Utilization of Family Mid upper Arm Circumference Tape for Early Detection of Child Malnutrition in Nomadic Communities - Turkana South, Kenya.

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A Thesis Submitted to the School of Public Health, Biomedical Sciences and Technology in Partial Fulfillment of the Requirements for the Award of Master of Science in Public Health Nutrition Degree of Masinde Muliro University of Science and Technology.

November 2025

DECLARATION

I, **Benedicto Ekai Esekon**, declare that this thesis entitled *"*Utilization of Family Mid upper Arm Circumference Tape for Early Detection of Child Malnutrition in Nomadic Communities - Turkana South, Kenya.*"* is my original work and has not been presented for a degree or any other academic award in any other university or institution of higher learning.

I further declare that this work has been subjected to plagiarism screening and meets the institutional requirements for originality. I take full responsibility for the accuracy and integrity of the work presented herein

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DEDICATION

I dedicate this work to my beloved family. My Wife Selina Ng'akippi and our beloved children Joan, Enock, Victor, Levi, Precious and Adaeze whose unwavering love, support and inspiration have been the cornerstone of my journey throughout my Master's studies. I am deeply grateful for their encouragement in every step of the way. I also extend my heartfelt appreciation to my research team for their invaluable guidance, collaboration and commitment which greatly contributed to the success of this study. To the community of Turkana south where the research was conducted, I sincerely thank you for your participation and openness. It is my hope that the findings from this study will help address existing gaps and contribute to the improved utilization of F-MUAC as an effective tool in promoting child health and nutrition.

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ABSTRACT

Malnutrition remains a major public health concern in Turkana South Sub-County, Kenya, where children from nomadic pastoralist communities often present at health facilities with advanced stages of undernutrition. The Family-led Mid-Upper Arm Circumference (F-MUAC) screening approach is promoted as a community-based strategy for early detection and referral of malnutrition cases. However, evidence on its uptake and utilization in this context has been limited. This study assessed the utilization, coverage and key determinants of F-MUAC use among caregivers in Turkana South. A cross-sectional mixed-methods design was employed, involving quantitative data from 244 caregivers of children aged 6–59 months selected through simple random sampling and qualitative data from six focus group discussions. Quantitative tools included structured questionnaires and F-MUAC demonstrations, qualitative data explored perceptions and contextual barriers. A 100% response rate was achieved with most respondents being women (97.95%), married (92.21%) and engaged in livestock rearing (26%) or petty trade (25%). About 70.5% of caregivers reported screening their children in the two weeks prior to the survey while 29.5% had not used the tape consistently. Knowledge of malnutrition was significantly associated with F-MUAC utilization (OR = 6.05, $p < 0.001$). However, technical measurement errors were common, strongly linked to incorrect tape placement (OR = 203.85) and misalignment of the reading window (OR = 136.55) ($p < 0.001$). Mistrust in the tool due to discrepancies with facility-based readings was noted by 5.3% of respondents. Undernutrition prevalence remained high particularly among children aged 6–24 months (19.5%) compared to those aged 25–59 months (15.2%). The study shows that family-led F-MUAC screening improves early detection and promotes community ownership of child health. While the approach reduces the burden on overstretched health systems and lowers screening costs, its utilization depends on the household's ability to act on referrals. Economic empowerment is therefore crucial not only to create time for screening but also to support access to care. Linking F-MUAC with income-generating activities and broader livelihood programs can enhance its uptake and impact. Integrating F-MUAC into routine outreach, harmonizing home and facility tools and ensuring policy-level support can foster a more resilient and inclusive nutrition response in fragile, underserved areas.

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ABBREVIATIONS AND ACRONYMS

ALOS : Average length of stay

CHV : Community health volunteer

CHW : Community health Worker

CMAM : Community management of acute malnutrition

CNAP : County nutrition action plan

FGD : Focus Group Discussion

F-MUAC : Family mid-upper arm Circumference

GAM : Global Acute Malnutrition

HBM : Health belief model

HC : Health care

HH : Household

HHH : Household head

IERC : Institutional Ethics and Review committee

IMAM : Integrated management of acute malnutrition

KAP : Knowledge, Attitudes and Practices

KDHS : Kenya Demographic Health Survey

KII : Key Informant Interview

KNBS : Kenya National Bureau of Statistics

MAM : Moderate acute malnutrition

MMUST : Masinde Muliro University of Science and Technology

MOH : Ministry of Health

F-MUAC : Mid Upper Arm Circumference

NDMA : National Drought Management Authority

RA : Research assistants

SAM : Severe acute malnutrition

SHIF : Social health insurance fund

SMART : Standardized Monitoring and Assessment of Relief and Transitions

SPSS : Statistical Package for Social Sciences

UNICEF : United Nation Children Fund

WASH : Water sanitation and hygiene

WHO : World health organization

Operationalization of Terms

Alarm and Emergency threshold	These categorizations represent the number of admissions for severe acute malnutrition recorded at health facilities. They are used to identify surges or increases in malnutrition cases originating from the community, providing essential data to guide timely and appropriate surge responses or interventions.
CMAM	Empowered CHV screen, identify and manages malnourished child
Early detection	Identification of malnourished child as soon as the child F-MUAC reads yellow color on the F-MUAC tape.
Family MUAC (F-MUAC)	Broad bands is used by the caretakers of under five children to screen for malnutrition in their children with the aim of timely identification of changes in body measurements that indicate the child is malnourished.
Household head	Main person in the family/household who is recognized to be responsible for making decision, leads and provides the basic needs..
Knowledge	Knowledge here means the ability of caregiver to handle, insert, position, read, interpret F-MUAC measurement and describe the effects of malnutrition to the child, family and community.
Kraal	An enclosure of all livestock and all household in one fence, the group moves together in search of water and pasture and provide security to one another
Nutritional status	State of the body as determined by classification of F-MUAC by either being at Red as severe case of malnutrition or yellow moderate case of malnutrition.
Pastoralist/Nomadic community	Type of animal husbandry where the Nomadic community move with animals from one place to the other in search of water and pasture.
ReCos	Community health agents called Community Relays (in French, ReCos) - are community health workers
Utilization	Refers to the usage of the tape to screen under five children and referring the child for skilled treatment/support.

CHAPTER ONE

Introduction

This chapter discusses in depth the background information, statement of the problem, objectives, significance, justification, theoretical framework and conceptual framework of the study. It sheds more light on the purpose of the research and how it intend to accomplish the objectives of the study.

1.1 Background of the study

Family Mid-Upper Arm Circumference (F-MUAC) is a community-based malnutrition screening approach that empowers mothers, caregivers and family members to identify early signs of acute malnutrition in children using color-coded F-MUAC tapes. Unlike standard MUAC tapes designed for trained health workers, F-MUAC tapes is simplified so that even individuals with low literacy levels can easily use them. This approach promotes early detection of malnutrition before it advances to severe stages, thereby preventing complications, reducing treatment costs and improving recovery rates. By placing screening responsibility within households, F-MUAC strengthens community participation and ensures that more children is identified and referred for treatment in a timely manner.

Severe malnutrition (SAM) is a phenomenon present in the entire world since it is estimated that 45 million children below the age of five years have SAM and that 13.6 million children need some treatment every year. Though, merely one-fourth of these children are treated in time (UNICEF, World Health Organization & World Bank, 2023). It is a common situation that many children arrive at health facilities when malnutrition has already escalated to a severe stage, which means that it is treated late thus exposing the child to further complications, protracted hospital stays, and mortality. Facility based screening on its own has failed to suffice particularly in remote areas, conflict prone regions or inaccessible regions. This gap is filled in F-MUAC strategy because the strategy enables families to

implement frequent screenings at home where they can easily detect and refer children to get treatment.

The F-MUAC model has been piloted in over 16 countries across Africa such as: Niger, Nigeria, Chad, Mali and Ethiopia with positive outcomes in early diagnosis and better results. A randomized controlled trial conducted in Niger found that mothers were just as effective as trained community health workers to identify SAM by F-MUAC and prompted earlier hospitalization and fewer complications (Alé et al., 2016). Equally, in Chad and Mali, F-MUAC boosted caregiver confidence, raised screening rates and alleviated the overstressed health systems (International Rescue Committee [IRC], 2021). In addition, it has been found that family-based screening is cost-effective and the screening by mothers is about USD 1.04 per child as opposed to USD 3.00 screening by the community health workers (Alé et al., 2016; Blackwell et al., 2015). These findings underscore the potential of F-MUAC to improve community-level interventions to reduce malnutrition especially in Western and Central African regions with high malnutrition levels.

In Kenya, the F-MUAC model that was first implemented as a nationwide intervention in 2017 and experienced a series of boosts by the COVID-19 pandemic when health facilities access dropped. The program has particularly been effective in the pastoralist and dry areas like Turkana where screening on facilities is difficult due to logistical and accessibility problems. Pilot projects in Nairobi, Baringo and Isiolo proved that trained caregivers were able to find malnutrition efficiently as community health workers and achieve higher rates of early case diagnosis and timely referrals (Save the Children, 2021). The F-MUAC strategy was piloted in Turkana County where malnutrition is among the largest in the country to understand its efficacy to detect and treat malnutrition among pastoralist populations; it has potential to be a sustainable and community-based intervention as a solution to close service delivery gaps (Action against Hunger, 2018).

1.2 Problem Statement.

Malnutrition is one of the perennial public healthcare issues affecting the Turkana South region of Kenya, especially among the nomadic populations whose exposure to health services is a challenge and inconsistent. Even after continuous nutrition programs, it is still found that a good number of cases of Severe Acute Malnutrition (SAM) is reported at a late stage where children present themselves at the health facilities when the Mid-Upper Arm Circumference (F-MUAC) records within the red band (less than 11.5 cm), which is a critical situation. The result of such late diagnosis is that the chances of recovery are significantly low, the risk of death is elevated, the treatment periods are extended and the health care costs are high.

The Health and Nutrition Survey that was carried out by the Ministry of Health in January 2023 in cooperation with the UNICEF and other partners showed that the SAM prevalence in Turkana South has 7.4%. This figure dipped to 4.7% as of June 2023 but it is still higher than the emergency level. Simultaneously, signs of chronic malnutrition deteriorated with the global stunting rates climbing to 27.8% in June 2023, compared to 23.0% in June 2022, and the severe stunting rates rising up to 8.8% in June 2023. The data presented by the Integrated Management of Acute Malnutrition (IMAM) Surge dashboard (Turkana County Government, June 2024), further suggests that 17 out of 26 health facilities in the sub-county had already exceeded SAM admissions thresholds, which is a matter of concern on the case rates of malnutrition.

The lack of use of community-based screening methods like the Family Mid-Upper Arm Circumference (F-MUAC) tape is one of the main critical factors that lead to the delays in the detection of child malnutrition. This instrument will enable the caregivers to detect malnutrition at an early stage at the domestic level and pursue medical attention in time. Only in the case of nomadic populations, it is impeded by the barriers of poor knowledge and little training, poor color coding interpretation and mobility obstacles. Therefore, the number of malnourished children who go unnoticed until their

condition deteriorates is high.

The study at hand thus aims at evaluating the use of F-MUAC tapes in early identification of malnutrition in children aged 6-59 months among caregivers based on nomadic communities in the Turkana South. The results will be used to determine areas of knowledge deficiency, use and contextual barriers, and to present evidence based information to enhance community based nutrition surveillance and early malnutrition detection in pastoralist communities.

1.3 Study Objectives

1.3.1 Broad Objective

In order to determine the use of Family Mid-Upper Arm Circumference (F-MUAC) tape in the immediate identification of malnutrition in children among nomadic Turkana South Sub-County, Turkana County, Kenya.

1.3.2Specific Objectives

1. To find out things that affect household use of F-MUAC tape amongst caregivers in family of children aged 6-59 months in nomadic communities of Turkana South within the preceding two weeks before the time of study.
2. To determine the reliability and validity of F-MUAC when evaluating the use of the technique by the caregivers of children under the age of five years within the study area in Turkana South.
3. To evaluate caregivers' knowledge and interpretation of F-MUAC tape color codes for early detection of child malnutrition during the study period in Turkana South.
4. To determine the relationship between caregivers' knowledge and interpretation of F-MUAC tape color codes and the household utilization of F-MUAC tape among caregivers of children aged 6–59 months in nomadic communities of Turkana South.

1.4 Research Questions

1. What factors influence household utilization of F-MUAC tape among caregivers of children aged 6–59 months in nomadic communities of Turkana South within the two weeks preceding the study?
2. How consistent and accurate is the use of F-MUAC tape by caregivers of children under five years in Turkana South?
3. What is the level of caregivers' knowledge and interpretation of F-MUAC tape color codes for early detection of child malnutrition in Turkana South?
4. What is the relationship between caregivers' knowledge and interpretation of F-MUAC tape color codes and the household utilization of F-MUAC tape among caregivers of children aged 6–59 months in nomadic communities of Turkana South?

1.5 Hypothesis

Null Hypothesis (H_0):

i. There is no significant association between socio-demographic, economic or contextual factors and the utilization of F-MUAC tape among caregivers in Turkana South.

ii. Caregivers in Turkana South do not demonstrate adequate knowledge or correct interpretation of F-MUAC tape color codes for identifying malnutrition.

1.6 Justification of the study

According to the National Drought Management Authority (NDMA), there are four main livelihood zones in the county. Approximately 60% of the population are pastoralists, 20% are agro-pastoralists, 12% are fisherfolk and 8% engage in urban or peri-urban formal and informal employment (Advancing Nutrition, 2021). Despite ongoing nutrition interventions, malnutrition has remained persistent in the county with

many children presenting at health facilities in the severe stage of malnutrition. Periodic screening using F-MUAC tapes facilitates earlier diagnosis of acute malnutrition which if addressed promptly can reduce morbidity and mortality, lower program costs through shorter treatment durations and minimize the number of children requiring expensive inpatient management for complicated severe acute malnutrition.

While the effectiveness of F-MUAC has been demonstrated in other settings such as Niger and Chad, studying its utilization among pastoralist communities in Turkana remains crucial. Contextual differences including nomadic lifestyles, mobility patterns, limited access to health services, cultural feeding practices and high poverty levels may influence the uptake, consistency and accuracy of home-based screening. The knowledge of the impacts of these peculiarities on the implementation of F-MUAC will produce locally relevant evidence that may be used to tailor the approach to the needs of nomadic populations.

The study will thus seek to evaluate the use of F-MUAC among the pastoralists in the Turkana community and the impediments and conditions that support its successful application. In contrast to the previous studies which were mainly based on efficacy, the present study will address the practical implementation concerns that include the engagement of caregivers, the rate of screening and connection to health facilities through referrals. Addressing those gaps, the study will offer evidence to direct policy modifications, enhance implementation of F-MUAC in established Community-Based Management of Acute Malnutrition (CMAM) and Integrated Management of Acute Malnutrition (IMAM) interventions and empower the early detection processes in mobile populations.

The timeliness of this research is particularly high because climate shocks, repeated droughts and food insecurity remain in the process of exacerbating nutritional outcomes in Turkana. Enhancing family-based screening can be a sustainable community-based intervention to reduce the malnutrition trends, referrals can be made in time, and overstretched health systems can also be relieved. The result will make available practical advice to the policy makers, health managers and implementing partners to improve the F-

MUAC coverage, training and supply chain support to similar arid and semi-arid areas.

4.4 Significance of the study

The research results of this study will go directly to Kenya health and nutrition agenda under the Bottom-Up Economic Transformation Agenda (BETA) and the Health Pillar that focuses on equitable access to affordable quality health care by all. The operationalization of these national priorities is achieved through programs like Universal Health Coverage (UHC), better health facility capacity and bettering communal health systems. The study achieves the larger aim of preventive and promotive health care, the core of which is in Kenya UHC, by promoting early detection of malnutrition by ensuring F-MUAC screening in communities.

On the policy level, the study contributes to Kenya by helping it achieve its goal of eradicating every type of malnutrition by 2030 as stated in the Kenya Nutrition Action Plan (KNAP 20182027) and Food and Nutrition Security Policy (FNSP, 2011, revised 2022). These frameworks highlight the solutions of under-nutrition under the community led approach by early identification and prompt control of under-nutrition as the strategy to realizing a healthy and productive population.

On the basis of its goals, the outputs of the study on the utilization and factors contributing to utilization and coverage of F-MUAC will provide a practical evidence that can be used by local counties as well as nationally in their decision-making. First, the utilization research will provide evidence on how the caregivers and households in Turkana use F-MUAC to perform regular screening, which will provide insight into the reach of operations of the program. Second, determining the aspects that support or impede utilization like the availability of tapes, cultural beliefs, movement patterns and health worker support will determine specific action to be taken to promote adoption amongst nomads. Third, coverage evaluation will be used to identify the extent to which the intervention is implemented and areas of service delivery will be identified.

Such insights will be used to inform the nutrition planning at the county level especially with regard to the technical capacity and structural issues in the Turkana County Nutrition Action Plan. The findings will inform the process of improving the integration of F-MUAC intervention in Community-Based Management of Acute Malnutrition (CMAM) and Integrated Management of Acute Malnutrition (IMAM) initiatives. In addition, the study, through its focus on the role of caregivers in regular nutrition checking, shall offer suggestions on how to make the F-MUAC model fit the nomadic setting to be inclusive, sustainable and cost-effective. Finally, the results will benefit the overall goal of Kenya in attaining zero hunger and malnutrition by 2030 by having stronger community health systems, enhanced early detection and responsive policy.

1.7 Scope of the study

The study was conducted in Turkana South Sub-County and the 3 administrative wards were sampled out of a total of 5. Research was conducted by randomly selecting community units linked to health facilities and identification of mother-to-mother support groups that were trained by health and nutrition partners. The sample households included those that were provided with F-MUAC tapes. Data was collected by 10 research assistants across 10 days, utilizing qualitative as well as quantitative methods to assess F-MUAC usage and challenges at the household level.

1.8 Limitations of the Study

This study utilizes a cross-sectional research design, which restricts the ability to establish causal relationships between F-MUAC utilization and early detection of malnutrition among the nomadic population of Turkana South. Because data are collected at a single point in time, changes in malnutrition status or F-MUAC practices over time cannot be observed. Additionally, the reliance on self-reported data from family members regarding F-MUAC use introduces the possibility of recall bias and social desirability bias potentially impacting data accuracy. Variability in measurement techniques and tools

used by family members may further affect the reliability of the data. Moreover, the research design does not fully control for confounding factors such as seasonal variations in food availability, access to healthcare and cultural practices which may influence both malnutrition prevalence and the use of F-MUAC at the household level.

1.8.1 Delimitations

This study is deliberately confined to assessing the utilization of F-MUAC as the sole method for early detection of malnutrition, excluding other diagnostic approaches such as clinical examinations or biochemical testing. Geographically, the study focuses exclusively on the nomadic communities within Turkana South, limiting the scope and generalizability of the findings to other nomadic populations or regions. The research is further delimited by targeting children under five years of age as this age group is most vulnerable to malnutrition and the primary focus of early detection efforts. The cross-sectional nature of the design means that the study does not include longitudinal follow-up to assess changes in F-MUAC utilization or malnutrition outcomes over time. Lastly, the study is observational, does not involve any interventions or training programs aimed at improving F-MUAC use, focusing instead on the status, and factors influencing utilization.

1.9 Theoretical Model

This study is grounded on the Health Belief Model (HBM), which helps explain health behaviours based on an individual's perceptions of severity, susceptibility, benefits and barriers. The HBM suggests that people are more likely to engage in health-promoting behaviour when they perceive a high threat from a health condition (e.g., malnutrition) and believe that acting (e.g., using F-MUAC) will reduce that threat.

Key components of HBM applied in this study include:

The Health Belief Model (HBM) was employed as the guiding theoretical framework for this study to

explain and predict caregiver behaviors related to the utilization of Family Mid-Upper Arm Circumference (F-MUAC) screening for early detection of acute malnutrition among children in Turkana South. Developed in the 1950s, the HBM posits that individuals' health behaviors are influenced by personal beliefs or perceptions about a disease and the strategies available to decrease its occurrence (Rosenstock, 1974).

Perceived Severity - Caregivers' belief in the seriousness of malnutrition and its potential consequences for the child and family.

Perceived Susceptibility -The awareness of the risk of malnutrition within the community.

Perceived Benefits - The benefits of early detection including quicker recovery and reduced treatment costs.

Perceived Barriers - The perceived challenges to using F-MUAC, such as lack of time or knowledge.

In this study, mediating variables such as caregivers trust, measurement errors and integration with health system directly shaped the perceived susceptibility, perceived benefits, perceived barriers and self-efficacy components of the model.

1.10 Conceptual framework

Figure 1 below presents the conceptual framework of the study, which illustrates the relationship between the utilization of the F-MUAC tape and the early detection of malnutrition among the nomadic population of Turkana South.

The framework shows that utilization of the F-MUAC tape (independent variable) directly influences the early detection of malnutrition (dependent variable). The more knowledgeable, skilled and consistent caregivers are in using the F-MUAC tape, the more likely they are to identify malnutrition in its early stages, allowing for timely intervention and prevention of severe outcomes. Social economic factors may

strengthen or weaken the relationship between F-MUAC utilization and early detection. For example, families with better health knowledge or easier access to health facilities may utilize F-MUAC more effectively than those facing mobility challenges.

In summary, the conceptual framework posits that effective utilization of the F-MUAC tape enhances early detection of malnutrition, while socio-demographic and contextual factors influence the strength and direction of this relationship

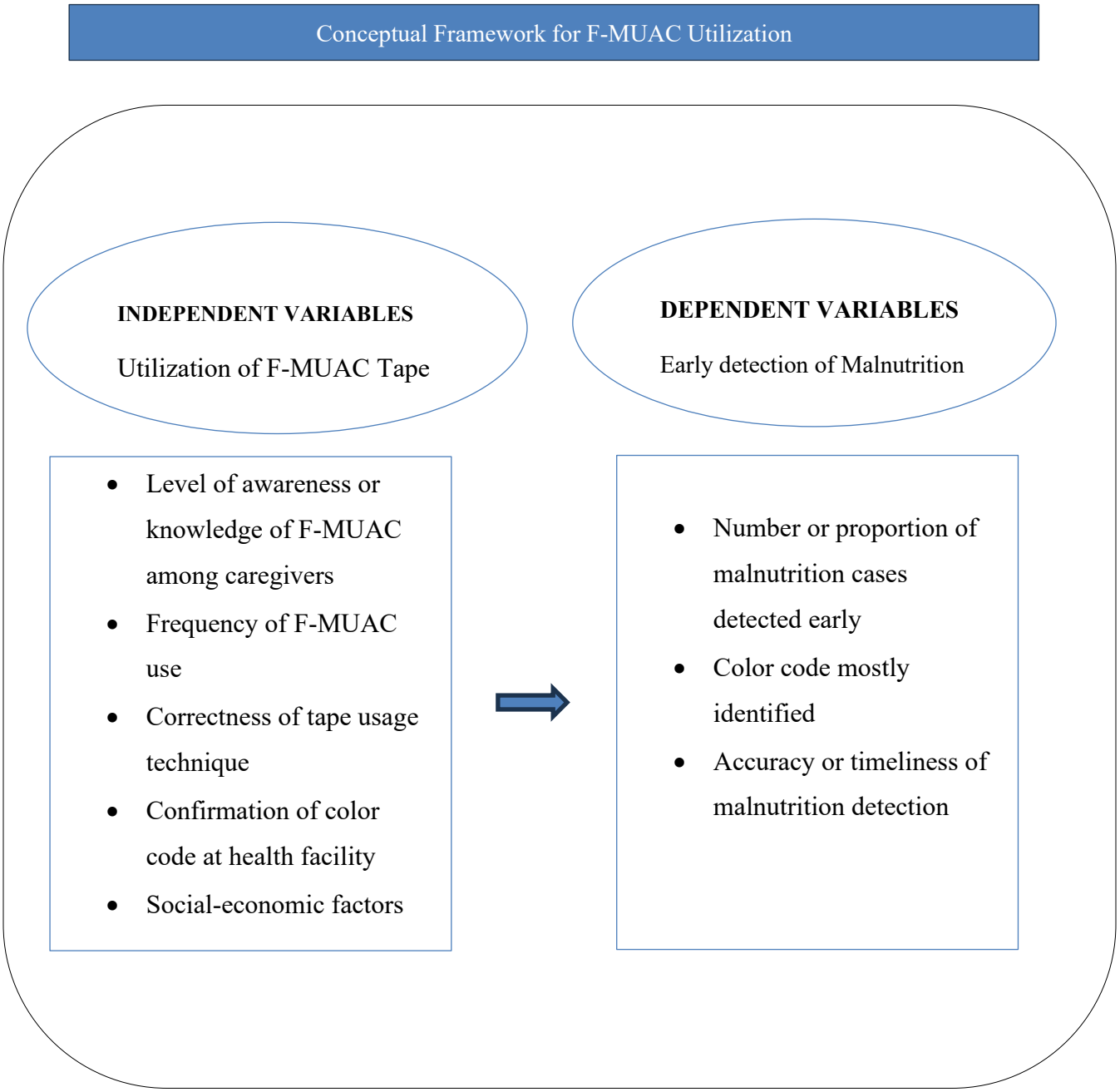

Figure 2 Conceptual framework for early detection of malnutrition using family F-MUAC

CHAPTER TWO – LITERATURE REVIEW

Introduction

This chapter reviews literature on the F-MUAC approach, which empowers caregivers to measure their children's mid-upper arm circumference for early malnutrition detection especially in nomadic communities. This method improves community involvement and overcomes barriers caused by limited health access and mobility (UNICEF, 2018; Kimani et al., 2021). While the Community Health Strategy (CHS) supports health delivery by using mobile outreach teams and locally recruited Community Health Volunteers to reach migrating populations, its implementation is challenged by population movement and poor infrastructure. F-MUAC shifts routine screening to families, making it practical in settings like Turkana South where distance and insecurity limit contact with health workers. This approach strengthens early detection and timely treatment of malnutrition. The following section examines F-MUAC interventions, focusing on how household involvement enhances child nutrition and health outcomes in resource-limited and mobile populations.

2.1 F-MUAC intervention

The F-MUAC (Mid-Upper Arm Circumference) approach was first developed and tested by the Alliance of International Medical Action (ALIMA) in Niger, with the aim of training mothers and caregivers to screen children for signs of malnutrition. The initial trial trained 12,893 caregivers to use the F-MUAC tape as a primary screening tool, providing color-coded classifications to assess children's nutritional status. The Mothers Zone and CHWs Zone were used to compare effectiveness, with Mothers Zone showing a higher likelihood of referral to health centers. By the end of the pilot project, 60% of mothers were trained and more than 70% of Community Management of Acute Malnutrition (CMAM) admissions were referred by mothers (Alé, 2016).

Subsequent interventions have expanded the approach with organizations like World Vision scaling up the use of F-MUAC across Mauritania and other regions. For instance, 1,879 mothers were trained in the Assaba region to screen children aged 6-59 months. By 2018, the program expanded to over 8,500 mothers trained across five regions (Hod El Charqui, Hod El Gharbi, Guidimaghama, Brakna, and Assaba) through partnerships with ADICOR, AMAMI, and other organizations. Similarly, Première Urgence International introduced the approach in Chad's Ouaddaï province, increasing screening coverage from 79.6% to 85.5% through family-led screenings (Olusola et al., 2022).

2.2 Knowledge of mother's/caregivers on utilization of F-MUAC

Continuous decentralization on the use of F-MUAC has led to simplification of the tools to include mother or caregivers of under-five years children to use F-MUAC to identify early signs of malnutrition in their children and refer appropriately. The main role of caregiver here is to ensure he or she assesses the child using F-MUAC weekly or monthly basis. This involves correct placing of the tape on the left upper part of the arm, ensuring correct positioning of the arrows on the reading window and be able to read and interpret finding while making correct decision to seek for appropriate action. The results of the studies provided evidence that mothers/caregivers can perform sensitive and specific classifications of their child's nutritional status using F-MUAC with a higher sensitivity of over 93%, (Grant, A. et al, 2018). Further findings suggest that the choice of arm exact location of the tape on the upper arm is not important for screening children; it is likely the choice of arm remains relevant when measuring adolescents and adults. Frequent screening by mothers would allow early diagnosis and treatment of SAM in their children. This study demonstrated that mothers could classify their children by F-MUAC and it suggests mothers can do F-MUAC regularly. (Blackwell, N et al, 2015)

The study by Aguayo and colleagues provides compelling evidence supporting family-led F-MUAC screening programs in East African contexts. Their research demonstrates that with adequate training,

caregivers can achieve remarkable proficiency in malnutrition detection, with accuracy rates exceeding 90% in F-MUAC measurements. This finding underscores the potential of community-based approaches effectively identifying malnutrition cases without relying solely on healthcare facilities.

Several critical success factors emerged from their analysis. The implementation of these programs required not only intensive initial training but also regular refresher sessions to maintain skills. Successful programs characterized by strong community engagement strategies and seamless integration with existing health systems, particularly through community health worker networks. (Aguayo, V.M, et al.,, 2016). Finding from this research provides an insight on the accuracy, frequency, knowledge and utilization of the F-MUAC tape by the caregiver in Turkana south, looking on the relationships between the social economic and demographic status of specific household and their impact on the use of F-MUAC. The effectiveness of F-MUAC interventions largely depends on caregivers' training and knowledge. Proper training guarantees accurate measurement and accurate interpretation of F-MUAC results which is crucial in the early identification of malnutrition (Nambiar, 2014).

2.3 Utilization of F-MUAC in early detection of child malnutrition

Family Mid-Upper Arm Circumference (F-MUAC) screening is now a critical intervention for improving early child malnutrition diagnosis in low-resource settings. Most studies highlight its effectiveness when implemented in community health programs. In Sierra Leone for instance, it was found that 80% of mothers who received training for the F-MUAC were able to accurately identify malnutrition in their children, with similar levels recorded in Senegal and Madagascar (60–93% accuracy) (Olusola et al., 2022). These findings point to the possibility of structured training making caregiver proficiency in screening for malnutrition a reality. Also, an NGO rapid review report quoted that 86% of self-referrals from F-MUAC were valid SAM cases, demonstrating its potential for enhancing screening coverage when used optimally (Action against hunger, 2022). However, there are variations across regions. In Chad,

health facility diagnoses concurred with just 63.2% of maternal evaluations likely because health systems were weaker and communities were less engaged (Grant, A. et al, 2018). These variations emphasize the significance of contextual factors such as government commitment, healthcare infrastructure and cultural acceptability in the implementation of F-MUAC.

The application of F-MUAC is effective in the prevention of severe malnutrition across different settings. In India, a community intervention led to a 32% reduction in SAM among children aged 6–24 months and emphasized the value of early detection and caregiver support (Kapur, 2019). Similarly, Ethiopia's Health Extension Program effectively integrated F-MUAC into its community health program with beneficial effects on malnutrition screening and referral rates (Teklie, H. et al, 2020). These gains are contrasted with challenges faced in Chad, where limited training and logistical difficulties lowered F-MUAC precision (Grant, 2018). One key driver of success in Ethiopia was the deployment of trained community health workers (CHWs) which supplemented caregiver training and provided regular follow-up support (Teklie, H. et al, 2020). Such findings suggest that sustained training, supervision and health system integration are key to ensuring optimal effectiveness for F-MUAC.

Despite the promise, most of the available evidence on F-MUAC is based on program evaluations and not on stand-alone research which can introduce bias. An independent assessment in this study of F-MUAC use in Turkana South, Kenya, addresses some gaps in caregiver training as well as enhancing measurement accuracy. Misplacement of F-MUAC tapes and incorrect interpretation of F-MUAC readings have been identified in earlier studies as major barriers to effectiveness (Gera, T. et al, 2017). Besides, climate-related shocks such as drought and food insecurity elevate the risk of malnutrition, necessitating adaptive F-MUAC (UNICEF, 2023). By both utilization rates and contextual issues analysis, this study provides an even perspective of F-MUAC's role in preventing malnutrition thus enabling policy recommendation to pastoralist communities.

2.4 Factors affecting utilization of F-MUAC

The Family Mid-Upper Arm Circumference(F-MUAC) methodology gives caregivers especially, mothers the power to identify malnutrition of children early in the home. Although the practice has been successful in enhancing screening coverage and early detection, its long-term use has been a big challenge when it is not supported by other parties. F-MUAC is a success that requires not only preliminary training but the constant encouragement, the refresher training and the community support networks especially when working with nomadic and low-resource communities like Turkana South (UNICEF, 2023; Mwesigye, 2020).

The knowledge of the caregivers, the ability to interpret and intrinsic motivation are the main factors that influence the adequate use of F-MUAC. Indian and Kenya research indicates that most mothers are initially able to use the F-MUAC tape correctly, but over time with non-reinforcement use decreases. As an illustration, in India only 30% of caregivers screened their children seven months after training (UNICEF, 2023). Sustenance of use therefore requires refresher training, peer support and community engagement. In contrast to monetary benefits, the personal drive of mothers to prioritize the well-being of their children has been identified to implement a more sustainable model of engagement (Oladeji et al., 2022).

Community health systems are also a very important factor in maintaining F-MUAC usage. Follow-up, mentorship and motivation are facilitated by Community Health Workers (CHWs) and Community Health Volunteers (CHVs) and largely determine further engagement of caregivers. Homesteads that were receiving monthly CHV visits in the Turkana County were 4.5 times more probable to have regular F-MUAC screenings relying on the absence of follow-up (Mwesigye, 2020). Nevertheless, continuity is usually interrupted by nomadic lifestyles and migration behavior with up to 38% of the caregivers lost to follow-up at seasonal migration. A community-based approach by using community elders, peer networks

and mobile health units could be used to maintain follow-ups of the mobile populations (Oladeji et al., 2022).

Community engagement and adaptability are very critical in coverage and sustainability of F-MUAC interventions. In some places in Africa, like Nigeria and South Sudan, early program coverage was between 80 and 85 per cent (Alé, 2016; UNICEF, 2023). Sometimes, however, the coverage tends to dwindle with a termination of the external project assistance. In Turkana, F-MUAC tapes were available to all the sampled households but were only used by 70% of the participants on a regular basis (Mwesigye, 2020). Compared studies report no or better performance of the mother-led F-MUAC model in comparison with CHW-led screening with high accuracy of detection, higher cure and 27% less cost of the program support (Diop et al., 2023; Oladeji et al., 2022). Other contextual influences, including nomadic movement, food insecurity and low literacy also influence long-term F-MUAC use. Indian studies indicate that low-literacy caregivers are better adherers and accurate with mobile health reminders, pictorial job aids, peer learning groups, and pictorial job aids (Jadhav, 2018). Nevertheless, caregivers tend to discontinue screening when the F-MUAC of their child is restored to normal, which implies that more effective preventive education is required (Jadhav, 2018). It is necessary to focus on these barriers to make community-based interventions culturally-specific in order to maintain long-term F-MUAC sustainability in nomadic communities such as those found in Turkana south.

2.5 Summary

The analyzed literature highlights the importance of the F-MUAC method in empowering caregivers especially mothers to identify early malnutrition in children below the age of five and thus enhance prompt referrals and treatment in resource constrained and nomadic areas. The experience of different settings such as Niger, Chad, India and Kenya, Turkana County indicate that when the caregivers are trained and supported by the community, they can measure and interpret the F-MUAC readings successfully; driving

more coverage and health improvement. Nevertheless, maintaining a steady implementation of F-MUAC is a major issue particularly in nomadic communities whereby mobility, poor follow-up and logistical provisions lead to underutilization and loss to follow-up.

This under use is also a factor that has led to the chronic issue of late reporting of cases of malnutrition in health centers which undermines early intervention measures. Although the program is promising to evaluate, there are gaps in the interpretation of the socio-demographic and contextual determinants of F-MUAC adoption and continuation in the group of nomadic caregivers. The proposed paper will thus help to address these gaps by studying knowledge, usage and impediments of the F-MUAC utilization in Turkana South to inform specific interventions that can help to instigate early malnutrition surveillance and decrease morbidity and mortality related to malnutrition.

CHAPTER THREE - MATERIALS AND METHODS

Introduction

This chapter addresses various aspects of study execution. It presents details of the study area, research design, target population, inclusion and exclusion criteria and sampling strategy. It also presents research protocol and instruments, their reliability and validity, quality assurance, pretest, data presentation and analysis, ethical approvals and logistical considerations.

3.1 Study area

The study area for this research is Turkana South Sub-County, Turkana County, Kenya. Turkana South is predominantly inhabited by nomadic and semi-nomadic pastoralist communities who depend on livestock for their livelihood. The area experiences frequent droughts, high food insecurity and poor access to health services due to its vast terrain and limited infrastructure. These factors contribute to recurrent cases of acute malnutrition among children under five. The nomadic lifestyle characterized by frequent migration and lack of fixed settlements poses challenges to consistent health monitoring and follow-up, making it an ideal setting for examining the utilization of F-MUAC for early detection of malnutrition.

3.1.1 Geography and climate

The sub-county is situated on the southern part of Turkana County and has five wards: Katilu, Lokichar, Lobokat, Kalapata and Kaptir. The Turkwel Riverine Agro-Pastoral Livelihood Zone is located along the Turkwel River, where irrigation schemes have been developed in what is otherwise a semi-arid to arid area. Turkana South lies in Kenyan semi-arid region that is severely food insecure because of inadequate rainfall (averaging <300mm annually) and prolonged droughts which destroy pastoralist livelihoods by reducing pasture and livestock productivity. Distance to water sources usually >10km forces households to accord water fetching priority over farming or income-generating activities, further restricting food access. These climatic and environmental conditions disrupt

traditional coping strategies leading to high malnutrition rates. These cyclical malnutrition and poverty are a feature of the intervention required for climate-resilient solutions.

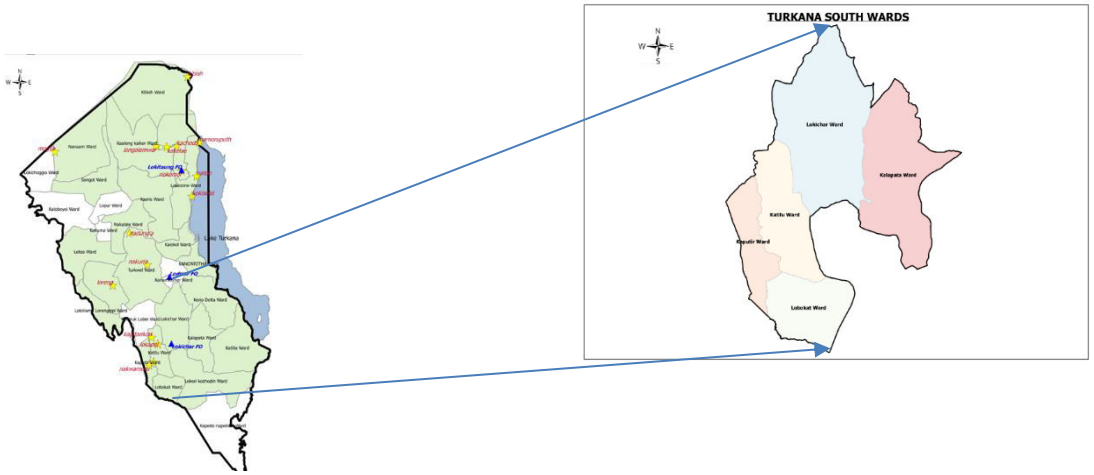

Figure 3 Map of Turkana showing administrative wards in Turkana south

3.1.2 Livelihoods

Residents of Turkana south are majorly pure pastoralist and agro-pastoral livelihood zone where households both grow crops and rear livestock in addition to pursuing other income generating activities like charcoal production, handicrafts, brewing, petty trade, casual labour and building material sales. The population is made up of former pastoralists who previously only engaged in opportunistic farming. The main crops grown are sorghum, maize, green grams, cow peas, vegetables, watermelon, pumpkins and butternut. The main types of livestock kept are goats and sheep, cows and camels.

3.2 Study design

The study used a descriptive analytical cross-sectional study. Cross-sectional studies are observational and involve the measurement of data at one point in time. This design was chosen to measure the rate of F-MUAC utilization at home level, assess the relationship between caregiver attributes, knowledge and accuracy in using the F-MUAC tape and explore associations between awareness, training and practice.

3.3 Study population

These were household members who had access to F-MUAC tape in Turkana south, trained and equipped with F-MUAC tapes and should be from Turkana South Sub-County pastoral livelihood Zone. The primary respondent comprised of mothers/caregivers with child/children aged 6-59 months old and secondary respondents were community health promoters (CHPs) supporting the selected mother to mother support groups selected, local health facility staff and nutritionists.

3.3.1 Inclusion criteria

This study included household with children aged 6-59 months and who were the residents of Turkana South by the time of the study. They should be pastoralists.

i. A household with F-MUAC tape.

ii. Only mothers/caregiver who gave consent to participate in the study were to be included.

iii. Only one family member within the household at the time of the study will be interviewed.

3.3.2 Exclusion criteria

i. Household without under- five child.

ii. Households that refuse to provide informed consent.

iii. Household without F-MUAC tape

iv. Un sampled household was not interviewed.

For the safety of the team household in the insecure region was not interviewed.

3.4 Study variables

3.4.1 Dependent variable

The dependent variable in this study is the early detection of malnutrition among children under five years. Early detection refers to the timely identification of malnutrition at its initial stages before the onset of severe complications enabling prompt treatment and recovery. This outcome will be evaluated

using indicators such as the rate of early detection, timely identification and referral and accuracy of diagnosis by caregivers. The rate of early detection will be measured by the proportion of malnutrition cases identified through F-MUAC compared to total reported cases. Timely identification & referral assesses the proportion of malnourished children identified who the caregivers were able to refer for intervention. Accuracy evaluates the degree to which caregiver-reported F-MUAC classifications (green, yellow, or red zones) correspond with research assistant assessments. These indicators will provide insight into how effective F-MUAC utilization is in achieving the goal of reducing late presentations of malnutrition and improving child survival in nomadic settings like Turkana South.

3.4.2 Independent variable

The independent variable in this study is the utilization of the F-MUAC tape by caregivers for early detection of malnutrition among children under five years. Utilization refers to the extent to which caregivers apply the F-MUAC tape correctly, consistently and confidently in monitoring their children's nutritional status. This variable will be assessed through several indicators including knowledge, frequency of use and technique or skill level. Knowledge captures caregivers' understanding of F-MUAC use, interpretation of color codes and recognition of malnutrition signs. Frequency assesses how often caregivers conduct F-MUAC screening in the last two weeks. Technique evaluates the accuracy of tape placement and reading reflecting the caregiver's competence. Together, these indicators will help determine how effectively F-MUAC is utilized in nomadic households and what factors influence consistent and correct application.

Table 3.1 Dependent and independent Variables

Variable Type	Variable Name	Indicators	Data Collection Tools	Data Analysis Methods
Independent Variable	**Utilization of F-MUAC Tape**	Knowledge of F-MUAC use Frequency of screening Technique/accuracy of measurement Occupation, Household mobility and access to service	Structured questionnaire Observation checklist Key informant interviews Socio-demographic section of caregiver questionnaire	Descriptive statistics Chi-square tests for association Correlation analysis Descriptive statistics Multivariate regression to assess moderating effect
Dependent Variable	**Early Detection of Malnutrition**	- Rate of early detection - Timeliness of identification - Accuracy of caregiver diagnosis	Review of Ras Measurement & Caregiver measurements Observation checklist	Descriptive statistics Logistic regression

3.5 Sampling method

Turkana south was selected purposefully due to its high rate of severe malnutrition compared to other sub-counties. The sampling frame for the study was MOH 513 registered households in selected community health unit (CHU) catchment areas in Turkana South Sub-County. A multistage cluster sampling approach was employed to obtain geographic and demographic representation of the nomadic and semi-nomadic populations. During the first stage, administrative wards were identified then Kraals or villages were randomly selected from a list of active CHU catchment areas. In the second stage, mother-to-mother support groups (M2MSGs) within each of the chosen villages were identified as priority platforms to identify study participants. Household heads from these groups were subjected to simple random sampling to select a household that will participate in the study. To complement household-level data, Key Informants were chosen purposively based on their direct engagement in

the provision of nutrition services or F-MUAC promotion at the community level. These included Community Health Promoters (CHPs), nutrition personnel at health facilities and program officers who were supporting implementation of the F-MUAC approach in Turkana South. The figure below illustrates the flow of study participants identification.

Multi- stage cluster sampling flow chart

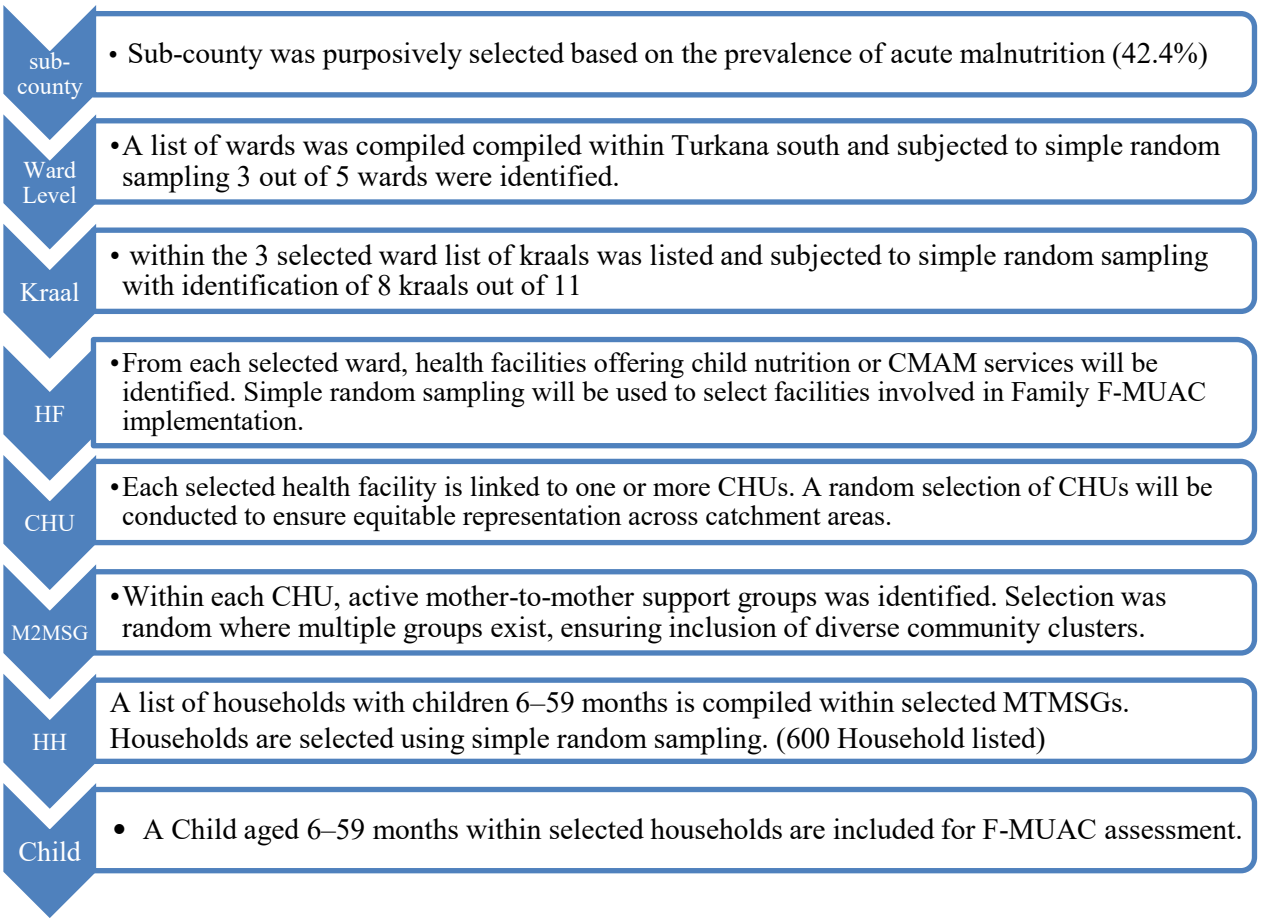

Figure 4 Multi-Stage Sampling Design for F-MUAC Utilization in Nomadic Communities.

Sampling design

Sampling strategy.

List of all household with under five years children in kraals and have F-MUAC and trained on the use of the tape accessed from the link health facility was compiled. Each household was coded and randomly selected using random numbers table to identify household to participate in the survey. Each household had an equal chance of selection using simple random sampling. During the interview, a

household member who frequently use F-MUAC tape was engaged during the interview. For focus group discussions, group of mother-to-mother support group was sampled one per village.

3.6 Sample size calculation for HHs interviews

To calculate the required minimum sample, the principal investigator used the Fischer sample size formula to determine sample size as follows: $\mathbf{n = (z)^2\, p\, (1 - p) / d^2}$

where p = 1/2 (0.5)

$n = (z)^2 / 4d^2$

n = sample size

z = level of confidence according to the standard normal distribution (for a level of confidence of 95%, z = 1.96,

p = estimated proportion of the population that presents the characteristic (when unknown we use p = 0.5)

d = tolerated margin of error (for example we want to know the real proportion within 5%)

therefore

$No = (1.96)^2 / (0.5)\,(0.5) * 4 = 384$

A finite sample was calculated as the total target population is less than 10,000 that is 600 mothers with F-MUAC Tape

$$\mathbf{n_finite = (N * n) / (N + n - 1),}$$

Where n= sample size desired & N= the estimate of the population size.

n = (600*384)/600+384-1)

n =234.

The sample size for the study was 234 respondents. A 5% of the population was added. to cater for non-response. Thus, a sample of 244 respondents was correct representative of the population with F-MUAC tape in the three wards.

A priori power analysis (Faul et al., 2009) determined that 234 participants were needed to detect a 15% difference in F-MUAC utilization rates (power = 80%, $\alpha = 0.05$, two-tailed test). The final sample (N=244) exceeded this target. Primary analyses used logistic regression (for ORs) and chi-square tests (for proportions), with significance at $*p* < 0.05$. While the sample powered main findings, subgroup comparisons (e.g. by location) were interpreted cautiously due to smaller cell sizes.

3.7 Data and information collection

The demographic and economic status of the household was collected including but not limited to skills on the use of F-MUAC, understanding of referral mechanism and possible challenges they encounter while implementing F-MUAC approach.

Procedure *data*

Data for this study were collected using a mixed-methods approach, combining structured household surveys, direct observation and Focus Group Discussions (FGDs) to comprehensively assess the utilization, coverage and determinants of F-MUAC among caregivers in Turkana South.

3.7.1 Qualitative data collection tools

Use of focus Group Discussion guide during discussions with mothers to get more details regarding their understanding of F-MUAC and their nutritional knowledge, malnutrition and its cause within the community. The researcher used Key Informant Interview guide to get information from the Key Informants.

3.7.2 Quantitative data collection tools

Primary data were gathered through structured interviews administered to selected caregivers of children aged 6–59 months. The survey tool included modules on demographic information, knowledge of malnutrition, awareness and use of F-MUAC tapes, frequency of screening and past referrals. To assess the caregiver's knowledge of malnutrition, participants were asked to state signs and symptoms of malnutrition and to describe its health effects on both the child and the household. In addition to interviews, enumerators conducted direct observations of each caregiver's ability to perform F-MUAC measurements. The mother or primary caregiver was asked to demonstrate how she takes F-MUAC measurements on a child and her technique was assessed using a standardized checklist based on tape positioning, reading alignment and interpretation of colour bands. Observers documented whether caregivers correctly identified green, yellow and red and interpreted the result accurately in terms of malnutrition severity.

3.8 Quality Assurance

Research assistants trained in nutrition and who have experience in data collection were engaged in data collection and data entry. Research assistant should be fluent in Swahili or English and having experience with the local language was an added advantage. Principle investigator trained the research assistance on data collection methods and piloting of the tools. Data collection involved use of mobile app software i.e. ODK. Periodic monitoring with schedule debriefs every day helped in addressing challenges and providing the required guidance.

3.8.1 Reliability of data collection tools

Data collection tool was pretested to check for its reliability and validity, the consistency and the ability of the tool to provide data set required. The research assistant used a test re-test method to ascertain whether the questionnaire was consistent in collecting required data. Same respondent was interviewed more than once after a week to check for this. The exercise was done two weeks before the actual research was done. The sample size was 10% of the research sample size (244) making up 24 participants.

3.8.2 Validity of data collection tools

Data collection tool should be able to collect accurate information that serves the purpose of the research. This was taken care of by ensuring that the right sampling design, the correct tool and sample size is gotten. Peer review and pretesting of the tools supported in ensuring that the questionnaire can collect the response to the key objective of the research.

3.8.3 Pretest Results and data use

Prior to the actual data collection, pre-testing of the data collection tools was conducted in a neighbouring sub-county - Loima within Turkana County that shared similar characteristics with the study population but was not part of the final sample. The aim was to assess the precision, cultural responsiveness, length and logical flow of the questionnaires and interview guides used to gather data from caregivers and Community Health Promoters (CHPs). The pre-test revealed several areas that

required improvement. Some questions, particularly those related to the interpretation of F-MUAC color bands were found to be ambiguous or too technical for respondents. The sequence of questions was revised to improve logical flow and reduce respondent fatigue. Local terminologies were also refined or added to ensure the tools were culturally appropriate and easily understood, especially when referring to signs of malnutrition and locally known foods.

Based on the pre-test findings, several adjustments were made to improve the effectiveness of the data collection instruments. The questionnaires were revised for clarity, accuracy and consistency. Translations into the local language Ng'aturkana, were also updated to ensure they accurately reflected the community's understanding. Furthermore, data collectors received refresher training on the revised tools to ensure standardized administration during the actual fieldwork. These steps helped to enhance the validity and reliability of the data collection process and ensured the tools were well-suited for use in the nomadic pastoralist context of Turkana South.

3.9 Data analysis

Analysis was conducted using Microsoft Excel 2016 and Python to conduct statistical analysis. The output is presented with tables, charts and graphs to facilitate a clear understanding of findings. Descriptive statistics were used to describe and summarize the background information of the study population. Thematic analysis of qualitative data gathered by Focus Group Discussions (FGDs) was employed to assess contextual determinants and perceptions that influence F-MUAC uptake. For dichotomous results, as with whether a caregiver had applied the F-MUAC tape in the past two weeks (yes/no) or whether a child had been referred for treatment (yes/no), logistic regression was used.

Table 3.2 Data analysis method per objectives

Research Objective	Variable(s)	Type of Analysis	Statistical Tool / Test	Expected Output
Objective No.1	Independent Variable: Socio-demographic factors (household income, access to health services)	Descriptive Analysis	Descriptive statistics (frequencies, percentages) Chi-square test	Tables showing key demographic factors influencing F-MUAC use and their statistical significance (p-values, ORs, CIs)
Objective No.2	Dependent Variable: Consistency and accuracy of F-MUAC use (frequency of screening, correct tape placement, accurate reading)	Descriptive Analysis & Logistic regression	Descriptive statistics frequencies	Summary tables showing levels of consistency and accuracy
Objective No.3	Independent Variable: Knowledge and interpretation skills (understanding of color codes, recognition of malnutrition signs, correct decision-making)	Descriptive Analysis	Frequencies, percentages,	Tables summarizing caregivers' knowledge levels and interpretation accuracy
Objective No.4	Independent Variable: Knowledge and interpretation skills Dependent Variable: Household utilization of F-MUAC tape	Logistic regression	Chi-square test for association	Cross-tabulations and correlation results showing how knowledge and interpretation skills predict F-MUAC utilization; regression coefficients (β), p-values

This gave the scope for calculating odds ratios, providing information on the likelihood of an outcome occurring based on predictor variables such as source of income for caregivers or previous training on the application of F-MUAC. Using both linear and logistic regression analysis, the research extensively investigated determinants of the use of F-MUAC. This approach of analysis gave a detailed insight into factors that encourage or discourage early malnutrition detection among caregivers in Turkana South

3.10 Logistical and ethical considerations

Logistical and ethical process and requirements of conducting research was followed to the later. Approval of the thesis from the school of graduate studies Board and approval from the Institutional Ethics and Review Committee of the institution (Masinde Muliro University of Science and Technology (MMUST – IERC Ref No. MMU/COR: 509099) was sort for. License from National Commission for Science, Technology and Innovation (NACOSTI Ref No. 574395). Permission to conduct research in T. South Sub-County was obtained from the Turkana County Director of Health, the County Commissioner at County level and Sub-County Community Health Services Coordinator, Deputy County Commissioner at the Sub-County level. Permission to conduct the research at Ward and village level was obtained from the Ward and Village Administrators /Chiefs, Sub-chiefs and Kraal Elders. Household head who was the main respondent provided consent for the study using the preferred language.

On field movement, the field team was facilitated within their area of operation to reduce cost of vehicle hire. Those involved in data collection were supported with airtime and bundles to be used during evening debrief call sessions.

3.11 Ethical Consideration

Autonomy

Permission to collect data was be sought from the Ward Administrator, the area chief/sub-chief and the researcher assured respondents that data pertaining the name of the respondents, place of residence or next of kin was not recorded in the study. During data collection, every individual's record meeting the criteria was coded to maintain anonymity and the code used for data analysis. These actions ensured that respondents are protected from any harm as it was impossible to conduct them directly.

Beneficence

The data obtained was used for research purpose only with a view of improving screening. It will help

immensely in advising the respondents on their diet and dietary intake. The respondents may not directly benefit from the study, but the information obtained will be instrumental in informing decision makers on how best to plan and improve malnutrition management in the county.

Confidentiality

The researcher assured the respondents of confidentiality on the information obtained from them. To ensure anonymity and confidentiality, data concerning the names of the respondents and next of kin was not recorded and special codes numbers were assigned to each questionnaire to conceal identity of the respondent. All questionnaires were safely kept in lockable cupboards and data entered in a computer which was encrypted with passwords for maximum confidentiality of the information.

Informed Consent

The researcher and the research assistants introduced himself or herself and clearly explained the objectives of the study to the respondents before starting the interviews. An informed consent was sought from the respondent before proceeding with the data collection without being coerced. The decision of the respondent to either consent or not was also respected in case they decide not to take part in the study. The respondent was required to sign a consent form tailored to local language upon agreeing to allow the researcher/research assistant to collect data from them.

Justice

This study picked clients whose households meet the criteria for selection and all data collected was analyzed. During the study, all the respondents were treated equally regardless of the religion, age, their position and social status in the community. There was no physical harm to the respondents as data collection methods were non-invasive.

CHAPTER FOUR - RESULT

4.0 Introduction

All the 244 caregivers responded making a 100% response rate. The results are presented in the following sections, organized according to the research objectives:1) To determine factors affecting household utilization of family mid upper arm circumference tape. 2) To determine the coverage and use of F-MUAC among Nomadic communities in Turkana South, Turkana County. 3) To determine utilization of family mid up arm circumference and 4) To determine the knowledge of mothers/caregivers on interpretation of F-MUAC in early detection of childhood malnutrition.

4.1 Factors affecting household utilization of F-MUAC tape

Table 4.1 Comparing Household occupation and income

Primary Occupation	**Petty Trade**	**Sale of Crops**	**Casual Labor**	**Sale of Livestock**	**Sale of Livestock Products**	**No Income**	**Other Sources**	**Total**
	n (% of Row)	n (% of Row)	n (% of Row)	n (% of Row)	n (% of Row)	n (% of Row)	n (% of Row)	n (% of Total)
Livestock Herding (n=64)	15 23.4%	8 12.5%	10 15.6%	18 (28.1%)	5 (7.8%)	5 (7.8%)	3 (4.7%)	64 26.2%
Petty Trade (n=63)	55 87.3%	2 3.2%	4 (6.3%)	0 (0.0%)	0 (0.0%)	2 (3.2%)	0 (0.0%)	63 25.8%
Charcoal/Firewood (n=54)	50 92.6%	0 0.0%	2 (3.7%)	0 (0.0%)	0 (0.0%)	2 (3.7%)	0 (0.0%)	54 22.1%
Own Farm Labor (n=28)	0 0.0%	20 71.4%	5 17.9%	3 (10.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	28 11.5%
Wage Labour (Casual) (n=17)	1 5.9%	10 58.8%	3 17.6%	0 (0.0%)	0 (0.0%)	3 17.6%	0 (0.0%)	17 7.0%
Other Occupations (n=18)	0 0.0%	5 27.8%	0 0.0%	0 (0.0%)	1 (5.6%)	9 50.0%	3 16.7%	18 7.4%
Total (n=244)	121 49.6%	45 18.4%	24 (9.8%)	21 (8.6%)	6 (2.5%)	21 (8.6%)	6 (2.5%)	244 100%

4.1.1 Findings on Primary Occupation and Main Sources of Income

Table 4.1 presents the distribution of respondents by their primary occupation and corresponding main sources of income. 244 respondents participated in the survey. The majority were engaged in livestock herding (26.2%), petty trade (25.8%), and charcoal/firewood sales (22.1%), while smaller proportions reported own farm labor (11.5%), wage labor (casual) (7.0%), and other occupations (7.4%) as their main livelihoods. Across all respondents, petty trade emerged as the leading source of income accounting for 49.6% of all cases followed by sale of crops (18.4%), casual labor (9.8%), sale of livestock (8.6%) and no income (8.6%). Income from livestock products (2.5%) and other sources (2.5%) was relatively minor. This indicates that the majority of households depend heavily on informal trading activities for their livelihoods.

Disaggregating by primary occupation, the findings reveal distinct livelihood patterns. Among those whose main occupation was livestock herding, the sale of livestock (28.1%) constituted the principal income source, though a considerable proportion also engaged in petty trade (23.4%) and casual labor (15.6%), suggesting a relatively diversified income structure. Conversely, respondents in petty trade were highly specialized with 87.3% deriving their main income from trading activities. Participants engaged in charcoal and firewood sales also reported a strong dependence on petty trade (92.6%), showing limited diversification. For those in own farm labor, sale of crops (71.4%) was the predominant income source, followed by casual labor (17.9%) and sale of livestock (10.7%), indicating a mixed reliance on both crop production and supplemental income streams. Among casual wage laborers, the sale of crops (58.8%) and casual labor (17.6%) were the main income sources while a smaller number reported no income (17.6%). Respondents in other occupations demonstrated the greatest economic vulnerability, with half (50.0%) reporting no income at all and smaller shares relying on sale of crops (27.8%) or other income sources (16.7%). Overall, these findings suggest that while income diversification is common among some livelihood groups particularly livestock herders and farm laborers petty trade remains the dominant and most reliable income-generating activity within the

study population. The data also highlight a notable level of economic insecurity, as evidenced by the proportion of respondents reporting no income, particularly among those in non-agricultural or undefined occupations.

Table 4.2 Household source of income and health seeking behavior

Primary Source of Income	Public Clinic n (%)	Private Clinic n (%)	CHP n (%)	Traditional Healer n (%)	Total HHs n (% of Sample)	Odds Ratio (OR)	95% CI	p-value
Petty trade (e.g., firewood)	64 (52.9%)	3 (2.5%)	49 (40.5%)	5 (4.1%)	121 (49.6%)	Reference	-	-
Sale of crops	34 (75.6%)	2 (4.4%)	9 (20.0%)	0 (0.0%)	45 (18.4%)	-	-	-
Casual labor (wage)	18 (75.0%)	0 (0.0%)	4 (16.7%)	2 (8.3%)	24 (9.8%)	-	-	-
No income	11 (52.4%)	4 (19.0%)	6 (28.6%)	0 (0.0%)	21 (8.6%)	-	-	-
Sale of livestock	4 (26.7%)	0 (0.0%)	11 (73.3%)	0 (0.0%)	15 (6.1%)	4.04	1.22–13.42	0.023
Other (e.g., remittance)	5 (62.5%)	0 (0.0%)	2 (25.0%)	1 (12.5%)	8 (3.3%)	-	-	-
Sale of livestock products	1 (16.7%)	0 (0.0%)	5 (83.3%)	0 (0.0%)	6 (2.5%)	7.35	0.83–64.83	0.073
Permanent job	3 (75.0%)	0 (0.0%)	1 (25.0%)	0 (0.0%)	4 (1.6%)	-	-	-
Total	140 (57.4%)	9 (3.7%)	87 (35.7%)	8 (3.3%)	244 (100%)			

4.1.2 Findings on Primary Source of Income and Healthcare Provider Utilization

Table 4.2 presents the association between households' primary source of income and their preferred healthcare provider. Among the 244 households surveyed the majority sought care from public clinics (57.4%), followed by community health providers (CHPs) (35.7%), private clinics (3.7%) and traditional healers (3.3%). Households primarily engaged in petty trade, including firewood sales represented the largest income group (49.6% of the total sample). Of these, 52.9% sought care at public clinics while 40.5% used CHPs and only a small proportion (2.5%) used private clinics. This group

was used as the reference category for odds ratio calculations. Households relying on sale of crops (18.4%) and casual labor (9.8%) also predominantly sought care from public clinics (75.6% and 75.0%, respectively), indicating a strong preference for public health services among lower-income or agriculturally dependent households. Very few of these households reported use of private clinics or traditional healers.

In contrast, households whose primary income came from sale of livestock (6.1%) and sale of livestock products (2.5%) showed a markedly different pattern. A substantial majority in these groups sought healthcare from community health providers (73.3% and 83.3%, respectively) rather than public facilities. The logistic regression results indicate that households dependent on livestock sales were four times more likely (OR = 4.04, 95% CI: 1.22–13.42, $p = 0.023$) to seek care from CHPs compared to those in petty trade. Similarly, those earning from livestock products were 7.35 times more likely (95% CI: 0.83–64.83, $p = 0.073$) to use CHPs, though this association was not statistically significant at the 5% level.

4.1.3 Coverage of F-MUAC utilization

Table 4.3 Logistic regression on the association between caregivers' likelihood of using F-MUAC Tape

Ward	B Coefficient	Std. Error	z	p	Odds Ratio (OR)	95% CI for OR	% Yes (Checked F-MUAC)	% No	Total Respondents
Katilu (Ref)	—	—	—	—	1.00 (Ref)	—	72.5%	29.5%	102
Kalapata	1.04	0.38	2.74	0.006	2.82	(1.34 – 5.92)	71.0%	29.0%	69
Lokichar	0.41	0.33	1.24	0.214	1.51	(0.79 – 2.91)	71.0%	29.0%	71

Table 4.3 presents a logistic regression analysis examining the association between the caregiver's likelihood of checking a child's F-MUAC tape and the ward of residence, using Katilu as the reference

category. Katilu (Reference): Caregivers in Katilu had 72.5% reporting that they checked the F-MUAC tape. Being the reference category, the odds ratio (OR = 1.00) represents the baseline against which the other wards are compared. Caregivers in Kalapata were significantly more likely to check F-MUAC compared to Katilu (B = 1.04, p = 0.006). The odds ratio of 2.82 (95% CI: 1.34–5.92) indicates that caregivers in Kalapata had almost 3 times higher odds of performing F-MUAC checks than those in Katilu. Approximately 71% of caregivers in Kalapata checked the F-MUAC tape. Caregivers in Lokichar showed no statistically significant difference from Katilu (B = 0.41, p = 0.214; OR = 1.51, 95% CI: 0.79–2.91). Around 71% of caregivers in Lokichar checked the F-MUAC tape, similar to Katilu, suggesting comparable levels of engagement in F-MUAC monitoring.

Caregiver F-MUAC checking varied slightly by ward. Kalapata showed a significantly higher likelihood of checking compared to Katilu, indicating potential local differences in knowledge on F-MUAC use. Lokichar did not differ significantly from the reference ward. Overall, the majority of caregivers in all wards (≈71–73%) reported checking F-MUAC, but there remains a proportion who did not highlighting areas for continued training and support.

4.2 Consistency and accuracy of F-MUAC tape usage by caregivers of children under five in Turkana South during the study period.

From table 4.4 below among 244 caregivers, 70% reported using the F-MUAC tape in the past two weeks, while 30% did not. Among those who used the tape, 71% placed it correctly, and 29% misaligned or misplaced it. Caregiver knowledge significantly influenced both F-MUAC use and tape placement accuracy. Caregivers with adequate knowledge were 4.9 times more likely to use F-MUAC (OR=4.87, 95% CI: 2.60–9.12, p<0.001) and 5.2 times more likely to place the tape correctly (OR=5.21, 95% CI: 2.65–10.24, p<0.001) compared to those with poor knowledge. Occupation and primary income source were also associated with F-MUAC use and accuracy. Petty traders had higher odds of correct placement compared to other occupations (OR=2.75, 95% CI: 1.15–6.55, p=0.03) and caregivers whose primary income came from petty trade were more likely to place the tape correctly

than those relying on other sources (OR=2.12, 95% CI: 1.05–4.26, p=0.014).

Table 4.4 F-MUAC use and tape placement accuracy

Outcome	Predictor	Category	n (% of group)	Chi-square (χ^2)	p-value	Odds Ratio (OR)	95% CI
F-MUAC Use in Past 2 Weeks	Caregiver Knowledge	Used F-MUAC	170 (70%)	18.50	<0.001	4.87	2.60–9.12
		Did not use	74 (30%)			Ref	-
	Occupation	Petty Trade	100 (82%)	10.12	0.03	2.75	1.15–6.55
		Livestock	45 (70%)			1.63	0.65–4.08
		Other	25 (66%)			Ref	-
	Income Source	Sale of crops	35 (78%)	12.45	0.014	1.89	0.88–4.07
		Casual labor	18 (75%)			1.63	0.66–4.02
		Petty trade	120 (70%)			2.12	1.05–4.26
		Other sources	24 (65%)			Ref	-
Tape Placement Accuracy	Caregiver Knowledge	Correctly Used	120 (70.6%)	22.14	<0.001	5.21	2.65–10.24
		Misaligned/Misplaced	50 (29.4%)			Ref	-
	Occupation	Petty Trade	100 (66.7%)	10.57	0.03	2.75	1.15–6.55
		Livestock	45 (60.8%)			1.63	0.65–4.08
		Other	26 (55.3%)			Ref	-
	Income Source	Sale of crops	35 (66.0%)	12.45	0.014	1.89	0.88–4.07
		Casual labor	18 (64.3%)			1.63	0.66–4.02
		Petty trade	120 (70.6%)			2.12	1.05–4.26
		Other sources	24 (58.5%)			Ref	-

The study found that caregivers engaged in petty trade, either as their primary occupation or main source of income were significantly more likely to correctly use F-MUAC tapes compared to those involved in livestock herding, casual labor or other occupations. This association may reflect multiple

factors petty traders often have greater exposure to health information through frequent interactions within the community and local markets possess higher familiarity with handling measurements due to their trading activities and may have more flexible schedules that allow dedicated attention to child health monitoring. In contrast, caregivers reliant on livestock herding or casual labor may experience time constraints, limited access to educational messages or reduced opportunities to practice correct tape placement, which could contribute to lower accuracy in F-MUAC use. These findings highlight the importance of considering livelihood patterns when designing interventions to improve family-based nutritional monitoring in nomadic communities

4.3 To examine knowledge and interpretation skills of caregivers regarding F-MUAC tape color-codes for early detection of child malnutrition in Turkana South during the study period.

The figure below shows classification of malnutrition by caregiver using F-MUAC color code and the referral channels used. From the 244 children assessed with the F-MUAC tape the majority (162, 66.4%) were classified as having normal nutritional status (green), while 42 children (17.2%) were moderately acutely malnourished (MAM, yellow) and 40 children (16.4%) were severely acutely malnourished (SAM, red). Approximately one-third of children in this community were experiencing acute malnutrition. Referral practices for malnourished children (yellow and red) indicated that most children were referred via community health workers (CHWs) (61, 74.4%), followed by health facilities (18, 21.5%) and other channels (3, 4.1%). This demonstrates that CHWs are the main access point for malnutrition management in the nomadic context. Caregiver knowledge of F-MUAC tape use and referral procedures showed that 155 caregivers (63.5%) had adequate understanding, including correct recognition of color-coded zones and appropriate referral decisions. However, 89 caregivers (36.5%) demonstrated limited or inadequate knowledge, which could result in misclassification or delayed referral for malnourished children.

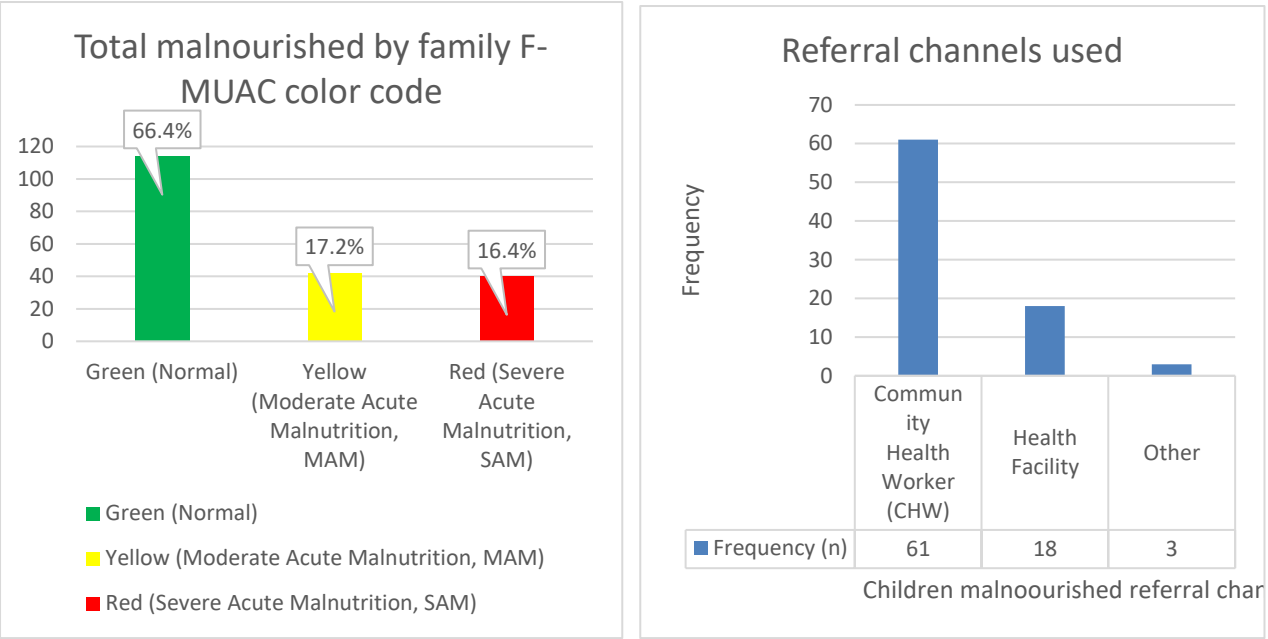

Figure 5 . F-MUAC Classification and Referral Channels (n = 244)

Left panel: Nutritional status of children based on color-coded F-MUAC tape. Green indicates normal; yellow indicates moderate acute malnutrition (MAM) and red indicates severe acute malnutrition (SAM). Right panel: Referral channels used for malnourished children, highlighting the predominant role of community health workers.

4.4 To examine the relationship between caregivers' knowledge and interpretation skills of F-MUAC tape color codes

Table 4.5 presents the results of a logistic regression analysis examining the association between caregiver F-MUAC checks and confirmation of the child F-MUAC color at the health facility. Constant: The constant term (B = -0.96, p = 0.003) represents the log odds of the child's F-MUAC color being confirmed at the health facility when the caregiver does not check the F-MUAC tape. The corresponding odds ratio (OR = 0.38, 95% CI: 0.2–0.72) indicates that in the absence of caregiver checks, the odds of correct color confirmation are low.

Table 4.5 F-MUAC color confirmation at HF Vs Checking F-MUAC by caregivers

	Coefficient B	Standard error	z	p	Odds Ratio	95% conf. interval
Constant	-0.96	0.33	2.95	.003	0.38	0.2 - 0.72
colour confirmed (Yes)	2.4	0.38	6.33	<.001	11.02	5.24 - 23.17
Colour confirmed (Always Yes)	3.26	0.81	4.03	<.001	26.15	5.34 - 127.98

Color Confirmed (Yes): Caregivers who sometimes checks the color of the F-MUAC tape had significantly higher odds of correct F-MUAC color confirmation at the health facility (B = 2.4, OR = 11.02, 95% CI: 5.24–23.17, $p < 0.001$). This means that children whose caregivers checked the F-MUAC color even occasionally were 11 times more likely to have their F-MUAC color correctly confirmed at the health facility compared to children whose caregivers did not check. Color Confirmed (Always Yes): Caregivers who always confirmed the color of the F-MUAC tape had even higher odds of correct color confirmation at the facility (B = 3.26, OR = 26.15, 95% CI: 5.34–127.98, $p < 0.001$). This indicates that children whose caregivers consistently checked the F-MUAC tape were 26 times more likely to have their F-MUAC color accurately confirmed at the health facility. Therefore, the analysis shows a strong positive association between caregiver engagement in F-MUAC checks and accurate F-MUAC color confirmation at the health facility. Consistent checking ("Always Yes") markedly improves the likelihood of correct F-MUAC assessment, emphasizing the importance of caregiver knowledge and active participation in community-based malnutrition screening.

4.5 Qualitative Findings: Focus Group Discussions (Based on Key Influencing Factors)

Introduction

To complement the quantitative results, 3 Focus Group Discussions (FGDs) of 7-15 caregivers were conducted with caregivers of children aged 6–59 months across 3 selected wards (nomadic settlements) in Turkana South. The aim was to explore in-depth the community's perceptions, experiences and challenges influencing the utilization of the F-MUAC tape for early detection of malnutrition. The

discussions focused on major themes that emerged from the survey knowledge, attitude toward F-MUAC use and perceptions surrounding child nutrition.

Thematic Analysis of FGD Data

Table 4.6 Showing thematic analysis of FGD data

Theme	Sub-theme	Illustrative Quote	Interpretation
1. Knowledge of F-MUAC	Awareness of F-MUAC purpose	"Before, we used to wait until a child looked very thin, but now we know what the tape means and can act earlier." [FGD, Katilu]	While most caregivers were aware of F-MUAC, understanding of its purpose and regular use remained partial, showing the need for refresher training.
2. Attitude and Perception	Motivation and perceived importance	"When the child looks healthy, we don't see the need to measure."	Positive attitudes exist, but many caregivers view F-MUAC use as unnecessary unless illness is visible, leading to irregular screening.
4. Training and Supervision	Frequency of follow-up	"When you take your child to the health facility with a yellow or red F-MUAC the health care worker takes long to attend to you and when they put the child to measure height and weight you are told the child is healthy, so we ask ourselves why these two measurements do not agree". (FGD, 2024)."	Regular CHV supervision strengthens correct technique and encourages consistent screening.
5. Livelihood /Income	Seasonal movement	"Sometimes we move far with animals, and we forget or lose the tape."	Frequent migration interrupts regular monitoring and leads to loss or neglect of F-MUAC practice among nomadic households.
6. Cultural Beliefs and Practices	Traditional indicators of malnutrition	"Our elders tell us to look at the eyes or hair color to know a child is weak."	Cultural reliance on visual signs delays the use of F-MUAC, showing the need to align modern screening with local knowledge systems.

Summary of the Chapter

This chapter presented the results of the study on the utilization of F-MUAC tape for early detection of malnutrition among caregivers of children aged 6–59 months in nomadic communities of Turkana South. The quantitative analysis identified key factors influencing utilization, including caregivers'

knowledge, frequency of use, correct technique and attitudes toward the tool. It also highlighted challenges such as limited availability of tapes, inconsistent usage and gaps in caregivers' understanding and interpretation of F-MUAC color codes. Complementing these findings, the qualitative data from Focus Group Discussions provided deeper insights into the contextual and socio-cultural dynamics affecting F-MUAC utilization. Caregivers reported that while knowledge of the tool was relatively high, actual practice was hindered by factors such as seasonal migration, limited tape distribution and reliance on traditional indicators of malnutrition. The role of Community Health Volunteers in training and supervision emerged as a crucial facilitator for improving consistency and accuracy of F-MUAC measurements.

These findings underscore the complex interplay of individual knowledge, resource availability, mobility patterns and cultural beliefs in shaping the effective use of F-MUAC for early malnutrition detection. This comprehensive understanding lays a strong foundation for the subsequent discussion chapter which will interpret these results in relation to existing literature, explore implications for policy and practice and offer recommendations for improving F-MUAC utilization in nomadic settings.

CHAPTER 5 - DISCUSSION

5.0 Introduction

This chapter is about the results of the research conducted on the use of the F-MUAC tape by caregivers of children aged 6-59 months of age in nomadic communities in Turkana South Sub county, Kenya. The objectives of the study were to: (1) determine the degree of utilization and coverage of the F-MUAC tool; (2) determine the level of knowledge and interpretation skills of the caregivers with the F-MUAC colour-bands; (3) determine the consistency and accuracy of F-MUAC tape use at the household level; and (4) find out the factors that affect its use in this scenario. These objectives are used to organize the discussion and combine the findings with the existing literature and theory.

5.1- Knowledge and Interpretation Skills of Caregivers in F-MUAC Color Codes.

5.1.1.1. Accuracy of Classification and Knowledge Levels.

The researchers evaluated the knowledge of the caregivers in the interpretation of F-MUAC color codes and categorizing nutritional status. The knowledge of the 244 exceptional caregivers assessed was excellent: 74% of them were able to recognize all three-color bands correctly (green, yellow, and red), 21% possessed good knowledge and 5% fair knowledge. This level of knowledge is an indication that F-MUAC training and awareness campaigns have been very successful at Turkana South. Interestingly, the level of knowledge was the greatest in remote (Katilu, Lokichar) and less in major road (Kalemngorok, Lochwaa) which could be the mark of more active outreach in the remote environment. This could have been through more specialized and perhaps smaller trainings; a more cohesive community or less competing training in remote areas. On the other hand, reduced knowledge along primary roads could indicate access differences between health-promotion or caregiver busy-ness.

The results reinforce previous research by Alé et al. (2016) and Ndemwa et al. (2017) that demonstrated that decentralized community based capacity building plays an important role in enhancing the

competence of caregivers in screening malnutrition.

5.1.2 Skills and confidence Interpretation.

The caregivers that were able to read the green band well were twice as likely to apply the F-MUAC tape regularly (OR = 2.1, p = 0.011). This helps in the suggestion that knowledge is action. The same has been stressed by previous operation work that knowledge on its own is not enough, and that it has to be reinforced, supervised, and incorporated into habitual behavior.

5.1.3. Referral Behavior and Response to F-MUAC Results.

The patterns of referrals indicated the level of knowledge and confidence of the caregivers. A vast majority of caretakers who had reported having witnessed green F-MUAC levels (which signified normalcy) had still approached CHPs or health facilities which is responsible involvement. In particular, 142 caregivers were provided with referrals at CHPs and 46 were patients directly addressed at the facilities. There was a positive correlation between the correct interpretation of color code and the use of F-MUAC. The caregivers that correctly recalled the green classification had a twofold probability of regular use of F-MUAC (OR = 2.1, p = 0.011). The correlation of knowledge and its use implies that clinical awareness of the color system can enable caregivers to be decisive and in line with the goals of the F-MUAC model as it detects the condition at an early stage. However, some caregivers were also unsure with interpretation especially when the facility results ran amok with home outcomes. This highlights the necessity to train CHPs and facility-based employees together in order to achieve uniformity in messages and make sure caregivers are given the same information.

5.2 F-MUAC Tape Usage consistency and accuracy.

5.2.1 Frequency of Use and Caregiver Engagement.

The survey showed that 70.5 percent of the caregivers had measured F-MUAC in the two weeks before data collection, which is a good adoption of F-MUAC approach in this nomadic environment. Nonetheless, almost one-third of them (29.5) had not screened their child within that period of time.

The primary reasons mentioned were time-related and the fact that it was believed that seeing the health of the child was unnecessary (I know my child; I can see when she is not alright).

These results are consistent with the literature on behavior in other settings: in India, Jadhav et al. (2018) and in South Sudan, Myatt et al. (2018), tool-distribution does not predict sustained use without follow-up and motivation. ENN has cited sustainability of caregiver measurement as one of the implementation challenges in the review.

5.2.2 Validity of F-MUAC Technique and Measurement Validity.

The precision of F-MUAC readings was very sensitive to the correct position of the tape and reading. The logistic regression showed that improper placement of the tape on the arm was a highly important factor with respect to measurement validity and caregivers who improperly placed the tape were 203 times more likely to make erroneous measurements (OR = 203.85, $p < 0.001$). On the same note, the inability to hold the reading window on eye level multiplied the chances of inaccuracy by 137 times (OR = 136.55, $p = 0.001$). These results indicate that technique is one of the key determinants of F-MUAC accuracy. Although the utilization rate was high, a significant number of caregivers were not guided consistently or their technique vindicated periodically. The Blackwell et al. (2015) study also revealed that refresher supervision can help to significantly increase the accuracy of caregivers.

Caregiver F-MUAC readings at health facilities were strongly predicted to be in continuous use on validation. Caregivers having their F-MUAC results validated by health workers were 11 times as likely to use the tool again ($p < 0.001$) and where validation is identified as always reliable, the odds ratio was 26 times greater. This highlights the importance of health worker feedback in creating confidence among the caregivers and having a reliable home-based screening.

5.2.3 Structural/ Programmatic Constraints.

In rural and insecure regions, it was reported by the caregivers that CHPs followed up in irregular manner, partly because of the large geographical areas and related lack of logistical support. This points

to community health infrastructure gaps in the nomads. Unless supervision is conducted on a regular basis and practical reinforcement is implemented, there is a great probability that the errors in technique will remain and decrease the accuracy of F-MUAC screening performed at home. Programmatically, the incorporation of F-MUAC refresher sessions in an already established community outreach or maternal health day might guarantee long-term caregiver participation and precision enhancement.

The ENN review highlighted that only F-MUAC programmes governed by the caregivers can be sustainable when incorporated into the health systems and monitored, evaluated and supervised constantly. ennonline.net.

5.1 Factors that affect the use of F-MUAC Tape by the household.

5.1.1 Livelihood Patterns and Occupation of the caregiver.

This research found that subsistence and informal sources of household earnings were the major ones in Turkana South, which include petty trade, fire wood and charcoal selling, livestock keeping and casual labor. Such activities are labor intensive, low salary and time consuming to such an extent that care givers are not able to offer standard checks of children through F-MUAC tape. The relatively higher degrees of F-MUAC utilization were reported among petty traders that tend to be concentrated within a village centre or a market, rather than pastoralists and herding households. Quantitatively, 64 of 121 petty-trading households sought help in the hands of the public health facilities and 49 the community health promoters or CHPs. According to the logistic regression, families reliant on livestock sales were considerably more proximate to utilize CHPs when making malnutrition referrals (OR = 4.04, p = 0.023) and the household reliant on livestock products also had high though statistically non-significant odds (OR = 7.35, p = 0.073). This implies that mobility and occupational structure acts have a direct relationship with the frequency of F-MUAC use, and the kind of health services demanded. The kind of nomadic and semi-nomadic lifestyles restrict the regular engagement of health facilities by caregivers and thus community-based referral system becomes more applicable.

Kimani et al. (2022) observed similar with Marsabit and Ahouandjinou et al. (2021) with Niger because mobility and seasonal migration decreased household participation in formal health programs.

5.1.2 Time constraints and Economic exposure.

Caregivers often complained that their income earning action took much of their time leaving little time to screen children. Numerous female caregivers who had to attend household chores and earn a living reported that they usually were at home before the kids would rise, and it is not easy to conduct regular F-MUAC examinations. One of the caregivers said that she does not usually take F-MUAC measurements because she is in a hurry. They depend on me. I get out of house early before even they can wake up. These stories show that the two-fold amount of care and income-earning imposed on women is a direct limitation on the use of F-MUAC. Additionally, the seasonal variations in income particularly among the individuals who use charcoal, firewood or animal markets bring about the financial strains, which in turn are associated with the decrease in F-MUAC screening and increased risk of malnutrition. A study in Mali established that behaviour-economics sensitive interventions (e.g. reminders via savings groups) had the potential to increase uptake. ennonline.net. Efforts directed to promote the use of F-MUAC should thus be livelihood-sensitive, with training and supervision planning to be done in accordance with the changes in local mobility and economic cycles. This may be mobile F-MUAC outreach using CHPs to suit pastoralist movements as also suggested by Oduor et al. (2021) in arid areas of Kenya.

5.1.3. Health System Accessibility and Trust.

The F-MUAC practice was also reported to be hindered by long distances to health facilities, absence of transport and irregular access to health workers. Caregivers had complaints about the experiences at the facilities, by stating that in instances where they traveled long distances, they found out that the health staff or drugs were not available. These experiences lowered their interest in using facility-based check of F-MUAC readings. Also, there were gaps between home F-MUAC outcomes and facility

anthropometric data that undermined the confidence of the caregiver. Others said one of the kids that had been tested as red or yellow at home were considered as normal at the clinic leading to confusion. This discrepancy highlights the importance of standardization of communication across F-MUAC and facility-based methods of assessment to reclaim the trust of the caregivers. Such experience damages the confidence in the system and discourages screening led by caregivers. The significance of the harmonization of screening procedures and the existence of feedback channels in between the home-based screening and facility measurement can be highlighted by the operational reviews. ennonline.net+1.

5.2 A Model of F-MUAC Utilization

The F-MUAC-utilization model creates emphasis on the conditions of livelihood, geographic location and seasonal migration as external factors that determine the efficacy of malnutrition screening programs. All these influences the availability and the uniformity of F-MUAC screening particularly within communities that have nomadic populations or remote locations. The geographical barrier and mobility patterns may restrict the presence of screening tools, as well as access to the treatment services, which highlights the necessity of localized and flexible methods that will address local truths.F-MUAC utilization Model

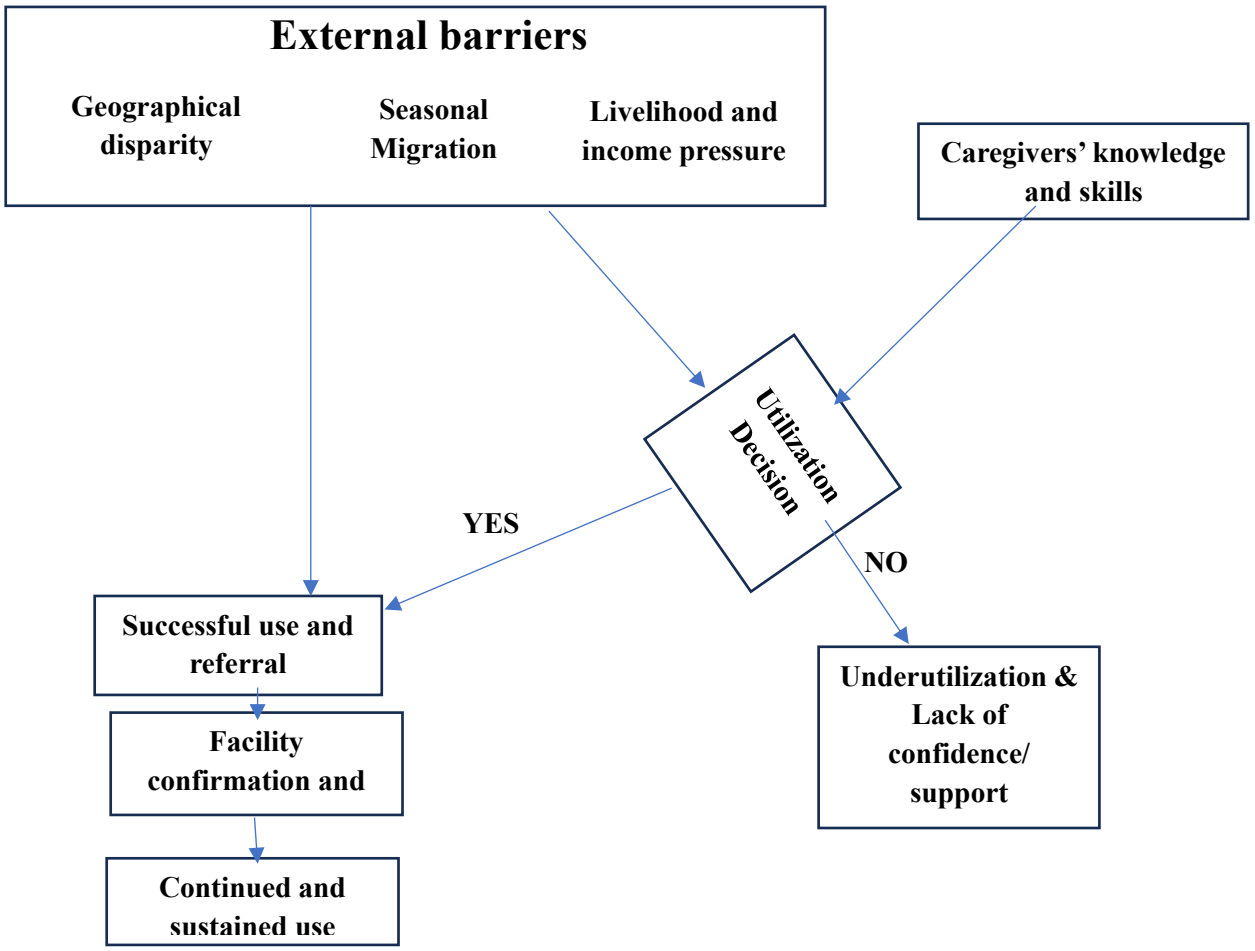

Figure 6 A model of F-MUAC Utilization

Besides the external factors, the model also lays stress on the significance of knowledge and skills of caregivers and health workers in the accurate measurement of F-MUAC and interpretation of the results. To make sure that children diagnosed with the acute malnutrition are subjected to proper care, adequate decision-making and prompt response to such screenings are essential. In the end, a synthesis between the contextual knowledge and capacity building and responsive health measures is the base of enhancing the development of malnutrition detection and management among the populations that are at risk.

5.3 Correlation between Caregiver Knowledge, interpreting skills and using F-MUAC.

The last goal was to determine the connection between caregiver knowledge and interpretation skills and their general use of the F-MUAC tape. Results of logistic regression applied showed that the care givers who were aware of malnutrition were six times more likely to use the F-MUAC tape (OR =

6.05, 95% CI: 3.0611.96, p = 0.001). In addition, caregivers that stated they had the validation of their measurements in health facilities were more likely to continue using it ($p < 0.001$) more than 11 times. The findings are a clear indication that the sustained use of the F-MUAC tool is instigated by knowledge, health system support and reinforcement. The probability of regular F-MUAC use was four times greater in households in which all eligible children were screened (OR = 4.26, p = 0.001), in which complete household coverage corroborates the use of regular F-MUAC.

Results are consistent with those of Blackwell et al. (2015), who established that effective caregiver knowledge of F-MUAC color and routinely getting feedback with the community health worker increased home-based screening retention and adherence. Apparently, community trust and having peer support models appeared to have a significant positive impact on the use of F-MUAC by caregivers according to Alé et al. (2016). In Turkana South, knowledge of caregivers was predictive of utilization, besides being protective against errors in measurement. The participants that were able to interpret F-MUAC colors correctly were less likely to misplace the tape and read the color bands incorrectly. This fact reinforces the point that cognitive and practical knowledge should be built up so that the F-MUAC approach can become effective.

5.4 Summary

In this chapter, the research results of the use of F-MUAC in nomadic Turkana South caregivers were discussed. The discussion provided that household livelihood patterns, economic vulnerability, workload of caregivers and access to health facilities affect the use of F-MUAC remarkably. Although the coverage rates were relatively high (more than 70 percent), the consistency of use and its accuracy differed, and it mostly depended on the knowledge of caregivers and feedback on the health workers. The pivotal knowledge and interpretation skills were major elements of successful F-MUAC implementation that highly predicted frequency and accuracy of use. Nevertheless, obstacles like time limits, irregular supervision, cultural attitudes and mistrust at the facility level were impediments to

ideal utilization. These results demonstrate the relevance of context-specific, livelihood-sensitive, culturally-congruent F-MUAC strategies in nomadic contexts, continuous training of caregivers, decentralization of supervision, and better connection between CHPs and health facilities are critical to maintain the gains obtained.

To sum up, although the F-MUAC methodology promises to be effective in identifying malnutrition in children in a nomadic context, the efficacy of the implementation process depends on the ability to tailor it to the specifics of the local environment (mobility, occupation, access), enhance the level of caregiver knowledge/skills, and implement robust support and trust arrangements within the health-system.

CHAPTER SIX - SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

The chapter is a summary of major conclusions, the test and recommendations to hypotheses of the study conducted on the subject Utilization of Family Mid-Upper Arm Circumference (F-MUAC) Tape among Nomadic communities of Turkana south, Turkana county. The study was conducted to evaluate the level, predictors and consequences of the use of F-MUAC by caregivers of children aged 659 months of age in a pastoralist community where there is mobility and livelihood diversity.

The chapter provides a summary of research findings as per the four objectives of the study, elaborates on the result of the hypotheses developed and gives a practical policy and research advice on how the efficacy and sustainability of F-MUAC interventions may be enhanced.

6.1 Caringgiver Knowledge and Interpretation Skills.

Assessment of knowledge revealed that caregivers in Turkana South had a high level of understanding of F-MUAC color codes as 74% of them had excellent knowledge regarding all three classifications (green, yellow, red). But 26 percent had voids in interpretation or referral decision-making.

The majority of caregivers (80 percent) acknowledged the green F-MUAC color and knew it was an indication of normal nutritional status, and 13 percent of them reflected yellow (moderate acute malnutrition) and 2 percent red (severe acute malnutrition). However, focus group discussions provided qualitative information that showed that there was still interpretation and trust issues. When the facility based measurements did not match the home-based F-MUAC measurements, caregivers reported confusion, and some of them were even concerned about the accuracy of their own measurements. The above finding indicates that there must be co-ordinated communication between home-based and facility-based assessment systems to enhance the trust and awareness of the F-MUAC method by the caregivers.

6.2 Accuracy and consistency of F-MUAC Tape Usage.

Relatively high short-term utilization (70.49) but inconsistent accuracy of the tape placement and reading technique were found in the study. The errors were those of misplacing the tape on the arm and not reading it at the eye level, and the probability of errors was increased by 203-fold ($p < 0.001$) and 137-fold ($p < 0.001$) respectively. The accuracy of the measurements in caregivers who had undergone F-MUAC training or had their measurements tested at health facilities was significantly higher. Health worker validation of F-MUAC color readings enhanced future use 11 times (OR = 11.02, $p < 0.001$) and valid feedback (told always yes) 26 times (OR = 26.15, $p < 0.001$). Such findings indicate that continuous training, positive supervision and verification of outcome by health professionals are very important in achieving technical consistency and measurement validity.

6.3 The factors that affect household use of F-MUAC Tape.

The researchers concluded that the decision to use F-MUAC tape at home depended on a set of socioeconomic, livelihood and structural determination. Informal and subsistence-based livelihoods were major in Turkana South such as; petty trade, charcoal/firewood sales and livestock herding. These revenue generating processes were labour and time consuming in regard to the capability of caregivers to monitor the F-MUAC measurements of their children at all times. The cross-tabulation and logistic regression analysis have shown that the household which had livestock-related livelihoods had higher likelihoods of depending on the community referral system using Community Health Promoters (CHPs) (OR = 4.04, $p = 0.023$), and petty traders and casual workers were more likely to rely on the public health facilities. The mobility of the distance to the closest facility and livelihoods also influenced the utilization rates.

In general, 72% of caregivers also reported the use of the F-MUAC tool in the past two weeks, which speaks of a high adoption rate with a difference in the wards. Kalapata ward was much more likely to be utilized (OR = 2.82, $p = 0.006$) than Katilu which indicates that livelihood patterns, accessibility of

health infrastructure and supportive community structures significantly determine the use of F-MUAC.

6.4 Correlation of Knowledge and Utilization of F-MUAC.

There was a significant and statistical relationship between the knowledge of the caregivers and the use of the F-MUAC tape. Based on the logistic regression analysis, caregivers who were aware of the symptoms of malnutrition are six times more likely to use the tape (OR = 6.05, $p < 0.001$) than were caregivers who did not know the signs of malnutrition. Additionally, caregivers, the measurement of whom was confirmed in the health facility, were 11 times more likely to continue using the F-MUAC tape ($p < 0.001$). The ward-level differences indicated that the ward with the most active CHPs and integrated outreach (Kalapata ward) was the highest in the rate of regular use of F-MUAC. These results affirm that knowledge, trainings, validation, and supportive community connections play a major role in promoting the use of F-MUAC and improved detection of malnutrition at the household stage.

6.5 Testing of Hypotheses and Discussion.

Two null hypotheses which were tested at a confidence level of 95 percent, guided the study.

6.5.1 Hypothesis 1

H_{01}: Socio-demographic, economic or contextual factors do not significantly predict the use of F-MUAC tape among the caregivers in Turkana South.

Findings and Discussion:

The logistic regression results rejected this null hypothesis. The data indicated a significant association between socioeconomic and contextual factors and F-MUAC utilization. Livelihood type, distance to health facility and ward location all demonstrated statistically significant relationships with the frequency and accuracy of F-MUAC use. Specifically, caregivers in Kalapata had 2.82 times higher odds ($p = 0.006$) of using the tape compared to those in Katilu, highlighting the influence of contextual

support systems. Similarly, households engaged in livestock sales (OR = 4.04, p = 0.023) or product-based trade (OR = 7.35, p = 0.073) were more inclined to use CHPs for nutrition support, illustrating the link between economic activities and health-seeking behavior. Therefore, socioeconomic and contextual factors such as livelihood patterns, accessibility and community health outreach significantly influence F-MUAC utilization leading to the rejection of the null hypothesis (H_{01}).

6.1.1 Hypothesis 2

H_{02}: Caregivers in Turkana South do not demonstrate adequate knowledge or correct interpretation of F-MUAC tape color codes for identifying malnutrition.

Findings and Discussion:

The results of the study also rejected the second null hypothesis. Data revealed that 74% of caregivers had excellent knowledge,21% had good knowledge and only 5% had fair knowledge of F-MUAC color code interpretation. This indicates high awareness of malnutrition classifications and appropriate referral responses. Additionally, logistic regression analysis showed that caregivers who correctly identified color bands especially the green category were 2.1 times more likely (p = 0.011) to use the F-MUAC tool regularly. These findings demonstrate that caregiver knowledge and correct interpretation of F-MUAC colors significantly enhance utilization and response to malnutrition detection. However, while quantitative results confirmed adequate knowledge, qualitative data pointed to lingering trust and communication gaps between caregivers and health workers, particularly when F-MUAC results at home differed from facility readings. Thus while the null hypothesis was rejected, the findings highlight the need for continued capacity building and harmonized messaging to sustain trust and accuracy.

6.2 Conclusions

Socioeconomic and contextual determinants - particularly livelihood type, household mobility and proximity to health services significantly affect F-MUAC utilization in Turkana South. Caregiver

knowledge and regular validation of F-MUAC readings at health facilities are key enablers of accurate and sustained use of the tool. Community Health Promoters (CHPs) remain central actors in facilitating screening, supporting correct use and linking households to treatment services. Despite high knowledge, some caregivers still rely on visual health cues rather than routine F-MUAC checks, necessitating behavior change communication. Consistent integration of F-MUAC into existing outreach and livelihood support programs is critical for ensuring early detection and reduction of child malnutrition in nomadic settings.

6.3 Recommendations

6.3.1 Programmatic Recommendations

i. Institutionalize refresher training - for caregivers through CHPs to reinforce correct tape positioning and color interpretation.

ii. Enhance mobile and community-based health outreach to reach migratory families and reduce dependence on static facilities.

iii. Establish F-MUAC validation and feedback mechanisms between households and health facilities to build confidence and consistency.

iv. Support CHPs with transport and incentives to expand coverage in remote and pastoralist areas.

6.3.2 Policy Recommendations

i. Integrate F-MUAC into Kenya's Community Health Strategy and County Nutrition Action Plans to ensure sustainable scale-up.

ii. Address livelihood-related barriers by aligning health interventions with community mobility and work patterns.

iii. Harmonize nutrition messaging between facility and community levels to eliminate confusion over differing anthropometric results.

6.3.3 Research Recommendations

i. Conduct longitudinal studies to assess long-term retention of F-MUAC skills and sustained utilization.

ii. Undertake comparative studies between nomadic and sedentary populations to understand contextual determinants of F-MUAC success.

iii. Explore digital and peer support innovations (e.g., mobile reminders, mother-to-mother groups) to improve regular screening and follow-up.

Overall Implication

This chapter concludes that F-MUAC is a feasible and effective community-based tool for early detection of child malnutrition in nomadic settings. Sustaining its success requires context-specific program designs, regular supervision, harmonized communication, and trust between caregivers and health systems. By empowering caregivers with skills, feedback, and confidence, the F-MUAC approach can play a transformative role in reducing child malnutrition in Turkana South and similar arid regions of Kenya.

REFERENCES

Action Against Hunger. (2022). Adaptations to the management of acute malnutrition in the context of COVID-19. New York, NY.

Advancing Nutrition. (2021). Household economy analysis baseline for three livelihood zones in Turkana County, Kenya. USAID Advancing Nutrition. https://www.advancingnutrition.org/sites/default/files/2023-07/HEA%20Baseline%20Study%20Turkana_2021-10-19.pdf

Aguayo, V. M., Badgaiyan, N., & Paintal, K. (2016). Family-based nutrition interventions in India: Evaluating the feasibility and acceptability of F-MUAC measurement for malnutrition screening. Journal of Global Health, 6(2), 1–9. https://doi.org/10.7189/jogh.0

Alé, F. G. B., Phelan, K. P. Q., Issa, H., Defourny, I., Le Duc, G., Harczi, G., … Blackwell, N. (2016). Mothers screening for malnutrition by mid-upper arm circumference is non-inferior to community health workers: Results from a large-scale pragmatic trial in rural Niger. Archives of Public Health, 74, 38. https://doi.org/10.1186/s13690-016-0149-5

Ahouandjinou, E. A., Alouki, K., & Agueh, V. D. (2021). The impact of mobility and livelihood diversification on child nutrition monitoring among nomadic families in Niger. BMC Public Health, 21, 1245. https://doi.org/10.1186/s12889-021-11327-7

Amouzou, A., Hazel, E., Shaw, B., Miller, N. P., Tafesse, M., Mekonnen, Y., & Bryce, J. (2018). Effects of the integrated community case management of childhood illness strategy on child mortality in Ethiopia: A cluster randomized trial. The Lancet Global Health, 6(11), e1231–e1241. https://doi.org/10.1016/S2214-109X(18)30312-1

Bhutta, Z. A., Das, J. K., Rizvi, A., Gaffey, M. F., Walker, N., Horton, S., … Black, R. E. (2013). Evidence-based interventions for improvement of maternal and child nutrition: What can be done and at what cost? The Lancet, 382(9890), 452–477.

Blackwell, N., Myatt, M., Allafort-Duverger, T., Balogoun, A., Ibrahim, A., & Briend, A. (2015). Mothers understand and can do it (F-MUAC): A comparison of mothers and community health workers determining mid-upper arm circumference in 103 children aged 6 months to 5 years. Archives of Public Health, 73, 26. https://doi.org/10.1186/s13690-015-0074-z

Briend, A., Maire, B., Fontaine, O., & Garenne, M. (2012). Mid-upper arm circumference and weight-for-height to identify high-risk malnourished under-five children. Maternal & Child Nutrition, 8(1), 130–133. https://doi.org/10.1111/j.1740-8709.2011.00340.x

Daures, M., Phelan, K., Issaley, K., Defourny, I., & Harczi, G. (2020). New approach to simplifying and optimising acute malnutrition treatment in children. British Journal of Nutrition, 123(7), 756–767. https://doi.org/10.1017/S0007114519003258

Diop, L., Gauthier, B., Ismael, T., & Sidikou, M. (2023). Evaluation of the family-led F-MUAC component of an integrated package of interventions to reduce wasting in Chad and Mali. Field Exchange, 69, 34–39.

Food and Agriculture Organization (FAO). (2020). Pastoralism in Africa's drylands: Reducing risks, addressing vulnerabilities and enhancing resilience. Rome: FAO.

Gera, T., Shah, D., Sachdev, H. S., & Sinha, R. (2017). Accuracy of F-MUAC in the detection of severe wasting. Indian Pediatrics, 54(10), 861–863. https://doi.org/10.1007/s13312-017-1165-4

Grant, A., Njenga, M., & Aber, D. (2018). Comparing performance of mothers using simplified mid-upper arm circumference (F-MUAC) classification devices with an improved F-MUAC insertion tape in Isiolo. Archives of Public Health, 76, 11. https://doi.org/10.1186/s13690-018-0260-x

Guesdon, B., & Myatt, M. (2016). The F-MUAC approach: Empowering mothers to screen for malnutrition in their own children. Field Exchange, 52, 66–69.

Isanaka, S., Boundy, E. O., Grais, R. F., Myatt, M., Briend, A., & Roberfroid, D. (2016). Improving screening for acute malnutrition by combining mid-upper arm circumference and weight-for-height z-score. BMC Nutrition, 2(1), 63. https://doi.org/10.1186/s40795-016-0094-3

Jadhav, A. B., Yadav, K., Singh, P., & Mangal, D. K. (2018). Utilization of F-MUAC for child malnutrition monitoring: A community-based study in rural India. The Lancet Global Health, 6(12), e1309–e1317. https://doi.org/10.1016/S2214-109X(18)30327-9

Jadhav, S. M., Chavan, S. S., & Reddy, S. S. (2018). Community-based screening of undernutrition using mid-upper arm circumference by caregivers: Evidence from rural India. Indian Journal of Community Health, 30(2), 165–171.

Jessica, B., Thomas, A., & Khamis, S. (2018). Use of mid-upper arm circumference by novel community platforms to detect, diagnose, and treat severe acute malnutrition in children. Nutrition Exchange, 10, 24–26.

Kapur, D. S., Sharma, S., & Kumar, A. (2019). Impact of community-based F-MUAC screening on child malnutrition in rural India. Journal of Tropical Pediatrics, 65(2), 123–130. https://doi.org/10.1093/tropej/fmy042

Kenya National Bureau of Statistics (KNBS), & UNICEF. (2022). Kenya Demographic and Health Survey (KDHS) 2022. Nairobi: Government of Kenya.

Kimani, E., Wambui, W., & Kabiru, E. (2022). Barriers to effective community-based nutrition screening among nomadic pastoralists in northern Kenya. East African Health Research Journal, 6(1), 12–22.

Majiwa, P. R., & Omondi, D. O. (2024). Family-led mid-upper arm circumference (FL-F-MUAC) approach and the screening of acute malnutrition in children aged 6 to 59 months in Africa: A scoping review. The Pan African Medical Journal, 49, 38. https://doi.org/10.11604/pamj.2024.49.38.36956

Ministry of Health [Kenya]. (2018). National Guidelines for Integrated Management of Acute Malnutrition (IMAM). Nairobi: Government of Kenya.

Ministry of Health [Kenya]. (2020). Kenya Community Health Policy (2020–2030). Nairobi: Government of Kenya.

Ministry of Health [Kenya], Turkana County Government, & UNICEF. (2023). Turkana County SMART Survey Report. Lodwar: Turkana County Nutrition Office.

Ministry of Health [Kenya], UNICEF, & WFP. (2019). F-MUAC Training Guide: Empowering caregivers to screen children for malnutrition. Nairobi: Government of Kenya.

Mude, A., & Kaimba, G. (2015). Livelihood diversification and child welfare outcomes among pastoral households in northern Kenya. African Journal of Rural Development, 2(4), 345–359.

Mwangome, M. K., Fegan, G., Mbunya, R., Prentice, A., & Berkley, J. A. (2012). Reliability and accuracy of anthropometry performed by community health workers among infants under six months of age in rural Kenya. Tropical Medicine & International Health, 17(5), 622–629. https://doi.org/10.1111/j.1365-3156.2012.02973.x

Myatt, M., Khara, T., Dolan, C., Garenne, M., Briend, A., & Blackwell, N. (2018). Improving screening for acute malnutrition using F-MUAC approach in low-resource contexts. Field Exchange, 58, 4–9.

ENN (2023). *F-MUAC: Review of Evidence and Practice.* Emergency Nutrition Network, Oxford, UK.

F-MUAC SURVEY QUESTINAIRE FEB 2024

Appendix I: Household questionnaire

1.IDENTIFICATION 1.1 Data Collector____1.2 Team Leader_1.3 Survey date (dd/mm/yy)----------							
1.4 County	1.5 Sub County	1.6 Ward	1.7 Location	1.8 Sub-Location	1.9 Village	1.10 HH No	1.11 Team No.

2. Household Demographics				
2.1	**2.2**	**2.3**		**2.4**
Age Group	**Please code children <5yrs starting from the youngest to the oldest.**	**Age (Recordage in MONTHS for children <5yrs**		**sex** 1= Male 2= Female
<5 yrs		Months	years	
	1			
	2			
	3			
	4			

2.5	**Main Occupation of the Household Head – HH.(enter code from list)** 1=Livestock Herding 2.=Own farm labour 3=Employed (salaried) 4=Waged labour (Casual) 5=Petty trade 6=Merchant/trader 7=Firewood/charcoal 8=Fishing 9=Others (Specify) | |	**2.6.** What is your **main** current source of income 1. =No income 2. = Sale of livestock 3. = Sale of livestock products 4. = Sale of crops 5. = Petty trading e.g. sale of firewood 6. =Casual labor 7. =Permanent job 8. = Sale of personal assets 9. = Remittance 10. Other-Specify |_____|
2.7	Marital status of the respondent 1. = Married 2. = Single 3. = Widowed 4. = separated 5. = Divorced. |_____|	**2.8 What is the residency status of the household**? IDP Refugee Resident |_____|

3. **CHILD HEALTH AND NUTRITION (ONLY FOR CHILDREN 6-59 MONTHS OF AGE;**

Instructions: *The caregiver of the child should be the main respondent for this section*

3.0 CHILD ANTHROPOMETRY *(**Please** fill in **ALL REQUIRED** details below. Maintain the same child number as part 2.2)*

A	B	C	D	E	F	G	3.1	3.2
Child No.	**what is the relationship of the respondent with the child/children** 1=Mother 2=Father 3=Sibling 4=Grandmother 5=Other (specify)	**SEX** F= Female M= Male	**Edema** Y= Yes N= No	**F-MUAC Color**	**Did you check your child's (NAME) F-MUAC in the past two weeks?** Yes No *If No, skip part G and proceedto3.1)*	**If YES,** **What was thecolor of F-MUAC)** 1 = red 2= yellow 3 = green 4 = can't remember	**When the child was sick did you seek assistance ?** Yes No	**If the response is yes to question # 3.1, where did you seek assistance? (More than one response possible-** 1. Traditional healer 2. Community health worker 3. Private clinic/ pharmacy 4. Shop/kiosk 5.Public clinic 6. Mobile clinic 7. Relative or friend 8. Local herbs 9. NGO/FBO
1								
2								

Continuation…				
3.3	**3.4**	**3.5**	**3.6**	**3.7**
If YES to the health facility, what was the reception like? Excellent Good Fair Poor V. poor	**If NO, why did you choose not to go to the health facility** Far Facility staff not friendly Cannot get helpQuickly	**Was the color you measured confirmed at the health facility?** YES NO Always YES Always NO	**How will you rate your motivation on taking child F-MUAC measurement using F-MUAC** Very low Low level Medium level High level Very high level	**If Low or very low, how do you think you should be motivated?** (*probe and write the comment*)

4.0 Mothers knowledge on Nutrition/F-MUAC					
4.1	4.2	4.3	4.4	4.5	4.6
Show a photo of a child aged 6-59 months with wasting and one đa child with edema	**Causes of this condition? (Tick all that apply)**	**The population at risk of Malnutrition include in your household: (tick all that apply)**	**What are the Consequences of Malnutrition in children?**	**Show the mother F- F-MUAC tape.** **Ask the mother to;** **Explain the F-MUAC colors**	**Referral mechanism she understands within her community.**
Ask if the mother is aware of this phenomenon? YES NO If yes go to 4.1.2, If No go to section 4.3	1.Environmental or medical conditions: 2. Reduced food intake 3. Social and mobility problems leading to difficulty in preparing or Finding meals 4. Lack of breastfeeding 5. Mental health problems like schizophrenia, depression, dementia and anorexia nervosa 6. Digestive disorders and stomach conditions like ulcerative colitis 7.Alcoholism	1.Older people, especially those who are hospitalized or in long-term institutional care 2. Those who have difficulty absorbing nutrients 3. Socially isolated individuals 4. People with chronic eating disorders 5. People who are recovering from a serious illness or condition 6. Under five children	Sickness Death Poor school performance Burden to the community and country economy	How will you rate the knowledge on color identification Fair- only one color identified Good- two color correctly identified Excellent- three colors identified with correct classification	1.Referral to the CHV for verification 2.Referral to the health facility for verification and treatment both 3.Take the child F-MUAC ***(Tick all that were correctly done)*** Did the mother correctly hold and insert the F-MUAC tape Did she correctly place the F-MUAC on the correct part of the arm 4.Was correct reading done (Use of arrow aligning to the color of the F-MUAC? 5.Was the reading window correctly at the eye view

APPENDIX II: F-MUAC Key informant interview guide.

Key Informants including County nutritionist, Sub-County nutritionist, Sub-County Communitystrategy focal person, health facility nutritionist, community health officers and facility in charges.

FLM

Now, I would like to ask you some questions about F-MUAC.

1. How can F-MUAC integration help accelerate task shifting from health care workers to mothers?
2. What do you think should be done to improve:
3. Mothers' diagnosis of malnutrition in the community
4. Self-referral of malnutrition in the community?
5. What do you think can be done to ensure continuous screening malnutrition is done?Probe:
6. At the health facility
7. At the community level (Mothers)
8. What are your recommendations on what can be done to improve the implementation ofF-MUAC
9. What are some of the learning you noted during implementation that we need to adapt goingforward?
10. What modification can be done on F-MUAC implementation to suit the pastoral way oflife?
11. What can motivate women to routinely screen and refer malnourished child to the healthfacility?
12. What discourages women/ caregivers to routinely screen children for malnutrition?
13. What challenges if any, do mothers experience when using F-MUAC?
14. What challenges do health workers face during implementation of F-MUAC
15. Do mothers understand the nutrition status of their children in T. south Sub-County

CONCLUSION

Is there anything you would like to add based on the discussions we just had?

Do you have any questions for me?

Appendix III: - F-MUAC- FGD Community Members Guide

Focus groups with mothers of children 0 to 5 years in all sampled sites in the area of intervention,maximum 8 participants per focus group.

HEALTH FACILITY SUPPORT

First, we would like to ask you about facility support and feedback for you when you screen andrefer your child

1. How does the facility here support CHVs to support you at the community?
2. Probe on social support and other forms of support
3. How do you receive F-MUAC at the facility during health facility visit? I.e. duringa health clinic visit?
4. What are your views on health facility support to the mother?
5. Probe on benefits and challenges
6. What are your suggestions on how health facility support to mothers can be improved?

F-MUAC (Mid Upper Arm Circumference)

Now, we would like to ask about your experiences with F-MUAC in this community.

1. What will you say about F-MUAC training in your community?
2. If the answer to Qn 1 is; there has been training on F-MUAC within the community, ask to:
3. Please tell us about your experiences measuring children yourself
4. How often do you measure your children's F-MUAC?
5. How do you feel about it?
6. Who in the household usually takes measurements? (List of all mentioned)
7. Who in the family decides what to do if the result for a child is in yellow or red zone?
8. What happens if you are not able to take the action you would prefer when a child hasa result in the

yellow or red zone?

9. Has using F-MUAC changed household dynamics around food distribution and decisionmaking? Kindly explain

10. What are your suggestions on what can be done to improve community members measuringthe mid-upper arm circumference of children to check for malnutrition?

APPENDIX IV: Consent form

Proposal: F-MUAC intervention improves IMAM coverage among the Nomadic people of Turkana South,
Turkana County.

Informed Consent Form for Participating in the F-MUAC Survey

Introduction

Hello. My name is (*your name*) and I am part of a research team. We are conducting research in this sub-county to try to understand how F-MUAC has improved the coverage of IMAM coverage in the nomadic people of Turkana south. This information will help us in optimizing the use of this simplified tool and ultimately address persistent acute malnutrition more effectively.

Ejok robo, kanyaritae ayong' (ekiro kon) ani arai ayong ajore na arebor a ngakiro. Kisubisua arebor a ngakiro anakaunti ana lokwap taanyunae eger loa ekeu apokot awui akitedeko angirogoiangide. Ngakiro nguna king'arakini sua atiekun angaresearch assistanceit nationo apokot kana anakitijiere echaniterogo siit lokojokon.

Explanation of procedures

You have been selected to participate in this study because you are a resident in this sub-county. Being part of this study involves taking part in two 15–20-minute interviews with our research team. One interview will be conducted now, and the second interview will be conducted after one week. We will seek your information on your household demographics and composition; socioeconomic status; training on F-MUAC you have received; referral mechanism; your role in screening the child as a mother/caretaker including motivation, we will be collecting this information using a tablet.***Kitiekunitae iyong alomar nalolom aswamaru kana kotere irai iyong akakaunti kana. Iraun ipei anaswamaru kana erai alomun nia ngatachet/ngakingiset kosi-arei ngasaa 15-20 anarebor kosi. Ipeiangatachuneta/ngakingiseta kanguna emini tokona, ngakingiseta kon na ngaarei eponio sua anaukit anapei kana. Kipedori sua ankingitun ekoi kidiama ekol kon alowai akimarun ngitunga, ngitichisio kon lukisumujete, ngakitatameta apokot awui na isubakini iyong napei iyanyunia***

ikokuedeak ka ngakuro daang na kitonyounit iyong akichok ikoku.

Voluntary participation and confidentiality

Your participation in this study is voluntary, and if you choose not to participate, you will not be treatedwith prejudice. Please note that if at any point in time you feel you do not want to continue participating,you can withdraw at any time without any consequences or penalty. Consent forms will be locked in cabinets only accessed by the research team and the data will be kept until at least the end of the studybefore discarding.

Alomun kon naswamaru na erai achamun aetau kon, ani pekichamunit yong, mam taan kichani yong/king'oikini yong. Ani keyei akolong'it nairaria yong niaronon, tolimokinae ayong. Kitowei suaekien ngolo ka emam ngichan kianyunete yong. Nikipedori sua alimor yong anieyarere ng'atachet kon. Ngirora kon iweiyo aniajokon anipeneyanyunete ngitunga anakomputa anesubeta ngitunga arebor etich. Abuk achamunet kon togolokinoe lometha niajokon toruwor itwaan niepedori alemunarai ngitunga arebor kana bon, epedorete akiboikin tanang nierumoror etich lo eroko nechakara.

Benefits, harms, and risks

You will not get any material gift for participating in this study. However, the information gathered during the observation will be useful to inform the adaptation on the implementation of F-MUACat sub- county. There is no anticipated harm or risks that you will suffer resulting from your participationin this study.

Nipedori yong aanyun idio bore nikitachere anaswamaru kana. Ngakiro neechununio kaneanalolom kana ingarakinete akiteyen ngipitesinei ngice lu itojokere apokot awui. Emam ngichan kitee sua nianyuni iyong analolom kon alomar naswamaru kana kori apolou kon irai ekangarakinan asegis anadakar nepedori akilochokin.

Questions and your rights as a participant

You have the right to ask and have answers to any question you may have about this research. If you have any questions or concerns about this study or the results you can ask me before or after the interview or you can contact the Research and design lead, Esekon Benedicto on 0726098897. If you have questions about your

rights as a study subject, you may contact

Iyakar yong alolom akingit ka ayakau ngatachet kon ania ngakingiseta anaiyakar yong kidiama arebor kosi. Ani kiyakar yong ngakingiseta kori ng'adi kiro kidiama aswamaru na kori ngatachet kosi, kingitae ayong eroko kori neerumoror ngakingiseta nuku kori ipedori yong akian anadiit ekapolon arebor kosi, Esekon Benedicto, anadiit keng 0726098897. Ani kiyakar yong akingiset kidiama alolom irai ipei aitwaan anieyei nakiro nu, taram adiit nieyei

Do you have any questions at this time?

Iyakar yong akingiset adio analolom kana?

Part II: Certificate of Consent

I have read the above information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to participate in this study.

Apedo ayong akiswam ngakiro nu, kori keswamakin ayong. Aanyu ayong alolom akingitun ngakingiseta kidiama ngakiro nu ka adi kingiset niapedori ayong atachun tochamunia etau. Achametau kang aniajokon alomar nalolom aswamaru kana.

Print name ofSubject	[at least forename and surname] [ekiro ekingaren ka loa apokon]
Signature ofSubject	
DD/MM/YYYY	

If visually impaired, physically impaired, mentally impaired or illiterate

Statement by the researcher/person taking consent

Thank you