determining cost effective interventions [92]. In this guide, an intervention is considered highly cost-effective if it costs between one and three times the per capita GDP of the country. In the past two decades, there has been an explosion of numerous CEA studies conducted in different LMIC settings evaluating different health care interventions, highlighting the importance of information derived from CEAs especially as evidence for decision making for policy makers [97–100]. Similarly, there have been numerous CEA assessments for interventions designed to reduce the burden of malnutrition. For example, *Wilford et al* conducted a cost-effectiveness of community-based management of acute malnutrition (CMAM) in Malawi which showed that the scale up of CMAM within essential health services was indeed cost effective as compared to health services without CMAM [101]. Another study by *Puett et al* assessed the cost effectiveness of the use of lipid nutrient supplements for preventing child malnutrition and morbidity and found that this addition was less cost-effective than other standard intervention options [102]. *Horton et al* went further to use cost effectiveness analysis to ranked child health care interventions in terms of their cost effectiveness (Figure 4), information that can be used in LMIS for national health care planning and budgeting [103]

Figure 4: Ranking of cost effectiveness of interventions for children



Source: Horton et al,[103]

Chapter Three

5. Project Justification

The findings of this project are important because they will inform policy makers, planners, researchers and implementers with evidence regarding the status of health facility nutrition service delivery, which would then allow for focused intervention. The first aim of this study was to carry out an assessment of the quality of care provided to children admitted with acute malnutrition at out-patient therapeutic care (OTC) level in Arua district, West Nile region. This assessment was an important step towards improvement of nutrition service delivery by identify areas of sub-standard quality for targeted intervention such as during SS.

The second aim of this project was to provide evidence of effectiveness and cost effectiveness for SS as a quality of care improvement approach for consideration during decision making process. It also provides a specific package of the SS approach with activities during implementation, that can be easily adopted in the national IMAM guidelines. This study also provides support for the need for harmonization of SS activities with an approach that is not only effective but collectively acceptable to the supervisors and health care workers. The supervisors in this approach included the district nutritionist as a way of building ownership and sharing experiences, both factors that promote sustainability. For this aim, a cluster randomized design was adopted because the intervention could only be delivered at the health facility level and not at the individual level.

For this SS approach to have a higher likelihood to be considered for adoption and sustainability especially in LMIC settings with limited resources, it needs to not only to be effective but also cost effective. This is an important aspect especially when considered in the current circumstances in LMICs. For example, Uganda is one of the LMIC whose budget allocations for health care have consistently been less than 10% of the overall budget, which is less than the

15% agreed in the 2001 African Heads of State Abuja Declaration [104,105], emphasizing the importance of this assessment. Therefore, the third aim for this study was to determine whether SS is a cost effective approach in this setting. The outcome chosen for this assessment was the Disability Adjusted Life Years (DALY) which combines both fatal and non-fatal outcomes of a disease condition. This is the most widely used measure for CEAs and it allows the comparisons of effects across studies even with interventions that have different objectives, making it broader than the other effect measures such as natural units of deaths, cured, cases etc [94]. This measure was first used in the Global Burden of Disease and Injury study in 1993 [106] and overtime, it has been refined and is routinely used in numerous CEA studies and reports on cost effective interventions [92,107]. A provider perspective for cost assessment was chosen because the anticipated end user for this information would be the MoH, partners and donors who incur most of the program running costs.

6. Overall aims of the project

The aims of this project were to;

1. To determine the baseline status of the quality of care of nutrition services and health outcomes among out-patient therapeutic facilities
   The aim was to describe the baseline status of the quality of care of nutrition services and health outcomes at health facility level using a cross sectional study design

2. To test the effectiveness of supportive supervision to improve health outcomes and quality of care of nutrition services among malnourished children admitted at OTC
   Using a cluster randomized control trial design, this objective tested the hypothesis that regular nutritional supportive supervision delivered to staff at HC level and to community health workers managing malnourished children, would improve the quality of care, access to care and overall health outcomes of children with malnutrition.

3. To estimate the cost effectiveness of supportive supervision as an intervention to improve the cure rates of malnourished children admitted at OTC.

   This aim tested the hypothesis that supportive supervision delivered to both health facility workers and community health workers would be a more cost effective intervention as compared to when SS was delivered to only the health workers.

7. Project phases

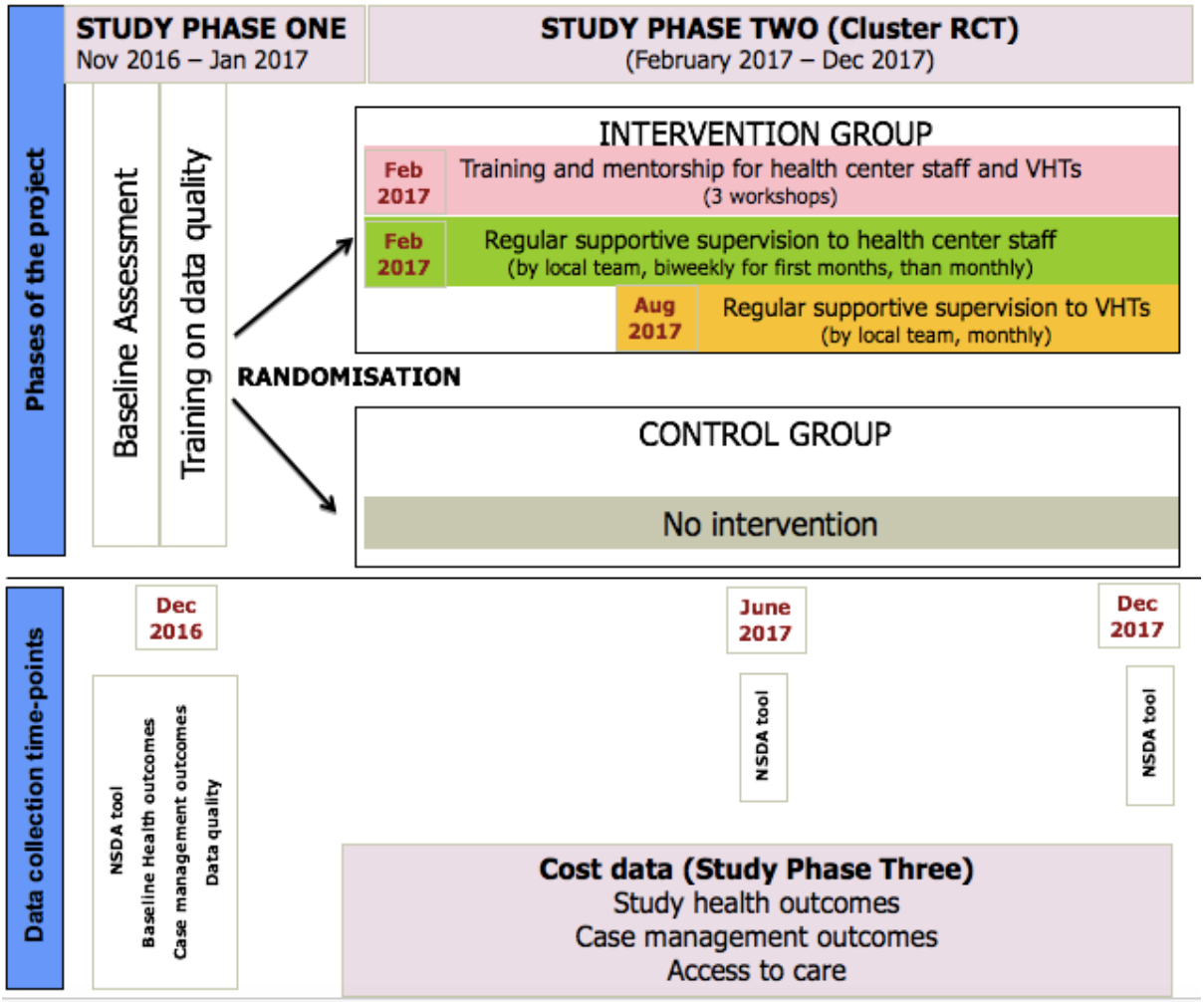
This project was divided into three study phases, with each set up to answer the three project aims above (Figure 5).

I. Phase one: Systematic baseline assessment as described in **chapter four.**

II. Phase two: Cluster randomized control trial with details in **chapter five**.

III. Phase three: Cost effectiveness analysis study. The CEA cost data collection in this phase was conducted alongside the implementation of the Cluster RCT with further details described in **chapter six**

Figure 5: Summary of study phases, activities and timelines



Chapter Four

8. Phase One: Systematic baseline assessment of the quality of care for children with acute malnutrition at out-patient health centre level

Study aim

This study phase was conducted to better understand the baseline status of the quality of care of nutrition service delivery and health outcomes among children admitted in OTCs. This process enabled the assessment facility performance at baseline including the identification of areas of strengths and weakness for nutritional service delivery. This information also fed into the Phase two SS implementation plan for a more efficient and focused intervention. Additionally, it was used to estimate an accurate benchmark to measure the potential magnitude of the benefit of SS in this setting.

Specific objectives

At health facility level

I. To determine the overall quality of nutritional service delivery status at OTC level among facilities offering nutritional services in Arua district during the 2015/2016 financial year

At individual level

II. To estimate the rate of health outcomes including cured, defaulters, non responders, transfers to in-patient care (ITC) or another out-patient care facility (OTC) and death, among malnourished children admitted to OTC in Arua district during the 2015/2016 financial year
III. To establish the quality of case management (correct diagnosis, HIV status assignment, RUTF treatment, counselling and assignment of health outcomes)

among malnourished children admitted to OTC in Arua district during the 2015/2016 financial year

IV. To establish the quality of nutrition service data (data completeness and consistency) in the official facility records of malnourished children admitted to OTC in Arua district during the 2015/2016 financial year

Methods

8.3.1 Study design

This was a cross sectional study, conducted between August and November 2016 and reported according to the STROBE guidelines[108].

8.3.2 Study setting

The project setting was Arua district, located in the West Nile region of Uganda as illustrated in Figure 6. This district lies between latitude 200 30'N and 300 50'N and longitude 300 30'E and 310 30' E in the north western part of Uganda. It is bordered by Yumbe district in the North West, Moyo district in the north east, Maracha district in the North West, Democratic Republic of Congo in the west, Nebbi district in the south, Zombo district in the south west and Amuru district in the east.

Figure 6: Map of Uganda showing the West Nile region

Data source: Map constructed using international ArcGIS coordinates for districts in Uganda.

According to the 2014 national census, this district has an estimated population of 808,745 residents [37]. However, following the recent insurgencies in the Democratic Republic of Congo and South Sudan, the district experienced a massive refugee influx and by May 2017, it was reported to host approximately 174,000 refugees from both countries [37]. Based on the 2016 demographic and health Survey [109], the West Nile region has the highest prevalence of malnutrition in Uganda[2]. Out of 79 facilities in Arua District, 50 (63.3%) provide nutritional care,(Table 2)

Table 2: Government owned facilities in Arua district

Level of facility	**Number of facilities**	
	Government owned	**Providing OTC nutrition services**
Hospital	5	3
Health Centre IV	4	4
Health Centre III	37	34
Health Centre II	33	3
Total	**79**	**50**

8.3.3 Selection of health facilities

Six health facilities (Adumi HC IV, Aripea HC III, Ediofe HC III, Ayivuni HC III, Cilio HC III and Vurra HC III) providing nutrition service at the out-patients (OTC) were included for assessment in this study after a thorough consideration of the number of facilities that could give a scientifically sound result with the available funding. The main objective of the second phase of the study (the cluster RCT design) was the main determinant for the selection of the six facilities considered as 'clusters' that would provide a scientifically sound result to adequately respond to the study objectives (**chapter six**). Inclusion criteria involved; those providing nutrition services, those with the highest burden of malnourished children according to the Health Management and Information System (HMIS) data for the financial year 2015/2016 (July 2015 to June 2016) [110] and those whose staff agreed to participate. Exclusion criteria was facilities that were more than 40km from Arua urban center and those without a staff assigned to be responsible for nutrition service delivery.

8.3.4 Data collection tools, procedures and study variables

Nutrition Service Delivery

The Nutrition Service Delivery Assessment (NSDA) was the main tool used for this evaluation. The tool was developed by the Uganda MoH with support from external partners as the official national instrument for assessing performance of nutritional services [111]. It assesses 10 key capacity areas of nutrition service relevant at outpatient level, including: general information on service implementation, adequate human resources, provision of nutritional services, community linkage, quality improvement activities, materials and supplies, nutrition unit requirements, store management, logistics management for commodities, monitoring and evaluation **(Appendix 3).** Data sources include: direct observation, documents review, interviews with health staff, CHWs and mothers of children diagnosed with malnutrition. For

each assessment area, there is a criteria specified for assessment (similar to checklists) so as to make a final judgment on the quality of the services for that areas. This final judgment assigned was one of four categories: poor, fair, good and excellent**(Appendix 3).**

The NSDA tool was also used as a guide to conduct of key informant interviews with the health facility nutritional focal persons. The open-ended interview questions focused on; organization of services, malnutrition case management, treatment practices, the use of integrated Management of childhood illnesses (IMCI), nutritional supplies, staffing levels, community linkage and quality improvement. During the interviews, the interviewer also took notes of the discussion and summaries were written in English.

The study team involved in the NSDA assessment included a senior pediatrician, a nutritionist and a public health expert, all experienced in the National IMAM guidelines [2] and in the use of the NSDA tool [111].

Health outcomes

Health outcomes were extracted from the HMIS by a national HMIS focal person for the review period (financial year 2016), according to six categories (cured, defaulters, non responders, transferred to in-patient care (ITC), transferred to to another out-patient care facility (OTC), died) based on the national definitions in the IMAM guidelines [2] (Box 1).

Quality of case management and quality of data

The assessment of quality of case management and quality of data was based on data extracted for each child enrolled in the program during the 2016 financial year using the Integrated Nutrition Register as the source of data. This is the official register at the health facility level where all information on malnourished children is recorded. Data extraction was conducted by a team of six data collectors, trained for this purpose, and directly supervised by a nutritionist.

Data collection tools were pre-defined and pilot tested, and standard operating procedures (SOP) were developed to standardize the data extraction process. Quality of case management was assessed using the national guidelines as reference [2] and using five pre-defined process outcomes :1) correct diagnosis; 2) correct treatment; 3) correct evaluation of HIV; 4) correct patients' counselling; 5) correct exit outcome assignment **(Appendix 4).** Correct complementary treatment could not be conducted in this phase because this information was not recorded in the INR. Detailed case definitions are reported in Box 2.

Data quality was assessed using the following two pre-defined indicators: a) data completeness; b) internal consistency (Box 2).

Box 2: Case definition

Health outcomes

Exit categories as for the national guideline [2], as follows:

1. Cured: attaining a weight-for-height ≥ -2 standard deviation (SD) from the mean based on the WHO 2006 standards [29] or mid upper circumference (MUAC) of ≥ 12.5 cm, and no bilateral pitting oedema for two weeks, and clinically well.
2. Non-responders: not reaching discharge criteria after three months (four months for the HIV/TB patients)
3. Defaulters: absent for 2 consecutive follow up visits
4. Transferred to in-patient care (ITC): condition has deteriorated and requires in-patient care or not responding to treatment
5. Transferred to another out-patient care facility (OTC): patient transferred to other nearby OTCs or as requested by caregiver
6. Died: patient died while in the program

Quality of case management

1. Correct diagnosis: correct assignment of the category of malnutrition based on weight-for-height Z-score or MUAC as for the national guideline criteria [2], as follows:
    - MAM if weight-for-height Z-score > -3 and < -2 standard deviation or MUAC (6 to 59 months) ≥ 11.5 and < 12.5 cm and no bilateral pitting oedema
    - SAM if weight-for-height Z-score < -3 standard deviation or MUAC (6 to 59 months)

< 11.5 cm, bilateral pitting oedema, no medical complications and passes appetite test.

2. Correct RUTF treatment: correct RUTF dosage, based on the weight of the child, as for the national guideline [2]
3. Correct complementary treatment: correct treatment of cases as for the national guideline [2], if complying with all following criteria:
   - Amoxicillin for bacterial infections on first day (only for SAM)
   - Measles vaccination on admission (if > 9 months and not yet received)
   - Vitamin A capsule given once at discharge
   - Iron and folic acid prescribed in presence of anaemia
   - Mebendazole/Albendazole for helminthic infections on second visit
4. Correct evaluation of HIV: HIV test performed on all patients following the national testing algorithm [112]
5. Correct counselling of care givers/patients on key messages: delivery of counselling in any of the following area, as for the national guideline[9]: nutrition, RUTF administration, hygiene, HIV
6. Correct exit health outcome assigned: correct assignment of the exit criteria as for the national guideline criteria [2], as follows:
   - Cured: weight-for-height Z-score ≥ -2, no bilateral oedema for more than 2 weeks and clinically well
   - Non-respondent: not reached discharged criteria after three months (four months for the HIV/TB patients)
   - Defaulted: absent or lost to follow up for two consecutive visits
   - Transfer to in-patient care (if deteriorating condition or not responding to treatment)
   - Transfer to another OTC (as requested by care giver)
   - Died: died while on the program

Data Quality assessment *(only assessed during the baseline survey – study phase one)*

Quality of data was based on the following 2 indicators:

1. Data completeness: defined for each single case as “complete” if in information on the following 15 key required fields were filled in: date, patient name, type of nutritional

management, nutritional status at enrolment, HIV status at enrolment, anti-retroviral therapy services at enrolment, visit date, oedema, weight, height/length, MUAC colour, Z-score, therapeutic feeds, target exit criteria, exit outcome.

2. Internal consistency: defined for each single case as "consistent" if a) the height of the child was consistent over time (ie not decreasing) and b) the date of the visits was consistent over time (ie progressive dates in the register)

5.3.5 Data management

Data was collected and double entered into pre-formatted excel spreadsheets and checked for consistency and accuracy by two supervisors before analysis. The distribution of the health facility categorical parameters was presented as frequencies with respective proportions. Health outcomes were assessed against the SPHERE standards [34]. Case management and data quality indicators were assessed against a predefined target of at least 80%. Cases with missing information on health outcomes and quality of case management were counted as incorrect. A two sided p-value of <0.05 was considered as statistically significant.

Qualitative data from the key informant interviews were analyzed using thematic analysis. Interview notes from the interviews were analyzed using themes developed from pre-defined topics from the NSDA together with themes emerging from the data. The study personnel went through the interview notes, discussing and agreeing how best to record information from the transcripts.

Results

8.4.1 Characteristics of the health facilities

The selected population sample, from the six facilities, accounted for 45.4 % (1,020/2,248) of total caseload of malnourished children treated in Arua district during this review period (Figure 7). Characteristics of the health facilities are reported in Table 3. Overall, the number of children treated in each facility varied (from 318 to 61) but this was not directly proportional to

the estimated population coverage (number of children diagnosed per 1000 population coverage ranging from 2.8 to 32.8).

Four out of six facilities had two or less staff assigned to the nutrition unit, with only one facility having a clinical officer involved. Only one staff (7.6%) had been trained in the IMAM guidelines.

Figure 7: Study flow diagram

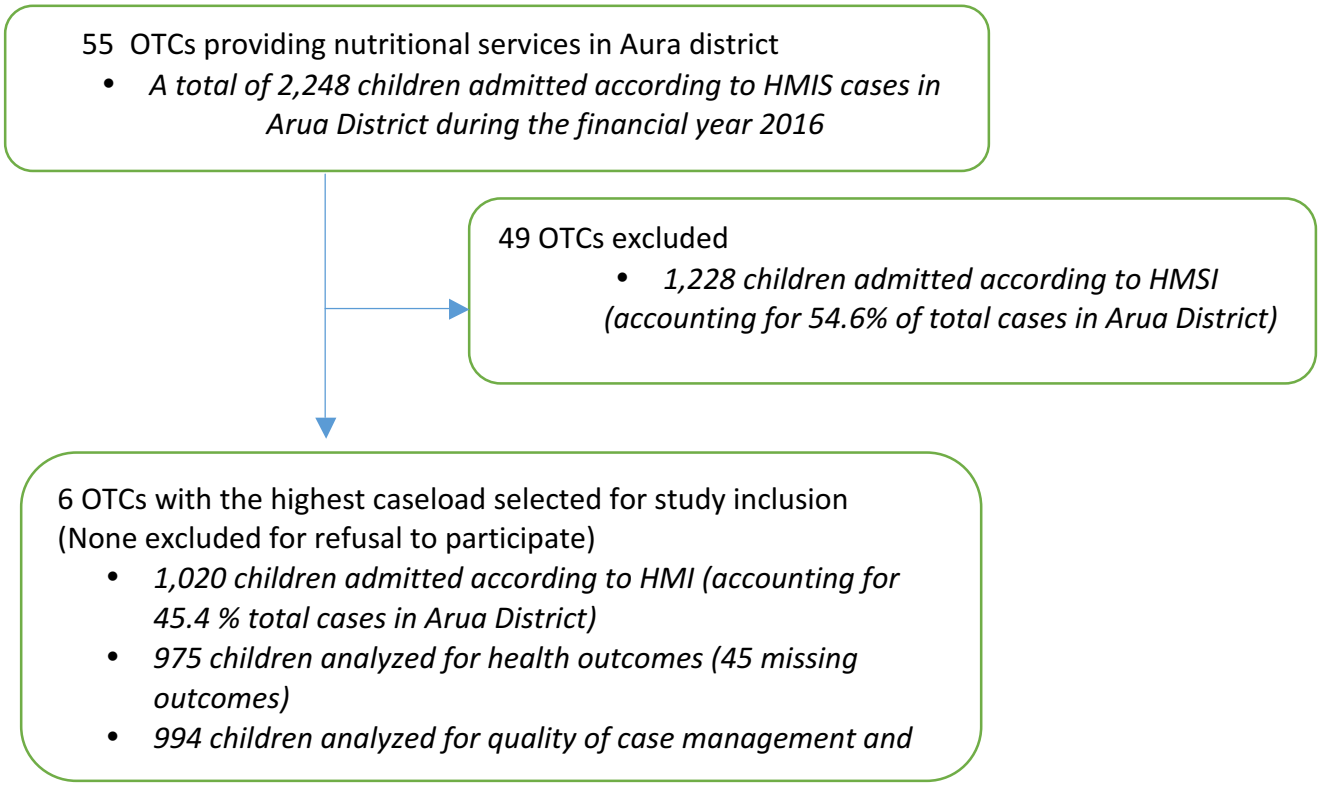


Table 3. Key characteristics of the health facilities

Variable	Health facility						
	HC 1	HC 2	HC 3	HC 4	HC 5	HC 6	Totals
Health Center level *	IV	III	III	III	III	III	-
Estimated population coverage	32,000	3,960	22,548	13,779	2,500	21,662	96,449
Children diagnosed with acute malnutrition**	318	292	116	151	82	61	1,020
Number of staff assigned to the nutritional unit	2	2	3	1	3	2	13
Nutritional staff qualification							
Clinical officer	1	0	0	0	0	0	1
Enrolled nurse/midwife	1	1	1	0	3	2	8
Nursing assistant	0	1	2	1	0	0	4
Staff trained in IMAM guideline	1	0	0	0	0	0	1

* Levels of primary health care in Uganda is tiered into health center I,II,III and IV.

**HMIS data July 2015 – June 2016 (financial year)

8.4.2 Nutrition service delivery assessment

All facilities except two scored either poor or fair under all the 10 assessment areas of the NSDA tool (Table 4). Overall, 33/60 (55.0%) areas were scored as poor, 25/60 (41.7%) as fair, 2/60 (3.3%) as good, and none as excellent. In particular, the following two areas were scored as poor in all facilities: quality improvement activities and monitoring and evaluation. Figure 8 shows a summary of the distribution of NSDA scores.

Table 4. Performance of health facilities in the selected capacity areas

Capacity area	Health facility Score*					
	HC 1	HC 2	HC 3	HC 4	HC 5	HC 6
1. General information on service implementation	Fair	**Good**	Fair	Fair	Fair	Fair
2. Adequate human resources	Poor	Poor	Poor	Poor	Fair	Poor
3. Provision of nutritional services	Fair	Fair	Fair	Poor	Fair	Poor
4. Community Linkage	Fair	Fair	Fair	Poor	Poor	**Good**
5. Quality improvement activities	Poor	Poor	Poor	Poor	Poor	Poor
6. Materials and Supplies	Poor	Fair	Poor	Poor	Fair	Poor
7. Nutrition unit requirements	Fair	Fair	Poor	Fair	Fair	Poor
8. Store management	Poor	Fair	Fair	Poor	Fair	Fair
9. Logistics Management for commodities	Poor	Poor	Fair	Poor	Fair	Poor
10. Monitoring and evaluation	Poor	Poor	Poor	Poor	Poor	Poor

*Score performance categories according to the NSDA tool : poor; fair; good; excellent [111]

Figure 8. Distribution of NSDA scores by facility

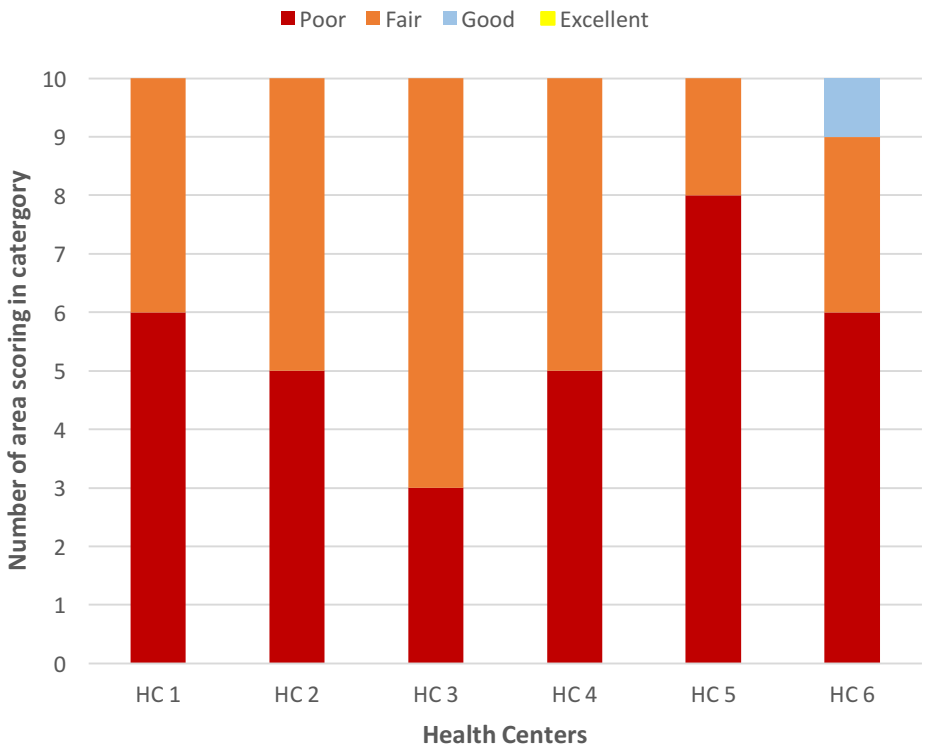


Table 5 shows the specific gaps in quality of nutritional services identified with the NSDA tool observation and interviews with health facility nutritional focal persons. Key findings included: poor organization of services at the nutrition service delivery point; poor case diagnosis and treatment; stock out of nutrition foods; weak community linkage mechanisms.

Table 5. Gaps in quality of nutritional services observed by capacity area

Capacity area	**Observed issue**
Organization of services	Nutrition services delivered "under the tree"
	Working hours unclear
	Frequent service delays if rain
	No triage
	Chaotic organisation, no clear roles and responsibilities
	No transport for children sent In-patient Therapeutic Care (ITC)
	Working hours unclear
Case management	Triage not performed
	Mid Upper Aram Circumference (MUAC) not routinely done at all entry points (Out patients department -OPD, Tuberculosis and Anti retroviral therapy - TB/ART)
	Mis-classification SAM/MAM
	Z-score never used (only MUAC used)
	No history taking
	Comprehensive clinical examination as per the Integrated Management of Childhood Illnesses (IMCI) not performed
Treatment	Water with sugar not offered at admission
	10 key messages on RUTF not delivered
	Individual counselling never performed
	Amoxicillin, vitamin A, Iron and mebendazole not prescribed
	MAM and SAM usually treated the same

Integrated Management of childhood Illnesses (IMCI)	HIV status often indicated as unknown despite availability of testing kits TB rarely assessed Children at OPD not always assessed for nutritional status Children with malnutrition not assessed according to IMCI Staff working in out-patient care not trained in IMCI Old IMCI job aids in some facilities
Supplies	Stock out of RUTF observed in many facilities Lack of mean of transport to facilities Lack of timely request from facilities
Staffing	Lack of staffing with some facilities having no nutritional focal person appointed Lack of nutritional specific training Poor practices even among trained staff Community Health Workers (CHWs) usually not formally trained but doing the job at OTC in place of facility staff
Community linkage	CHWs screening reports not readily available Blank CHWs registers No effective means of communication between facilities and CHWs No incentives for the CHWs
Quality improvement	Several SS activities are conducted on a quarterly basis, at facilities but only few are specific to nutrition

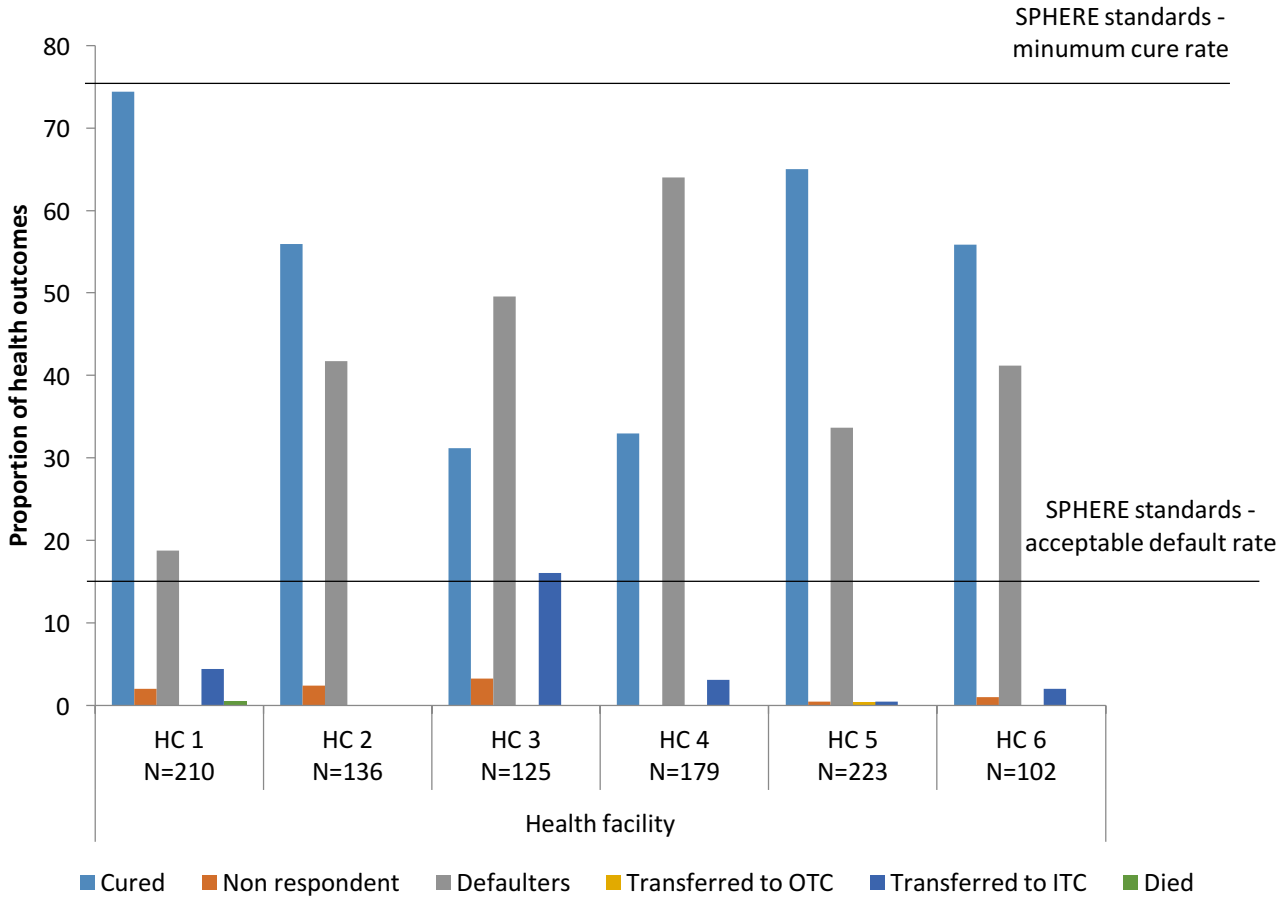
Abbreviations: ART= Anti Retro-viral Therapy; HIV = Human Immune-deficiency Virus; IMCI = Integrated Management of Childhood Illness; ITC = In-patient Therapeutic Care; MAM = Moderate Acute Malnutrition; MUAC = Mid-Upper Arm Circumference; OPD = Out Patients Department; OTC = Out-patient Therapeutic Care; RUTF = Ready-to-Use Therapeutic Foods; SAM = Severe Acute Malnutrition; TB = Tuberculosis; CHW = Community Health Workers.

Of note, the assessment also identified some areas with good service delivery. All health facilities were using HMIS forms (INR and monthly quarterly reports), had basic nutrition equipment (weighing, length/height measuring scales and MUAC tapes), essential job aids (Z-score classification and counselling aids), CHWs were engaged and there was evidence of quarterly supervision conducted by district health team.

8.4.3 Health outcomes

The distribution of health outcomes is shown in Figure 9. The cure rate and defaulter rate were the two health outcomes that were predominantly assigned. The overall cured rate in all the six health facilities was 52.9% (95% CI: 49.7 – 56.1) while the overall defaulting rate was 38.2% (95%CI: 35.2 – 41.4). Significant heterogeneity was observed between these outcomes across health centers with the cure rate ranging from 31.2% to 74.4% and the defaulting rate ranging from 18.7% to 63.9%. During the entire study period, 37 children (4.0%) were transferred to ITC, 13 (1.3%) were classified as non-responders and only one participant (0.1%) was recorded to have died.

Figure 9. Distribution of health outcomes



8.4.4 Quality of case management

A total of 994 cases of malnourished children were identified in the INR and reviewed. Health facility performance on all case management process indicators was highly heterogeneous across facilities (Table 6). The rate of correct diagnosis ranged from 4.5% to 91.2%, correct treatment from 0 % to 50.0%, correct HIV status assignment from 58.1% to 91.2%, correct counselling from 11.2% to 99.3% and correct exit outcome from 0 to 75.9%. The overall average rates were as follows: correct diagnosis at 34.6%; correct treatment at 19.2%; correct counselling at 47.6%; correct evaluation of HIV at 73.5% and correct exit outcome at 16.7%. None of the total estimates for process outcomes reached the pre-defined target of 80% with a statistically significant difference when compared to this threshold (chi p-value = 0.001).

8.4.5 Data quality

There was high heterogeneity across health centers in data quality. Data completeness ranged from 0% to 32.1% and data consistency ranged from 0% to 87.6% (Table 6). The overall mean completeness rate was 4.4% and consistency at 20.7% with both indicators far below the pre-defined threshold of 80% (chi p-value=0.001).

8.4.6 Additional analysis

No clear correlation could be found between single indicators (NSDA scores, cured rate, process outcomes, quality of data) and the type of health center (level IV vs III), or the volume of work (number of children admitted). No clear internal correlation among different indicators could be found (performance of the different indicators did not seem to be directly linked to each other).

Table 6. Case management and data quality

Variable	Health facility							
	HC 1 N=194	HC 2 N=137	HC 3* No data	HC 4 N=301	HC 5 N=228	HC 6 N=134	Total N=994	Chi p-value#
Correct process outcomes								
Diagnosis	30(15.5)	125(91.2)	-	88(29.2)	95(41.7)	6(4.5)	344(34.6)	0.001
IMAM treatment	0	0	-	151(50.0)	28(12.3)	12(9.0)	191(19.2)	0.001
Evaluation of HIV	158(81.4)	90(65.7)	-	175(58.1)	208(91.2)	100(74.6)	731(73.5)	0.001
Counselling of patients	39(20.1)	136(99.3)	-	172(57.1)	111(48.7)	15(11.2)	473(47.6)	0.001
Exit outcome assigned	19(9.8)	104(75.9)	-	31(10.3)	12(5.3)	0	166(16.7)	0.001
Data quality								
Data completeness	0	44(32.1)	-	0(0)	0(0)	0(0)	44(4.4)	0.001
Data consistency	0	120(87.6)	-	74(25.6)	11(4.8)	1(0.8)	206(20.7)	0.001

Data source: Integrated Nutrition Register

* Data not available in the integrated nutrition register

#p-value assessed against a pre-defined target of 80% achievement

Discussion

The assessment shows that, even though some positive aspects were observed, there are substantial deficiencies in the quality of nutrition services at health center level in Arua district. Significant gaps were observed both by using the national tool for Nutrition Service Delivery Assessment (NSDA) and by reviewing key indicators of health outcomes, case management and data quality in the official records.

The observed health facility cure rate of 52.9% was far below the international SPHERE standards target set at above 75% [34], while the defaulting rate of 38.3%, was significantly higher than the standard's target set at below 15%. One of the possible reasons for this low cure rate may be the lack of adherence to guidelines for case management as observed in this study. Important clinical practices such as triage, screening of all children for malnutrition, history taking, detailed examination, diagnosis of SAM and MAM, individual counselling, complementary treatment and assignment of exit outcomes were not being performed according to the IMAM guidelines [2]. Additionally, laboratory screening for HIV and TB was not routinely conducted, despite the availability of laboratory diagnostic kits. Such poor performance of quality of health service delivery has also been reported in other studies both in routine settings in Uganda [11,13],[113,114] and in refugee settings such as in Ethiopia [115,116], [117,118].

Another key reason explaining the poor performance of case management, in addition to inadequate human resource, is the substantial lack of training of heath facility staff, both frequently observed challenges in low and middle income countries [119]. The impact of targeted training on both health workers' performance and children outcomes is relatively well documented. For example, a systematic review by *Suguya et al* examining the effectiveness of nutritional training of health workers showed a clear benefit in improving feeding frequency, energy intake, and dietary diversity of children [120].

Notably, almost all the assessed health facilities had basic nutritional equipment such as digital weighing scales, length/height measuring boards, MUAC tapes and essential job aids. However,

the frequent stock out of RUTF, an essential nutrition management commodity, was a significant issue, a finding in line with two earlier studies conducted in other regions of Uganda [113,114].

The observed challenges such as stock out of RUTF, poor organization of services including irregular working hours, long waiting times and weak community linkages re-affirm some of the underlying factors explaining the very high defaulting rate observed [113]. The poor performance of CHWs especially regarding case-identification and referral of cases is an observation that deserves further scrutiny since this study was not designed to identify the reasons as to why this happened. Nonetheless, there is evidence from a systemic review by *Kok et al* which found that factors such as lack of supervision, lack of training and lack of financial incentives were the main barriers to achieving an acceptable performance from CHWs [121]. Minimizing such barriers would improve access to care as a result of increasing community patient screening and referrals and ultimately better health outcomes. Evidence shows that barriers to access for service users may increase mortality, especially among children with SAM who actually requires urgent medical attention [122].

Poor data quality is another important and frequently reported issue in LMIC settings, including Uganda [123,124]. Good quality data is the basis for evidence based decision making and two suggested approaches for improvement in such settings include better training on data quality assurance procedures and intensive SS [122–124].

As already documented, the influx of refugees into a community negatively impacts the performance of health services in such settings due to the unplanned and sudden increase in workload [115,116]. However it is also true that poor performance has been reported in settings experiencing no refugee crisis [113,114], indicating that refugee circumstances is not the sole explanation for such a performance. This study did not aim at comparing the performance of nutritional service before and during the most recent refugee crisis In Arua, but rather at collecting baseline data for service delivery evaluation.

Limitations of this study included the relatively small sample size in terms of health facilities, however, the study sample population captured over 45% of cases of children admitted to nutritional services in Arua district. This sample was representative of the district population and allowed adequate assessment of key study outcomes. Even though most of the assessment was conducted by direct evaluation using the NSDA tool [111], health outcomes and case management were assessed using recorded data which are associated with the risk of recall bias. This was minimized through data triangulation, which involved the use of different data sources such as the official registers, participant observations, the use of the NSDA tool and HMIS data extractions. The data extraction process was conducted by independent data collectors who had been trained on the pre-defined data collection variables using standard operating procedures and all results were reported with transparency. Even with this technique, there was still the risk of poor data quality especially from the data extractions for which there was no full accountability to provide accurate estimates.

Chapter Five

9. Phase Two: Supportive Supervision for improving health outcomes and quality of care for malnourished children at out-patient level: cluster randomized trial

Study hypothesis

This study phase used a cluster RCT design to test the hypothesis that regular enhanced nutritional Supportive supervision delivered to health facility staff and community health workers managing malnourished children, together with complementary interventions, improved staff knowledge and practical case management. As a result, there would be improvement of health outcomes of malnourished children as well as access to care.
SS was first delivered to staff at health center level during the first five months of the study period and later extended to CHWs in the second five months' period.

Specific objectives

Primary objective

To compare the cure rate of children admitted with acute malnutrition between the intervention and control OTC facilities.

Secondary objectives

I. To compare other health outcomes including the rate of defaults, rate of transfer, rate of deaths and rate of non-response of malnourished children admitted to either intervention or control OTC facilities
II. To compare the quality of process outcomes (correct diagnosis, HIV status assignment, RUTF treatment, complementary treatment, counselling and assignment of health

outcomes) of malnourished children admitted to either intervention or control OTC facilities.

III. To compare the overall quality of nutritional service delivery status at OTC level (using the NSDA) for admitted malnourished children between intervention or control OTC facilities.

IV. To compare access to care for malnourished children admitted to either intervention or control OTC facilities.

Methods

9.3.1 Study Design

This was a Cluster Randomized Trial conducted from December 2016 to December 2017 in the same setting as the phase 1 baseline assessment, with health facility as the unit of randomization and reported according to the CONSORT statement [125]

The decision to perform this study with an RCT design had five major justifications:

1. The intervention, SS, was only applicable at the health facility level and not the individual level.
2. There is a lack of high quality research in this field such as that from an RCT
3. An RCT design ensures protection from several biases, and therefore provides robust and more informative than all other study designs
4. Given the way the study was designed (i.e. quality improvement intervention) it carried minimal risk for the patients or the health workers while providing a great potential to benefit both children and healthcare staff.
5. There was no deprivation of the control group from any ongoing routine activity as they continued to received the standard of care

9.3.2 Health facilities randomization

The intervention was delivered at facility level; the health center was considered as the unit of randomization. After stratification by characteristics (Table 3) such as HC level, setting (urban vs rural) and number of staff assigned to the nutritional unit, HCs were randomly allocated by extraction ("urn randomization" [126]) to either receive SS or continue with standard care.
The "urn randomization" approach was chosen because of the small number of clusters and to also ensure equal distribution of facilities between study arms after randomization. A simultaneous approach was used that ensured intervention assignment to facilities at the same time. The randomization sequence was only known to the study investigators who then informed the study team of the assignments at the start of study implementation. The study was un-blinded at the health facility level, while the patients were not aware of the allocation group.

9.3.3 Study participants

The primary outcome (cure rate) was measured at patients' level, among children accessing the nutritional services in the HCs involved in the study. Children fulfilling the following criteria were included: diagnosis of SAM or MAM according to the national criteria [2]; aged between 6 to 59 months; a documented HIV status as per the national HIV guidelines [112]. Exclusion criteria were; guardians refusing participation and those who were unable to adhere to study procedures.

9.3.4 Sample size

The sample size was calculated by taking into account a fixed number of clusters (6 HCs), the intra-cluster correlation coefficient (ICC) resulting from the baseline cure rate data **(Figure 6)**, the expected control event rate, the expected effects, and the level of significance and power of the study [127]. An estimated sample size of 716 children was calculated based on the

assumptions that in the intervention HCs the mean cure rate would have been 85% compared to 45% in the control HCs, with an ICC of 0.2, a power of 80%, an alfa of 5%.

9.3.5 Intervention

The intervention consisted of SS, delivered with "high intensity" and specific to the nutritional services. SS was delivered by a team of two trained local staff (a nutritionist and district health team officer). During the first period (February to July 2017), SS was provided only to HC staff, biweekly in the first 3 months, and then monthly. Each SS session lasted approximately two hours in each HC. The main activities included: training on the key concepts of the IMAM guidelines, monitoring the availability of equipment and supplies, and evaluating of overall quality of care and of case management (Box 3). Dedicated tools included a checklist, to enable the supervisors provide guidance in a standardized way (**Appendix 5**). The national IMAM guidelines [2] were used as reference standards. Based on the specific deficiencies identified, the supervisors discussed local problems, provided technical support and facilitated the development of solutions, in a participatory manner [81]. Complementary activities included: i) facilitation of networking among staff of different HCs, with the objective building ownership in the process; and ii) tools for tracing of defaulters such as telephone credit and location maps (although tracing of defaulter is recommended in the national guidelines, no specific tool is provided to HC staff). The study protocol also included the delivery of essential key equipment if needed, but since all key equipment were already available, only regular check of accuracy of the weighing scales for calibration was performed.

In the second period (August to December 2017), SS was extended to also include CHWs, with the objective of improving community screening and case-referral. Every week, a selection of villages associated with the intervention HCs was visited, and every CHW was involved in SS at least twice during the duration of the project. Specific activities implemented included: on-site training on the key concepts of the IMAM guidelines, enhanced supervision during work, and provision of a small financial incentive (recommended in the Ugandan guidelines, but not formalized in practice).

Box 3: Summary of SS activities

Monitoring activities included checking for:

- Essential equipment and supplies;
- Case management as per the national guidelines;
- Data quality (data completeness, accurate and consistency);
- HC staff knowledge and skills

Supporting activities:

- Based on the specific deficiencies identified, providing technical support, such as on-site refresher training on the national protocols and on data reporting;
- discussing local problems and conceptualized solutions in a participatory approach with local HC staff.
- facilitating good team dynamics;
- improving the quality of case management including nutritional counselling;
- supporting the HC staff in discussing the reasons for defaulting with service users, and supporting tracing of defaulters (using location maps and telephone),

Complementary activities:

- Established networking activities among staff of the intervention HCs
- Regularly checked accuracy of the weighing scales for calibration
- Conducted brief up short course training on the national IMAM guidelines
- Facilitated the acquisition of therapeutic and supplementary nutrition foods and essential medicines by getting in touch with the responsible authorities to improve delivery and minimize stock out
- Conducted activities to improve community involvement and adherence to the national guidelines through CHWs attached to the intervention HCs.

SS activities to CHWs:

- Specific interventions implemented included: enhanced supervision during work, training on basic nutrition concepts
- Provision of a small financial incentive (which is recommended in the Ugandan guidelines, as well as in other guidelines, but more often not formalized in practice).
- This was delivered once twice a month to the CHWs attached to an intervention facility.

9.3.6 Control

The control group continued to receive the "standard of care" health service delivery as per the IMAM guidelines [2]. Accordingly, these facilities received the basic nutritional related supplies such as RUTF, equipment (MUAC tapes, weighing scales and) and job aids such as the z-score charts from the MoH and partners such as UNICEF. Even though the IMAM guidelines indicate that supervision is to be conducted on a quarterly basis by the DHT, during the course of the study period there were no observed supervisory visits or additional training from any provider, that could have changed the prevailing quality of care.

9.3.7 Data collection tools, procedures and study variables

Health outcomes was measured using six pre-defined indicators (cured, non-responders, transferred to in-patient care (ITC), transferred to another out-patient care facility (OTC), died), based on the national case-definitions [2] (Box 1). Data was collected prospectively at each visit (i.e, every week) for each child enrolled in the study, using a pilot tested tool (**Appendix 6**) and standard operating procedures (SOP), by six trained staff (each assigned to one HC). In line with the national guidelines [2], the duration of follow up for each single child with malnutrition was up to three months (four months for the HIV/TB patients). Children not cured within this time frame were classified as "non-responders" (Box 2). All children who defaulted were followed up to ascertain their living status.

Quality of case management was assessed from the official nutritional registers using six pre-defined process indicators and having national guidelines as reference standards [2] (Box 2): 1) correct diagnosis; 2) correct RUTF treatment; 3) correct complementary treatment; 4) correct evaluation of HIV; 5) correct patients' counselling; 6) correct exit outcome assignment. Data was collected for each child enrolled in the study, using a pilot tested data collection tool (**Appendix 4**) and SOP, at fixed intervals, by two external data monitors.

Quality of nutritional services was measured at three time points (baseline, 6 months and 12 months) using the Nutrition Service Delivery Assessment (NSDA) tool [111].

Access to care was measured by the absolute number of malnourished children enrolled in the health facilities with SAM or MAM. This was because there was no specific accurate data on population coverage for the health facilities for reference. It was therefore assumed that the total population in the coverage area did not change. To evaluate the additional effectiveness of SS to CHWs, access to care in the the first period, was compared to access in the second period**.**

9.3.8 Data management and quality control

All tools for data collection were pre-defined and pilot-tested, SOP were developed and tested, and performance of data collectors was verified before the start of the study. Data collectors were trained in key aspects of the IMAM guidelines [2] and in data quality assurance procedures, and constantly supervised by a study manager and a study coordinator **(Appendix 7)**. Quality of data in both the intervention and control group were regularly monitored for each enrolled case using the following three pre-defined indicators: a) data completeness; b) accuracy and c) internal consistency (Box 2). The filled data collection forms were checked daily for completeness and accuracy and errors were corrected before data entry. Data was cleaned and double-entered into Epidata version 3.1. Range, consistency and validity checks were built in to the entry program to minimize errors. Data were collected at fixed intervals and entered in the databases in real time. The databases were monitored at fixed intervals for completeness and internal consistency and any problem was discussed in real time, and all efforts were made to achieve data completeness and accuracy. An interim data analysis was performed at fixed intervals of 6 weeks and checked by an independent analyst.

9.3.9 Data analysis

Data was analyzed with STATA 14. Categorical variables were presented as absolute numbers and percentages with 95% confidence intervals (95% CI). Categorical variables were compared using the Fisher exact test or Yates corrected chi-square, as appropriate. This was a cluster

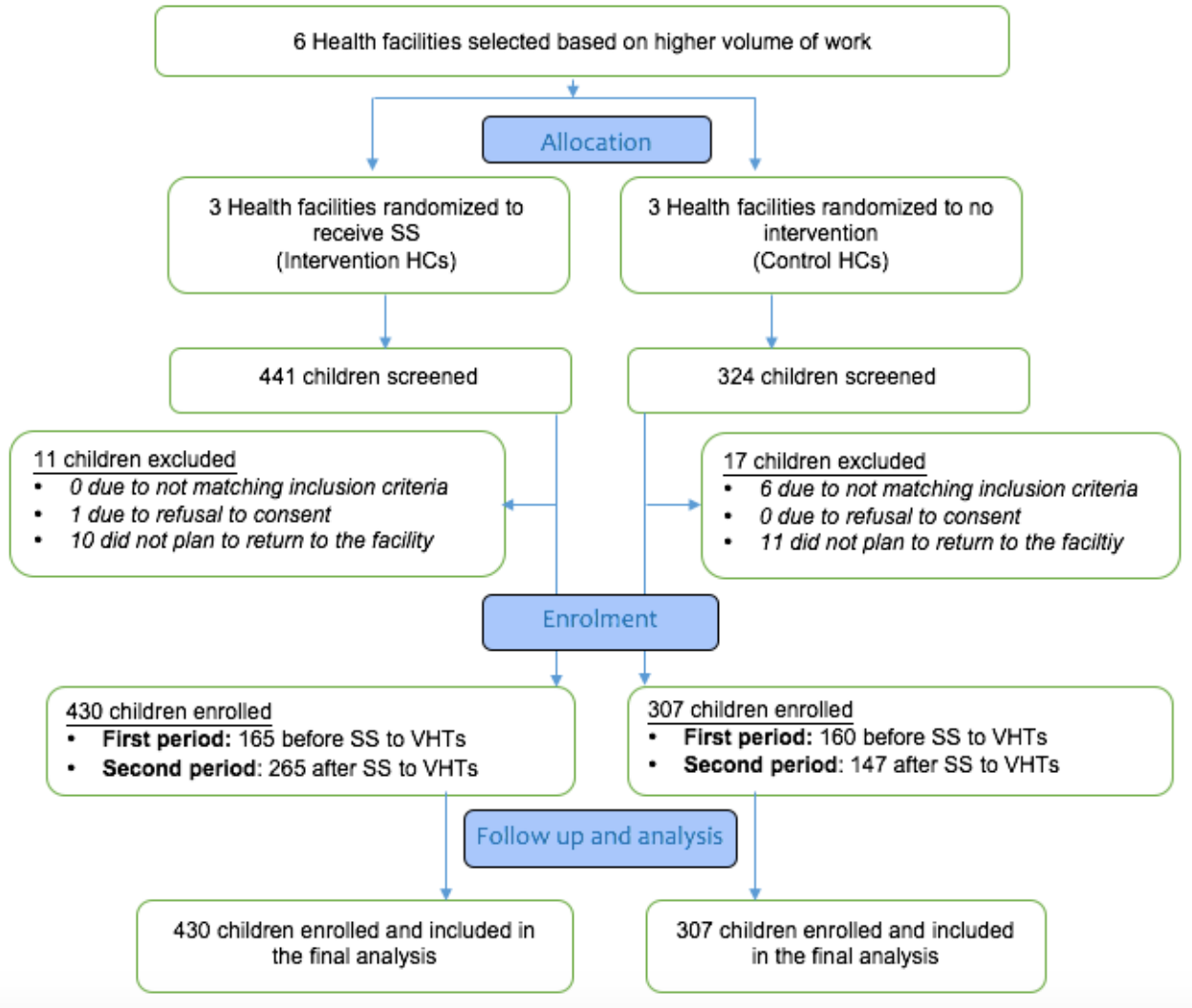
randomized trial and therefore correlated observation analysis techniques were used for analysis for the main study outcomes. The proportion of children with specific health outcomes or for which a correct case management process outcome was conducted were first estimated at each the health facilities (clusters). These summary measures were then used to estimate the overall mean proportion (95% CI) for each of the randomization arms. The significance of the difference of the mean proportion between the intervention and control arms was estimated using the t-test. Specific for the health outcome of cure rates, a conditional logistic regression model was used to evaluate the effect of imbalances in baseline characteristic to the primary outcome. The choice of the regression model was because the primary outcome, cured was a dichotomous variable and because the data were clustered. The outcome was cured/not cured, the main independent variable was receiving SS or standard of care and other covariates included were age categories in years (6 – 11, 12 – 24, above 24), sex (male or female), vaccination status (up to date, not up to date or never vaccinated) and nutritional status (MAM or uncomplicated SAM). A univariate model with the primary outcome and randomization arm as exposure was used to derive the crude odds ratio (95% CI). A multivariate forward fitting model, taking effect modification into consideration, was used to estimate the adjusted Odds Ratio (OR) and associated 95% Confidence Interval (CI). All statistical tests were 2-sided. A p value of less than 0.05 was considered statistically significant. Results were interpreted looking both at the level of statistical significance and at plausibility and consistency of results across different outcomes.

Results

9.4.1 Study enrolment and access to care

The study profile showing the flow of enrolment of children is shown in Figure 10. Overall, 737 children were enrolled in the study, 430 on the intervention arm and 307 on the control arm and included in the final analysis.

Figure 10: Consort Flow diagram



The difference in enrolment numbers was mainly due to the extension of SS to CHWs. Table 7 shows results of the effect of SS on number of children enrolled in the intervention arm. When SS was delivered only to HC staff, the number of children accessing nutritional services at HC level in each group was not significantly different (in Study period 1: 165 in intervention group vs 159 in control arm, proportion difference = 1.8, p = 0.517). After the extension of SS to the CHWs there were significant more children enrolled on the intervention arm compared to control [Study period 2: 265 in intervention group vs 147 in control arm, proportion difference = 28.4%, OR = 1.7 (1.3 – 2.3), p = 0.001].

Table 7: SS during the two study periods

Intervention	**Study period**	
	Before SS to CHWs N = 324	**After SS to CHWs N = 413**
	n(%)	**n(%)**
Intervention	165 (50.9)	265 (64.2)
Control	159 (49.1)	148 (35.8)
Differences	***6 (1.8)***	***117 (28.4)***
Chi p-value	***p = 0.517***	***p = 0.001***

9.4.2 Baseline characteristics

Baseline characteristics of enrolled children are reported in **Table 8**. There were some significant differences in children characteristics between the study arms, and specifically more children in the intervention group had SAM (p=0.005), were twins (p=0.001), were HIV positive (p=0.001), had a mother no longer breastfeeding (p=0.014), or died were abandoned children (p=0.023). The imbalance was mainly due to the extension of SS to CHWs in the second period of the study to improve access to care in the intervention arm (Table 7).

Table 8: Children characteristics at enrolment

Variable	Randomization arm		
	Intervention N = 430	Control N = 307	Chi p-value
Age categories (months)			
6 to 12	203 (47.2)	122 (39.7)	
12 to 24	139 (32.3)	118 (38.4)	
Above 24	88 (20.5)	67 (21.8)	0.114
Sex			
Male	209 (48.6)	133 (43.3)	
Female	221 (51.4)	174 (56.7)	0.156
Vaccination status			
Up to date	369 (85.8)	249 (81.1)	
Not up to date	59 (13.7)	58 (18.9)	
Never vaccinated	2 (0.5)	0	0.085
Child status			
Single	373 (86.7)	290 (94.5)	
Multiple	**57 (13.3)**	17 (5.5)	**0.001**
Feeding practice			
Exclusive B/F	7 (1.6)	0	
Replacement feeding	0	0	
Mixed feeding	5 (1.2)	4 (1.3)	
Complimentary feeding	241 (56.1)	201 (65.5)	
No longer B/F	**177 (41.2)**	102 (33.2)	**0.014**
Mother status			
Pregnant	18 (4.2)	18 (5.9)	
Lactating	256 (59.5)	204 (66.5)	
Died or abandoned	**55 (12.8)**	18 (5.9)	
Non-lactating	97 (22.6)	64 (20.9)	
Unknown	4 (0.9)	3 (1.0)	**0.023**
Nutritional status			
MAM	122 (28.4)	117 (38.1)	
Uncomplicated SAM	**308 (71.6)**	190 (61.9)	**0.005**
HIV status			
Positive	**17 (4.0)**	1 (0.3)	
Negative	413 (96.0)	302 (98.4)	
Unknown	0	0	
Exposed	0	4 (1.3)	**0.001**

9.4.3 Health outcomes

Table 9 presents the health outcomes during the intervention phase of the study. In the HCs receiving SS the cure rate was significantly higher than in the control facilities [83.8% (95%CI 71.0-96.6) vs 44.9%(95%CI 38.2-51.6)], mean difference 38.9% [RR = 1.91 (95% CI 1.56 to 2.34), p=0.010]. Whereas the defaulting rate was significantly lower in the intervention HCs compared to control facilities; [1.4% (95%CI 1.1% to 1.8%) vs 47.2% (95%CI 37.3% to 57.1 %)] in the control, mean difference - 45.8% [RR = 0.03 (95%CI 0.0 to-0.06), p=0.001]. All defaulting children were ascertained to be alive when they were followed up. Overall less than five percent of children had any of the other outcomes (non-responder, OTC transfer, ITC transfer, dead), and for these outcomes there were no statistical significances differences among allocation groups.

Table 9: Health outcomes

	Randomization arm									
	Intervention Health Centers				Control Health Centers					
	HC 1 n (%)	HC 2 n (%)	HC 3 n (%)	**Mean % (95% CI)**	HC 4 n (%)	HC 5 n (%)	HC 6 n (%)	**Mean % (95% CI)**	**Difference in mean %**	**p-vale**
	182	114	134		140	82	84			
Cured	153 (84.1)	110 (96.5)	95 (70.9)	**83.8 (71.0-96.6)**	52 (37.6)	40 (48.8)	41 (48.8)	**44.9 (38.2-51.6)**	**38.9**	**0.010**
Non-responders	13 (7.1)	2 (1.8)	9 (6.7)	**5.2 (2.2-8.2)**	4 (2.9)	5 (6.1)	5 (6.0)	**5.0 (3.1-6.8)**	0.2	0.926
Defaulters	2 (1.1)	2 (1.8)	2 (1.5)	**1.4 (1.1-1.8)**	82 (58.6)	33 (40.2)	36 (42.9)	**47.2 (37.3-57.1)**	**-45.8**	**0.001**
OTC Transfer	5 (2.8)	0	4 (3.0)	**1.9 (0.3-3.6)**	0	0	1 (1.2)	**0.4 (-0.3-1.1)**	1.5	0.231
ITC Transfer	9 (5.0)	0	24 (17.9)	**7.6 (-1.6-16.9)**	2 (1.4)	3 (3.7)	1 (1.2)	**2.1 (0.7-3.5)**	5.5	0.364
Dead	0	0	0	**0**	0	1 (1.2)	0	**0.4 (-.3-1.1)**	-0.4	0.378

Table 10 shows that even after controlling for imbalances in baseline characteristics between intervention and control arms, the odds of being cured in the intervention arm were approximately 9.5 times the odds in the control arm [AOR = 9.5(2.7-34.2) p = 0.001]. There was a significant trend of decreasing odds of being cured among children who had never been vaccinated [AOR =0.1(0.0-1.0) p=0.049)] and among children diagnosed with uncomplicated SAM had a lower odd of being cured [AOR =0.4(0.3-0.6) p=0.001)].

Table 10: Multivariate conditional logistics regression results

Characteristics	**Patient cure status**				
	Cured N=492	**Not cured N=245**	**Crude OR**	**Adjusted OR✶**	
	n(%)	**n(%)**	**(95% CI)**	**(95% CI)**	**p-value**
Study arm					
Control	134(43.7)	173(56.4)	1	1	
Intervention	358(83.3)	72(16.7)	7.7(2.74-21.4)	9.5(2.7-34.2)	**0.001**
Age categories (months)					
6 to 12	209(64.3)	116(35.7)	1	1	
12 to 24	174(67.7)	83(32.3)	1.3(0.9-2.0)	1.4(0.9-2.6)	0.183
Above 24	109(70.3)	46(29.7)	1.5(0.9-2.5)	1.6(0.9-2.7)	0.097
Sex					
Male	236(69.0)	106(31.0)	1	1	
Female	256(64.8)	139(35.2)	0.8(0.6-1.2)	0.8(0.5-1.1)	0.149
Vaccination status					
Up to date	419(67.8)	199(32.2)	1	1	
Not up to date	72(61.5)	45(38.5)	0.7(0.5-1.2)	0.9(0.5-1.4)	0.554
Never vaccinated	1(50.0)	1(50.0)	0.1(0.0-1.8)	0.1(0.0-1.0)	**0.049**
Nutritional status					
MAM	171(71.6)	68(28.5)	1	1	
Uncomplicated SAM	321(64.5)	177(35.5)	0.4(0.3-0.6)	0.4(0.3-0.6)	**0.001**

✶Adjusted for study arm, age, sex, vaccination and nutritional status

9.4.4 Quality of case management

Quality of case management did not significantly differ between the two groups for most indicators (Table 11). Diagnosis, RUTF treatment, HIV evaluation, counselling and assignment of the exit outcomes were correctly performed in most cases in both groups. Meanwhile, complementary treatment was correctly assigned only in 58.8% (95%CI 43.2 to 74.3) of control facilities, compared to 94.0% (95%CI 83.7% to 100%) of intervention facilities (OR= 1.52 [1.40-1.67], p=0.001).

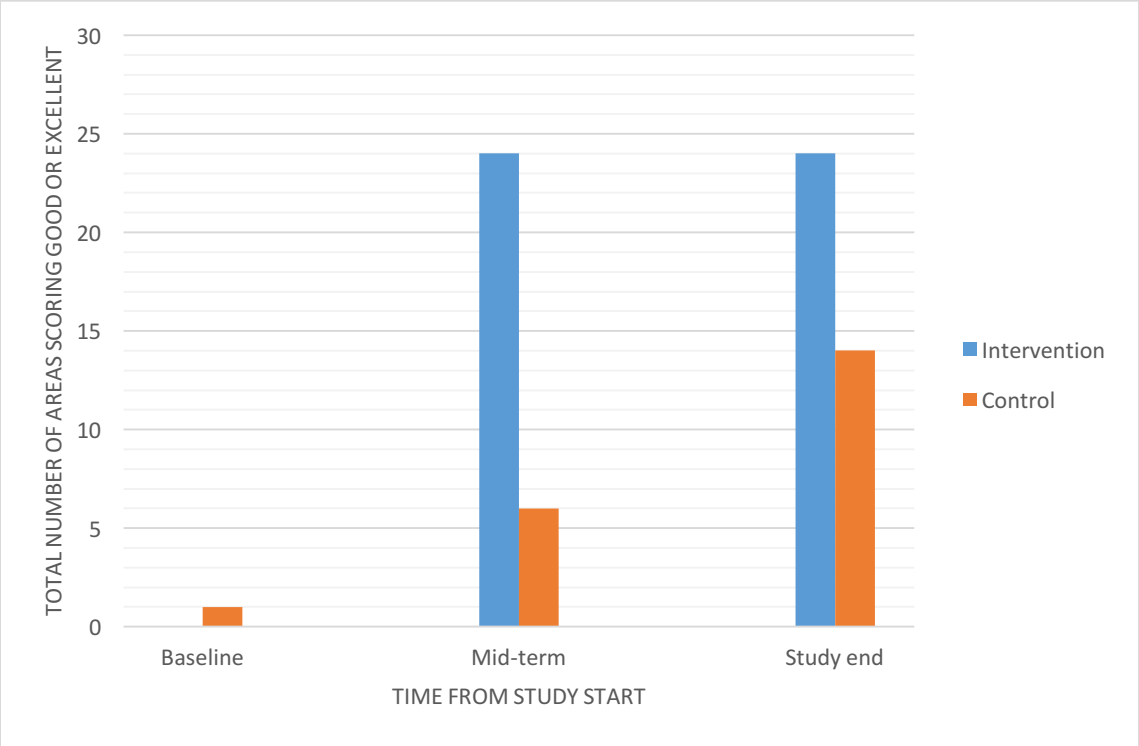
Table 11: Quality of case management

Correct process outcomes	**Randomization arm**									
	Intervention Health Centers				**Control Health Centers**					
	HC 1 n (%)	HC 2 n (%)	HC 3 n (%)	**Mean % (95% CI)**	HC 4 * n (%)	HC 5 n (%)	HC 6 n (%)	**Mean % (95% CI)**	**Difference in mean %**	**p-value**
	182	114	134		140	82	84			
Diagnosis	182 (100)	114 (100)	134 (100)	**100 (100)**	140 (100)	75 (91.5)	84(100)	**97.2 (92.3-100)**	2.8	0.378
RUTF treatment	182 (100)	114 (100)	134 (1000	**100 (100)**	140 (100)	82 (100)	84(100)	**100 (100)**	0	-
Complementary treatment	182 (100)	114 (100)	110 (82.1)	**94.0 (83.7-100)**	105 (75.0)	47 (57.3)	37(44.0)	**58.8 (43.2-74.3)**	35.3	0.001
HIV evaluation	182 (100)	114 (100)	134 (100)	**100 (100)**	140 (100)	82 (100)	84(100)	**100 (100)**	0	-
Patient counselling	182 (100)	114 (100)	134 (100)	**100 (100)**	140 (100)	82 (100)	84(100)	**100 (100)**	0	-
Exit outcome	182 (100)	114 (100)	134 (100)	**100 (100)**	140 (100)	82 (100)	84(100)	**100 (100)**	0	-

9.4.5 Quality of nutritional services

Figure 11 shows the trend of NSDA scores for each facility. At baseline, all facilities except one scored either poor or fair in the 10 assessment areas of the NSDA tool. There was no significant difference between the intervention and control groups. At the end of the study, both groups had increased the total number of area scoring either good or excellent, however, there was still a significant difference between intervention and control arm [24/30 (80%) vs 14/30 (46.6%), OR = 4.6 (1.3 – 17.4), p = 0.015].

Figure 11: Total number of areas with either good or excellent NSDA score, by group, over time



Discussion

This study showed that Supportive supervision significantly improved the cure rates of malnourished children at outpatient level, increasing it above the SPHERE standard. This result was observed, despite the fact that the children in the intervention group had more risk factors. The intervention also resulted in a significant decrease of the rate of defaulters, and a significant improvement in general nutritional service delivery, and access to care. These findings contribute

to the body of evidence from other studies in LMIC suggesting that SS can be an effective strategy to improve quality of care at the facility level [86,128–131]. However, this is the first study that specifically tested SS to improve health outcomes of children. The study was conducted in a humanitarian setting with low resources, were baseline quality of care was reported to be highly substandard [48]. In such settings identifying effective intervention capable to improve child survival, especially for malnourished children who have a very high risk of death, is crucial. As such, study findings are extremely relevant and this study adds to the previous knowledge that, in a setting with very low resources, this intervention may be a highly effective strategy for improving the cure rate, and thus survival of malnourished children.

Different components of the intervention may have contributed to the final results such as the SS and complementary networking activities. The engagement of CHWs in activities such as provision of practical tools including a localization map and telephone credit that were used for patient tracing and sending reminders when the parents/guardians missed a visit respectively, resulted in a lower defaulters' rate in facilities receiving intervention. There is also the possibility that the improvement in overall quality and organization of care at the facility created a positive perception of service delivery among the parents/guardians which is more likely to have encouraged them to return than to default.

Two interesting phenomena were observed in this study that warrant mentioning. First, over time we observed that there was a relative improvement in general nutritional service delivery (NSDA tool [111]) in the control HCs even though the intervention facilities performed better. This may have been due what is termed as the "study effect". It is plausible that the presence of well trained data collectors at facility level could have positively affected the overall staff performance at the health facilities. Secondly, despite the fact that almost all the process indicators were assessed as good in both groups (with the exception of complementary treatment which was significantly better in the intervention arm), the cure rate was still significantly higher in the intervention compared to the control group. This means that there are other factors at play in determining the cure rate with the most significant being minimizing of defaulters, emphasizing the importance of active engagement of CHWs.

The health service delivery assessment revealed that some areas, such as human resources, continued to perform fairly or poorly irrespective of the intervention. This is not surprising

considering that SS alone cannot solve all gaps in quality of care. This needs a holistic approach such as hiring of adequate human resources, activities that require a bigger structural set up and economic resources, coupled with actions from the district and central government authorities. These activities went beyond SS, and the actual mandate of the supervisors.

When SS was extended to include CHWs, combined with a small financial incentive, it also increased the number of malnourished children who were able to access to care. It is acknowledged that the use of absolute numbers to assess access to care can be perceived as a weak approach especially under circumstances that there was no accurate population for reference. However, this was the only possible alternative to assess this outcome based on the assumption of an identical and static population coverage in both groups. The increase in access to care is important, since delays have been shown to contribute to increase in mortality rates among vulnerable malnourished children [132]. The inclusion of a financial incentive is in agreement with other studies conducted such as those conducted in India and Uganda which have suggested that providing some sort of economic recognition is crucial for ensuring CHWs' performance [121,133,134].

The study strengths include the cluster randomized trial design that minimized the effect of other known and unknown factors which could affect the cure rate. Even though there was observed imbalance among groups in patient characteristics, this did not favor a positive effect of the intervention because they were mainly risk factors for not being cured, and therefore the impact of SS could be a possible under-estimation, and not in an over-estimation, of the treatment effect. Also, the study instituted robust quality assurance procedures to ensure good data quality. Even though the study was not blinded, the use of objective outcomes measures should have limited the potential for assessment bias.

The current IMAM guidelines in Uganda [2] recommends SS, although there are specific details of activities or approach. As such, this study is of interest to policy makers, by providing both evidence in support of the effectiveness of high intensity SS, and experience on dedicated tools. The use of local staff already under district employment as provider of SS and of local guidelines as reference standard may facilitate the sustainability of SS. However, external coordination and monitoring need to be ensured, and appropriate resources need to be allocated. However, it must be acknowledged that the study also used well trained, highly motivated local staff and SS was provided at a relatively high frequency. The study finding suggest that when the above described

factors are present, quality of care can be achieved. These characteristics need to be kept in mind, when planning to replicate the intervention.

There were study limitations that need to be acknowledged such as the already discussed small facility sample size in the phase one of this project. However, it is also important to add that the primary outcome of this study was estimated at the individual level and the study managed to enroll an adequate number of children, as estimated in the sample size calculations, to adequately answer the study objectives. There is also the possibility that the observed effect of SS was due to other study components, beside the intervention, such as the presence of data collectors. However, this could not be avoided because the study could not be conducted without data collectors, who also ensured the robustness of the data quality for accurate outcome estimations. Nonetheless, it is also important to add that data collectors were present in both study groups, and again, the observed difference in effect between groups suggest that this intervention was actually effective. The unavailability of population coverage data specific for selected facilities may have limited the study from estimating a more accurate access to care measure. However, the study findings are still reliable mostly because the randomization design ensured the equal distribution of population coverage characteristics in both study arms, in addition to the assumption that the populations coverage could not significantly change over the one year course of the study. Heterogeneity in quality of care at baseline was observed in our sample, despite no significant differences in the mean cure rate among groups. Heterogeneity in quality of care, even among facilities in the same setting, is a common finding (21,22,36) and should not be perceived as unusual. Most importantly, and similarly to other previous studies (36), this study showed that SS reduced heterogeneity in health outcomes.

Chapter Six

10. Phase Three: Cost effectiveness of Supportive Supervision to improve the health outcomes of malnourished children at out-patient level

Study aim

The information used in this study phase was from the cluster RCT with cost data collected during its implementation. The intervention was delivered in two study periods reflecting the two SS approaches used in this project: In the first period, SS was delivered to the staff at health center and in the second period, it was extended to include CHWs. The aim of this phase was to estimate the provider perspective costs of delivering SS in both study periods in one year and associated cost effectiveness ratios as an estimate of their cost effectiveness.

Study objectives

I. Estimate the provider perspective cost of delivering SS in one year to health workers only (first study period) and to health workers and community health workers (second study period).
II. To estimate the additional cost of conducting SS that is required for every additional DALY averted for SS to health workers only (first study period) as compared to SS to health workers and community health workers (second study period)

Methods

This CEA is reported according to the CHEERS statement [96].

10.3.1 Study area, population and SS intervention

Data on both effectiveness and cost were collected during a cluster RCT. Detailed RCT methods including the SS and its effect are described in detail under chapter five.

10.3.2 Measurement of effect

The primary effect measure in this study was the Disability Adjusted Life Years (DALYs) averted, with the number of deaths averted as an intermediary outcome. The DALY is an aggregate of mortality, expressed in years of life lost (YLL) and morbidity, expressed in years lived with disability (YLD) [135,136]. The number of YLL represents the time lost due to premature mortality while the number of YLD represents the healthy time lost while living with a disease or disability.

In this analysis, the number of DALYs averted represented the ability of SS to prevent mortality, among the intervention HCs greater than among the controls, which would otherwise have occurred in the absence of any malnutrition intervention. The effect comparison was the difference in number of deaths averted and the resulting DALYs averted in the intervention HCs (received SS) as compared to the control HCs (No SS). Results from the Cluster RCT showed that SS led to an improvement of number of cured children (Table 12) defined as a child who attained a weight-for-height ≥ -2 standard deviation (SD) from the mean based on the WHO 2006 standards or mid upper circumference (MUAC) of ≥ 12.5 cm, with no bilateral pitting oedema for two weeks, and clinically well. To estimate the number of deaths averted, we followed a similar method used by *Puett et al* [137]. The cure rate was used to estimate the number of deaths averted, that were expected if there was no treatment of malnourished children. Deaths averted was therefore a product of the proportion of expected deaths multiplied by the number of successfully cured children. The number of cured children was derived by multiplying the cure rate with the number of treated children. *Puett et al* reported that the proportion of expected deaths is approximately 20.7% (95% CI: 14.6 – 29.2) of malnourished children who would die within a mean duration of 6 months from the time of onset of malnutrition[137]. Mortality among children with SAM is ten fold higher than those with MAM, therefore the expected deaths in this group was considered as 2.07%[30]. There was also one death reported in the control group, this was considered as additional death averted in the intervention group.

Using the WHO template for calculating DALYs [138], the deaths averted, together with parameters such as life expectancy [41], discount rates and age-weighting [93,106,136] (Table 12), were applied to determine the number of averted years of life that could have been lost (averted YLL) due to premature death caused by malnutrition in the absence of SS. The same was applied

for the one death experienced in the control group and considered as additional YLL averted in the intervention group.

To estimate the second component of the DALY, the 2016 Global Burden of Disease disability weights for MAM with edema and SAM without edema [139], together with the duration of illness and age at admission were the parameters used to determine the number of Years Lost with Disability (YLD) experienced by malnourished children.

Even though SS was able to avert several years of life that could have been lost due to death (YLL averted), the admitted children still experienced disability due to the malnutrition, therefore the overall DALYs averted were estimated as the number of YLL averted minus the experienced YLD.

Table 12: Parameters and assumptions used to estimate DALYs averted

Parameter	**Units**	**Estimate**	**Range**	**Parameter data source**
Intervention HCs cure rate	%	83.8	71.0 - 96.6	Cluster RCT study
Number treated in phase one (Intervention incidence)	cases	165	-	
Number treated in phase two (Intervention incidence)	cases	265	-	
Control HCs cure rate (%)	%	44.9	38.2 – 51.6	
Number treated in phase one (Control incidence)	cases	159	-	
Number treated in phase two (Control incidence)	cases	148	-	
Proportion of females in study	%	51.4	-	
Proportion with MAM	%	32.4	-	
Proportion with SAM	%	67.6	-	
Deaths in Control HCs	cases	1	-	
Deaths in Intervention HCs	cases	0	-	
Degree of disability for MAM with oedema (YLD)	n.a.	0.051	(0.031–0.079)	Global Burden of Disease Study 2016 Weights [139]
Degree of disability for SAM without oedema (YLD)	n.a	0.128	(0.082–0.183)	
Life expectancy (Males) (YLL)	years	60	-	WHO Uganda Life

Life expectancy (females) (YLL)	years	65	-	expectancy (2016)[41]
Age at start of episode (Males) (YLD)	months	17.6	(6.8 -28.4)	Mean age at admission: Cluster RCT study
Age at start of episode (Females) (YLD)	months	16.7	(5.3 – 28.1)	
Mean duration before death, untreated cases	months	6	-	Puett (2013) [137]
Age at death (Males) (YLL)	months	23.6	-	Cluster RCT study, Puett (2013) [137]
Age at death (Females) (YLL)	months	22.7	-	
Mean duration of episode (YLD) in intervention	months	0.9	0.2 – 1.6	Cluster RCT
Mean duration of episode (YLD) in control	months	1.3	(0.2 – 2.0)	
Age weight	n.a.	0.04	-	Drummond (2005), Fox-Rushby [93,106]
Constant	n.a.	0.1658	-	
Discount rate	n.a.	0.03	-	
Proportion of expected deaths among those with SAM, %	%	20.7	14.6 – 29.2	Puett (2013) [137]
Proportion of expected deaths among those with MAM, %	%	2.07	1.5 – 2.9	Black et al, 2013 [30]

10.3.3 Measurements of costs

Perspective

This was a provider perspective CEA focusing only on the additional cost of delivering the two SS approaches in the intervention HCs as compared to the controls. All estimates on costs were obtained from the project financial accounts and are presented in Euro (€) in accordance to these reports. Costs were divided into: 1) start-up costs; 2) cost for delivering the intervention under normal circumstances. Start-up costs included: training of two supervisors, a coordinator (district nutritionist) and five health facility staff from each of the 3 intervention HCs whose costs were based on the current Ugandan nationally recommended daily allowance rate. The intervention running costs included: SS activities; fuel for transportation to the sites during SS; communication (phone calls airtime); equipment maintenance (which only comprised of replacing batteries of the

electronic weighing scales); networking activities (workshop meetings with the health facility staff to discuss strategies to improve quality of care and also share lessons learned). Other health care delivery related costs such as medications, ready-to-use foods, salaries of the HC staff were not included because they were not specific to the intervention. Costs of developing SS tools were not included, because these could be developed at an early stage together with other MoH tools as part of the national guidelines. The per-diem for the district nutritionist for coordinating the SS was also not included because this is already a specific duty of the nutritionist as described in the guidelines [2].

10.3.4 Time horizon and discount

All estimates on costs were directly obtained from the project financial account, reporting the actual costs at the time when each expenditure was made, during the study period (February 2017 to December 2017); no other adjustment for inflation was therefore needed. The annual discount of 3% [93] was not applied because the time horizon of the study was less than one year

10.3.5 Incremental cost effectiveness analysis

In order to determine the additional cost for DALY or death averted under the two SS approaches, the incremental cost-effectiveness ratios (ICERs) for phase one and phase two were calculated using the formula [140];

$$= \frac{C_1 - C_0}{E_1 - E_0} = \frac{C_1}{E_1}$$

where C_1 is the cost of SS and E_1 is the number DALYs or death averted by the two SS approaches:
First study period ICER; where C_1 is the cost of SS delivered to only the HC staff and E_1 is either the number of DALYs or deaths averted during this phase
Second study period ICER; where C_1 is the cost after extending SS to CHWs and E_1 is the number of DALYs or deaths averted during this phase

And C_0 and E_0 are the costs and effects estimated in the control HCs that received no SS. Since only additional SS costs were considered and no control HC received intervention, the C_0 was taken as zero among the controls, during both phases.

10.3.6 Sensitivity analyses

One-way sensitivity analysis [141] was used to assess for uncertainty around parameter estimates in both study periods to demonstrate the extent of varying selected variable estimates affected the base ICER. The first period study variables included were the start up costs, running costs, the expected mortality range and the relative difference in number of DALYs averted between intervention and control. The second period study variables included all those selected in phase one, in addition to costs of SS to CHWs.

Uncertainty estimates were derived from 95% confidence interval of the DALYs averted and for the expected mortality (Table 12) while a three-fold decrease or increase in cost was applied to estimate the sensitivity range on the start up costs, running costs and costs of SS to CHWs (Table 13). These estimates were applied individually while maintaining the base estimates of the other variables to generate the range of ICER. Using excel, the generated ICER values for both phases, including the lower and upper ICER estimates for each of the variables were then plotted in a tornado diagram.

Table 13: Parameter estimates for the sensitivity analysis

Variable	Value	Sensitivity variation
DALY's averted (95% CI)		
First period		
Intervention	637	514 - 702
Control	259	219 - 299
Second period		
Intervention	935	791 – 1,112
Control	256	217 - 296
Costs (3x variation)		
First period		
Start up costs	588.0	196.0 – 1764.0
Running costs	3071.9	1024 – 9215.8
Second period		
Start up costs	588.0	196.0 – 1764.0
Running costs	3071.9	1024 – 9215.8
Costs of SS to CHWs	924.5	308.2 – 2773.4
Expected deaths, %	20.7	14.6 – 29.6

Results

10.4.1 Study participants

Overall, 737 children were enrolled in the study, 430 on the intervention arm and 307 on the control arm. Of these, 324 children were enrolled in phase one (intervention arm = 165 versus control arm = 159) and 413 in phase two (intervention arm = 265 versus control arm = 148) (Table 12). Females contributed 53.6% (395) of the study population while 67.6% (498) were SAM diagnosis and 32.4% (239) were MAM diagnosis.

10.4.2 Effects of SS

The number of deaths averted in the control arm was 9.6 (first period) and 9.5 (second period) as compared to the higher number of deaths averted in intervention arm of 21.8 when SS was delivered to only HC staff (first period) and 34.0 when SS was extended to include CHWs (second period) (Table 14). The resulting number of DALYs averted in the control arm were 280.0 (first period) and 279.0 (second period). In the intervention arm, this rose to 665.0 (first period) and further to 975.0 (second period).

Table 14: Effect measures

Effect measure	First period		Second period	
	Control HCs	Intervention HCs	Control HCs	Intervention HCs
Deaths averted				
MAM	0.6	0.8	0.5	2.0
SAM	9.0	21.0	9.0	32.0
Total deaths averted	***9.6***	***21.8***	***9.5***	***34.0***
DALYs averted				
YLL averted				
MAM	17.0	21.0	14.0	38.0
SAM	255.0	634.0	255.0	923.0
Total YLL averted	*272.0*	*655.0*	*269.0*	*961.0*
YLD experienced				
MAM	2.0	2.0	1.0	2.0
SAM	6.0	8.0	6.0	12.0
Total YLD experienced	*8.0*	*10.0*	*7.0*	*14.0*
Total DALYs averted*	**280.0**	**665.0**	**276.0**	**975.0**

*Summation of YLL averted – Summation of YLD experienced

10.4.3 Cost of delivering Supportive supervision among the intervention facilities

In the first period, the total cost of delivering SS to the three intervention facilities in one year was estimated at € 3659.9 with running costs contributing up to 80% of this cost (Table 15). The three largest expenditures in the running costs were SS visits (€1175.2) followed by networking activities (€1079.1) and communications and patients' follow up (€618.1).

When SS was extended to CHWs in the second period, this additional activity that was estimated to cost € 924.5, raised the cost of delivering SS to € 4584.4.

The resulting cost of SS per child admitted was €22.2 (€3659.9/165 children) in the first period and reduced to €17.3 (€4584.4/265 children) in the second period.

Table 15: Costs of delivering SS

Cost categories	**Costs (€)**	
	First period	**Second period**
Start-up costs		
Training of two supervisors	120.0	120.0
Training of a coordinator (DN)	60.0	60.0
Training of the health facility staff	408.0	408.0
Sub-total	***588.0***	***588.0***
Running costs		
SS to the HC	1175.2	1175.2
Fuel for transportation	180	180
Communication and patients' follow up	618.1	618.1
Equipment maintenance	11.2	11.2
Print outs	8.4	8.4
Networking activities	1079.1	1079.1
Sub-total	***3071.9***	***3071.9***
SS to CHWs	-	***924.5***
Total costs	***3659.9***	***4584.4***

10.4.4 Base incremental cost effectiveness ratio

The base ICER estimates for both DALYs and deaths averted are presented in table 16. In the first period, the additional cost of SS required to avert each additional death was €300 and reduced to €195.1 in the second period.

The same trend was observed for DALYs averted, however, the additional costs were much lower. The additional cost of SS required for each each additional DALY averted was € 9.7 in the first period and reduced to €6.8 the second period.

Table 16: Base incremental cost effectiveness ratio results

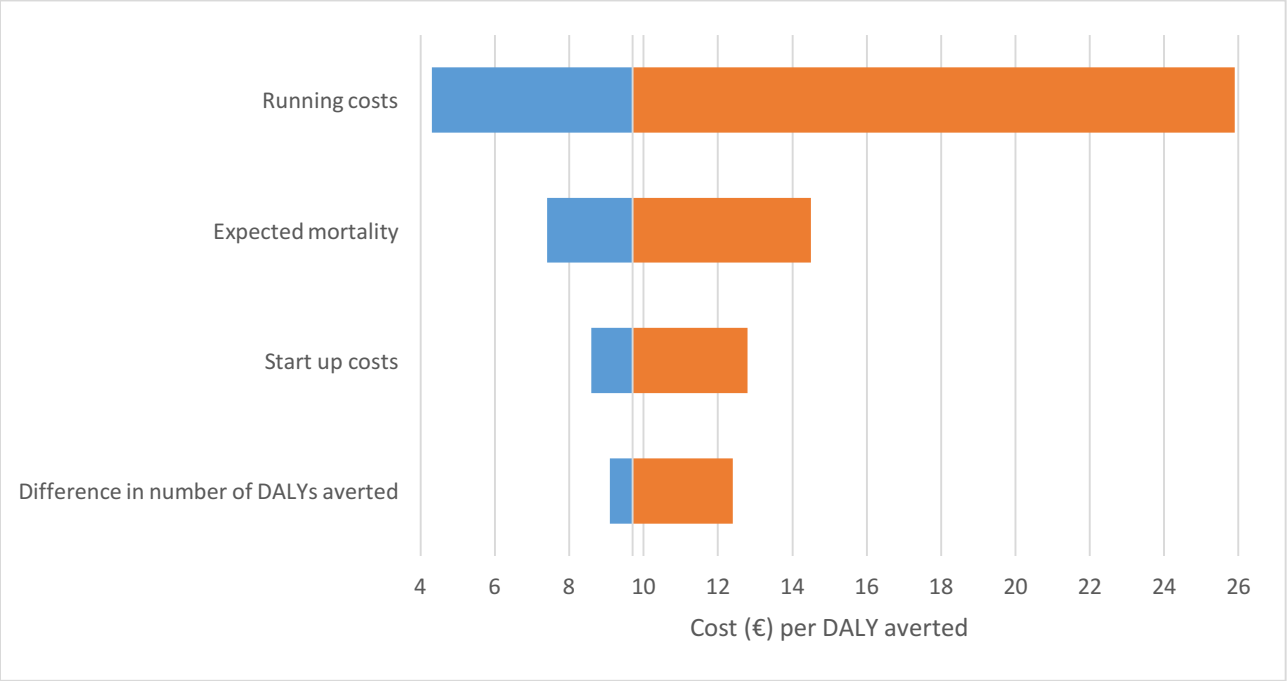
Comparisons	Effectiveness		Cost		
	Effect	IE	Total cost	IC	ICER
Deaths averted					
First period comparison					
Intervention (SS to HC staff only)	21.8		3659.9		
Control (No SS)	9.6	12.2	0	3659.9	300.0
Second period comparison					
Intervention (SS to HC staff + extension to CHWs)	34.0		4584.4		
Control (No SS)	10.5	23.5	0	4584.4	195.1
DALYs averted					
First period comparison					
Intervention (SS to HC staff only	637.0		3659.9		
Control (No SS)	259.0	378.0	0	3659.9	9.7
Second period comparison					
Intervention (SS to HC staff + extension to CHWs)	935.0		4584.4		
Control (No SS)	256.0	679.0	0	4584.4	6.8

IE: Incremental Effectiveness, IC: Incremental Cost, ICER: Incremental Cost Effectiveness Ratio

10.4.5 Sensitivity analysis

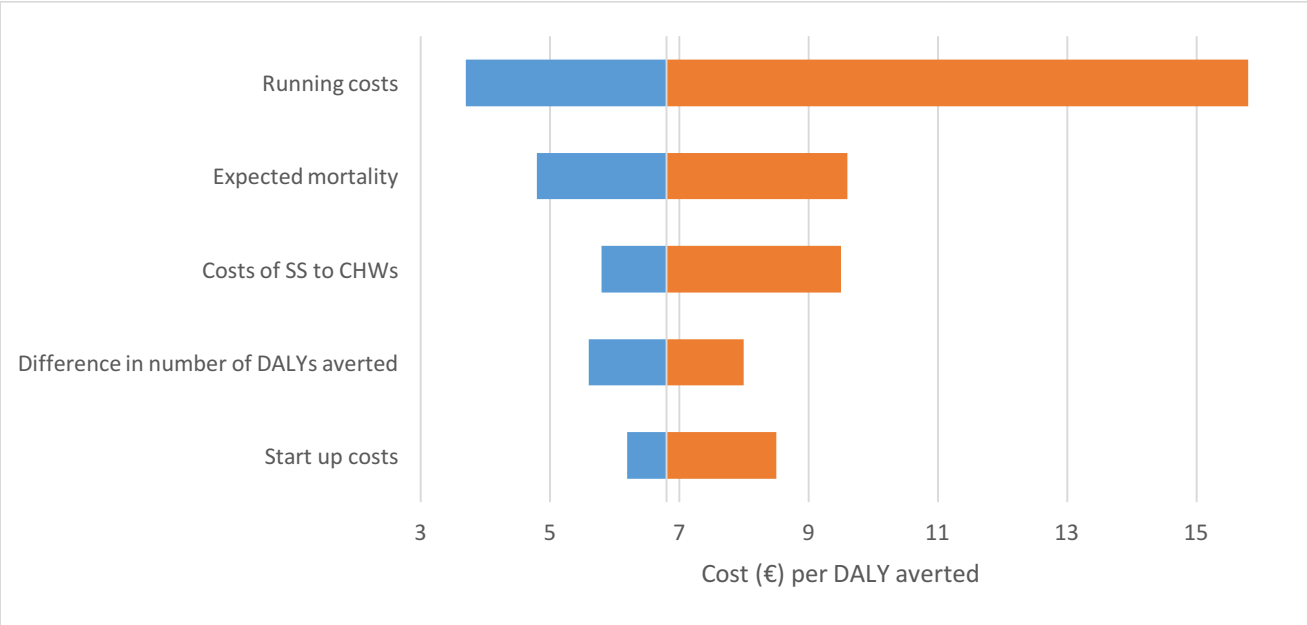
In the first period, the greatest variation in the base ICER was due to the running costs (ICER: €4.3 to €25.9) followed by expected mortality (ICER: €7.4 to €14.5). The least variations were due to start up costs and difference in number of DALYs averted (Figure 12).

Figure 12: Tornado diagram for the first period one-way sensitivity analysis



A similar trend was also observed during the second period (Figure 13). The running costs were still the biggest contributor to the variation in base ICER (ICER: €3.7 to €15.8), but with a narrower range as compared to the first period. This was followed by expected mortality (ICER: €4.8 to €9.6), the the additional costs of SS to CHWs (ICER: €5.8 to €9.5), the differences in number of DALYs averted (ICER: €5.6 to €8.0) and start up costs (ICER: €6.2 to €8.5) which produced the least variation.

Figure 13: Tornado diagram for second period one-way sensitivity analysis



Discussion

The incremental cost of delivering SS for each additional death averted was €300 when SS was delivered to HC staff only and reduced to €195.1 when it was extended to CHW. The resulting additional cost for each additional DALY averted was €9.7 and €6.8 respectively. In the cluster RCT study, extending SS to CHW in the second period, increased the number of children who had access to care and also minimized defaulting of those who were already on treatment, activities that translated to more cured children, and therefore in a more cost effective SS approach. The cost effectiveness of including CHWs in nutrition care at community level have been documented in other similar settings such as Malawi, Zambia and Bangladesh where treatment of SAM at community level was a more cost effective intervention as compared treatment at the facility level [97,101,137]. This is because involvement of CHWs increases coverage and equity of health services at lower costs since they are part of the community and bring health care services closer to the households, especially the poorest.

The threshold used in this study to determine cost effectiveness of SS was adopted from the WHO CHOICE reference [92] where a cost effective intervention is defined as that whose cost per DALY averted is less than three times the country's Gross Domestic Product (GDP). Uganda's GDP per capita is estimated at approximately $600 [142], therefore based on the WHO CHOICE assessment, SS is a cost effective interventions with its extension to CHWs being a more cost effective approach. Additionally, when the costs per DALY averted realized from the SS is compared to findings from a recent systematic review by *Hurton et al*, that ranked the most cost effective interventions for children in LMIC, SS is as cost effective among the interventions with the least costs per DALY averted such as the treatment of severe malaria with artesunate, immunization (pneumococcus and rotavirus) and oral rehydration therapy, [103].

However, these results need to be interpreted in the context of SS being an additional low cost intervention to improve the health outcomes of malnourished children. This is because the cost estimates considered in this study were only those of administering the intervention in the midst of other ongoing good service delivery practices. These included the availability of RUFT, essential medicines and well trained data collectors who were an additional resource at the facility, all factors that are bound to improve health outcomes of malnourished children. Therefore, to maximize the impact of SS, it should be implemented alongside other already known effective interventions for management of malnutrition including adequate resources (financial and human), supplies (RUTF and medicines), and materials (anthropometric instruments etc).

The investment into SS in HC that are treating children with malnutrition is a worthwhile undertaking considering the additional large impact of its effectiveness on cure rate. This is also in support of a recent report indicating that for every US$1 spent in nutrition, there is a US$16 return in health and economic benefits such as a higher GDP [143]. This is the first study that is estimating the cost of delivering these two SS approaches (to HC staff and CHWs), an area with very limited information. Most important is that these findings can be used as a benchmark for SS budget planning, can also be used to improve the priority status of SS and for resource mobilization and allocation.

These study results are robust considering that SS was still a very cost effective intervention even after varying the impact of selected variables on the base ICER. In both study periods, the running costs contributed the greatest variations in ICER, followed by the expected mortality. A greater understanding/estimation of the running costs and expected mortality is therefore necessary. The variability was narrower when SS was extended to CHWs because more children were cured during this period, which was associated with a narrower confidence interval.

Study limitations such as the small cluster sample size have been discussed in detail in both chapter four and five. However, it is important to also acknowledge that this CEA only considered a provider perspective cost estimation of provision of the intervention. This perspective does not include all the costs and benefits offered at the societal level, such as costs associated with provision of RUFT, essential medicines and other indirect costs associated with the facility care workers (remuneration, training, additional support etc), patient and family support and institutions such as the government and other key implementing partners. However, the effects of such external factors were minimized by the cluster RCT design whose strength is the equal distribution of such societal factors between the control and intervention arm. This study considered a one-way sensitivity analysis to demonstrate the impact of varying one parameter at a time on the baseline ICER, however, this simpler approach does not take into consideration that the overall uncertainty is dependent on combined variability of several factors. Nonetheless, this approach is satisfactory for our study with estimates still showing that the two approaches are still cost effective even after the one-way sensitivity analysis. This study strength included the use of data from a cluster RCT which was collected using robust data quality assurance procedures. Others included the objective outcome measures which minimized the potential for assessment bias while the use of independent study accounts limited cost assignment bias.

Chapter Seven

11.GENERAL DISCUSSION

11.1 Quality of care of nutrition services and health outcomes of malnourished children

The baseline assessment showed that the estimated health facility cure rates were far below the 75 % international SPHERE standards [34], which could be explained by the significant deficiencies in quality of care provided. Such deficiencies included no clear work flow organization at triage, patient assessment, treatment and counselling contrary to what was stipulated in the IMAM guidelines [2], leading to frequent patient delays. Such irregular working hours and long waiting times have already been shown to be barriers to health care service utilization in Uganda [113]. And there is strong evidence to show that such delays lead to increased mortality especially among children diagnosed with SAM who actually require urgent medical attention [122].

Even though all facilities were assigned personnel and an in-charge to manage nutrition related activities, as outlined in the IMAM guidelines[2], the number of staff were still inadequate compared to the patient workload, highlighting the human resource challenges faced in low and middle income countries [119]. This was further worsened by the lack of training of most of the available staff which could be a possible explanation for the poor performance of case management among facilities.

Almost all the assessed health facilities had basic nutritional equipment such as digital weighing scales, length/height measuring boards, MUAC tapes and essential job aids mostly provided for by UNICEF. However, there were still challenges that limited the attainment of optimal resources at the facility level. Such included the lack of funds to maintain the equipment, miss-use of job aids, stock out of RUFT and complimentary drugs at health facility level, all similar findings that have been documented from other studies in this setting [113,114].

Non-adhere to guidelines in low and middle income countries is well document [11,13]. Indeed this study found that important clinical practices such as triage, screening of all children for malnutrition, history taking, detailed examination, patient diagnosis, individual counselling, complementary treatment and assignment of exit outcomes were not being performed according

to both the IMAM [2] and IMCI guidelines [144]. Additionally, laboratory screening for HIV and TB was not routinely conducted, despite the availability of laboratory diagnostic kits an oversight considering that both conditions have been shown to be associated with malnutrition in children in such settings [30,38–40].

All facilities had VHT members attached as a part of the community linkage with the main purpose of screening children in the community to identify cases for referral and patient follow up to minimize defaulting, however, most of them were not actively carrying out these activities. This could explain the reported high defaulting rate at 38.3%, which is significantly higher than the SPHERE standard's target set at below 15% [34].

The integrated nutritional register and monthly quarterly reports were widely available at the facility but the data from these files was of very poor quality, a finding that has been documented by other studies in similar settings [123,124]. There was a lot of missing information for key data fields and even in instances where data was filled in, it was inconsistent over time. This could render the reliability of the national HMIS data questionable for decision making.

Such poor performance of quality of health service delivery has also been reported in refugee settings such as in Ethiopia [115,116], [117,118], a justification of the importance of interventions such as SS to improve quality of care in such settings.

11.2 Supportive Supervision to improve quality of care and health outcomes of malnourished children

The cluster RCT study revealed that SS was an effective intervention that improved the cure rate of malnourished children above the 75% SPHERE standards [34]. Even after controlling for imbalances in baseline characteristics, SS significantly improved cure rates by 9 times as compared to those in the control facilities. These findings contribute to the body of evidence from other studies in LMIC suggesting that SS can be an effective strategy to improve quality of care at the facility level [86,128–131]. This result was observed, despite the fact that the children in the intervention group had more risk factors emphasizing the benefit of SS in improving the cure rates of malnourished children. However, as already reported in other studies, this study also showed that children with SAM[30] continued to be less likely to be cured as compared to those with MAM.

This study phase also provides detailed and clear activities for implementing a successful SS. This information is relevant in similar settings like Uganda's context, especially in humanitarian areas, to strengthen the supervision component of the IMAM guidelines, that currently do not provide details of activities of conducting a supervisory visit [2]. The supporting supervision intervention package in this study involved monitoring progress of a set of outcomes (health and process outcomes) and quality of service delivery, provision of technical support when gaps were identified and using a peer-to-peer model to facilitate good team dynamics and encouraging problem solving attitude. This model, which was delivered more frequently than the national routine supervision, ensured continuous and close engagement with health facility staff and community health workers. Additionally, the use of local staff employed by district local government as supervisors and local guidelines as reference standard may facilitate the sustainability of this approach, however, external coordination and monitoring need to be part of this process, and appropriate resources need to be allocated.

The finding that extension of SS to CHWs also increased access to care is important, since delays have been shown to contribute to increase in mortality rates among vulnerable malnourished children [132]. This SS approach encouraged CHWs to adequately conduct activities, such as community screening and case referral. Specific SS activities implemented for CHWs included training on basic nutrition concepts, enhanced supervision and provision of a small financial incentive. The inclusion of a financial incentive is in agreement with other studies conducted such as those conducted in India and Uganda which have suggested that providing some sort of economic recognition is crucial for ensuring CHWs' performance [121,133,134]. However, there is limited literature of the sustainability of such an incentive in such LMIC settings, therefore future studies may test whether providing a financial incentive to CHW during SS and effective and sustainable approach.

The finding that, some areas, such as human resources, still performed poorly or fairly, irrespective of the intervention, is not surprising. This goes to show that SS alone cannot solve all gaps in quality of care. Some improvements like the number of human resources which require financial resources and actions from the district and central government authorities, are beyond the implementation of this SS approach, emphasizing the need for a collaborative approach with all relevant stakeholders if the best results are to be realized from this intervention.

These study findings can be generalizable to other similar LMIC settings especially those located in humanitarian settings and are therefore of great interest to both researches and policy makers. It must also be acknowledged that the study was conducted in the context of well trained, highly motivated local staff and SS was provided at a relatively high frequency which may not be easily replicable in a program setting. However, this is a lesson that when the above described factors are present, quality of care can be achieved and therefore, these characteristics need to be kept in mind, when planning to replicate this intervention.

11.3 Cost effectiveness of supportive supervision

Overall, this CEA showed that SS was a cost effective approach to improvement of cure rates of malnourished children, especially when delivered to both the HC staff and CHWs. The main reason for the better performance of SS to HC staff and CHWs was mainly because extending SS to CHW, improved access to care and also minimized the defaulting rate, both strategies which greatly improved the cure rate. This finding is similar to nutrition care studies from settings such as Malawi, Zambia and Bangladesh, that showed that interventions which included CHWs were more cost effective as compared to those that only involved HC staff [97,101,137]. Furthermore, the CEA findings from this study were also compared to the WHO CHOICE reference which defines a cost effective intervention as that whose cost per DALY averted is less than three times the country's Gross Domestic Product (GDP)[92]. Based on this and Uganda's GDP per capita estimated at approximately $600 [142], both SS approaches were indeed cost effective interventions.

However, these results need to be interpreted in the context of SS being an additional low cost intervention to improve the health outcomes of malnourished children. This is because the cost estimates considered in this study were only those of administering the intervention in the midst of other ongoing good service delivery practices. These included the availability of RUFT, essential medicines and well trained data collectors who were an additional resource at the facility, all factors that are bound to improve health outcomes of malnourished children. This is the first study reporting on the cost effectiveness of delivering SS in this setting and therefore these findings can be used as a benchmark for SS budget planning and important information for resource mobilization and allocation.

These findings, for both SS approaches were still significant even after factoring in uncertainty of parameters emphasizing the robustness of these results. Even though this study considered a simpler one-way sensitivity analysis, it was a satisfactory approach for our study demonstrating that varying a set of selected parameters had minimal impact on the cost effectiveness of both SS approaches. Of note, during both approaches, the running costs contributed the greatest variations in ICER which was an indication that this parameter was not precisely measured, therefore future studies examining this SS approach should consider a more accurate approach of measuring costs related to running the study. Also, when SS was extended to CHWs, the variability was narrower when SS was delivered to only HC staff. This was because more children were cured during the extension of SS to CHWs and therefore associated with a narrower confidence interval.

11.4 Study strengths and limitations

The strengths of this project included the use of the standard national tool for assessment of nutrition services [111] that allowed comparisons over time or over settings, the use of trained data collectors and pre-defined data collection variables with standard operating procedures in all the project phases. In the second phase, the use of a cluster randomized control trial design and robust data quality assurance procedures set up during intervention ensured that the observed improvements in cure rates of malnourished children admitted to health facility level were attributed to SS. Also the use of objective outcomes measures adopted limited the potential for assessment bias since the study was not blinded to the study participants.

There were also limitations that need to be acknowledged. The small sample of health facilities included may not be representative, however this was minimized by including facilities with the highest burden of malnutrition resulting into a coverage of 46 % of cases admitted in Arua district. Additionally, during the estimation of the second phase sample size (the main project phase), the cluster sample size calculations (with a fixed number of clusters) resulted in a scientifically sound estimates that would support a significant difference in cure rates between the intervention and control groups if one truly existed.

In the first phase, there was also the possibility of information bias from the review of historical data and individual interviews during the cross sectional study, however this was minimized through data triangulation and using multiple data sources. The poor quality of baseline data from

the historical data from the HMIS and nutrition registers, is a frequently reported issue in these settings, including Uganda [123,124]. There is the possibility that this data may not be fully accountable. However, this was the only available official data for which the baseline findings were based with the expectation that all information of each child with malnutrition was recorded. To minimize the impact of poor data quality, trained data collectors, using pre-defined data collection variables and following standard operating procedures were used and all results were reported with transparency. However, this was not the case with the second phase of the study, which as already reported, had robust data quality procedures that ensured high quality data collection during the second phase.

12.CONCLUSION

In Phase one, this assessment revealed that health outcomes of children with malnutrition in Arua district are far below the internationally acceptable SPHERE standards. Additionally, the quality of care assessment identified significant deficiencies under organization of service, case management, procurement, community linkage and data quality.

In Phase two, the study showed that SS was an effective intervention to improve the cure rate of malnourished children at outpatient level in a setting with very low resources to levels above the SPHERE standards. This approach also improved quality of case management, overall quality of care, and access to care. As such, high intensity SS may be considered among the strategies to improve nutritional outcomes of children in Uganda, and in other similar settings.

In phase three, SS especially when delivered to HCs staff and CHWs, is a cost effective intervention to improve the health outcomes of malnourished children at HC level. However, this conclusion should be interpreted in the context of SS being an additional low cost and cost effective approach to complement already existing malnutrition interventions.

Recommendations derived from this project include: hiring and training of health facility staff to fill in the human resource gap; strengthening SS to improve performance at different levels (case management, timely requests of supplies including therapeutic foods, data quality, community linkages); and conducting regular NSDA assessments to monitor progress of achievements over time. Furthermore, the CEA also provides evidence that can be used for funding advocacy in low resource settings beyond what has been the norm (provision of supplies, materials and human

resources).

Future research aiming to replicate these study findings and exploring SS approaches could consider using a larger sample size, in different settings and also consider a societal perspective for CEA.

Product from this project

The Baseline assessment findings were submitted and accepted for publication in the BMC health services research journal **(Appendix 8)**

References

1 Levels and Trends in Child Malnutrition. Joint Child Malnutrition estimates. UNICEF/WHO/World Bank.2017 Edition. http://www.who.int/nutgrowthdb/jme_brochoure2017.pdf?ua=1 (accessed 2 Nov 2017).

2 Ministry of Health, Uganda. Guidelines for Integrated Management of Acute Malnutrition in Uganda, January 2016.

3 Uganda Bureau of Statistics. Uganda Demographic and Health Survey. 2016.Kampla, Uganda.

4 World Vision Uganda. West Nile refugee response situation report 8. Kampala. 2017.

5 Appeal for urgent response to Uganda refugee crisis. NRC. https://www.nrc.no/news/2016/august/appeal-for-urgent-response-to-uganda-refugee-crisis/ (accessed 5 Apr 2017).

6 World Health Organization, Nutrition for Health and Development. *Ambition and action in nutrition 2016-2025.* 2017. http://apps.who.int/iris/bitstream/10665/255485/1/9789241512435-eng.pdf (accessed 9 Nov 2017).

7 WHO Wasting Policy Brief. Global Nutrition Targets 2025. Geneva: World Health Organization; 2016. http://apps.who.int/iris/bitstream/10665/149023/1/WHO_NMH_NHD_14.8_eng.pdf (accessed 9 Nov 2017).

8 Ministry of Health, Uganda. Integrated Management of Acute Malnutrition Guidelines December 2010.

9 Uganda Nutrition Action plan 2011-2016: Scaling Up Multi-Sectoral Efforts to Establish a Strong Nutrition Foundation for Uganda's Development.

10 Government of Uganda – UNICEF COUNTRY PROGRAMME ACTION PLAN 2016 - 2020.

11 Ayieko P, Ntoburi S, Wagai J, *et al.* A Multifaceted Intervention to Implement Guidelines and Improve Admission Paediatric Care in Kenyan District Hospitals: A Cluster Randomised Trial. *PLOS Medicine* 2011;**8**:e1001018. doi:10.1371/journal.pmed.1001018

12 Dettrick Z, Firth S, Soto EJ. Do Strategies to Improve Quality of Maternal and Child Health Care in Lower and Middle Income Countries Lead to Improved Outcomes? A Review of the Evidence. *PLOS ONE* 2013;**8**:e83070. doi:10.1371/journal.pone.0083070

13 Pariyo GW, Gouws E, Bryce J, *et al.* Improving facility-based care for sick children in Uganda: training is not enough. *Health Policy Plan* 2005;**20**:i58–68. doi:10.1093/heapol/czi051

14 Huicho L, Dávila M, Campos M, *et al.* Scaling up Integrated Management of Childhood Illness to the national level: achievements and challenges in Peru. *Health Policy Plan* 2005;**20**:14–24. doi:10.1093/heapol/czi002

15 Gillespie S, Menon P, Kennedy AL. Scaling Up Impact on Nutrition: What Will It Take? *Adv Nutr* 2015;**6**:440–51. doi:10.3945/an.115.008276

16 Falbo AR, Alves JG, Batista Filho M, Cabral-Filho JE.Implementation of World Health Organization guidelines for management of severe malnutrition in a hospital in Northeast Brazil. Cad Saude Publica. 2006 Mar;22(3):561-70.

17 Wanzira H, Muyinda R, Lochoro P, *et al.* Quality of care for children with acute malnutrition at health center level in Uganda: a cross sectional study in West Nile region during the refugee crisis. *BMC Health Serv Res* 2018;**18**:561. doi:10.1186/s12913-018-3366-5

18 Hoque DM, Arifeen SE, Rahman M, Chowdhury EK, Haque TM, Begum K, Hossain MA, Akter T, Haque F, Anwar T, Billah SM, Rahman AE, Huque MH, Christou A, Baqui AH, Bryce J, Black RE. Improving and sustaining quality of child health care through IMCI training and supervision: experience from rural Bangladesh. Health Policy Plan. 2014;29:753-62.

19 McAuliffe E, Daly M, Kamwendo F, Masanja H, Sidat M, de Pinho H. The critical role of supervision in retaining staff in obstetric services: a three country study. PLoS One. 2013;8(3):e58415.

20 National Department of Health (NDH): Quality Assurance. Primary Health Care Supervision Manual. Quality Assurance Directorate, Pretoria, October 2009.

21 Bailey C, Blake C, Schriver M, *et al.* A systematic review of supportive supervision as a strategy to improve primary healthcare services in Sub-Saharan Africa. *Int J Gynaecol Obstet* 2016;**132**:117–25. doi:10.1016/j.ijgo.2015.10.004

22 Sebring et al. The Nuremberg Doctors' Trial. *Health and Human Rights in a Changing World* 2013;:93.

23 Persson et al. World Medical Association. Declaration of Helsinki. *Acta Physiologica* 2013;**203**:403–407.

24 European Medicines Agency 2014. Guideline for Good Clinical Practice. Available at http://www.ema.europa.eu/docs/en_GB/document_library/Scientific_guideline/2009/09/WC500002874.pdf (accessed 22 January 2018).

25 UNICEF, WHO, The World Bank. Levels & Trends in Child Malnutrition. 2017.

26 Khara, T., & Dolan, C. (2014). Technical Briefing Paper: Associations between Wasting and Stunting, policy, programming and research implications. Emergency Nutrition Network (ENN) June 2014.

27 Oruamabo RS. Child malnutrition and the Millennium Development Goals: much haste but less speed? *Archives of Disease in Childhood* 2015;**100**:S19–22. doi:10.1136/archdischild-2013-305384

28 UNICEF. UNICEF's Approach to Scalling up Nutrition: For Mothers and their Children. 2015.https://www.unicef.org/nutrition/files/Unicef_Nutrition_Strategy.pdf

29 WHO Multicenter Growth Reference Study Group. WHO Child Growth Standards based on length/height, weight and age. *Acta paediatrica* 2006;**95**:76–85.

30 Black RE UR, Victora CG BZ, de Onis M EM, *et al.* Maternal and Child Nutrition Study Group. Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet* 2013;**3**:427–51.

31 Rosa W, editor. Transforming Our World: The 2030 Agenda for Sustainable Development. In: *A New Era in Global Health*. New York, NY: : Springer Publishing Company 2017. doi:10.1891/9780826190123.ap02

32 International Food Policy Research Institute. 2015. Global Nutrition Report 2015: Actions and Accountability to Advance Nutrition and Sustainable Development. Washington, DC.

33 United Nations. Millennium Development Goals. 2000.

34 SPHERE, Sphere project: humanitarian charter and minimum standardising disaster response. 2011.

35 Briend A, Prinzo ZW. Dietary Management of Moderate Malnutrition: Time for a Change. *Food and Nutrition Bulletin* 2009;**30**:S265–6. doi:10.1177/15648265090303S301

36 WHO. Guideline: Updates on the management of severe acute malnutrition in infants and children. Geneva, World Health Organization; 2013.

37 Uganda Bureau of Statistics. Uganda National Population and Housing Census Kampala, 2014.

38 Rose AM, Hall CS, Martinez-Alier N. Aetiology and management of malnutrition in HIV-positive children. Arch Dis Child. 2014;99:546-51.

39 Tuberculosis, malnutrition and wasting : Current Opinion in Clinical Nutrition & Metabolic Care. LWW. http://journals.lww.com/co-clinicalnutrition/Fulltext/2000/07000/Tuberculosis,_malnutrition_and_wasting.8.aspx (accessed 6 Apr 2017).

40 Hood MLH. A narrative review of recent progress in understanding the relationship between tuberculosis and protein energy malnutrition. *Eur J Clin Nutr* 2013;**67**:1122–8. doi:10.1038/ejcn.2013.143

41 WHO | Uganda. WHO. http://www.who.int/countries/uga/en/ (accessed 13 Oct 2018).

42 Republic of Uganda. Vision 2040. Kampala Uganda.

43 Republic of Uganda. Second National Development Plan 2015/16 – 2019/20. 2015. Kampala, Uganda.

44 World Health Organization. (2006). Quality of care : a process for making strategic choices in health systems. Geneva : World Health Organization. http://www.who.int/iris/handle/10665/43470.

45 Standards for improving the quality of care for children and young adolescents in health facilities. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO.

46 UNICEF, WHO, World Bank, UN-DESA Population Division. Levels & trends in child mortality report 2017. Estimates developed by the U Inter-Agency Group for Child Mortality Estimation. Geneva: United Nations Children's Fund; 2017.

47 Primary health care systems (PRIMASYS): case study from Uganda, abridged version. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.

48 Sabastian Taylor, 2013. Research Report: Fragile but not helpless, scaling up nutrition in fragile and conflict affected states. World Vision-UK April 2013.

49 Austin A, Langer A, Salam RA, *et al.* Approaches to improve the quality of maternal and newborn health care: an overview of the evidence. *Reprod Health* 2014;**11 Suppl 2**:S1. doi:10.1186/1742-4755-11-S2-S1

50 Chopra M, Sharkey A, Dalmiya N, *et al.* Strategies to improve health coverage and narrow the equity gap in child survival, health, and nutrition. *The Lancet* 2012;**380**:1331–40. doi:10.1016/S0140-6736(12)61423-8

51 Souza et al. Moving beyond essential interventions for reduction of maternal mortality (the WHO Multicountry Survey on Maternal and Newborn Health): a cross-sectional study. *Lancet* 2013;**381**:1747–55. doi:10.1016/S0140-6736(13)60686-8

52 van den Broek N, Graham W. Quality of care for maternal and newborn health: the neglected agenda. *BJOG: An International Journal of Obstetrics & Gynaecology* 2009;**116**:18–21. doi:10.1111/j.1471-0528.2009.02333.x

53 WHO, 2013. Consultation on improving measurement of the quality of maternal, newborn and child care in health facilities. WHO. http://www.who.int/maternal_child_adolescent/documents/measuring-care-quality/en/ (accessed 22 Jan 2018).

54 WHO Europe, 2013. Health 2020: the European policy for health and well-being - Health 2020. A European policy framework and strategy for the 21st century (2013). http://www.euro.who.int/en/health-topics/health-policy/health-2020-the-european-policy-for-health-and-well-being/publications/2013/health-2020.-a-european-policy-framework-and-strategy-for-the-21st-century-2013 (accessed 22 Jan 2018).

55 Standards for improving quality of maternal and newborn care in health facilities. Geneva: World Health Organization; 2015.

56 Ayieko P et al. A multifaceted intervention to implement guidelines and improve admission paediatric care in Kenyan district hospitals: a cluster randomised trial. *PLoS Med* 2011;**8**:e1001018.

57 Gillespie S et al. Scaling Up Impact on Nutrition: What Will It Take? 2015 Jul 15;6(4):440-51. *Adv Nutr* 2015;**6**:440–51.

58 Huicho L et al. Scaling up integrated management of childhood illness to the national level: achievements and challenges in Peru. 20(1):14-24. *Health Policy Plan* 2005;**20**:14–24.

59 Som M, Panda B, Pati S, *et al.* Effect of supportive supervision on routine immunization service delivery-a randomized post-test study in Odisha. *Glob J Health Sci* 2014;**6**:61–7. doi:10.5539/gjhs.v6n6p61

60 Management Science for Health, 2006. Supportive Supervision to Improve Integrated Primary Health Care. *Management Science for Health*;**2**:1–44.

61 National Department of Health, 2009. Quality Assurance. Primary Health Care Supervision Manual. Quality Assurance Directorate, Pretoria, October 2009.

62 Rowe AK, Rowe SY, Peters DH, *et al.* Effectiveness of strategies to improve health-care provider practices in low-income and middle-income countries: a systematic review. *The Lancet Global Health* 2018;**6**:e1163–75. doi:10.1016/S2214-109X(18)30398-X

63 Ashworth A, Chopra M, McCoy D, Sanders D, Jackson D, Karaolis N, Sogaula N, Schofield C. WHO guidelines for management of severe malnutrition in rural South African hospitals: effect on case fatality and the influence of operational factors. Lancet. 2004 Apr 3;363(9415):1110-5.

64 Gathara D, Opiyo N, Wagai J, Ntoburi S, Ayieko P, Opondo C, Wamae A, Migiro S, Mogoa W, Wasunna A, Were F, Irimu G, English M. Quality of hospital care for sick newborns and severely malnourished children in Kenya: a two-year descriptive study in 8 hospitals. BMC Health Serv Res. 2011 Nov 11;11:307.

65 Ojikutu B, Higgins-Biddle M, Greeson D, Phelps BR, Amzel A, OkechukwuE,Kolapo U, Cabral H, Cooper E, Hirschhorn LR. The association between quality of HIV care, loss to follow-up and mortality in pediatric and adolescent patients receiving antiretroviral therapy in Nigeria. PLoS One. 2014 Jul 30;9(7):e100039.

66 Taylor MJ, McNicholas C, Nicolay C, Darzi A, Bell D, Reed JE. Systematic review of the application of the plan-do-study-act method to improve quality in healthcare. BMJ Qual Saf. 2014 Apr;23(4):290-8. doi: 10.1136/bmjqs-2013-001862.

67 Testa J, Sinnaeve O, Ibrahim Y, Ayivi B. [Evaluation of the quality of screening and management of infant malnutrition in Cotonou, Benin]. Med Trop (Mars). 2008 Feb;68(1):45-50.

68 Singh D, Negin J, Orach CG, *et al.* Supportive supervision for volunteers to deliver reproductive health education: a cluster randomized trial. *Reprod Health* 2016;**13**:126. doi:10.1186/s12978-016-0244-7

69 UNHCR Uganda Factsheet May 2017.pdf. https://reliefweb.int/sites/reliefweb.int/files/resources/UNHCR%20Uganda%20Factsheet%20May%202017.pdf (accessed 8 Jun 2018).

70 Hoque DME, Arifeen SE, Rahman M, *et al.* Improving and sustaining quality of child health care through IMCI training and supervision: experience from rural Bangladesh. *Health Policy Plan* 2014;**29**:753–62. doi:10.1093/heapol/czt059

71 Ministry of Health, Uganda. Health Sector Quality Improvement Framework and Strategic Plan 2015/16 - 2019/20. 2016.

72 Kilminster SM, Jolly BC. Effective supervision in clinical practice settings: a literature review. *Med Educ* 2000;**34**:827–40.

73 Vasan A, Mabey DC, Chaudhri S, *et al.* Support and performance improvement for primary health care workers in low- and middle-income countries: a scoping review of intervention design and methods. *Health Policy Plan* 2017;**32**:437–52. doi:10.1093/heapol/czw144

74 Bosch-Capblanch X, Liaqat S, Garner P. Managerial supervision to improve primary health care in low- and middle-income countries. *Cochrane Database Syst Rev* 2011;:CD006413. doi:10.1002/14651858.CD006413.pub2

75 Cueto M. The origins of Primary Health Care and selective Primary Health Care. *Am J Public Health* 2004;**94**:1864–74.

76 Clements CJ, Streefland PH, Malau C. Supervision in primary health care--can it be carried out effectively in developing countries? *Curr Drug Saf* 2007;**2**:19–23.

77 McAuliffe E, Daly M, Kamwendo F, *et al.* The Critical Role of Supervision in Retaining Staff in Obstetric Services: A Three Country Study. *PLOS ONE* 2013;**8**:e58415. doi:10.1371/journal.pone.0058415

78 Marquez L KL. Making Supervision Supportive and Sustainable: New Approaches to Old Problems. 2002.https://usaidassist.org/sites/assist/files/maqno4final.pdf

79 WHO P, Children's Vaccine Program. Guidelines for Implementing Supportive Suppervision: A step-by-step guide with tools to support immunization.

80 Rohde J. Supportive Supervision to Improve Integrated Primary Health Care.

81 Taylor MJ, McNicholas C, Nicolay C, *et al.* Systematic review of the application of the plan–do–study–act method to improve quality in healthcare. *BMJ Qual Saf* 2013;:bmjqs-2013-001862. doi:10.1136/bmjqs-2013-001862

82 Burnett SM, Mbonye MK, Martin R, *et al.* Effect of On-Site Support on Laboratory Practice for Human Immunodeficiency Virus, Tuberculosis, and Malaria Testing. *Am J Clin Pathol* 2016;**146**:469–77. doi:10.1093/ajcp/aqw138

83 Das A, Friedman J, Kandpal E, *et al.* Strengthening malaria service delivery through supportive supervision and community mobilization in an endemic Indian setting: an evaluation of nested delivery models. *Malar J* 2014;**13**:482. doi:10.1186/1475-2875-13-482

84 Suh S, Moreira P, Ly M. Improving quality of reproductive health care in Senegal through formative supervision: results from four districts. *Hum Resour Health* 2007;**5**:26. doi:10.1186/1478-4491-5-26

85 Henry R, Nantongo L, Wagner AK, *et al.* Competency in supportive supervision: a study of public sector medicines management supervisors in Uganda. *J Pharm Policy Pract* 2017;**10**:33. doi:10.1186/s40545-017-0121-y

86 Lazzerini et al. Improving the quality of hospital care for children by supportive supervision: a cluster randomized trial, Kyrgyzstan. *Bulletin of the World Health Organization* 2017;**95**:397–407. doi:10.2471/BLT.16.176982

87 WHO. Training for mid-level managers: Supportive Suppervision. 2008.

88 Ministry of Health, Uganda. Ministry of Health National Health Policy. 2000.

89 Ministry of Health, Uganda. The Second National Health Policy: Promoting People's Health to Enhance Socio-economic Development. 2010.

90 Ministry of Health, Uganda. The Quality Improvement Methods: A manual for health workers in Uganda. 2015.

91 Ministry of Health, Uganda. Strategy for Improving Health Service Delivery 2016 - 2021. 2016.

92 Edejer TT-T, World Health Organization, editors. *Making choices in health: WHO guide to cost-effectiveness analysis*. Geneva: : World Health Organization 2003.

93 Drummond M, Manca A, Sculpher M. Increasing the generalizability of economic evaluations: recommendations for the design, analysis, and reporting of studies. *Int J Technol Assess Health Care* 2005;**21**:165–71.

94 Polinder S, Toet H, Panneman M, *et al.* Methodological approaches for cost–effectiveness and cost–utility analysis of injury prevention measures. ;:108.

95 World Health Organization, Baltussen RMPM, Adam T, *et al.* Making choices in health : WHO guide to cost-effectiveness analysis. Geneva: : Geneva : World Health Organization 2003. http://apps.who.int/iris/handle/10665/42699 (accessed 13 Oct 2018).

96 Husereau D, Drummond M, Petrou S, *et al.* Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement. *BMJ* 2013;**346**:f1049. doi:10.1136/bmj.f1049

97 Bachmann MO. Cost effectiveness of community-based therapeutic care for children with severe acute malnutrition in Zambia: decision tree model. *Cost Eff Resour Alloc* 2009;**7**:2. doi:10.1186/1478-7547-7-2

98 Alfonso YN, Bishai D, Bua J, *et al.* Cost-effectiveness analysis of a voucher scheme combined with obstetrical quality improvements: quasi experimental results from Uganda. *Health Policy Plan* 2015;**30**:88–99. doi:10.1093/heapol/czt100

99 Chola L, Fadnes LT, Engebretsen IMS, *et al.* Cost-Effectiveness of Peer Counselling for the Promotion of Exclusive Breastfeeding in Uganda. *PLOS ONE* 2015;**10**:e0142718. doi:10.1371/journal.pone.0142718

100 Colbourn T, Pulkki-Brännström A-M, Nambiar B, *et al.* Cost-effectiveness and affordability of community mobilisation through women's groups and quality improvement in health facilities (MaiKhanda trial) in Malawi. *Cost Eff Resour Alloc* 2015;**13**:1. doi:10.1186/s12962-014-0028-2

101 Wilford R, Golden K, Walker DG. Cost-effectiveness of community-based management of acute malnutrition in Malawi. *Health Policy Plan* 2012;**27**:127–37. doi:10.1093/heapol/czr017

102 Puett C, Salpéteur C, Lacroix E, *et al.* Protecting child health and nutrition status with ready-to-use food in addition to food assistance in urban Chad: a cost-effectiveness analysis. *Cost Eff Resour Alloc* 2013;**11**:27. doi:10.1186/1478-7547-11-27

103 Horton S, Gelband H, Jamison D, *et al.* Ranking 93 health interventions for low- and middle-income countries by cost-effectiveness. *PLOS ONE* 2017;**12**:e0182951. doi:10.1371/journal.pone.0182951

104 Organization of African Union. Abuja Declaration on HIV/AIDS, Tuberculosis and other related infectious diseases. 2001.http://www.un.org/ga/aids/pdf/abuja_declaration.pdf

105 The Republic of Uganda, Ministry of Finance, Planning and Economic Development. National Budget Framework paper: FY 2018/19 - FY 2022/23.

106 Fox-Rushby JA, Hanson K. Calculating and presenting disability adjusted life years (DALYs) in cost-effectiveness analysis. *Health Policy Plan* 2001;**16**:326–31.

107 Devleesschauwer B, Havelaar AH, Maertens de Noordhout C, *et al.* Calculating disability-adjusted life years to quantify burden of disease. *Int J Public Health* 2014;**59**:565–9. doi:10.1007/s00038-014-0552-z

108 Von Elm E, Altman DG, Egger M, *et al.* The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. *International Journal of Surgery* 2014;**12**:1495–1499.

109 Uganda Bureau of Statistics, 2016. Uganda Demographic and Health Survey, 2016.

110 Ministry of Health. Uganda Health Management and Information System. Kampala, Uganda.

111 Nutrition Service Delivery Assessment Tool. 2015.

112 Ministry of Health, Uganda, Kampala. Consolidated Guidelines for Prevention and Treatment of HIV in Uganda, 2016.

113 S.N. Kiwanukaa, E.K. Ekirapaa, S. Petersona, O. Okuia, M. Hafizur Rahmanc, D. Petersc, G.W. Pariyoa, S.N. Kiwanukaa, E.K. Ekirapaa, S. Petersona, O. Okuia,. Access to and utilisation

of health services for the poor in Uganda: a systematic review of available evidence. *Transactions of the Royal Society of Tropical Medicine and Hygiene (2008) 102, 1067—1074*

114 Wilunda C, Oyerinde K, Putoto G, *et al.* Availability, utilisation and quality of maternal and neonatal health care services in Karamoja region, Uganda: a health facility-based survey. *Reproductive Health* 2015;**12**:30. doi:10.1186/s12978-015-0018-7

115 Mary Corbett, Allison Oman. Acute Malnutrition in Protracted Refugee Situation:A Global Strategy. UNHCR/WFP. January 2016. https://www.unscn.org/web/archives_resources/files/Acute_Malnutrition_in_Protracted_Re_522.pdf (accessed 27 Nov 2017).

116 Doocy S, Tappis H, Haskew C, *et al.* Performance of UNHCR nutrition programs in post-emergency refugee camps. *Conflict and Health* 2011;**5**:23. doi:10.1186/1752-1505-5-23

117 Shanka NA, Lemma S, Abyu DM. Recovery Rate and Determinants in Treatment of Children with Severe Acute Malnutrition using Outpatient Therapeutic Feeding Program in Kamba District, South West Ethiopia. *Journal of Nutritional Disorders & Therapy* 2015;**5**. doi:10.4172/2161-0509.1000155

118 Yebyo HG, Kendall C, Nigusse D, *et al.* Outpatient Therapeutic Feeding Program Outcomes and Determinants in Treatment of Severe Acute Malnutrition in Tigray, Northern Ethiopia: A Retrospective Cohort Study. *PLOS ONE* 2013;**8**:e65840. doi:10.1371/journal.pone.0065840

119 World Health Organization, editor. *The world health report 2006 - Working together for health*. Geneva: : World Health Organisation 2006.

120 Sunguya BF, Poudel KC, Mlunde LB, *et al.* Effectiveness of nutrition training of health workers toward improving caregivers' feeding practices for children aged six months to two years: a systematic review. *Nutrition Journal* 2013;**12**:66. doi:10.1186/1475-2891-12-66

121 Kok et al. Which intervention design factors influence performance of community health workers in low- and middle-income countries? A systematic review. *Health Policy and Planning* 2015;**30**:1207–27. doi:10.1093/heapol/czu126

122 Black RE, Allen LH, Bhutta ZA, *et al.* Maternal and child undernutrition: global and regional exposures and health consequences. *The Lancet* 2008;**371**:243–60. doi:10.1016/S0140-6736(07)61690-0

123 Vincent Micheal Kiberu1, Joseph KB Matovu, Fredrick Makumbi, Carol Kyozira, Eddie Mukooyo, and Rhoda K Wanyenze. Strengthening district-based health reporting through the

district health management information software system: the Ugandan experience. *BMC Medical Informatics and Decision Making 2014, 14:40*

124 Peter Kintu, Miriam Nanyunja, Amos Nzabanita, Ruth Magoola. Development of HMIS in poor countries: Uganda as a case study. *HEALTH POLICY AND DEVELOPMENT* 2005;**3**:46–53.

125 Campbell MK, Piaggio G, Elbourne DR, *et al.* Consort 2010 statement: extension to cluster randomised trials. *BMJ* 2012;**345**:e5661.

126 Higgins JPT GS. Cochrane Handbook for Systematic Reviews of Interventions. Version 5.1.0. Updated March 2011. http://handbook-5-1.cochrane.org/ (accessed 25 Feb 2018).

127 Hemming K, Girling AJ, Sitch AJ, *et al.* Sample size calculations for cluster randomised controlled trials with a fixed number of clusters. *BMC medical research methodology* 2011;**11**:102.

128 Hoque DM et al. Improving and sustaining quality of child health care through IMCI training and supervision: experience from rural Bangladesh. *Health Policy Plan* 2014;:753–62.

129 McAuliffe E et al. The critical role of supervision in retaining staff in obstetric services: a three country study. *PLoS One* 2013;**8**:e58415.

130 Bello DA, Hassan ZI, Afolaranmi TO, *et al.* Supportive supervision: an effective intervention in achieving high quality malaria case management at primary health care level in Jos, Nigeria. *Ann Afr Med* 2013;**12**:243–51. doi:10.4103/1596-3519.122695

131 Burnett SM, Mbonye MK, Martin R, *et al.* Effect of On-Site Support on Laboratory Practice for Human Immunodeficiency Virus, Tuberculosis, and Malaria Testing. *Am J Clin Pathol* 2016;**146**:469–77. doi:10.1093/ajcp/aqw138

132 Puett C, Guerrero S. Barriers to access for severe acute malnutrition treatment services in Pakistan and Ethiopia: a comparative qualitative analysis. *Public Health Nutrition* 2015;**18**:1873–82. doi:10.1017/S1368980014002444

133 Das A, Friedman J, Kandpal E, *et al.* Strengthening malaria service delivery through supportive supervision and community mobilization in an endemic Indian setting: an evaluation of nested delivery models. *Malaria Journal* 2014;**13**:482. doi:10.1186/1475-2875-13-482

134 Singh D, Negin J, Orach CG, *et al.* Supportive supervision for volunteers to deliver reproductive health education: a cluster randomized trial. *Reprod Health* 2016;**13**:126. doi:10.1186/s12978-016-0244-7

135 Murray CJ. Quantifying the burden of disease: the technical basis for disability-adjusted life years. *Bull World Health Organ* 1994;**72**:429–45.

136 Devleesschauwer B, Havelaar AH, Maertens de Noordhout C, *et al.* Calculating disability-adjusted life years to quantify burden of disease. *Int J Public Health* 2014;**59**:565–9. doi:10.1007/s00038-014-0552-z

137 Puett C, Sadler K, Alderman H, *et al.* Cost-effectiveness of the community-based management of severe acute malnutrition by community health workers in southern Bangladesh. *Health Policy Plan* 2013;**28**:386–99. doi:10.1093/heapol/czs070

138 WHO | National tools. WHO. http://www.who.int/healthinfo/global_burden_disease/tools_national/en/ (accessed 13 Oct 2018).

139 Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2016 (GBD 2016) Disability Weights. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2017.

140 Cohen DJ, Reynolds MR. Interpreting the results of cost-effectiveness studies. *J Am Coll Cardiol* 2008;**52**:2119–26. doi:10.1016/j.jacc.2008.09.018

141 Walker D, Fox-Rushby J. Allowing for uncertainty in economic evaluations: qualitative sensitivity analysis. *Health Policy Plan* 2001;**16**:435–43.

142 Uganda Bureau of Statistics: Key Economic Indicators. 106th Issue: Quarter Four 2016/17 (April - June 2017).

143 Malnutrition in Uganda: We've Already Paid Too High a Price - Economic Development and Nutrition Fact Sheet - December 2017 | Food and Nutrition Technical Assistance III Project (FANTA). https://www.fantaproject.org/node/977 (accessed 13 Oct 2018).

144 World Health Organisation. Integrated Management of Childhood Illness. March 2014.

Appendices

Appendix 1: Informed consent #1

CUAMM DOCTORS WITH AFRICA
Informed consent for HC staff

Title: Improving the quality of care for children with acute malnutrition: Cluster Randomized Controlled Trial in West Nile Region, Uganda

Introduction

Thank you for your interest in participating in this study. CUAMM Doctors with Africa in collaboration with the Collaborating Centre with the World Health Organization (WHO CC) of Trieste, Italia and Makerere University is conducting a study to groped to improve the quality of care provided by the health service in Arua for children with malnutrition. Before you decide whether to participate in this research we would like to explain the objectives of the study, how the study can help you or other people, and if there is any possible risks to you or other people. This information process is called informed consent.

Important notes:
1. Participation in the study is completely voluntary
2. You can decide at any time to discontinue participation in the study.
3. If you decide not to participate, it will not lose any of the benefits that normally receives

Please ask any questions it deems appropriate to understand the methods of the study.

Reasons to carry out this study

Recent global estimates indicate that the mortality of malnourished children varies between 10% and 30% To improve the adherence to the lines of diagnosis and treatment guide is one of the essential factors to reduce this mortality. There are national and international recommendations for care to the malnourished child, but sometimes, for various reasons, it is difficult for health professionals fully respect the protocols. This study aims at evaluating the effectiveness and the cost of an intervention, which consists mainly of supervision and technical support, to improve the outcomes of children with moderate and severe malnutrition. The ultimate goal of the study and 'to improve the quality' of care and the health of malnourished children. If the study will be 'successful, the intervention proposed in study may be used as an example to others and may be adopted in other provinces in Uganda, or in other countries with similar characteristics, and may benefit a large number of children and their families. .

Study methods

The study will use 2 groups: a group in which the intervention will be performed and a control group in which there will be no intervention. In the intervention group during the duration of the study team of national and international specialists regularly will support health workers with visits aiming at providing technical support regarding the management of malnourished children. In addition to this, some basic training and essential equipment and supplies may be provided, according to the needs, and other few activities (network activities among staff, activities to improve community engagement) may be supported.

The project has the ultimate goal of improving the performance of health workers in providing care to malnourished children, including improving the knowledge and staff satisfaction.

Data on staff knowledge and to their satisfaction will be collected in 4 time-points (baseline every six months), in a completely anonymous way.

Data on outcomes of children will be collected regularly, anonymously, by data collectors who will work every day in the HCs, without interfering with your job. Families will be asked by data collectors information relating to the costs borne by them (drugs, lab exams etc) and data useful to understand whether there are disparities' in access to care by socio-economic class. All these data will be collected anonymously.

We ask for your consent to perform the measure in the HC where she works, and to collect data anonymously. These data are needed to achieve the goal of the study.

For any question related to the study

RESEARCHERS

Name	**Institute**	**Role**	**Contact**
Marzia Lazzerini	CC OMS	Investigatore Principale	+39-040-3785555
Peter Lochoro	CUAMM	Coordinatore Nazionale	+25-6752-853501

ETHICAL COMITTEES

Makerere University School of Public Health Higher Degrees Research and Ethics Committee
Contact Person: Dr. Kiwanuka Suzanne Tel 256-701-888-163/ 256-312-291-397

Comitato Indipendente di Bioetica, IRCSS Burlo Garofolo
President: Dott. Giorgio Longo Tel +39-040-3785555

Consent: YES, I agree □ NO, I do not agree □

NAME _____SIGNATURE/THUMBPRINT _____

DATE (DD//MM/Y

Appendix 2: Informed consent #2

CUAMM DOCTORS WITH AFRICA
Informed consent for families of children with malnutrition treated in the HCs s

Title: Improving the quality of care for children with acute malnutrition: Cluster Randomized Controlled Trial in West Nile Region, Uganda

Good morning,
My name and '(SAY NAME), are a researcher CUAMM Uganda.

Thank you for taking the time to us. The Makerere University, in collaboration with the CUAMM Doctors with Africa and the Collaborating Centre with the World Health Organization (WHO CC) of Trieste, Italy is conducting a study to groped to improve the quality of care provided in the centers Arua health of children with malnutrition.

The ultimate aim of this data collection and 'improving access to services for the whole community' even for those with economic difficulties. In this project we are gathering important information from the population, in particular relating to: 1) what kind of families have access to these services; 2) what are the costs for families (eg. transport, drugs, blood tests etc).

This information will be used to check if the entire population in the community has the same chance 'access to health services, regardless of their level of wealth, and if it' possible to improve service efficiency (reducing costs).
In the first part of the interview we will ask some information about his upbringing, family and his home. In the second part of the interview will ask whether the claimed costs for his child. The first part of the interview will only be required at the first examination in the HC, while the second part will be repeated at every visit to the HC, to collect the costs incurred at each visit. The time needed do these interviews will be 10 minutes at the first visit, then s only five minutes to other visits

Important notes:
1. Participation in these interviews is completely voluntary.
2. You can decide at any time to terminate its participation.
3. If you decide not to participate, this will not change 'anything in the normal services you receive at this HC.

We hope, however, that wants to participate, to help us improve the services offered.
If you want more 'information on the study can answer your questions now, or can' to contact the contact persons for the study mentioned below

RESEARCHERS

Name	Institute	Role	Contact
Marzia Lazzerini	CC OMS	Investigatore Principale	+39-040-3785555
Peter Lochoro	CUAMM	Coordinatore Nazionale	+25-6752-853501

ETHICAL COMITTEES
Makerere University School of Public Health Higher Degrees Research and Ethics Committee
Contact Person: Dr. Kiwanuka Suzanne Tel 256-701-888-163/ 256-312-291-397

Comitato Indipendente di Bioetica, IRCSS Burlo Garofolo
President: Dott. Giorgio Longo Tel +39-040-3785555

Consent: YES, I agree □ NO, I do not agree □

NAME OF THE CHILD_____

NAME OF THE CHILD CARE TAKER_____ _____

SIGNATURE/THUMBPRINT _____ _____

DATE (DD//MM/YY)

Appendix 3: Abridged version of the Nutrition Service Delivery Assessment (NSDA) tool

A. General Health Facility Information

To be answered by the health facility manager or his/her appointee(s). Circle the coding corresponding to the correct/observed response. Observe and verify records accordingly.

No.	Question and filters	Response	Coding	COMMENTS
A01	Level of health facility	Health Centre IV Health Centre III Health Centre II	1 2 3	
A02	Health facility ownership	Government Private not-for-profit (PNFP) Private for profit (PFP)	1 2 3	
A03	Does the health facility offer nutrition services?	Yes No (Skip to A07)	1 2	
A04	Does the health facility have staff in charge of nutrition?	Yes No (skip to A07)	1 2	
A05	What is the cadre of the staff in charge of nutrition services in the health facility?	Cadre (specify)----------		
A06	Has the person in charge of nutrition services received any in-service training in nutrition in the past two years?	Yes No	1 2	
A07	Does the health facility have an established quality improvement (QI) team?	Yes No (Skip to A12)	1 2	
A08	What is the composition of the health facility QI team? (Tick all that apply)	Facility manager Heads of units CSO representative Community representative Other (specify)……	1 2 3 4 5	
A9	Does the health facility have a QI work plan and budget? (Verify)	Yes No	1 2	
A10	Is the QI team functional (i.e., meets monthly and minutes are available)?	Yes No	1 2	
A11	Does the facility leadership actively participate in the monthly QI meetings?	Yes No	1 2	
A12	Does the facility have a continuous professional development (CPD)/ continuous medical education (CME) schedule?	Yes No (Skip to A14)	1 2	
A13	Are nutrition topics included in the CPD/CME schedule?	Yes No	1 2	
A14	Is nutrition integrated in the health facility budget and work plan?	Yes No	1 2	
A15	Do you get regular (at least once per quarter) integrated support supervision that includes nutrition from the national/regional or district? (Verify with records)	Yes No (skip to A18)	1 2	
A16	Do you get regular feedback from the support supervision teams? (Verify with records)	Yes No	1 2	
A17	Does the health facility have an updated (bi-annual) equipment inventory? (HMIS 092)	Yes No	1 2	

Any other comments:

_____
_____
_____

Capacity to Offer Nutrition Services (A. General Health Facility Information)

Poor ☐	Fair ☐	Good ☐	Excellent ☐
If: A03 (nutrition services) = No	Must have: A03 (nutrition services) = Yes	Must have: A03 (nutrition services) = Yes **AND at least 2 'Yes' from below:** A04 (in charge of nutrition) = Yes A7 (QI team) = Yes A10 (QI team functional) = Yes	Must have: A03 (nutrition services) = Yes A04 (in charge of nutrition) = Yes **AND At least 2 'Yes' from below:** A7 (QI team) = Yes A10 (QI team functional) = Yes A11 (QI leadership) = Yes A13 (CPD/CME schedule with nutrition) = Yes A9 (budget and work plan) = Yes A17 (equipment inventory) = Yes

B. Human Resources Trained in Standard In-Service Short Courses in Nutrition and Quality Improvement (QI)

To be answered by the health facility manager or the person in charge of personnel at the health facility. Write the number as required.

No.	Cadre of health workers	No. available at facility	No. trained in each of the following in the last two years*					
			IMAM	IYCF	NACS	BFHI	GMP	QI
B01	Medical officers							
B02	Clinical officers							
B03	Nurses							
B04	Midwives							
B05	Nursing assistants							

* IMAM = Integrated Management of Acute Malnutrition
IYCF = Infant and Young Child Feeding
NACS = Nutrition Assessment, Counselling, and Support
BFHI = Baby-Friendly Hospital Initiative
GMP = Growth Monitoring and Promotion
QI = Quality Improvement

Any other comments:

_____
_____
_____

Capacity to Offer Nutrition Services (B. Human Resources)

Poor ☐	Fair ☐	Good ☐	Excellent ☐
If: No nurse trained in at least two of the following: IYCF, IMAM, or NACS	**Must have:** At least one of the available nurses has been trained in two of the following: IYCF, IMAM, and NACS	**Must have:** At least one of the available nurses has been trained in two of the following: IYCF, IMAM, and NACS **AND** 20% of available midwives have been trained in IMAM	**Must have:** At least one of the available nurses has been trained in two of the following: IYCF, IMAM, and NACS **AND** 20% of available midwives have been trained in IMAM **AND** 20% of any other available cadre have been trained in IYCF/NACS

C. Provision of Nutrition Services

To be answered by nutrition service providers. Indicate whether the following nutrition services are being provided at this health facility. Observe and verify with records as routinely required where applicable. For this section, write codes: 1 if answer is 'Yes' and 2 if answer is 'No'. For HCII, only outpatient department (OPD), young children clinic (YCC), and outpatient postnatal care (PNC) services may be available.

No.	Nutrition Services	Departments/Clinics						Comments
		Nutrition unit /corner	OPD	YCC	Outpatient antenatal care (ANC)	PNC [1]	ART/ TB	
Nutrition assessment								
C01	Taking mid-upper arm circumference (MUAC) correctly and accurately							
C02	Age of client recorded							
C03	Taking height/length correctly and accurately							
C04	Taking weight correctly and accurately							
C05	Plotting of the child health card correctly and accurately							
C06	Interpretation of growth curves to the mother							
C07	Checking for oedema correctly							
C08	Checking for pallor (i.e., pale palms and inner eyelids)							
C09	Haemoglobin estimation							

[1] For PNC refer to services related to the mother and child soon after delivery.

No.	Nutrition Services	Departments/Clinics						Comments
		Nutrition unit /corner	OPD	YCC	Outpatient antenatal care (ANC)	PNC [1]	ART/ TB	
C10	Taking dietary history							
C11	Categorization of nutrition status							
Nutrition education, counselling, and support								
C12	Infant and young child feeding and support							
C13	Maternal nutrition counselling							
C14	Counselling for malnourished clients							
C15	Health and nutrition education on various health and nutrition topics *(Check for documentation of talks)*							
C16	Conduct food demonstration sessions							
C17	Does the department provide therapeutic foods?[2] *(Note the type of therapeutic foods given in the comments section)*							
C18	Does the department provide supplementary foods?[3] *(Note the type of supplementary foods given in the comments section)*							
Micronutrient supplementation								
C19	Vitamin A supplementation							
C20	Iron-folic acid supplementation							
Other services								
C21	Mebendazole/ albendazole[4] administration							
C22	Referral of malnourished patients for further management/support							
C23	Health facility follow-up of young children and malnourished patients, e.g., they are given follow-up appointments (*Review records*)							

[2] Therapeutic foods may include F75, F100, Plumpy'Nut, and RUTAFA.
[3] Supplementary foods may include corn-soya blend, fortified blended foods, high energy biscuits, and super cereal.
[4] Albendazole is not recommended during pregnancy.

No.	Nutrition Services	Departments/Clinics						Comments
		Nutrition unit /corner	OPD	YCC	Outpatient antenatal care (ANC)	PNC [1]	ART/ TB	
Total the number of nutrition services available per department/clinic (add up the number of answers coded as 1 for Yes)								
		Nutrition unit /corner	OPD	YCC	Outpatient ANC	PNC	ART/ TB	
	Total number							

Any other comments:

_____

_____

_____

Capacity to Offer Nutrition Services (C. Provision of Nutrition Services)

HOW TO:

Step 1: Total the number of nutrition services available per department/clinic (referring to the last row in the table above).

Step 2: Refer to the table below titled 'For Rating of Each Available Department/Clinic'. Use this table to classify (tick) each available department/clinics performance as either Poor/Fair/Good/Excellent.

Step 3: Use the last row titled 'TOTAL# (Poor/Fair/Good/Excellent)' to sum the total classifications (ticks) under each category (Poor/Fair/Good/Excellent).

For Rating of Each Available Department/Clinic

Departments/Clinics	**Poor**	**Fair**	**Good**	**Excellent**
Nutrition Unit/Corner	Less than 6 ☐	7 to 11 ☐	12 to 18 ☐	More than 18 ☐
OPD	Less than 5 ☐	5 to 10 ☐	11 to 15 ☐	More than 15 ☐
YCC	Less than 5 ☐	5 to 10 ☐	11 to 15 ☐	More than 15 ☐
Outpatient ANC	Less than 4 ☐	4 to 8 ☐	9 to 14 ☐	More than 14 ☐
PNC	Less than 5 ☐	5 to 10 ☐	11 to 15 ☐	More than 15 ☐
ART/TB	Less than 6 ☐	7 to 11 ☐	12 to 18 ☐	More than 18 ☐
TOTAL # (Poor/Fair/ Good/Excellent)				

D. Community Linkages

To be answered by health facility manager or his/her appointee(s). Circle the coding corresponding to the correct/observed response.

No.	QuestionS	Response	Coding	CommentS
D01	Does this facility have links with community-based health workers or volunteers?	Yes No	1 2	
D02	Are clients referred from the community to the health facility for nutrition services? (Probe for referral slips)	Yes No	1 2	

D03	What kinds of community structures exist to support continuum of nutrition care and support? (Tick all that apply)	Village health teams Vaccinators Expert clients Family support groups Other groups Specify……	1 2 3 4 5 6	
D04	Is there a mechanism for periodical support of these groups in D03 by the health facility?	Yes No (Skip to E01)	1 2	
D05	What support mechanisms exist? (Tick all that apply)	Supervision Training/mentorship Other Specify…….	1 2 3	

Any other comments:

_____

_____

_____

Capacity to Offer Nutrition Services (D. Community Linkages)

Poor ☐	Fair ☐	Good ☐	Excellent ☐
If: D01 (links with community-based health worker/ volunteer) = No	**Either:** D01 (links with community-based health worker/ volunteer) = Yes **OR** D02 (referrals) = Yes	**Must have:** D01 (links with community-based health worker/ volunteer) = Yes D02 (referrals) = Yes **AND** D03 (community structures) = 2 or more	**Must have:** D01 (links with community-based health worker/ volunteer) = Yes D02 (referrals) = Yes D03 (community structures) = 2 or more **AND** D04 (mechanism) = Yes

E. Quality Improvement (QI)

To be answered by health facility QI team leader/team member in health facilities with QI. Circle the coding corresponding to the correct/observed response.

No.	Questions and filters	Response	Coding	CommentS
E01	Does the health facility have a nutrition work improvement team?	Yes No	1 2 (Skip to E05 as appropriate)	
E02	Is the nutrition work improvement team functional (i.e., meets frequently and has record of minutes)?	Yes No	1 2	
E03	Does the team have nutrition QI projects? *(If yes, probe and verify this information)*	Yes No	1 2	
E04	Does the health facility have up-to-date QI documentation journals for the nutrition QI projects above?	Yes No	1 2	
E05	Does the health facility have a QI mentorship schedule?	Yes No	1 2 (Skip to E07 as appropriate)	

No.	Questions and filters	Response	Coding	CommentS
E06	Is nutrition included in the QI mentorship schedule? *(Look at the schedule)*	Yes No	1 2	
E07	Did the health facility receive QI mentorship/coaching in the last three months?	Yes No	1 2	

Any other comments:

_____

_____

_____

Capacity to Offer Nutrition Services (E. Quality Improvement)

Poor ☐	Fair ☐	Good ☐	Excellent ☐
If: E01 (improvement team) = No	**Must have:** E01 (improvement team) = Yes	**Must have:** E01 (improvement team) = Yes E02 (improvement team functional) = Yes **AND at least 1 'Yes' from below:** E03 (nutrition QI projects) = Yes E04 (journals) = Yes E05 (QI mentorship) = Yes E07 (QI mentorship receipt) = Yes	**Must have:** E01 (improvement team) = Yes E02 (improvement team functional) = Yes E03 (nutrition QI) = Yes **AND at least 2 'Yes' from below:** E04 (journals) = Yes E06 (nutrition in mentorship schedule) E07 (QI mentorship receipt) = Yes

F. Materials and Supplies

For this section, circle the coding corresponding to the correct/observed response. The assessor should verify availability.

No.	Questions and filters	response	Coding	CommentS
Current guidelines/guides/standards[5] (to be answered by the health facility manager or his/her appointee[s])				
F1	Service Delivery Standards for the Health Sector	Yes No	1 2	
F2	Uganda Clinical Guidelines	Yes No	1 2	
F3	Nutrition Care and Support for People Living (PLHIV) with HIV/AIDS in Uganda: Guidelines for Service Providers	Yes No	1 2	
F4	Integrated Management of Acute Malnutrition (IMAM) Guidelines	Yes No	1 2	
F5	Maternal Nutrition Guidelines	Yes No	1 2	
F6	Comprehensive Micronutrient Guidelines	Yes No	1 2	
F7	Growth Monitoring and Promotion Guide	Yes No	1 2	

[5] The assessor should be aware of the current guidelines, guides, and standards.

No.	Questions and filters	response	Coding	CommentS
F8	Positive Deviance Hearth Guide	Yes No	1 2	
F9	Non Communicable Diseases Guidelines (screening guidelines, physical activity guidelines, nutrition guidelines, drug and substance abuse)	Yes No	1 2	
F10	Infant and Young Child Feeding Policy Guidelines	Yes No	1 2	
F11	Attaining the Baby Friendly Status: Role of Health Workers in Implementing the 16 Steps to Successful Infant Feeding, Promoting, Supporting and Protecting Breastfeeding through the Baby-Friendly Health Initiative (BFHI)	Yes No	1 2	
F12	The Integrated National Guidelines on Antiretroviral Therapy, Prevention of Mother-to-Child Transmission of HIV and Infant & Young Child Feeding	Yes No	1 2	
Counselling cards/job aids (to be answered by health workers providing nutrition services)				
F13	Infant and Young Child Feeding National Counselling Cards for Health Workers	Yes No	1 2	
F14	Question and Answer Guide: Infant and Young Child Feeding with a Special Focus on HIV/AIDS: Reference Tools for Counsellors	Yes No	1 2	
F15	Nutrition for PLHIV/AIDS Counselling Cards	Yes No	1 2	
F16	Nutrition for PLHIV Booklet	Yes No	1 2	
F17	Nutrition Care and Support for PLHIV: Health Facility Job Aids	Yes No	1 2	
F18	Availability of food demonstration kits and job aids (A box with food teaching aids: food dummies, dolls, utensils, counselling cards, display table, etc.)	Yes No	1 2	
F19	Demonstration garden	Yes No	1 2	
F20	Local audio visual/media materials on nutrition	Yes No	1 2	
Additional job aids for facilities with nutrition therapeutic care and supplementary feeding programmes. Ignore items F21–F32 when assessing health facilities that do not offer nutrition therapeutic care and do not provide food supplements, but indicate as such in the comments section.				
F21	Integrated nutrition register	Yes No	1 2	
F22	Outpatient/inpatient therapeutic care quarterly report form available? (Comment on their use)	Yes No	1 2	
F23	F75 reference card	Yes No	1 2	
F24	F100 reference card	Yes No	1 2	
F25	Ready-to-use therapeutic food (RUTF) appetite test reference card	Yes No	1 2	
F26	RUTF dosing reference card	Yes No	1 2	

No.	Questions and filters	response	Coding	CommentS
F27	24-hour feed intake charts	Yes No	1 2	
F28	Criteria for admission of malnourished clients	Yes No	1 2	
F29	Criteria for discharge of malnourished clients	Yes No	1 2	
F30	Chart showing correct way of taking MUAC measurement	Yes No	1 2	
F31	Critical care pathway (clinical monitoring form)	Yes No	1 2	
F32	Supplementary feeding programme job aids	Yes No	1 2	
Verify whether nutrition education materials for clients (brochures, flyers, or posters) are available on the topics listed below.				
F33	Infant and young child feeding	Yes No	1 2	
F34	Micronutrient deficiencies (iron, vitamin A, iodine, and zinc)	Yes No	1 2	
F35	Child immunization schedule	Yes No	1 2	
F36	General nutrition (e.g., food groups, balanced diet)	Yes No	1 2	
F37	Nutrition for PLHIV/TB	Yes No	1 2	
F38	Water, sanitation, and hygiene	Yes No	1 2	
F39	Maternal nutrition (nutrition in pregnancy and lactation)	Yes No	1 2	
Nutrition status indicator reference charts/growth monitoring and promotion charts				
F40	BMI-for-age z-score chart for children from 5–19 years (coloured)	Yes No	1 2	
F41	BMI cut-offs for adults	Yes No	1 2	
F42	Weight-for-height z-score tables for children less than 5 years	Yes No	1 2	
F43	MUAC-for-age tables	Yes No	1 2	
F44	Weight-for-age tables/child health growth charts	Yes No	1 2	
F45	Height-for-age tables	Yes No	1 2	
F46	Mother-child passport/child health card available	Yes No	1 2	
Other tools				
F47	Dispensing log available	Yes No	1 2	
F48	Requisition and issue voucher available	Yes No	1 2	
F49	Referral forms available? (Comment on their use)	Yes No	1 2	

Any other comments:

_____
_____
_____

Capacity to Offer Nutrition Services (F. Materials and Supplies)

Poor ☐	Fair ☐	Good ☐	Excellent ☐
Facilities without nutrition therapeutic care: * Less than 11 of all listed materials and supplies **Facilities with nutrition therapeutic care:** * Less than 19 of all listed materials and supplies	**Facilities without nutrition therapeutic care:** * Less than 19 (more than 11) of all listed materials and supplies **Facilities with nutrition therapeutic care:** * Less than 29 (more than 19) of all listed materials and supplies	**Facilities without nutrition therapeutic care:** * Less than 27 (more than 19) of all listed materials and supplies **Facilities with nutrition therapeutic care:** * Less than 39 (more than 29) of all listed materials and supplies	**Facilities without nutrition therapeutic care:** * More than 27 of all listed materials and supplies **Facilities with nutrition therapeutic care:** * More than 39 of all listed materials and supplies

G. Requirements Specific to the Nutrition Unit

To be answered by the nutrition unit in charge/nutritionist at the health facility. For this section, circle the coding corresponding to the correct/observed response. The assessor should verify availability. In health facilities where there is no nutrition unit, this section should be ignored and a comment to indicate so made in the comments section. Such health facilities should not be graded in the section, 'Capacity to Offer Nutrition Services (G. Nutrition Unit Requirements)'.

No.	Questions and filters	Response	Coding	CommentS
Kitchen equipment/supplies				
G01	Kitchen	Yes No	1 2	
G02	Utensils (feeding cups, saucers, spoons, plates, forks, bowls, sieves, sauce pans)	Yes No	1 2	
G03	Dietary scale able to weigh 5 g	Yes No	1 2	
G04	Manual whisks or electric blender	Yes No	1 2	
G05	Large containers and spoons for mixing/cooking food for the ward	Yes No	1 2	
G06	Tiffin or saucepans	Yes No	1 2	
G07	Source of fuel (gas, charcoal, firewood, electricity)	Yes No	1 2	
G08	Measuring cylinders (or suitable utensils for measuring ingredients and leftovers)	Yes No	1 2	

No.	Questions and filters	Response	Coding	CommentS
G09	Jugs (1 litre and 2 litres)	Yes No	1 2	
Ingredients for making F75 and F100				
G10	Dried skimmed milk, whole dried milk, fresh whole milk, or long-life milk	Yes No	1 2	
G11	Sugar	Yes No	1 2	
G12	Cereal flour	Yes No	1 2	
G13	Vegetable oil	Yes No	1 2	
G14	Safe water supply/drinking water	Yes No	1 2	
Other materials				
G15	Locally available foods (for teaching/use in transition to home foods)	Yes No	1 2	
G16	Waste disposal facilities	Yes No	1 2	
G17	Soap for handwashing (liquid or bar)	Yes No	1 2	
G18	Running water	Yes No	1 2	

Any other comments:

_____

_____

_____

Capacity to Offer Nutrition Services (G. Nutrition Unit Requirements)

Poor ☐	Fair ☐	Good ☐	Excellent ☐
If 'Yes' to only 1 of the below: G03 (scales) G09 (jugs) G14 (drinking water) G07 (fuel) G17 (soap)	**If 'Yes' to 2 to 3 of the below:** G03 (scales) G09 (jugs) G14 (drinking water) G07 (fuel) G17 (soap) **AND** At least three other requirements specific to the nutrition unit	**If 'Yes' to 4 of the below:** G03 (scales) G09 (jugs) G14 (drinking water) G07 (fuel) G17 (soap) **AND** At least five other requirements specific to the nutrition unit	**If 'Yes' to more than 4 of the below:** G03 (scales) G09 (jugs) G14 (drinking water) G07 (fuel) G17 (soap) **AND** At least seven other requirements specific to the nutrition unit

H. Facility Nutrition Equipment

To be answered by nutrition service providers and observation completed by the assessor. For each question and filters, refer to the response format row in order to either write coded responses (1 = Yes if the item is available and 2 = No if the item is not available) OR to specify

appropriate numeric values. Note, that cells highlighted in grey should not be filled in. The assessor should verify availability of equipment.

No.	Question and Filters	Response format (for row)	Departments/Clinics						CommentS
			Nutrition Unit/ Corner	OPD	YCC	Outpatient ANC	PNC	ART/ TB	
H01	Adult weighing scales available	*(specify number)*							
H02	Number of adult weighing scales functioning	*(specify number)*							
H03	Baby weighing scales available[6]	*(specify number)*							
H04	Number of baby weighing scales in good working condition	*(specify number)*							
H05	Child weighing scales available[7]	*(specify number)*							
H06	Number of the child weighing scales in good working condition	*(specify number)*							
H07	Observe for calibration of weighing scales before weighing	YES=1 NO=2							
H08	Does the health facility have a schedule for standardization and service of equipment?	YES=1 NO=2 (skip to H10)							
H09	Have the weighing scales been standardized as scheduled?	YES=1 NO=2							
H10	Infantometers (infant length meter available	*(specify number)*							
H11	Number of infantometers in good working condition	*(specify number)*							
H12	Number of height tapes/length/height boards available	*(specify number)*							
H13	Number of height tapes/length/height boards that are in good working condition	*(specify number)*							
H14	Number of MUAC tapes (colour-coded) for specific age groups available and in good working condition (two packets for each age group)	*(specify number)*							
	6 to 59 months	*(specify number)*							

[6] Baby weighing scales weigh up to 10 kg.
[7] Child weighing scales weigh up to 25 kg.

No.	Question and Filters	Response format (for row)	Departments/Clinics						CommentS
			Nutrition Unit/ Corner	OPD	YCC	Outpatient ANC	PNC	ART/ TB	
	5 < 10 years	*(specify number)*							
	10 < 15 years	*(specify number)*							
	15 < 18 years	*(specify number)*							
	Adults 18 years and above	*(specify number)*							
	Pregnant and lactating women with infants less than 6 months	*(specify number)*							
H15	Number of functional blood pressure machines available and accurate	*(specify number)*							
H16	Number of functional glucometers with matching glucostix available	*(specify number)*							
H17	Does the health facility have functional equipment for estimating Hb? *(Consult the laboratory where applicable)*	Yes=1 No=2							
Total the number of nutrition equipment available per department/clinic (i.e., count all columns that have either a 1 = Yes OR a numeric value greater than 0)									
			Nutrition Unit/ Corner	OPD	YCC	Outpatient ANC	PNC	ART/ TB	
Total number									

Any other comments:

_____

_____

_____

Capacity to Offer Nutrition Services (H. Facility Nutrition Equipment)

HOW TO:

Step 1: Total the number of nutrition equipment available per department/clinic (referring to the last row in the table above).

Step 2: Refer to the table below titled 'For Rating of Each Available Department/Clinic'. Use this table to classify (tick) each available department/clinics performance as either Poor/Fair/Good/Excellent.

Step 3: Use the last row titled 'TOTAL# (Poor/Fair/Good/Excellent)' to sum the total classifications (ticks) under each category (Poor/Fair/Good/Excellent).

For Rating of Each <u>Available</u> Department/Clinic

Departments/Clinics	Poor	Fair	Good	Excellent
Nutrition Unit/Corner	Less than 6 ☐	6 to 11 ☐	12 to 18 ☐	More than 18 ☐
OPD	Less than 5 ☐	5 to 11 ☐	12 to 17 ☐	More than 17 ☐
	☐	☐	☐	☐
	☐	☐	☐	☐

YCC	Less than 3	4 to 6	7 to 10	More than 10
Outpatient ANC	Less than 2	2 to 4	5 to 7	More than 7
PNC	Less than 4	4 to 7	8 to 11	More than 11
ART/TB	Less than 4	5 to 7	8 to 11	More than 11
TOTAL # (Poor/Fair/Good/Excellent)				

I. Store Management

To be observed and records checked by assessor. Health facilities will be assessed or graded based on whether they stock nutrition commodities or not. Write codes 1 = Yes and 2 = No.

No.	Question and filters	Commodities and Supplies		CommentS
		Nutrition commodities[8]	Drug and other supplies	
I01	The storage room/area is clean and dry.			
I02	Ventilation is adequate.			
I03	Lighting is adequate.			
I04	The storage area is free from vermin.			
I05	Are order forms used to request commodities and supplies?[9]			
I06	Stock cards are used to account for commodities and supplies.			
I07	Stock cards for commodities and supplies are updated at the time of visit.			
I08	Nutrition commodities and supplies are managed within the general health facility store.			
I09	Therapeutic and/or supplementary foods available in store in the past two years.			
I10	Is there a current stock-out of any of the therapeutic or supplementary foods? If yes, specify.			
I11	Commodities and supplies are stored according to FEFO/FIFO (first expiry first out/first in first out) procedures.			
I12	Commodities and supplies are protected from sunlight throughout the day.			
I13	Commodities and supplies are stored on pallets or shelves and away from walls to protect them from dampness.			
I14	Are any packets/tins/cartons of commodities and supplies expired?			
I15	Are any packets/tin/cartons of commodities and supplies damaged (e.g., leaking, dented, broken seal)?			
I16	Damaged or expired commodities and supplies are stored separately from usable stock.			
I17	Is the dispensing of nutrition commodities through the dispensing area that is used to dispense other medicines?			

[8] Nutrition commodities include therapeutic foods and supplementary foods.
[9] Order forms are only available in HCIV and above.

No.	Question and filters	Commodities and Supplies		CommentS
		Nutrition commodities[8]	Drug and other supplies	
Total the number of commodities and supplies (i.e., all columns marked with a 1 for Yes)				
Total Number				

Any other comments:

_____

_____

_____

Capacity to Offer Nutrition Services (I. Store Management)

Poor ☐	Fair ☐	Good ☐	Excellent ☐
(Facilities without nutrition commodities)	***(Facilities without nutrition commodities)***	***(Facilities without nutrition commodities)***	***(Facilities without nutrition commodities)***
Look at: Drugs & other supplies column:	Look at: Drugs & other supplies column:	Look at: Drugs & other supplies column:	Look at: Drugs & other supplies column:
* Less than 4 of all listed store management requirements fulfilled	* 4 to 6 of all listed store management requirements fulfilled	* 7 to 9 all listed store management requirements fulfilled	* More than 9 of all listed store management requirements fulfilled
(Facilities with nutrition commodities)	***(Facilities with nutrition commodities)***	***(Facilities with nutrition commodities)***	***(Facilities with nutrition commodities)***
Look at: Nutrition commodities column:	Look at: Nutrition commodities column:	Look at: Nutrition commodities column:	Look at: Nutrition commodities column:
*less than 6 of all listed store management requirements fulfilled	* 6 to 12 of all listed store management requirements fulfilled	* 13 to 15 all listed store management requirements fulfilled	* More than 15 of all listed store management requirements fulfilled

J. Logistics Management of Nutrition Commodities

To be filled out by the person responsible for logistics in the health facility that stocks nutrition commodities. For this section, circle the coding corresponding to the correct/observed response.

(Skip this section if the health facility does not stock nutrition commodities)

No.	Questions and filters	Response	Coding	CommentS
J01	Do you determine the quantities of therapeutic and/or supplementary foods required in your facility by EITHER calculating maximum stock quantity minus stock on hand OR compare number of clients with stock on hand?	Yes No	1 2	

J02	Do you place your orders for therapeutic and/or supplementary foods by filling out and submitting order forms?	Yes No	1 2	
J03	Does the health facility place orders for therapeutic and/or supplementary foods every two months?	Yes No	1 2	

Any other comments:

_____

_____

_____

Capacity to Offer Nutrition Services (J. Logistics Management of Nutrition Commodities)

Poor ☐	Fair ☐	Good ☐	Excellent ☐
If all responses are code 2 or NO (i.e., none of the requirements are fulfilled)	If there is only one code 1 or YES response (i.e., only one of the requirements is fulfilled)	If there are two code 1 or YES responses (i.e., two of the requirements are fulfilled)	All responses are coded 1 for YES.

K. Monitoring and Evaluation for Nutrition

To be answered by the person in charge of records/health management information system (HMIS). For this section, circle the coding corresponding to the correct/observed response. (*The assessor should verify responses*)

No.	Questions and filters	response	Coding	CommentS
K01	Does the health facility have a designated person for HMIS data?	Yes No	1 2	
K02	Do you register and report clients receiving nutrition services?	Yes No	1 2	
K03	Does the health facility collect data on nutrition?	Yes No	1 2	
K04	Does the health facility HMIS person compile data on nutrition?	Yes No	1 2	
K05	Does the health facility analyse and display data on nutrition?	Yes No	1 2	

Any other comments:

_____

_____

_____

Capacity to Offer Nutrition Services (K. Monitoring and Evaluation for Nutrition)

Poor ☐	Fair ☐	Good ☐	Excellent ☐

If:	Must have:	Must have:	Must have:
K02 (register/report) = No	K02 (register/ report) = Yes K03 (collect data on nutrition) = Yes	K02 (register/report) = Yes K03 (collect data on nutrition) = Yes **AND at least 1 ' Yes' below** K01 (designated HIMS person) = Yes K04 (compilation) = Yes	K02 (register/report) = Yes K03 (collect data on nutrition) = Yes **AND at least 2 'Yes' below** K01 (designated HIMS person) = Yes K04 (compilation) = Yes person K05 (analyse and display data) = Yes

Appendix 4: Quality of case management data collection tool

Name of the HC _____

Date _____ Data collector_____

Process outcomes	**Health facility**		
	#	Total	%
Correct diagnosis (at enrollment)			
Correct treatment (at enrollment)			
Correct complimentary treatment			
Correct evaluation of HIV status			
Counselling fo patients			
Correct assignment of exit outcome			

Appendix 5: Supportive Supervision check list

Area of focus
Part 1: Review of Previous Action Plan
Did the responsible personnel follow up on the actions of previous visit?
Have all the actions been resolved?
Has training being conducted as part of the action plan?
Part 2: Health facility management
Is quality improvement team set up?
Is quality improvement team functional?
Is nutritional continuous education conducted?
Does the facility have links with the community (VHT)?
Part 3: Space
Triage area organised and tidy?
Anthropomentry area organised and tidy?
Clinical assessment area organised and tidy?
Registration and counselling area organised and tidy?
Chair for health worker and caretaker?
Nutrition management chart hang in nutritional corner?
Nutritional IEC materials (Growth promotion, IYCF etc)
IMAM guidelines in health facility?
Weight for length/height z-score charts?
Job aids (RUTF appetite test, dosing charts, MUACs)?
Part 4: Nutritional equipment and supplies
Equipment
Availability of hanging weighing scale?
Availability of standing/electronic weighing scale?
Are the weighing scales in good working condition and calibrated?
Availability of length measuring board?
Availability of a height measuring board?
Are the height/length measuring boards in good working condition?
Availability of the children MUAC tape?
Is the tape measure in good condition?
Availability of a functional calculator?
Availability of a functional thermometer?
Availability of a functional clock?
Availability of well-kept scissors?
Supplies
Is storage clean and dry?
Is ventilation and lighting adequate?
Is the storage area free of vermin?
Are stock cards for RUTF, Amoxy, Vit A, mebendazole, measles vaccine, antimalarials, Iron and folic acid being updated in the pharmacy?
Is RUTF (Plumpy nut) in stock?

	Is Amoxy ,Vit A, mebendazole, measles vaccine, antimalarials, Iron and folic acid in stock?
	Are the nutritional supplements appropriately kept according to storage guidelines?
	Are they stored in order of expiry date?
	Are supportive medicines (Zinc, ORS, ARVs) in stock?
	Availability of safe water and storage jerry can?
	Availability of Jug and cups?
	Availability of sugar or glucose?
	Clean water and soap for hand washing?
	Availability of waste disposal bins?
	Availability of HIV testing kits?
	Availability of Malaria testing?
	Availability of food and cooking demonstration materials?
Part 4: Malnutrition management	
	Have all the staff offering nutritional management services received comprehensive training?
	Conduct group health and nutrition education
Observe health centre staff assess 2- 3 patients for the following	
	Noting down the child's baseline characteristics (age, gender etc)?
	Where child has come from/referred (need to have a referral form) from?
	Gave 50mls of 10% glucose or sugar solution?
	Reviewed previous treatment for patients referred/transferred?
	Child feeding practices?
	Child's other illness and medication history (fever, cough ,diarrhoea, ear problems, TB and HIV)?
	Family circumstances?
	Asked about child's immunization status?
	Taking the child's temperature?
	Examine for severe signs of disease (shock, dehydration, anaemia and Vit A deficiency)?
	Check for bilateral pitting oedema?
	Take the child's weight correctly?
	Take the child's length/weight correctly?
	Take the child's MUAC correctly?
	Estimate the Z-score correctly?
	Examine child for signs of other infections (Pneumonia, diarrhoea, TB, HIV, malaria etc)?
	Did they test for HIV?
	Did they test for TB?
	Conduct a RUTF (plumpy nut) appetite test?
Diagnosis	
	Made a correct malnutrition classification following the IMAM guidelines?
	Estimated the target weight correctly?
	Counselling/communication and client understanding?
Treatment	
	Made correct diet treatment following the IMAM guidelines?
	Prescribed appropriate quantities of RUFT (plumpy nut)?
	Prescribed other treatments correctly (Amoxy, Vit A, Fe-Folic acid, Mebendazole)
	Discussed when client should return for next appointment?
Outcome	

Are patient outcomes correctly determined following the IMAM guidelines?
Are complicated cases referred as per IMAM guidelines (review patient files and registers)?
Exit/discharge
Are patients discharge criteria correctly determined following IMAM?
Part 5: Data collection
Are patient's books appropriately filled with all the required information following the IMAM guidelines (check 2-3 patient files/books)?
Are patient anthropometric measurements correctly recorded in the patient book?
Is the integrated nutritional register present?
Is the data correctly extracted from the patient books in to the register (sample 2-3 patient files to compare to the register)?
Is all the patient data filled in to the register?
Is the data consistent over time (compare current visit data with previous visits)?
Are all those initiated on the program receiving their RUFT (plumpy nut) as per IMAM guidelines
Are quarterly reports aggregated data compare with that in the registers for the same month?
Are the health facility registers archived systematically in a safe place?
For study data collectors
Are they transcribing data correctly (pick 2-3 study questionnaires and compare to the integrated nutritional registers)?
Are study data collectors correctly completing the health and cost outcome questionnaire?

Appendix 6: Template for collecting health indicators

Health and Cost Outcomes Questionnaire

Patient ID: |___| -- |___|___|--|___|___|___| ___| (RCT ID, HC ID, Patient ID) Patient initials |___|___| (First, Last) Date of enrolment|___|___|/|___|___|/|___|___| (Day, Month, Year)

<table>
<tr><th colspan="12">At enrolment</th></tr>
<tr><th>Child Address</th><th>Sex</th><th>Age (months)</th><th>Vaccination status</th><th>Feeding practice (for children < 5 yrs)</th><th>Mother status: Pregnancy/ Lactating</th><th>Type of Admission</th><th>Type of nutritional management at enrolment</th><th>Nutrition status</th><th>HIV Status</th><th>ART service</th><th>TB status</th></tr>
<tr><td>District code
|___|___|
Sub county code
|___|___|__|
Village code
|___|___|__|___|</td><td>|1|M
|2|F</td><td>|___|___|
Entry care point
Code:
|___|___|</td><td>|1|Up to date
|2| Not up to date
|2|Never vaccinated
Child status
|1|Single
|2|Multiple</td><td>|1|EB
|2|RF
|3|MF
|4|CF
|5|NLB</td><td>|1|Preg
|2|Lact
|3|Died or Abandoned
|4|Non lact
|5|Unkown</td><td>|1|New admission
|2|Re-admission
Date of Previous admission
|___|___|/|___|___|/|___|___|
day month year</td><td>|1| ITC
|2| OTC
|3| SFP
|4| None</td><td>|1|MAM
|2|Uncomplicated SAM
|3|Complicated SAM
If complicated, indication: |___|
(1(Hypoglicemia)2(Hypothermia (3) infections (4(Severe dehydration/shock)5(Very severe anaemia (6)Cardiac failure(7) Severe Dermatosis (8(Corneal ulceration 9) Any Danger sign</td><td>|1|Positive
|2|Negative
|3|Unknown
|4|Exposed</td><td>|1|ART
|2|Pre-ART
|3|NA</td><td>|1|Negative
|2|Positive
|3|Unknown</td></tr>
</table>

<table>
<tr><th>On Admission</th><th>Visit 1</th><th>Visit 2</th><th>Visit 3</th><th>Visit 4</th><th>Visit 5</th><th>Visit 6</th><th>Visit 7</th><th>Exit visit</th></tr>
<tr><td></td><td>|___|___|/|___|___|/|___|___|
day month year</td><td>|___|___|/|___|___|/|___|___|
day month year</td><td>|___|___|/|___|___|/|___|___|
day month year</td><td>|___|___|/|___|___|/|___|___|
day month year</td><td>|___|___|/|___|___|/|___|___|
day month year</td><td>|___|___|/|___|___|/|___|___|
day month year</td><td>|___|___|/|___|___|/|___|___|
day month year</td><td>|___|___|/|___|___|/|___|___|
day month year</td></tr>
<tr><td>Weight (Kg)
|___|___| . |___|</td><td>Weight (Kg)
|___|___| . |___|</td><td>Weight (Kg)
|___|___| . |___|</td><td>Weight (Kg)
|___|___| . |___|</td><td>Weight (Kg)
|___|___| . |___|</td><td>Weight (Kg)
|___|___| . |___|</td><td>Weight (Kg)
|___|___| . |___|</td><td>Weight (Kg)
|___|___| . |___|</td><td>Weight (Kg)
|___|___| . |___|</td></tr>
<tr><td>Height/Length (cm)
|___|___|___|</td><td>Height/Length (cm)
|___|___|___|</td><td>Height/Length (cm)
|___|___|___|</td><td>Height/Length (cm)
|___|___|___|</td><td>Height/Length (cm)
|___|___|___|</td><td>Height/Length (cm)
|___|___|___|</td><td>Height/Length (cm)
|___|___|___|</td><td>Height/Length (cm)
|___|___|___|</td><td>Height/Length (cm)
|___|___|___|</td></tr>
<tr><td>MUAC (cm)
|___|___| . |___|
|1| ≥ 11.5 – < 12.5 cm (MAM)
|2| < 11.5 cm (SAM)
|3| ≥ 12.5 (Normal/cured)</td><td>MUAC (cm)
|___|___| . |___|
|1| ≥ 11.5 – < 12.5 cm (MAM)
|2| < 11.5 cm (SAM)
|3| ≥ 12.5 (Normal/cured)</td><td>MUAC (cm)
|___|___| . |___|
|1| ≥ 11.5 – < 12.5 cm (MAM)
|2| < 11.5 cm (SAM)
|3| ≥ 12.5 (Normal/cured)</td><td>MUAC (cm)
|___|___| . |___|
|1| ≥ 11.5 – < 12.5 cm (MAM)
|2| < 11.5 cm (SAM)
|3| ≥ 12.5 (Normal/cured)</td><td>MUAC (cm)
|___|___| . |___|
|1| ≥ 11.5 – < 12.5 cm (MAM)
|2| < 11.5 cm (SAM)
|3| ≥ 12.5 (Normal/cured)</td><td>MUAC (cm)
|___|___| . |___|
|1| ≥ 11.5 – < 12.5 cm (MAM)
|2| < 11.5 cm (SAM)
|3| ≥ 12.5 (Normal/cured)</td><td>MUAC (cm)
|___|___| . |___|
|1| ≥ 11.5 – < 12.5 cm (MAM)
|2| < 11.5 cm (SAM)
|3| ≥ 12.5 (Normal/cured)</td><td>MUAC (cm)
|___|___| . |___|
|1| ≥ 11.5 – < 12.5 cm (MAM)
|2| < 11.5 cm (SAM)
|3| ≥ 12.5 (Normal/cured)</td><td>MUAC (cm)
|___|___| . |___|
|1| ≥ 11.5 – < 12.5 cm (MAM)
|2| < 11.5 cm (SAM)
|3| ≥ 12.5 (Normal/cured)</td></tr>
<tr><td>Z score code
|___|
|1| ≥ -3 and < -2 (MAM)
|2| < -3 (SAM)
|3| ≥ -2 (Normal/cured)</td><td>Z score code
|___|
|1| ≥ -3 and < -2 (MAM)
|2| < -3 (SAM)
|3| ≥ -2 (Normal/cured)</td><td>Z score code
|___|
|1| ≥ -3 and < -2 (MAM)
|2| < -3 (SAM)
|3| ≥ -2 (Normal/cured)</td><td>Z score code
|___|
|1| ≥ -3 and < -2 (MAM)
|2| < -3 (SAM)
|3| ≥ -2 (Normal/cured)</td><td>Z score code
|___|
|1| ≥ -3 and < -2 (MAM)
|2| < -3 (SAM)
|3| ≥ -2 (Normal/cured)</td><td>Z score code
|___|
|1| ≥ -3 and < -2 (MAM)
|2| < -3 (SAM)
|3| ≥ -2 (Normal/cured)</td><td>Z score code
|___|
|1| ≥ -3 and < -2 (MAM)
|2| < -3 (SAM)
|3| ≥ -2 (Normal/cured)</td><td>Z score code
|___|
|1| ≥ -3 and < -2 (MAM)
|2| < -3 (SAM)
|3| ≥ -2 (Normal/cured)</td><td>Z score code
|___|
|1| ≥ -3 and < -2 (MAM)
|2| < -3 (SAM)
|3| ≥ -2 (Normal/cured)</td></tr>
<tr><td>Oedema grade
|1| I |2| II |3| III |4| None</td><td>Oedema grade
|1| I |2| II |3| III |4| None</td><td>Oedema grade
|1| I |2| II |3| III |4| None</td><td>Oedema grade
|1| I |2| II |3| III |4| None</td><td>Oedema grade
|1| I |2| II |3| III |4| None</td><td>Oedema grade
|1| I |2| II |3| III |4| None</td><td>Oedema grade
|1| I |2| II |3| III |4| None</td><td>Oedema grade
|1| I |2| II |3| III |4| None</td><td>Oedema grade
|1| I |2| II |3| III |4| None</td></tr>
<tr><td>History from caretaker
|1| Diarrhoea
|2| Vomiting
|3| Cough
|4| Fever
|5| Other: ____________
|6| None</td><td>History from caretaker
|1| Diarrhoea
|2| Vomiting
|3| Cough
|4| Fever
|5| Other: ____________
|6| None</td><td>History from caretaker
|1| Diarrhoea
|2| Vomiting
|3| Cough
|4| Fever
|5| Other: ____________
|6| None</td><td>History from caretaker
|1| Diarrhoea
|2| Vomiting
|3| Cough
|4| Fever
|5| Other: ____________
|6| None</td><td>History from caretaker
|1| Diarrhoea
|2| Vomiting
|3| Cough
|4| Fever
|5| Other: ____________
|6| None</td><td>History from caretaker
|1| Diarrhoea
|2| Vomiting
|3| Cough
|4| Fever
|5| Other: ____________
|6| None</td><td>History from caretaker
|1| Diarrhoea
|2| Vomiting
|3| Cough
|4| Fever
|5| Other: ____________
|6| None</td><td>History from caretaker
|1| Diarrhoea
|2| Vomiting
|3| Cough
|4| Fever
|5| Other: ____________
|6| None</td><td>History from caretaker
|1| Diarrhoea
|2| Vomiting
|3| Cough
|4| Fever
|5| Other: ____________
|6| None</td></tr>
<tr><td>Physical examination
|1| Temp: |___|___|. |___|
|2| Resp/min: |___|___|
|3| Dehydration
|4| Anaemia
|5| Skin infection
|6| None</td><td>Physical examination
|1| Temp: |___|___|. |___|
|2| Resp/min: |___|___|
|3| Dehydration
|4| Anaemia
|5| Skin infection
|6| None</td><td>Physical examination
|1| Temp: |___|___|. |___|
|2| Resp/min: |___|___|
|3| Dehydration
|4| Anaemia
|5| Skin infection
|6| None</td><td>Physical examination
|1| Temp: |___|___|. |___|
|2| Resp/min: |___|___|
|3| Dehydration
|4| Anaemia
|5| Skin infection
|6| None</td><td>Physical examination
|1| Temp: |___|___|. |___|
|2| Resp/min: |___|___|
|3| Dehydration
|4| Anaemia
|5| Skin infection
|6| None</td><td>Physical examination
|1| Temp: |___|___|. |___|
|2| Resp/min: |___|___|
|3| Dehydration
|4| Anaemia
|5| Skin infection
|6| None</td><td>Physical examination
|1| Temp: |___|___|. |___|
|2| Resp/min: |___|___|
|3| Dehydration
|4| Anaemia
|5| Skin infection
|6| None</td><td>Physical examination
|1| Temp: |___|___|. |___|
|2| Resp/min: |___|___|
|3| Dehydration
|4| Anaemia
|5| Skin infection
|6| None</td><td>Physical examination
|1| Temp: |___|___|. |___|
|2| Resp/min: |___|___|
|3| Dehydration
|4| Anaemia
|5| Skin infection
|6| None</td></tr>
</table>

Health and Cost Outcomes Questionnaire

Patient ID: |___| -- |___|___|_-- |___|___|___| ___| **Patient initials** |___|___| **Date of enrolment** |___|___|/|___|___|/|___|___|

RCT ID HC ID Patient ID First, Last Day Month Year

Nutrition Status |1|MAM |2|Uncomplicated SAM |3|Complicated SAM *If complicated, specify:* *(1)Hypoglicemia* *(2) Hypothermia* *(3) infections* *(4) Severe dehydr/shock* *(5)Very sev anaemia* *(6)Cardiac failure* *(7) Severe Dermatosis* *(8)Corneal ulceration* *(9) Any Danger sign*	**Nutrition Status** |1|MAM |2|Uncomplicated SAM |3|Complicated SAM *If complicated, specify:* *(1)Hypoglicemia* *(2) Hypothermia* *(3) infections* *(4) Severe dehydr/shock* *(5)Very sev anaemia* *(6)Cardiac failure* *(7) Severe Dermatosis* *(8)Corneal ulceration* *(9) Any Danger sign*	**Nutrition Status** |1|MAM |2|Uncomplicated SAM |3|Complicated SAM *If complicated, specify:* *(1)Hypoglicemia* *(2) Hypothermia* *(3) infections* *(4) Severe dehydr/shock* *(5)Very sev anaemia* *(6)Cardiac failure* *(7) Severe Dermatosis* *(8)Corneal ulceration* *(9) Any Danger sign*	**Nutrition Status** |1|MAM |2|Uncomplicated SAM |3|Complicated SAM *If complicated, specify:* *(1)Hypoglicemia* *(2) Hypothermia* *(3) infections* *(4) Severe dehydr/shock* *(5)Very sev anaemia* *(6)Cardiac failure* *(7) Severe Dermatosis* *(8)Corneal ulceration* *(9) Any Danger sign*	**Nutrition Status** |1|MAM |2|Uncomplicated SAM |3|Complicated SAM *If complicated, specify:* *(1)Hypoglicemia* *(2) Hypothermia* *(3) infections* *(4) Severe dehydr/shock* *(5)Very sev anaemia* *(6)Cardiac failure* *(7) Severe Dermatosis* *(8)Corneal ulceration* *(9) Any Danger sign*	**Nutrition Status** |1|MAM |2|Uncomplicated SAM |3|Complicated SAM *If complicated, specify:* *(1)Hypoglicemia* *(2) Hypothermia* *(3) infections* *(4) Severe dehydr/shock* *(5)Very sev anaemia* *(6)Cardiac failure* *(7) Severe Dermatosis* *(8)Corneal ulceration* *(9) Any Danger sign*	**Nutrition Status** |1|MAM |2|Uncomplicated SAM |3|Complicated SAM *If complicated, specify:* *(1)Hypoglicemia* *(2) Hypothermia* *(3) infections* *(4) Severe dehydr/shock* *(5)Very sev anaemia* *(6)Cardiac failure* *(7) Severe Dermatosis* *(8)Corneal ulceration* *(9) Any Danger sign*	**Nutrition Status** |1|MAM |2|Uncomplicated SAM |3|Complicated SAM *If complicated, specify:* *(1)Hypoglicemia* *(2) Hypothermia* *(3) infections* *(4) Severe dehydr/shock* *(5)Very sev anaemia* *(6)Cardiac failure* *(7) Severe Dermatosis* *(8)Corneal ulceration* *(9) Any Danger sign*	**Nutrition Status** |1|MAM |2|Uncomplicated SAM |3|Complicated SAM *If complicated, specify:* *(1)Hypoglicemia* *(2) Hypothermia* *(3) infections* *(4) Severe dehydr/shock* *(5)Very sev anaemia* *(6)Cardiac failure* *(7) Severe Dermatosis* *(8)Corneal ulceration* *(9) Any Danger sign*
Appetite test: |1| Passed |2| Not able to eat |3| Not done	**Appetite test:** |1| Passed |2| Not able to eat |3| Not done	**Appetite test:** |1| Passed |2| Not able to eat |3| Not done	**Appetite test:** |1| Passed |2| Not able to eat |3| Not done	**Appetite test:** |1| Passed |2| Not able to eat |3| Not done	**Appetite test:** |1| Passed |2| Not able to eat |3| Not done	**Appetite test:** |1| Passed |2| Not able to eat |3| Not done	**Appetite test:** |1| Passed |2| Not able to eat |3| Not done	**Appetite test:** |1| Passed |2| Not able to eat |3| Not done
	Amount taken (t/s) __________	**Amount taken (t/s)** __________	**Amount taken (t/s)** __________	**Amount taken (t/s)** __________	**Amount taken (t/s)** __________	**Amount taken (t/s)** __________	**Amount taken (t/s)** __________	**Amount taken (t/s)** __________
	Sharing foods |1| yes |2| no |3| not asked	**Sharing foods** |1| yes |2| no |3| not asked	**Sharing foods** |1| yes |2| no |3| not asked	**Sharing foods** |1| yes |2| no |3| not asked	**Sharing foods** |1| yes |2| no |3| not asked	**Sharing foods** |1| yes |2| no |3| not asked	**Sharing foods** |1| yes |2| no |3| not asked	**Sharing foods** |1| yes |2| no |3| not asked
Therapy- Suppl foods |1| Plumpy nut |2| Other: _________ |3| not prescribed	**Therapy- Suppl foods** |1| Plumpy nut |2| Other: _________ |3| not prescribed	**Therapy- Suppl foods** |1| Plumpy nut |2| Other: _________ |3| not prescribed	**Therapy- Suppl foods** |1| Plumpy nut |2| Other: _________ |3| not prescribed	**Therapy- Suppl foods** |1| Plumpy nut |2| Other: _________ |3| not prescribed	**Therapy- Suppl foods** |1| Plumpy nut |2| Other: _________ |3| not prescribed	**Therapy- Suppl foods** |1| Plumpy nut |2| Other: _________ |3| not prescribed	**Therapy- Suppl foods** |1| Plumpy nut |2| Other: _________ |3| not prescribed	**Therapy- Suppl foods** |1| Plumpy nut |2| Other: _________ |3| not prescribed
Dose prescribed per day(sachets) |___|.|___|	**Dose prescribed per day(sachets)** |___|.|___|	**Dose prescribed per day(sachets)** |___|.|___|	**Dose prescribed per day(sachets)** |___|.|___|	**Dose prescribed per day(sachets)** |___|.|___|	**Dose prescribed per day(sachets)** |___|.|___|	**Dose prescribed per day(sachets)** |___|.|___|	**Dose prescribed per day(sachets)** |___|.|___|	**Dose prescribed per day(sachets)** |___|.|___|
Delivered sachets(N): |___|___|	**Delivered sachets(N):** |___|___|	**Delivered sachets(N):** |___|___|	**Delivered sachets(N):** |___|___|	**Delivered sachets(N):** |___|___|	**Delivered sachets(N):** |___|___|	**Delivered sachets(N):** |___|___|	**Delivered sachets(N):** |___|___|	**Delivered sachets(N):** |___|___|
Plumpy nut available |1| Yes |2| no	**Plumpy nut available** |1| Yes |2| no	**Plumpy nut available** |1| Yes |2| no	**Plumpy nut available** |1| Yes |2| no	**Plumpy nut available** |1| Yes |2| no	**Plumpy nut available** |1| Yes |2| no	**Plumpy nut available** |1| Yes |2| no	**Plumpy nut available** |1| Yes |2| no	**Plumpy nut available** |1| Yes |2| no
Laboratory tests done |1|Malaria RDT |2|HIV |3|TB: ___________ |4|Other: ___________ |5|None	**Laboratory tests done** |1|Malaria RDT |2|HIV |3|TB: ___________ |4|Other: ___________ |5|None	**Laboratory tests done** |1|Malaria RDT |2|HIV |3|TB: ___________ |4|Other: ___________ |5|None	**Laboratory tests done** |1|Malaria RDT |2|HIV |3|TB: ___________ |4|Other: ___________ |5|None	**Laboratory tests done** |1|Malaria RDT |2|HIV |3|TB: ___________ |4|Other: ___________ |5|None	**Laboratory tests done** |1|Malaria RDT |2|HIV |3|TB: ___________ |4|Other: ___________ |5|None	**Laboratory tests done** |1|Malaria RDT |2|HIV |3|TB: ___________ |4|Other: ___________ |5|None	**Laboratory tests done** |1|Malaria RDT |2|HIV |3|TB: ___________ |4|Other: ___________ |5|None	**Laboratory tests done** |1|Malaria RDT |2|HIV |3|TB: ___________ |4|Other: ___________ |5|None
Other diagnosis |1|Malaria |2|Pneumonia |3|Diarrhoea |4|Other: ___________ |5|None	**Other diagnosis** |1|Malaria |2|Pneumonia |3|Diarrhoea |4|Other: ___________ |5|None	**Other diagnosis** |1|Malaria |2|Pneumonia |3|Diarrhoea |4|Other: ___________ |5|None	**Other diagnosis** |1|Malaria |2|Pneumonia |3|Diarrhoea |4|Other: ___________ |5|None	**Other diagnosis** |1|Malaria |2|Pneumonia |3|Diarrhoea |4|Other: ___________ |5|None	**Other diagnosis** |1|Malaria |2|Pneumonia |3|Diarrhoea |4|Other: ___________ |5|None	**Other diagnosis** |1|Malaria |2|Pneumonia |3|Diarrhoea |4|Other: ___________ |5|None	**Other diagnosis** |1|Malaria |2|Pneumonia |3|Diarrhoea |4|Other: ___________ |5|None	**Other diagnosis** |1|Malaria |2|Pneumonia |3|Diarrhoea |4|Other: ___________ |5|None

Health and Cost Outcomes Questionnaire

Patient ID: |___| -- |___|___| -- |___|___|___| ___| **Patient initials** |___|___| **Date of enrolment** |___|___|/|___|___|/|___|___|

RCT ID *HC ID* *Patient ID* *First, Last* *Day* *Month* *Year*

Prescribed med code: |1| Vitamin A |2|Iron and Folic acid |3|Meb/Albendazole |4|Amoxillin |5|Other: _________ |6|None	**Prescribed med code:** |1| Vitamin A |2|Iron and Folic acid |3|Meb/Albendazole |4|Amoxillin |5|Other: _________ |6|None	**Prescribed med code:** |1| Vitamin A |2|Iron and Folic acid |3|Meb/Albendazole |4|Amoxillin |5|Other: _________ |6|None	**Prescribed med code:** |1| Vitamin A |2|Iron and Folic acid |3|Meb/Albendazole |4|Amoxillin |5|Other: _________ |6|None	**Prescribed med code:** |1| Vitamin A |2|Iron and Folic acid |3|Meb/Albendazole |4|Amoxillin |5|Other: _________ |6|None	**Prescribed med code:** |1| Vitamin A |2|Iron and Folic acid |3|Meb/Albendazole |4|Amoxillin |5|Other: _________ |6|None	**Prescribed med code:** |1| Vitamin A |2|Iron and Folic acid |3|Meb/Albendazole |4|Amoxillin |5|Other: _________ |6|None	**Prescribed med code:** |1| Vitamin A |2|Iron and Folic acid |3|Meb/Albendazole |4|Amoxillin |5|Other: _________ |6|None	**Prescribed med code:** |1| Vitamin A |2|Iron and Folic acid |3|Meb/Albendazole |4|Amoxillin |5|Other: _________ |6|None
Counselling code:|__|	**Counselling code:**|__|	**Counselling code:**|__|	**Counselling code:**|__|	**Counselling code:**|__|	**Counselling code:**|__|	**Counselling code:**|__|	**Counselling code:**|__|	**Counselling code:**|__|
	If defaulter, VHT contacted |1| Yes |2| No |3|N/A	**If defaulter, VHT contacted** |1| Yes |2| No |3|N/A	**If defaulter, VHT contacted** |1| Yes |2| No |3|N/A	**If defaulter, VHT contacted** |1| Yes |2| No |3|N/A	**If defaulter, VHT contacted** |1| Yes |2| No |3|N/A	**If defaulter, VHT contacted** |1| Yes |2| No |3|N/A	**If defaulter, VHT contacted** |1| Yes |2| No |3|N/A	**If defaulter, VHT contacted** |1| Yes |2| No |3|N/A
	If VHT contacted, feedback from VHT received |1| Yes |2| No |3|N/A	**If VHT contacted, feedback from VHT received** |1| Yes |2| No |3|N/A	**If VHT contacted, feedback from VHT received** |1| Yes |2| No |3|N/A	**If VHT contacted, feedback fro VHT received** |1| Yes |2| No |3|N/A	**If VHT contacted, feedback fro VHT received** |1| Yes |2| No |3|N/A	**If VHT contacted, feedback fro VHT received** |1| Yes |2| No |3|N/A	**If VHT contacted, feedback fro VHT received** |1| Yes |2| No |3|N/A	**If VHT contacted, feedback fro VHT received** |1| Yes |2| No |3|N/A
Date of next visit |__|__|/|__|__|/|__|__| *day month year*	***Date of next visit*** |__|__|/|__|__|/|__|__| *day month year*	***Date of next visit*** |__|__|/|__|__|/|__|__| *day month year*	***Date of next visit*** |__|__|/|__|__|/|__|__| *day month year*	***Date of next visit*** |__|__|/|__|__|/|__|__| *day month year*	***Date of next visit*** |__|__|/|__|__|/|__|__| *day month year*	***Date of next visit*** |__|__|/|__|__|/|__|__| *day month year*	***Date of next visit*** |__|__|/|__|__|/|__|__| *day month year*	**Total days in the program:** |___|___||___| **Target Weight (Kg)** |___|___|.|___| **Exit Outcome** |1| Cured |2| Not cured |3| Defaulted |4| Transferred to IPC |5| Died |6| Transferred to another HC

Appendix 7. Data quality control

Data quality assurance procedures

- Roles and responsibility were clearly distributed among the research team to ensure that all activities had a responsible team capable of carrying them out efficiently.
- Data were collected using pre-defined pilot tested tools
- Guidance material with clear and comprehensive operational instructions on how to collect data (such as case definition, inclusion/exclusion criteria) were developed and made available, in a user-friendly format.
- Data collection staff were trained, and their knowledge pre-tested, and monitored at fixed intervals throughout the data collection process.
- Data were routinely checked before data entry, for completeness and internal consistency.
- The database for data collection included internal validations rules and queries.
- Data were collected at fixed intervals, and entered in the databases in real time, by dedicated staff trained in data entering
- The databases were monitored at fixed intervals for completeness and internal consistency and any problems (such as missing data) were discussed in real time, and all efforts were made to achieve data completeness and accuracy within the given deadlines.
- Interim data analysis was performed at fixed intervals and checked by an independent analyst.

Appendix 8: Phase one baseline study publication

Wanzira et al. BMC Health Services Research (2018) 18:561
https://doi.org/10.1186/s12913-018-3366-5

BMC Health Services Research

RESEARCH ARTICLE Open Access

Quality of care for children with acute malnutrition at health center level in Uganda: a cross sectional study in West Nile region during the refugee crisis

Humphrey Wanzira[1*], Richard Muyinda[2], Peter Lochoro[2], Giovanni Putoto[2], Giulia Segafredo[2], Henry Wamani[3] and Marzia Lazzerini[1]

Abstract

Background: Arua district, in Uganda, hosts some of the largest refugee camps in the country. The estimated prevalence of moderate and severe acute malnutrition in children is higher than the national estimates (10.4 and 5.6% respectively, compared to 3.6 and 1.3%). This study aimed at assessing the quality of care provided to children with acute malnutrition at out-patient level in such a setting.

Methods: Six facilities with the highest number of children with malnutrition were selected. The main tool used was the National Nutrition Service Delivery Assessment Tool, assessing 10 key areas of service delivery and assigned a score as either poor, fair, good or excellent. Health outcomes, quality of case management and data quality were assessed from the health management information system and from the official nutrition registers.

Results: All facilities except two scored either poor or fair under all the 10 assessment areas. Overall, 33/60 (55%) areas scored as poor, 25/60 (41%) as fair, 2/60 (3.3%) as good, and none as excellent. Main gaps identified included: lack of trained staff; disorganised patient flow; poor case management; stock out of essential supplies including ready-to-use therapeutic foods; weak community linkage. A sample coverage of 45.4% (1020/2248) of total children admitted in the district during the 2016 financial year were included. The overall mean cure rate was 52.9% while the default rate was 38.3%. There was great heterogeneity across health facilities in health outcomes, quality of case management, and data quality.

Conclusion: This study suggests that quality of care provided to children with malnutrition at health center level is substandard with unacceptable low cure rates. It is essential to identify effective approaches to enhance adherence to national guidelines, provision of essential nutritional commodities, regular monitoring of services and better linkage with the community through village health teams.

Keywords: Acute malnutrition, Children under 5 years, Quality of care, Quality assessment, Health center

* Correspondence: humphrey.wanzira@burlo.trieste.it
[1]WHO Collaborating Centre for Maternal and Child Health, Institute for Maternal and Child Health IRCCS Burlo Garofolo, Trieste, Italy
Full list of author information is available at the end of the article

Background

Under-nutrition is a major cause of morbidity in children under 5 years [1]. The most recent estimates indicate that 52 million children under 5 years are diagnosed with wasting and 17 million with severe wasting and of these, 26.9% occur in Sub-Saharan Africa [1].

In Uganda, under-nutrition is considered a condition of public health importance [2]. National estimates report that 3.6% children suffer from moderate acute malnutrition (MAM) while 1.3% have severe acute malnutrition (SAM) [3]. However, this prevalence is heterogeneous across regions. For instance, the West Nile region, currently considered as a humanitarian setting and hosting refuges from South Sudan and Congo [4, 5] has the highest reported prevalence of MAM and SAM in the country at 10.4 and 5.6% respectively [3]. This is far above the target identified by the World Health Assembly which adopted the goal of reducing and maintaining the prevalence of wasting in children to under 5% by 2025 [6, 7].

Uganda is committed to reducing malnutrition and has identified this as a key part of its strategy for becoming a middle-income country by 2040 [8]. Actions to address malnutrition were included in the National Development Plan 2015/2016–2019/20 [9] and in the Uganda Nutrition Action Plan 2011–2016 for multi-sectoral support [10]. The Ministry of Health (MoH) developed the Integrated Management of Acute Malnutrition (IMAM) guidelines in 2006 and updated them in 2011 [11] and 2016 [2], in line with the WHO recommendations. The guidelines provide details for the management of children with both MAM and SAM at health facility level and include recommendations for screening and follow up at community level. Support has been provided from both international and local stakeholders especially the procurement and distribution of therapeutic foods and basic nutritional equipment [10, 12].

However, several studies have shown that adopting guidelines, providing training and basic equipment per se do not actually ensure that care is delivered according to set standards [13–17]. Assessments of the quality of nutritional services in other settings have highlighted poor adherence to guidelines leading to substandard health outcomes [14, 15, 18]. Therefore identifying areas of substandard quality of care is an important step towards improvement of health services [18–23]. In Uganda there is limited published literature on the performance of health facilities offering nutritional services, especially in a refuge setting. The aim of this study was to carry out an assessment of the quality of care provided to children admitted with acute malnutrition at out-patient therapeutic care (OTC) level in Arua district, West Nile region.

Methods

Study design, population and setting

This was a cross sectional study and is reported according to the STROBE guidelines. It was conducted between July and August 2016 in Arua district. According to the 2014 census, the estimated population in the district is 808,745 residents, [24]. By May 2017, the district was hosting approximately 174,396 refugees mainly from South Sudan and DR Congo [4]. For this assessment, six health facilities were selected out of the 55 government owned facilities based on the following criteria; those providing nutrition services, those with the highest reported number of malnourished children according to the Health Management and Information System (HMIS) data for the financial year 2016 (July 2015 to June 2016) [25] and whose staff agreed to participate. Exclusion criteria included difficult to access facilities and those without a staff assigned to be responsible for nutrition service delivery.

Data collection tools, procedures and variables

Nutrition service delivery

The Nutrition Service Delivery Assessment (NSDA) was the main tool used for this evaluation. The tool was developed by the Uganda MoH with support from external partners as the official national instrument for assessing performance of nutritional services [26]. It assesses 10 key capacity areas of nutrition service relevant at out-patient level, including: general information on service implementation, adequate human resources, provision of nutritional services, community linkage, quality improvement activities, materials and supplies, nutrition unit requirements, store management, logistics management for commodities, monitoring and evaluation. Data sources include: direct observation, documents review, interviews with health staff, village health teams (VHTs) and mothers of children diagnosed with malnutrition. For each chapter, using strict criteria specified in the tool (similar to checklists), a final judgment on the quality of the services was made and a final score assigned as one of four pre-defined categories: poor, fair, good and excellent. The tool also guides the identification of specific gaps in service delivery in each of the capacity areas.

The study team involved in the NSDA assessment included a senior paediatrician, a nutritionist and a public health expert, all experienced in the National IMAM guidelines [2] and in the use of the NSDA tool [26].

Health outcomes

Health outcomes were extracted from the HMIS by a national HMIS focal person for the review period (financial year 2016), according to six categories based on the national definitions in the IMAM guidelines [2]: 1) Cured: attaining a weight-for-height ≥ – 2 standard deviation (SD) from the mean based on the WHO 2006 standards or

mid upper circumference (MUAC) of ≥12.5 cm; 2) Non-responders: not reaching discharge criteria after three months or four months for the HIV/TB patients; 3) Defaulters: absent for 2 consecutive follow up visits; 4) Transferred to in-patient care (ITC): condition has deteriorated and requires in-patient care or not responding to treatment; 5) Transferred to to another out-patient care facility (OTC): patient transferred to other nearby OTCs or as requested by caregiver; and 6) Died: patient died while in the program.

Quality of case management and quality of data

Quality of case management and quality of data were assessed for each child enrolled in the program during the 2016 financial year using the Integrated Nutrition Register (INR) as a source of data. The INR is the official register at the health facility level where all information on malnourished children is recorded. Data extraction was conducted by a team of six data collectors, trained for this purpose, and directly supervised by a nutritionist. Data collection tools were pre-defined and pilot tested, and standard operating procedures (SOP) were developed to standardise the data extraction process. Quality of case management was assessed using the national guidelines as reference for standards [2] and using five pre-defined process outcomes:1) Correct diagnosis: correct assignment of the category of malnutrition based on weight-for-height Z-score or MUAC as follows: MAM if weight-for-height Z-score > − 3 and < − 2 standard deviation or MUAC (6 to 59 months) > 11.5 and < 12.5 cm and no bilateral pitting oedema; and SAM if weight-for-height Z-score < − 3 Standard deviation or MUAC (6 to 59 months) < 11.5 cm, bilateral pitting oedema, no medical complications and passes appetite test; 2) Correct treatment: correct treatment of cases with SAM such as: 10% glucose/sugar for hypoglycaemia at triage, Amoxicillin for bacterial infections on first day, Measles vaccination on admission (if > 9 months and not yet received), Vitamin A capsule given once at discharge, Iron and folic acid prescribed in presence of anaemia, Mebendazole/Albendazole for helminthic infections on second visit and Ready to Use Therapeutic Foods (RUFT) called Plumpy nut, as main malnutrition prescription; 3) Correct evaluation of HIV: HIV test performed on all patients following the national testing algorithm [27]; 4) Correct counselling of care givers/patients on key messages: delivery of counselling in the following area, as for the national guideline [2]: nutrition, RUFT administration, hygiene, HIV; and 5) Correct exit health outcome assigned: correct assignment of the exit criteria as for the national guideline [2] criteria, as follows: cured, non-respondent, defaulted, transfer to in-patient care or out-patient care and died.

Data quality was assessed using the following two pre-defined indicators: 1) data completeness defined for each single case as "complete" if in information on the following 15 key required fields were filled in: date, patient name, type of nutritional management, nutritional status at enrolment, HIV status at enrolment, anti-retroviral therapy services at enrolment, visit date, oedema, weight, height/length, MUAC colour, Z-score, therapeutic feeds, target exit criteria, exit outcome; and 2) internal consistency defined for each single case as "consistent" if i) the height of the child was consistent over time (ie not decreasing) and ii) the date of the visits was consistent over time (ie progressive dates in the register).

Data management

Data was collected and double entered into pre-formatted excel spreadsheets and checked for consistency and accuracy by two supervisors before analysis. The distribution of the health facility categorical parameters was presented as frequencies with respective proportions. Health outcomes were assessed against the SPHERE standards [28]. Case management and data quality indicators were assessed against a predefined target of at least 80%. Cases with missing information on health outcomes and quality of case management were counted as incorrect. A two sided p-value of < 0.05 was considered as statistically significant.

Results

Characteristics of the health facilities

The selected population sample, from the six facilities, accounted for 45.4% (1020/2248) of total caseload of malnourished children treated in Arua district during this review period (Fig. 1).

Characteristics of the health facilities are reported in Table 1. Overall, the number of children treated in each facility varied (from 318 to 61) but this was not directly proportional to the estimated population coverage (number of children diagnosed per 1000 population coverage ranging from 2.8 to 32.8).

Four out of six facilities had two or less staff assigned to the nutrition unit, with only one facility having a clinical officer involved. Overall, only one staff (7.6%) had been trained in the IMAM guidelines.

Nutrition service delivery assessment

All facilities except two scored either poor or fair under all the 10 assessment areas of the NSAD tool (Table 2). Overall, 33/60 (55.0%) areas were scored as poor, 25/60 (41.7%) as fair, 2/60 (3.3%) as good, and none as excellent. In particular, the following two areas were scored as poor in all facilities: quality improvement activities and monitoring and evaluation (see Additional file 1). Figure 2 shows a summary the distribution of the NSDA scores.

Table 3 shows the specific gaps in quality of nutritional services identified with the NSDA. Key findings included: poor organisation of services at the nutrition

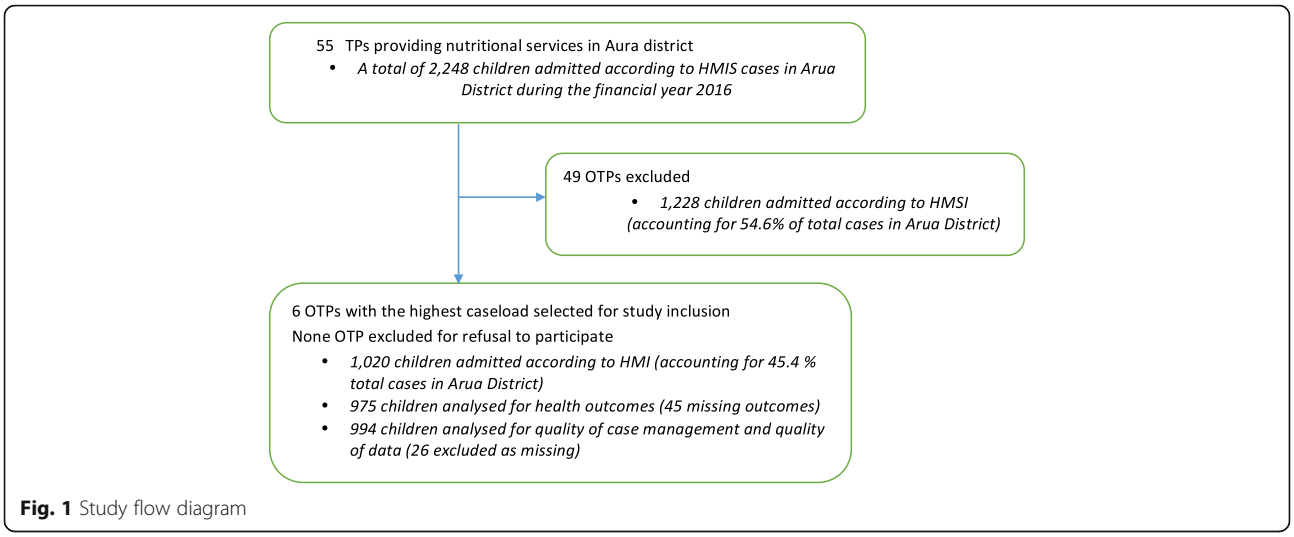


Fig. 1 Study flow diagram

service delivery point; poor case diagnosis and treatment; stock out of nutrition foods; weak community linkage mechanisms.

Of note, the assessment also identified some areas with good service delivery. All health facilities were using HMIS forms (INR and monthly quarterly reports), had basic nutrition equipment (weighing, length/height measuring scales and MUAC tapes), essential job aids (Z-score classification and counselling aids), VHTs were engaged and there was evidence of quarterly supervision conducted by district health team.

Health outcomes

The distribution of health outcomes is shown in Fig. 3. The cure rate and defaulter rate were the two health outcomes that were predominantly assigned (see Additional file 1). The overall cured rate in all the six health facilities was 52.9% while the overall defaulting rate was 38.2%. Significant heterogeneity was observed between these outcomes across health centers with the cure rate ranging from 31.2 to 74.4% and the defaulting rate ranging from 18.7 to 63.9%. During the entire study period, 37 children (4.0%) were transferred to ITC, 13 (1.3%) were classified as non-responders and only one participant (0.1%) was recorded to have died.

Quality of case management

Overall, 994 cases of malnourished children were identified in the INR and reviewed (see Additional file 1). Health facility performance on all case management process indicators was highly heterogeneous across facilities (Table 4). The rate of correct diagnosis ranged from 4.5 to 91.2%, correct treatment from 0 to 50.0%, correct HIV status assignment from 58.1 to 91.2%, correct counselling from 11.2 to 99.3% and correct exit outcome from 0 to 75.9%. The overall average rates were as follows: correct diagnosis at 34.6%; correct treatment at 19.2%; correct counselling at 47.6%; correct evaluation of HIV at 73.5% and correct exit outcome at 16.7%. None of the overall estimates for process outcomes reached the pre-defined target of 80% with a statistically

Table 1 Key characteristics of the health facilities

Variable	Health facility						
	HC 1	HC 2	HC 3	HC 4	HC 5	HC 6	Totals
Health Center level[a]	IV	III	III	III	III	III	–
Estimated population coverage	32,000	3960	22,548	13,779	2500	21,662	96,449
Children diagnosed with acute malnutrition[b]	318	292	116	151	82	61	1020
Number of staff assigned to the nutritional unit	2	2	3	1	3	2	13
Nutritional staff qualification							
Clinical officer	1	0	0	0	0	0	1
Enrolled nurse/midwife	1	1	1	0	3	2	8
Nursing assistant	0	1	2	1	0	0	4
Staff trained in IMAM guideline	1	0	0	0	0	0	1

[a]Levels of primary health care in Uganda is tiered into health center I,II,III and IV
[b]HMIS data July 2015 – June 2016 (financial year)

Table 2 Performance of health facilities in the selected capacity areas

Capacity area	Health facility Score[a]					
	HC 1	HC 2	HC 3	HC 4	HC 5	HC 6
1. General information on service implementation	Fair	Good	Fair	Fair	Fair	Fair
2. Adequate human resources	Poor	Poor	Poor	Poor	Fair	Poor
3. Provision of nutritional services	Fair	Fair	Fair	Poor	Fair	Poor
4. Community Linkagetable	Fair	Fair	Fair	Poor	Poor	Good
5. Quality improvement activities	Poor	Poor	Poor	Poor	Poor	Poor
6. Materials and Supplies	Poor	Fair	Poor	Poor	Fair	Poor
7. Nutrition unit requirements	Fair	Fair	Poor	Fair	Fair	Poor
8. Store management	Poor	Fair	Fair	Poor	Fair	Fair
9. Logistics Management for commodities	Poor	Poor	Fair	Poor	Fair	Poor
10. Monitoring and evaluation	Poor	Poor	Poor	Poor	Poor	Poor

[a]Score performance categories according to the NSDA tool: poor; fair; good; excellent [26]

significant difference when compared to this threshold (chi p-value = 0.001).

Data quality

There was high heterogeneity across health centers in data quality. Data completeness ranged from 0 to 32.1% and data consistency ranged from 0 to 87.6% (Table 4). The overall mean completeness rate was 4.4% and consistency at 20.7% with both indicators far below the pre-defined threshold of 80% (chi p-value = 0.001).

Additional analysis

No clear correlation could be found between single indicators (NSDA scores, cured rate, process outcomes, quality of data) and the type of health center (level IV vs III), or the volume of work (number of children admitted). No clear internal correlation among different indicators could

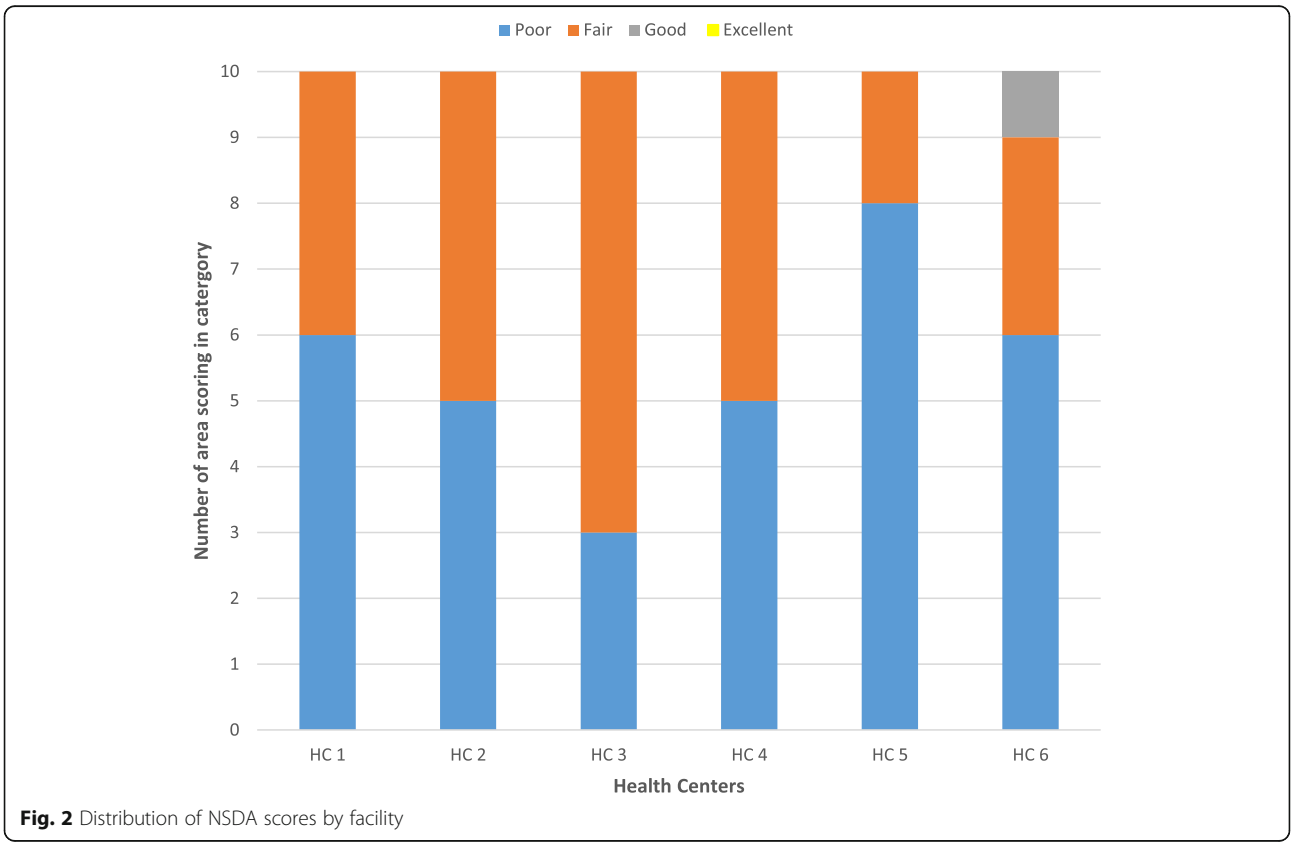


Fig. 2 Distribution of NSDA scores by facility

Table 3 Gaps in quality of nutritional services observed by capacity area

Capacity area	Observed issue
Organisation of services	Nutrition services delivered "under the tree"
	Working hours unclear
	Frequent service delays if rain
	No triage
	Chaotic organisation, no clear roles and responsibilities
	No transport for children sent In-patient Therapeutic Care (ITC)
	Working hours unclear
Case management	Triage not performed
	Mid Upper Aram Circumference (MUAC) not routinely done at all entry points (Out patients department -OPD, Tuberculosis and Anti retroviral therapy - TB/ART)
	Mis-classification SAM/MAM
	Z-score never used (only MUAC used)
	No history taking
	Comprehensive clinical examination as per the Integrated Management of Childhood Illnesses (IMCI) not performed
Treatment	Water with sugar not offered at admission
	10 key messages on RUTF not delivered
	Individual counselling never performed
	Amoxicillin, vitamine A, Iron and mebendazole not prescribed
	MAM and SAM usually treated the same
Integrated Management of childhood Illnesses (IMCI)	HIV status often indicated as unknown despite availability of testing kits
	TB rarely assessed
	Children at OPD not always assessed for nutritional status
	Children with malnutrition not assessed according to IMCI
	Staff working in out-patient care not trained in IMCI
	Old IMCI job aids in some facilities
Supplies	Stock out of RUTF observed in many facilities
	Lack of mean of transport to facilities
	Lack of timely request from facilities
Staffing	Lack of staffing with some facilities having no nutritional focal person appointed
	Lack of nutritional specific training
	Poor practices even among trained staff
	Village Health Teams (VHTs) usually not formally trained but doing the job at OTC in place of facility staff
Community linkage	VHTs screening reports not readily available
	Blank VHTs registers
	No effective means of communication between facilities and village health teams (VHTs)
	No incentives for the VHT
Quality improvement	Several supportive supervision activities are conducted on a quarterly basis, at facilities but only few are specific to nutrition

Abbreviations: *ART* Anti Retro-viral Therapy, *HIV* Human Immune-deficiency Virus, *IMCI* Integrated Management of Childhood Illness, *ITC* In-patient Therapeutic Care, *MAM* Moderate Acute Malnutrition, *MUAC* Mid-Upper Arm Circumference, *OPD* Out Patients Department, *OTC* Out-patient Therapeutic Care, *RUTF* Ready-to-Use Therapeutic Foods, *SAM* Severe Acute Malnutrition, *TB* Tuberculosis, *VHT* Village Health Teams

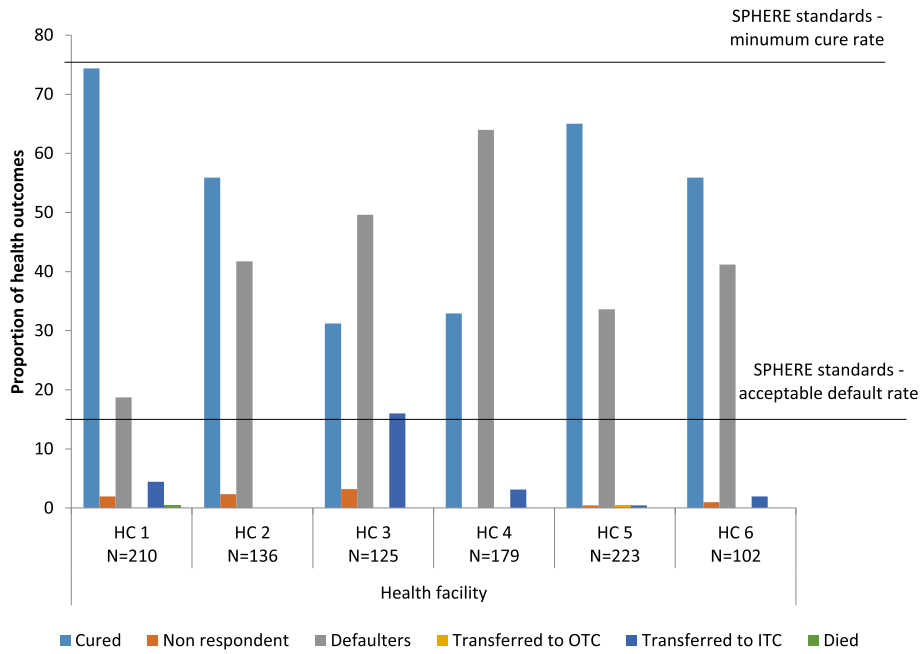


Fig. 3 Distribution of health outcomes

be found (performance of the different indicators did not seem to be directly linked to each other).

Discussion

This is the first study reporting on the performance of nutritional services for children in Arua district. The assessment shows that, even though some positive aspects were observed, there are substantial deficiencies in the quality of nutrition services at health center level in Arua district. Significant gaps were observed both by using the national tool for Nutrition Service Delivery Assessment (NSDA) and by reviewing key indicators of health outcomes, case management and data quality in the official records.

The observed health facility cure rate of 52.9% was far below the international SPHERE standards target set at above 75% [28], while the defaulting rate of 38.3%, was significantly higher than the standard's target set at below 15% (28). One of the possible reasons for this low cure rate may be the lack of adherence to guidelines for

Table 4 Case management and data quality

Variable	Health facility							
	HC 1 *N* = 194	HC 2 *N* = 137	HC 3[a] No data	HC 4 *N* = 301	HC 5 *N* = 228	HC 6 *N* = 134	Total *N* = 994	Chi *p*-value[#]
Correct process outcomes								
Diagnosis	30(15.5)	125(91.2)	–	88(29.2)	95(41.7)	6(4.5)	344(34.6)	0.001
IMAM treatment	0	0	–	151(50.0)	28(12.3)	12(9.0)	191(19.2)	0.001
Evaluation of HIV	158(81.4)	90(65.7)	–	175(58.1)	208(91.2)	100(74.6)	731(73.5)	0.001
Counselling of patients	39(20.1)	136(99.3)	–	172(57.1)	111(48.7)	15(11.2)	473(47.6)	0.001
Exit outcome assigned	19(9.8)	104(75.9)	–	31(10.3)	12(5.3)	0	166(16.7)	0.001
Data quality								
Data completeness	0	44(32.1)	–	0(0)	0(0)	0(0)	44(4.4)	0.001
Data consistency	0	120(87.6)	–	74(25.6)	11(4.8)	1(0.8)	206(20.7)	0.001

Data source: Integrated Nutrition Register
[a]Data not available in the integrated nutrition register
#*p*-value assessed against a pre-defined target of 80% achievement

case management as observed in this study. Important clinical practices such as triage, screening of all children for malnutrition, history taking, detailed examination, diagnosis of SAM and MAM, individual counselling, complementary treatment and assignment of exit outcomes were not being performed according to the IMAM guidelines [2]. Additionally, laboratory screening for HIV and TB was not routinely conducted, despite the availability of laboratory diagnostic kits. Such poor performance of quality of health service delivery has also been reported in other studies both in routine settings in Uganda [13, 15, 29, 30] and in refugee settings such as in Ethiopia [31–34].

Another key reason explaining the poor performance of case management, in addition to inadequate human resource, is the substantial lack of training of heath facility staff, both frequently observed challenges in low and middle income countries [35]. The impact of targeted training on both health workers performance and children outcomes is relatively well documented. For example, a systematic review examining the effectiveness of nutritional training of health workers showed a clear benefit in improving feeding frequency, energy intake, and dietary diversity of children [36].

Notably, almost all the assessed health facilities had basic nutritional equipment such as digital weighing scales, length/height measuring boards, MUAC tapes and essential job aids. However, the frequent stock out of RUTF, an essential nutrition management commodity, was a significant issue, a finding in line with two earlier studies conducted in other regions in Uganda [29, 30].

The observed challenges such as stock out of RUTF, poor organisation of services including irregular working hours and long waiting times and weak community linkages re-affirm some of the underlying factors explaining the very high defaulting rate observed [29]. The poor performance of VHTs especially regarding case-identification and referral of cases is an observation that deserves further scrutiny because this study was not designed to identify the causes of this occurrence. However, evidence from a systemic review on factors that influence performance of community health workers (CHWs) such as VHTs found that lack of supervision, lack of training and lack of financial incentives were the main barriers to achieving an acceptable performance from CHWs [37]. Minimizing such barriers would improve access to care and ultimately the achievement of better health outcomes. Evidence shows that barriers to access for service users may increase mortality, especially among children with SAM who actually requires urgent medical attention [38].

Poor data quality is another important but frequently reported problem in low income countries, including Uganda [39, 40]. Good quality data is the basis for evidence based decision making and two suggested approaches for improvement in such settings include better training on data quality assurance procedures and intensive supportive supervision [38–41].

As already documented, the influx of refugees into a community negatively affects the performance of health services in such settings [31, 32]. However it is also true that poor performance has been reported in settings experiencing no refugee crisis [29, 30], indicating that refugee circumstances is not the sole explanation for such a performance. This study did not aim at comparing the performance of nutritional service before and during the most recent refugee crisis In Arua, but rather at collecting baseline data for service delivery evaluation. Future studies should aim at monitoring health system performance over time while exploring the influence of different factors on key outcomes.

Limitations of this study included the relatively small sample size in terms of health facilities, however, the study sample population captured over 45% of cases of children admitted to nutritional services in Arua district. Even though most of the assessment was conducted by direct evaluation using the NSDA tool [26], health outcomes and case management were assessed using recorded data, which, by nature, are exposed to a risk of recall bias. We tried to minimised this bias in different ways such as choosing the official documents as data sources with the expectation that all information of each child with malnutrition was recorded, using trained data collectors, using pre-defined data collection variables, developing standard operating procedures and transparency during reporting of study findings.

Recommendations for policy makers derived from this study may include: hiring and training of health facility staff to fill the human resource gap; strengthening supportive supervision to improve performance at different levels (case management, timely requests of RUTF, data quality, community linkages); and conducting regular NSDA assessments to monitor progress over time. More studies are needed to identifying effective approaches to enhance adherence to national guidelines and ultimately improve health outcomes of children.

Conclusion

This assessment revealed that quality of care and health outcomes of children with malnutrition in Arua district are far below the internationally acceptable SPHERE standards. Significant deficiencies were observed under organization of service, case management, procurement, community linkage and data quality. In the future both researchers and policy makers should aim at identifying effective approaches to increase quality of care for children with malnutrition in Arua district and similar settings.

Additional file

Additional file 1: Quantitative dataset. (XLSX 57 kb)

Abbreviations

ART: Anti Retroviral Therapy; DHT: District Health Team; HC: Health Center; HIV: Human Immuno-defiency Virus; HMIS: Health Management and Information System; IMAM: Integrated Management of Acute Malnutrition; IMCI: Integrated Management of Childhood Illness; INR: Integrated Nutrition Register; ITC: In-patient Therapeutic Care; MAM: Moderate Acute Malnutrition; MoH: Ministry of Health; MUAC: Mid Upper Arm Circumference; NSDA: Nutrition Service Delivery Assessment; OPD: Out Patient Department; OTC: Out-patient Therapeutic Care; RUTF: Reay to Use Therapeutic Foods; SAM: Sever Acute Malnutrition; TB: Tuberculosis; UNICEF: United Nations International Emergency Fund; VHT: Village Health Team; WHO: World Health Organisation

Acknowledgements

The authors wish to thank the Arua district health team, CUAMM Uganda team, study data collectors, Goina Monica, and the health facility staff. The views expressed herein are solely of the authors and do not reflect the views of any other stakeholder.

Funding

Research discussed in the publication is funded by the World Food Programme (Office of Evaluation), the UK aid through the Department for International Development (DFID) and the International Initiative for Impact Evaluation (3ie). The views expressed in this publication are not necessarily those of WFP, DFID or 3ie.

Availability of data and materials

The quantitative data generated or analysed during this study are included in this published article as its additional file. Notes from the qualitative data are available from the corresponding author on reasonable request.

Authors' contributions

ML and HW1 conceived the study idea, in collaboration with, RM, GP, GS, HW2 and PL. ML, HW1 and RM lead the design and acquisition of data, ML and HW1 conducted the analysis and interpreted the data. HW1 and ML lead the drafting of manuscript, all authors were involved during critical revision for important intellectual content. All authors read and approved for the final manuscript to be published and are accountable for all aspects of the work

Ethics approval and consent to participate

The study was approved by the Makerere University School of Public health ethical committee, Uganda National Council of Science and Technology (UNCST) and the ethical committee of the IRCCS Burlo Garofolo, Italy. All participants interviewed gave their informed consent to participate and for the information derived to be published. The HMIS extracted data was aggregated with no individual level data details obtained, all the analysis was therefore anonymous.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

Publisher's Note

Author details

[1]WHO Collaborating Centre for Maternal and Child Health, Institute for Maternal and Child Health IRCCS Burlo Garofolo, Trieste, Italy. [2]Doctors with Africa, CUAMM, Kampala, Uganda. [3]Makerere University School of Public Health, Kampala, Uganda.

Received: 22 February 2018 Accepted: 8 July 2018
Published online: 17 July 2018

References

1. Levels and Trends in Child Malnutrition. Joint Child Malnutrition estimates. UNICEF/WHO/World Bank. 2017. Edition. New York: UNICEF.
2. Ministry of Health, Uganda. Guidelines for integrated management of acute malnutrition in Uganda, 2016.
3. Uganda Demographic and Health Survey. Kampala: Uganda Bureau of Statistics; 2016.
4. World Vision Uganda. West Nile refugee response situation report 8. May-2017. Kampala, Uganda.
5. Appeal for urgent response to Uganda refugee crisis', NRC. [Online]. Available: https://www.nrc.no/news/2016/august/appeal-for-urgent-response-to-uganda-refugee-crisis/. [Accessed: 05-Apr-2017].
6. World Health Organization and Nutrition for Health and Development, Ambition and action in nutrition 2016–2025. 2017.
7. WHO Wasting Policy Brief. Global nutrition targets 2025. Geneva: World Health Organization; 2016.
8. Uganda National Planning Authority. Vision 2040. Kampala, Uganda.
9. Uganda National Planning Authority. Second National Development Plan 2015/16–2019/20. 2015. Kampala, Uganda.
10. Uganda Nutrition Action plan 2011–2016: Scaling Up Multi-Sectoral Efforts to Establish a Strong Nutrition Foundation for Uganda's Development.
11. Ministry of Health, Uganda. Integrated Management of Acute Malnutrition Guidelines December 2010.
12. Government of Uganda – UNICEF country programme action plan 2016–2020.
13. Ayieko P, et al. A multifaceted intervention to implement guidelines and improve admission Paediatric Care in Kenyan District Hospitals: a cluster randomised trial. PLoS Med. 2011;8(4):e1001018.
14. Dettrick Z, Firth S, Soto EJ. Do strategies to improve quality of maternal and child health Care in Lower and Middle Income Countries Lead to improved outcomes? A review of the evidence. PLoS One. 2013;8(12):e83070.
15. Pariyo GW, Gouws E, Bryce J, Burnham G. Improving facility-based care for sick children in Uganda: training is not enough. Health Policy Plan. 2005; 20(suppl_1):i58–68.
16. Huicho L, Dávila M, Campos M, Drasbek C, Bryce J, Victora CG. Scaling up integrated Management of Childhood Illness to the national level: achievements and challenges in Peru. Health Policy Plan. 2005;20(1):14–24.
17. Gillespie S, Menon P, Kennedy AL. Scaling up impact on nutrition: what will it take? Adv Nutr Int Rev J. 2015;6(4):440–51.
18. Falbo AR, Alves JG, Batista Filho M, Cabral-Filho JE. Implementation of World Health Organization guidelines for management of severe malnutrition in a hospital in Northeast Brazil. Cad Saude Publica. 2006;22(3):561–70.
19. Ashworth A, Chopra M, McCoy D, Sanders D, Jackson D, Karaolis N, Sogaula N, Schofield C. WHO guidelines for management of severe malnutrition in rural south African hospitals: effect on case fatality and the influence of operational factors. Lancet. 2004;363(9415):1110–5.
20. Gathara D, Opiyo N, Wagai J, Ntoburi S, Ayieko P, Opondo C, Wamae A, Migiro S, Mogoa W, Wasunna A, Were F, Irimu G, English M. Quality of hospital care for sick newborns and severely malnourished children in Kenya: a two-year descriptive study in 8 hospitals. BMC Health Serv Res. 2011;11:307.
21. Ojikutu B, Higgins-Biddle M, Greeson D, Phelps BR, Amzel A, Okechukwu E, Kolapo U, Cabral H, Cooper E, Hirschhorn LR. The association between quality of HIV care, loss to follow-up and mortality in pediatric and adolescent patients receiving antiretroviral therapy in Nigeria. PLoS One. 2014;9(7):e100039.
22. Taylor MJ, McNicholas C, Nicolay C, Darzi A, Bell D, Reed JE. Systematic review of the application of the plan-do-study-act method to improve quality in healthcare. BMJ Qual Saf. 2014;23(4):290–8. https://doi.org/10.1136/bmjqs-2013-001862.
23. Testa J, Sinnaeve O, Ibrahim Y, Ayivi B. Evaluation of the quality of screening and management of infant malnutrition in Cotonou, Benin. Med Trop (Mars). 2008;68(1):45–50.
24. Uganda Bureau of Statistics: National population and housing census 2014, 2016.
25. Ministry of Health. Uganda Health Management and Information System. Kampala, Uganda.
26. Ministry of Health, Uganda. Nutrition service delivery assessment tool for health Centre IV, Health Centre III, and Health Centre II, 2015.

27. Consolidated Guidelines for Prevention and Treatment of HIV in Uganda, 2016. Ministry of Health, Uganda, Kampala.
28. SPHERE, Sphere project: humanitarian charter and minimum standardsin disaster response. 2011.
29. Kiwanukaa SN, Ekirapaa EK, Petersona S, Okuia O, Hafizur Rahmanc M, Petersc D, Pariyoa GW, Kiwanukaa SN, Ekirapaa EK, Petersona S, Okuia O. Access to and utilisation of health services for the poor in Uganda: a systematic review of available evidence. Trans R Soc Trop Med Hyg. 2008;102:1067–74.
30. Wilunda C, et al. Availability, utilisation and quality of maternal and neonatal health care services in Karamoja region, Uganda: a health facility-based survey. Reprod Health. 2015;12:30.
31. Mary Corbett, Allison Oman. Acute Malnutrition in Protracted Refugee Situation:A Global Strategy UNHCR/WFP. 2016.
32. Doocy S, Tappis H, Haskew C, Wilkinson C, Spiegel P. Performance of UNHCR nutrition programs in post-emergency refugee camps. Confl Health. 2011;5:23.
33. Shanka NA, Lemma S, Abyu DM. Recovery rate and determinants in treatment of children with severe acute malnutrition using outpatient therapeutic feeding program in Kamba District, south West Ethiopia. J Nutr Disord Ther. 2015;5(2)
34. Yebyo HG, Kendall C, Nigusse D, Lemma W. Outpatient therapeutic feeding program outcomes and determinants in treatment of severe acute malnutrition in Tigray, northern Ethiopia: a retrospective cohort study. PLoS One. 2013;8(6):e65840.
35. World Health Organization, editor. The world health report 2006 - working together for health. Geneva: World Health Organisation; 2006.
36. Sunguya BF, et al. 'Effectiveness of nutrition training of health workers toward improving caregivers' feeding practices for children aged six months to two years: a systematic review'. Nutr J. 2013;12:66.
37. Kok MC, et al. Which intervention design factors influence performance of community health workers in low- and middle-income countries? A systematic review. Health Policy Plan. 2015;30(9):1207–27.
38. Black RE, et al. Maternal and child undernutrition: global and regional exposures and health consequences. Lancet. 2008;371(9608):243–60.
39. Kiberu VM, Matovu JKB, Makumbi F, Kyozira C, Mukooyo E, Wanyenze RK. Strengthening district-based health reporting through the district health management information software system: the Ugandan experience. BMC Med Inform Decis Mak. 2014;14:40.
40. Kintu P, Nanyunja M, Nzabanita A, Magoola R. Development of HMIS in poor countries: Uganda as a case study. Health POLICY Dev. 2005;3:46–53.
41. Thangasamy P, Gebremichael M, Kebede M, Sileshi M, Elias N, Tesfaye B. A pilot study on district health information software 2: challenges and lessons learned in a developing country: an experience from Ethiopia. Int Res J Eng Technol. 2016;3(5):1646–51.