Examining the Complex Dynamics Influencing Persistent Acute Malnutrition in Turkana and Samburu Counties – A Longitudinal Mixed Methods Study to Support Community Driven Activity Design

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List of Acronyms

APHRC	African Population and Health Research Center
ARI	Acute Respiratory Infection
ASAL	Arid and Semi-arid Lands
CHV	Community Health Volunteer
ESRC	Ethical and Scientific Review Committee
EWS	Early Warning System
FDG	Focus Group Discussions
FWA	Federal Wide Assurance
GAM	Global Acute Malnutrition
IDI	In-depth Interview
IRB	Institutional/Internal Review Board
MAD	Minimum Acceptable Diet
MC	Mercy Corps
MDD	Minimum Dietary Diversity
MIYCN	Maternal, Infant and Young Child Nutrition
MUAC	Mid-upper Arm Circumference
NACOSTI	National Commission for Science, Technology, and Innovation
NDMA	National Drought Management Authority
PAM	Persistent Acute Malnutrition
PREG	Partnership for Resilience and Economic Growth
RTI	Research Triangle International
SBC	Social and Behavior Change
SMART	Standardized Monitoring and Assessment of Relief and Transitions
ToC	Theory of Change
USAID	United States Agency for International Development)
WASH	Water, Sanitation, and Hygiene
WRA	Women of reproductive age

Scientific abstract

Background: Acute malnutrition in infants and children less than 5 years is persistent in the arid and semi-arid   lands (ASALs) of East Africa and the Sahel region despite years of investment. In the ASALs of Kenya, the situation is exacerbated by deep-rooted poverty and unequal access to basic services, sustained community conflicts, migration, poor seasonal rainfall/drought and other shocks. Nutrition specific and nutrition sensitive national and county level programs have either not been developed or not implemented effectively.

Objectives: To understand and map immediate, underlying, basic and systemic drivers of acute malnutrition for the development of overarching as well as micro-solutions for the sustainable reduction of persistent acute malnutrition (PAM) and inform pilot studies and Phase 2 (second phase of NAWIRI project implementation) activities in Turkana and Samburu Counties.

Methods: This study will be a longitudinal mixed-methods observational cohort study of children less than 3 years and their mothers and/or caregivers in Samburu and Turkana Counties. Both quantitative and qualitative methods will be utilized in the data collection processes. Data collection is scheduled to begin in January 2021. Data analysis and learning and adapting will be ongoing so that results can inform pilots, theory of change (ToC) review and Phase 2 activities throughout the study.

Study outcomes: To develop new interventions, and to adapt and contextualize existing interventions to prevent global acute malnutrition (GAM); strengthen social and behavior change (SBC) strategies around maternal, infant and young child nutrition (MIYCN), water and sanitation (WASH), community health systems, gender dynamics, livelihoods and resilience, and to inform improvements of the current nutrition surveillance system.

Study duration: 24 months.

Summary budget: Total budget is KSH 140,400,000.00.

Lay summary:

The nutritional status of mothers and young children in Kenya's ASALs are strongly affected by deep-rooted poverty and unequal access to basic services, sustained community conflict, migration, poor seasonal rainfall/drought and other shocks. Inadequate women empowerment and limited control over household resources, high workload, domestic violence, insufficient household food security, inadequate social support, inadequate health services and an unhealthy environment, as well as inadequate dietary intake and high disease burden, are among other factors that contribute to poor maternal infant and young child feeding practice in these areas. Consequently, more than one in ten reproductive age women and 2-3 in ten young children in Turkana and in Samburu are undernourished. As such, this study aims to provide evidence for the appropriate policy and program design to improve the nutritional status of children and their mothers living in the two counties.

1. Introduction

Acute malnutrition in infants and children less than 5 years is persistent in the arid and semi-arid lands (ASALs) of East Africa and the Sahel region despite years of investment by the United States Agency for International Development (USAID) and other donors. In the ASALs of Kenya, including Samburu and Turkana counties, the situation is exacerbated by deep-rooted poverty, unequal access to basic services, such as health services and water and sanitation (WASH), sustained community conflict, migration, poor seasonal rainfall and other shocks. Nutrition- specific and nutrition- sensitive national and county level programs have either not been developed or not implemented effectively. Women of reproductive age (WRA; 15-49 years) and children are mostly affected by poor nutrition mainly because of systemic factors such as inadequate empowerment of women and limited control over household resources, high workload, domestic violence, alcohol consumption, and underlying factors such as insufficient household food security, inadequate social and care environment and inadequate health services and an unhealthy environment, as well as immediate factors such as inadequate dietary intake and high disease burden, especially among infants and young children [2-5]. Children living in extreme poverty, as is the case in many parts of Turkana and Samburu, face increased risks of undernutrition, poor health, and cognitive development [6]. There is evidence linking poverty to low maternal literacy and education. Low levels of maternal education are well-established to be associated with child undernutrition [7]. The most recent Standardized Monitoring and Assessment of Relief and Transitions (SMART) Surveys from Turkana and Samburu show very high levels of illiteracy; for example, 80% of caregivers in Turkana are functionally illiterate [7, 8].

Analysis of trends of global acute malnutrition (GAM) for children less than 5 years indicate that it is consistently at or above the emergency threshold of 15% [7-20]. GAM peaks during the hunger season (June and July), and worsens during drought seasons (November–March and May–August). Moreover, preventable and treatable illnesses, such as acute respiratory infection (ARI), diarrhea, and malaria/fever, are common, interacting with and contributing to undernutrition [21]. Feeding practices, including complementary feeding, are heavily influenced by cultural practices, women's time use, poverty and food insecurity [22]. Indeed, in these counties, the magnitude of protracted undernutrition has not improved over the past 3 decades [23].

Pregnant and lactating young women are particularly vulnerable nutritionally because of the high nutritional demands during these physiological states. Among WRA, 13% in Turkana and 10% in Samburu are undernourished [8, 13, 14, 19]. Data on undernutrition among adolescent girls are not available at the county level. However, at the national level, 16.6% of adolescent girls (15-19 years) are thin compared to around 5% for older women [23]. Minimum dietary diversity (MDD) in WRA is only 20% and 25.7% in Turkana and Samburu, respectively [24, 25].

The present study is borne out of on-going county consultation with government and key stakeholders in Turkana and Samburu counties on evidence gaps around key drivers of and most promising interventions to address persistent acute malnutrition. An initial scoping exercise conducted in both counties and desk review on the status and core drivers of persistent acute malnutrition (PAM) in the two counties informed the decision to include a longitudinal study designed to address a demonstrated gap in evidence on the influence of seasonality and shocks on key drivers on PAM. The proposal development process yielded an extensive draft ToC and the design of a longitudinal study that will generate detailed contextual information to explore multiple pathways to addressing PAM using the Nutrition in ASALS Within Integrated Resilient Institutions (NAWIRI)-ToC framework (Figure 1). NAWIRI is a USAID funded 5-year project aimed at addressing persistent acute malnutrition among children in Turkana and Samburu. The project will be carried out by consortium, which membership included but are not limited to APHRC, RTI, Mercy Corps, Save the Children, BOMA, and CARITAS. These partners handle different components of the project. However, this longitudinal study is being led by APHRC and RTI. It will provide evidence that will contribute to the implementation of the other components of the NAWIRI project, especially the design and implementation of Phase 2 project activities.

2. *Problem statement*

Turkana and Samburu have experienced persistent acute malnutrition (PAM) over the years. The recent data suggest acute malnutrition prevalence of 30% and 18% in Turkana and Samburu, respectively [7, 8]. The estimates in the two counties are   much higher than the national level average. For example, the results from the 2014 KDHS showed that 4% and 1% of children under five years suffer from moderate and severe acute malnutrition, respectively [23]. The causal pathways leading to   PAM in Turkana and Samburu Counties, are complex and interlinked. This requires an in-depth assessment and analysis to understand the context, season, and shock-specific drivers fully. Although cross-sectional research on PAM and its immediate and underlying drivers has been conducted in these Counties, there is almost no evidence on how these vary by season, within the same households, and by the synergistic effects of the frequent and severe climate-related and other shocks. Our study will identify the most salient modifiable factors that lead to PAM, as well as poor MIYCF, care practices and morbidity. This will provide evidence-based insights for the development of overarching as well as micro-solutions for the sustainable reduction of PAM. Consequently, the study will take a systems-based approach to craft contextualized and sustainable interventions to address modifiable factors contributing to PAM, including but not limited to strategies to improve food systems and livelihoods, social and behavior change (SBC); community health systems; water, sanitation, and hygiene (WASH); and gender dynamics, among others.

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3. *Review of literature*

Sub-optimal MIYCF practices contribute to high rates of malnutrition in the country. Overall, in both Turkana and Samburucounties, knowledge of optimal MIYCN practices is relatively high. However, complementary feeding practices are far from optimal and knowledge about best practices is less well documented. Further, maternal knowledge and attitudes do not necessarily translate into practice [24, 25]. Maternal dietary diversity remains a challenge with starch and protein foods consumed in relatively adequate quantities, but with markedly low consumption of fruits, vegetables, and other nutrient-rich foods, like organ meats and eggs [26]. Pregnant women restrict food intake in the belief that they will have an easier delivery. This leads to low birth weight, estimated at 13% among some pastoral groups [27]. Breastfeeding practices have continued to improve with notable challenges around the provision of pre-lacteal feeds, bottle feeding with teat or nipple and limited support given to mothers to initiate breastfeeding within one hour of delivery [24, 25]. Infants are introduced to animal milk when a few days old, which is a risk factor for malnutrition and morbidity [28]. Besides, timely initiation of breastfeeding within one hour of delivery and exclusive breastfeeding for 6 months is still challenging in both counties. Research indicates that cultural beliefs and taboos around breast milk hinder the breastfeeding practices in both counties. For example, mothers believe that breastfeeding should cease when a child has diarrhea because breast milk causes diarrhea and that colostrum or the 'first milk" is not suitable for the newborn child [29]. The continued practice of bottle feeding is a concern because of the possible contamination due to unsafe water and lack of hygiene in preparation. Bottle feeding is commonly practiced for children under two years of age in both Samburu and Turkana counties [29].

Infant and young child diets are often inadequate in terms of quantity and variety. Overall, only 18 percent of the children aged 6-23 months were receiving solid, semi-solid and soft foods the minimum number of times [24, 25]. The proportion of children receiving the minimum dietary diversity (MDD), or foods from at least four food groups, was much lower than that for the minimum meal frequency, indicating the need to focus on improving diet quality and nutrient intake among this vulnerable group. Cow and goat milk form the main complementary food, in addition to porridge and maize meal. Potatoes and fruits are included in the diet whenever available [29, 30]. Lack of knowledge on the nutritional value, preparation and use of some of the nutritious foods has hindered their adoption among pastoral communities. Also, some cultural beliefs and food proscriptions have prevented members of households, mostly women and children, from consuming certain nutritious foods, and even seeking medical care, further predisposing them to malnutrition. For example, in parts of Turkana, pregnant women are not allowed to eat eggs because of the belief that eggs would make the unborn child 'bigger' leading to difficulties during birth. Having a smaller baby is considered an advantage because the women did not have to deliver in hospitals [31].

Livelihoods: The ASALs, which include Turkana and Samburu counties, make up to 89% of the Kenyan territory [32]. The ASALs inhabitants constitute 36% of the total population in the country with 12% living in arid counties and 24% living in semi-arid, according to 2009 national census. The livestock sector accounts for 90% of employment and more than 95% of household incomes in the ASALs. Pastoralism is a significant contributor to household food and nutrition security directly through diet such as meat, milk or indirectly through the sale of livestock products to purchase other foods essential in the diet, such as cereals and vegetables [33]. About 60-70% of the ASALs populations in Kenya lived below the poverty line, and 40% are considered extremely food insecure and experience the highest rates of severe malnutrition due to their vulnerability and aridity of the regions   [34].

A typical response to food insecurity is humanitarian interventions that provide food through targeted and blanket supplementary feeding programs which are common in both Turkana and Samburu. Food aid has both positive and negative effects. It facilitates the attainment of food security in the short term. However, a major criticism is that it can lead to depressed prices for domestically produced food, resulting in a reduction in production and loss of livelihood for farmers in agro-pastoral zones. Less explored is its effect on creating dependence on recipients and reducing incentives to produce their own food or engage in economically remunerative activities to increase household income and purchasing power [35].

Livelihood systems are critical basic underlying drivers of nutrition. They are affected by climate, ecological systems, and social systems. Livelihood systems in   turn affect a household's ability to earn income, access nutritious food and hence meet their nutritional and health needs. Gender dynamics in livelihood systems based on livestock also contribute to less control   over household income and other resources by women, as they are male dominated. Age dynamics further complicate this with adolescent girls having less power and uncertain levels of control by women in polygamous households or those that are female headed. Organizations also tend to focus on individual livelihoods with less consideration to the environment that supports that livelihood as well as the role the livelihood plays within the household and positive nutrition outcomes and how these vary by livelihood strategy.

Water, sanitation, and hygiene (WASH): Available evidence suggests that there is a substantial disease burden due to poor WASH in Kenya's pastoralist communities. The disease burden in Samburu and Turkana counties is mostly related to communicable, maternal, neonatal, and nutritional disorders [36]. A very marginal proportion of deaths in Samburu County is linked to injuries and non-communicable diseases [36]. Overall, the data point to similar patterns of mortality and morbidity risk factors in both counties. For example, the four leading causes include unsafe water, sanitation and handwashing, child and maternal nutrition, unsafe sex and air pollution [36].

The common diseases in both Turkana and Samburu counties include malaria, diarrhea, acute respiratory tract infection, pneumonia, worms, malnutrition, and skin diseases [23, 29]. These diseases are caused by contaminated water, contaminated foods, poor ventilation, and dusty and windy environment. Low levels of water treatment at the household level and improper disposal of human waste, as mentioned, are also related to the high incidence of diarrhea among children. The prevalence of these diseases has a profound influence on the nutritional status of children, mediated by changes in dietary intake, absorption, and dietary requirements (especially for energy and protein). The high prevalence of diarrheal disease is attributed to a lack of awareness by the caregivers on what causes diarrhea and preventive measures of diarrheal disease. About 30% of households do not typically seek care for illnesses occurring among children (SMART surveys) [23, 29].

The most recent data from Samburu show that 27% of children less than 5 years suffered from at least one illness 2 weeks before the survey [20]. Among those who were sick, 64% had a respiratory infection or cough, 24% had malaria, and 12% had watery diarrhea. Similarly, most of the data from Turkana show that 41% of children less than 5 years were ill 2 weeks before the survey [7]. Among those who were sick, 41% had a respiratory infection or cough, 37% had malaria, and 18% had watery diarrhea. With regards to the mode of treatment, herbal treatment is often the preferred treatment option for such illnesses by the women in Turkana, followed by treatment from health facilities and home therapies [28].

The literature suggests that poor WASH practices are directly linked to undernutrition via the ingestion of fecal pathogens resulting in diarrheal diseases. WASH has also been linked to all the four "pillars" of the food and nutrition security framework, both as immediate and more distant causes. However, there is a critical evidence gap in understanding pathways between water insecurity, specifically women's time burden related to water insecurity, and under-nutrition through care practices (and hygiene) as well as seasonal food insecurity. This is likely to be a critical pathway for households in ASAL areas, particularly in rural areas. In contrast, in urban/semi-urban areas, diarrheal disease is related to poor sanitation. Recent studies suggest that water insecurity is strongly associated with food security and research conducted in Samburu county in 2018 reported significant links between water insecurity and care practices [38, 39].

Overall evidence on the association between poor WASH practices and acute malnutrition is limited and inconclusive [38]. A recent study in rural Ethiopia aiming to help address this gap found a clear association between acute malnutrition among children under 5 years, and use of toilet facility and the time needed to fetch water, but, interestingly, not with the source of drinking water [38]. An important study amongst pastoralists in Chad showed a significant association between hygiene practices, sources of water, and acute malnutrition [39].

Health seeking behavior and access to health services: The evidence available suggests that in the ASALs, health care is mainly sought from public health facilities. The services are usually provided by community health volunteers (CHVs) with operations embedded within community health units, which constitute level 1 of the health care system in Kenya. Other health service providers, to a lesser extent, include private health facilities, mobile clinics, traditional healers, and shops. Inadequate coverage of health facilities is often coupled   with a lack of adequate health personnel in these areas [29, 40].   CHVs   play a critical role in providing essential services and health education to households, focusing mainly on maternal and newborn health [27]. The lack of adequate health facilities is singled out as a critical factor for the high percentage of home births in Turkana and Samburu Counties   [21].

Consequently, immunization coverage for children is reasonably high in both counties but below the national target of 80% (60-90% across the six vaccine-preventable diseases namely, tuberculosis, diphtheria, whooping cough, tetanus, polio, and measles). The coverage for the 3rd dose of polio vaccine is particularly low (3.7% and 1.4% coverage respectively) [36]. Thus, evidence is needed to understand how to best tackle morbidity and mortality risk factors among children in both Samburu and Turkana counties, especially on ways to effectively support families for preventive and curative care along the continuum of care (including during pregnancy and antenatal care). A substantial proportion of women in both counties do not have the recommended number of contacts with health providers during pregnancy, and a high percentage still deliver at home despite the efforts to increase skilled birth deliveries in the counties [37]. The main reasons for giving birth at home include inaccessibility to health facilities because of poor road infrastructure, distance to health facilities, and difficulty in accessing transport to health facilities. This lack of appropriate contact with health care providers coupled with a low level of literacy, deep-rooted poverty, and prevalent social issues (such as alcohol consumption among caregivers in Turkana) constitute a significant barrier in health care prevention in both counties.

Furthermore, evidence is needed to understand the impact of gender disparities in household and livelihood-related tasks on access to health care services in pastoralists communities beyond the availability of services [41]. Men are the primary decision-makers regarding when and how women seek health care for themselves and their children. This can lead to barriers to care-seeking if the adult males in the household are far from home herding livestock. Evidence is also needed to understand the impact of cultural factors as prevalent beliefs can be detrimental in accessing care. The Turkana people, for instance, relate diseases to a kind of curse that they describe as something similar to the "evil eye" as it exists in other cultures, and believe that they can do offerings of cattle to their God 'Akuj' for healing [41]. For the Turkana people also, a disease which requires medical attention is one that hinders an individual from carrying out daily activities such as cattle herding or family responsibilities. They would,

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therefore, not seek health services unless unable to cater to their daily activities [41]. There is also a need to investigate the role of shame and discrimination in the process of seeking care for acute malnutrition in pastoralists communities, especially for children beyond the commonly known barriers such as women's time and labor constraints [42].

Also, the available evidence reveals that social systems and institutions have an impact on women's empowerment and consequently, optimal childcaring practices. Indeed, building maternal confidence is important for better child feeding practices. However, health education and promotion activities aimed at providing psychosocial and practical support for child feeding appear to be inadequate in Kenya [43]. Moreover, time poverty among women—due to their multiple 'reproductive and productive' tasks—leads to poor access to health care and inadequate nutrition practices. Although women's paid work is crucial for children's health, this is uncommon in marginalized settings of Africa (e.g. rural, pastoralist or nomadic areas) [44]. Moreover, children of non-educated and non-employed women do not usually meet minimum meal frequency and have stunted growth relative to educated and employed women in low-income countries, including Kenya [44, 45]. In food insecure, semi-arid rural areas of Kenya, available evidence suggests that women's agricultural decision-making positively affects child nutrition and growth, especially in poor male-headed households [46]. Women's empowerment in agriculture improves the health and nutrition of mothers, girls, and young children. Likewise, in a traditionally nomadic pastoralist population of northern Kenya, women's autonomy augments children's (3–10 years) nutritional outcomes [4]. Nevertheless, maternal intra-household autonomy on child feeding is not sustainable, and there appears a considerable variation and dependence on healthcare workers' support [45]. This could be attributed to inadequate knowledge, heavy maternal workload, cultural beliefs, societal norms, and household food insecurity [47].

Indeed, gender inequality, family and intimate partner violence, and community violence (youth violence, property crimes, workplace and other institutional violence)–have dire consequences on MIYCN in economically disadvantaged communities including ASALs [48]. For instance, women in sub-Saharan Africa (SSA) have less access to maternal and child health services, including nutrition. This is compounded by their poor knowledge on access and use of these services, less autonomy to healthcare decision-making [49] and *gendered* socio-cultural and economic barriers [50]. Maternal intra-household autonomy on child feeding is not the best, and there appear a considerable variation and dependence on healthcare workers' support [51]. This could be attributed to inadequate knowledge, heavy maternal workload, cultural beliefs, societal norms and household food insecurity [52]. These issues are serious in pastoralist and nomadic communities, which are characterized by sustained and low-intensity intercommunity conflict as well as political and economic marginalization [53]. In these communities, chronic violence and inequality interact and lead to continued health and nutrition disparities [54]. Household and community differences, poor psychosocial health and

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secondary community violence, affect health and nutritional outcomes in women, children and young populations of these communities [53]. Also, women of reproductive age in ASALs have diverse workloads and engagements in productive, reproductive and community roles. Conversely, gender barriers among adolescent mothers, and the effect of this on their health and nutrition practices. Understanding the mechanisms and pathway of the interaction of these seemingly distal factors to undernutrition using prospective study will help to provide more holistic evidence for the design of targeted interventions to address PAM and maternal and child health in general.

There is a call to consider the broader socio-cultural and economic contexts, including the value of women's autonomy [55] and men's involvement [56] in designing and implementing nutritional interventions for women and children. This helps to understand the potential interaction between these distal factors and how they affect nutrition outcomes and enables the design of gender-sensitive and nutrition-sensitive interventions [57]. For instance, gender awareness when designing nutrition interventions addresses and helps to understand the dynamics and processes underlying 'gendered' perceptions and respective outcomes [57]. Gender sensitive SBC approaches appear to improve nutrition outcomes during the first 1,000 days, but similar evidence on food insecure settings is scanty [58]. There is also a need to examine decision-making processes within different contexts of the family (e.g., polygamous, female-headed households) and community dynamics and gender hierarchies to design community-driven interventions to ensure sustained behavior change towards nutrition and public health interventions in fragile settings [43, 58]. Strategies to improve nutrition through women's empowerment concurrently considering household resource constraints and communal problems benefit vulnerable segments of the population and the wider community [59]. Importantly, less is known about the lived experiences of individuals and how social responses to violence interact with access to resources to create optimal patterns of nutrition as well as psychosocial wellbeing of the East African pastoralist communities, including those in Kenya [60].

Environment and seasonality: The ASALs are prone to severe climatic-related hazards that cause shocks, such as drought, floods, and livestock disease outbreaks. The shift in seasonality occasioned by climate change has led to changing livelihoods across various parts of the counties. Adaptation to these changes in livelihoods is a significant challenge and a likely contributor to PAM. These climatic hazards are frequently coupled with multiple other vulnerabilities, including land fragmentation, population growth, low literacy and education levels, poor infrastructure, and weak market integration. All these factors undermine the ASAL communities' capacity to respond to the increasing frequency and simultaneous occurrence of multiple shocks, creating a vicious cycle of crisis and underdevelopment [61]. The frequency and intensity of droughts have increased in the country over time. Kenya has declared at least seven national disasters due to drought between 1993 and 2009. Currently, drought trends are identified to occur every 2-3-years in Kenya [33, 62]. This rapid recurrence of drought-related

shocks leaves insufficient recovery time before the next shock occurs [63]. And pastoral societies previously presumed to be resilient to drought, are now facing eroding resilience capacities due to more frequent drought and immense pressure from social, economic, and environmental factors [64].

The increasingly unpredictable seasonal variations in the ASALs are believed to be the major causes of food production crises, food shortage and hunger in the East African region and the Horn of Africa. Seasonal variations are linked to reduced food availability, herd decline, degradation of the environment leading to rapid loss of biodiversity [65, 66]; spread of livestock's diseases [67]; encroachment of other grazing areas leading to conflicts with other pastoralist communities [68]; increase in herd conflicts [69]; and an increase in destitution due to partial livelihood recovery after each major climatic variability [70]. Seasonal variations in the ASALs also have an impact on food availability in markets, food availability being reliant on the production cycles [71]. Spikes in the price of essential food items affect households purchasing capabilities, limiting the ability of families to access adequate food, thereby affecting food consumption at the household level [72].

Access to markets is a problem in parts of Turkana and Samburu. It has been shown that better nutrition knowledge leads to considerable improvements in children's dietary diversity, though only in areas with relatively good market access [73]. Therefore, efforts to improve nutrition knowledge must be complemented by efforts to improve the availability of and access to food.

The effects of the unfolding COVID-19 pandemic pose an unprecedented unique challenge in both counties and threaten to reverse the gains made by USAID's Partnership for Resilience and Economic Growth (PREG) and other partners across a wide-range of nutrition-allied sectors. There are multiple ways COVID-19 may impact immediate and underlying drivers of persistent acute malnutrition. These include but are not limited to household food security (access, availability, and utilization), infant and young child feeding and care practices, access to and utilization of health care, access to and utilization of water and sanitation, environmental factors, insecurity and conflict, and gender inequalities. To date, very little is known about the relationship between undernutrition and COVID-19, as much of the evidence so far has been from high and middle-income economies where undernutrition is not a public health concern. We propose to include a module on COVID-19 in the first round of data collection to understand the effects of this shock on households and use the findings in the design of appropriate interventions building on actions and efforts being implemented through the NAWIRI COVID response plan in the two counties.

Surveillance system for nutrition: Despite the availability of resources (both human and financial), geographical inaccessibility and security issues constraint the ability to implement rigorous nutrition surveillance systems in most developing countries including Kenya. The

Kenya Government runs a comprehensive surveillance system through the National Drought Management Authority (NDMA). The NDMA mandate is to establish mechanisms which ensure that drought does not result in emergencies and that the impacts of climate change are sufficiently mitigated [74]. The surveillance system is articulated around three axes: Providing drought and food security Information; fostering drought Resilience; and formulating drought contingency planning and response strategies. There is, however, a crucial need to improve the system, particularly with regard to food security assessments and impacts of climatic conditions on the communities. The NDMA system in these two aspects relies mostly on socio-economic data collected from small samples of households in sentinel sites. Data from sentinel sites have the weakness of not being representative of the population at large. The proposed longitudinal study will provide an opportunity to collect more rigorous and accurate data on food security and the impacts of climatic shocks in the two NDMA counties with larger samples and a population-based design.

4. Research objectives

4.1 To understand and map how a variety of immediate, underlying, and basic and systemic drivers interact to influence PAM over time and geography among infants and young children living in different livelihood zones.

4.2 To identify and prioritize opportunities in implementing appropriate interventions to achieve sustained reductions in PAM.

4.3 To examine how the vulnerabilities associated with livelihood systems and socio-economic status vary over time.

4.4 To assess how access to and availability of water and influence hygiene and sanitation practices vary over time

4.5 To examine the trends in acute malnutrition and the associated factors over two years

4.6 To explore household experiences and coping strategies during time shocks and the extent to which these shocks disrupt livelihoods and impact on nutritional status?

Use of results for pilots and Phase 2 activities

We will continually engage with and draw on expertise from consortium partners, communities, diverse stakeholders and the local and national governments throughout study implementation and interpretation of results to support community driven activity design for pilots and Phase 2 activities. The findings from our study will inform the pilots and Phase 2 activities by:

1. Complementing formative data collected in other research/learning activities that are contextualized and address modifiable factors contributing to PAM;

2. Providing information for the adaptation of implementation plans to be risk informed and shock responsive before they are scaled up.

3. Generating information, with the active participation of decision-makers, that can contribute to improvement of the nutrition information system, including enhanced surveillance for food and nutrition security early warning systems and information needed for policy changes and programming.

The longitudinal study will provide critical evidence to better understand the connections and relative importance of the household dynamics from the NAWIRI ToC. The NAWIRI ToC mirrors the Conceptual Framework for addressing Acute Malnutrition in Africa's Drylands (Figure 1) and focus on the following areas: (i) how vulnerable households maintain food security despite exposure to shocks and stresses; (ii) why vulnerable households have low disease burden; (iii) stable and resilient nutrition enabling environment; and (iv)how formal institutions monitor, learn and adapt and scale interventions to prevent and respond to acute malnutrition. It also includes a detailed narrative that provides available evidence to justify each research question and their connection with the outcome and intermediary outcome levels as well as explains the connections and relative importance of each linkages. In other words, the structure and dynamics of distal factors (e.g., environmental and seasonality, systems and institutions) determines the dynamics of household systems, which in turn influence acute malnutrition. The ToC incorporates promising entry points for the design of interventions to effectively address PAM in the two counties. To achieve this goal, ToC will help answer the questions: What are the dynamics of the household system? And what are the most promising entry points to modify them? These entry points are interfaces with the systems examined in other formative research areas. This can be seen as the "demand" side of the intervention and all other areas are the "supply" side. Specific examples of implementation design that can be influenced by the longitudinal study include: adaptation of SBC strategies and mother support groups to enhance IYCF and care practices, tailoring CHS interventions to respond to the specific general and IMAM services needs of households, and tailoring livelihoods systems to socio-cultural dynamics in play in the context.

The longitudinal study will contribute in setting up a robust nutritional surveillance system by:

- Providing county specific evidence on the importance assessing PAM rate using both MUAC and weight-for-height (wt/ht) in the NDMA community sentinel system to ensure that it doesn't miss children with acute malnutrition especially SAM;

- It will also generate a longitudinal 'gold standard' PAM data by season and livelihood against which NDMA's sentinel site data could be compared to validate quality and reliability of future NDMA data in assessing and estimating PAM and its trend across seasons and livelihood zones;

- For community surveillance of PAM using sentinel sites like NDMA, it is preferable to assess MUAC and wt/ht every 2-3 months rather than monthly because it takes

some time to see the impact of shocks on nutritional outcomes. Less frequent nutrition data collection particularly weight and height reduces cost and improves quality of data. More and more countries are reducing frequency of nutritional data collection at their sentinel sites. Thus, the longitudinal data, which will be collected every 3-4 months, will generate county specific information/evidence on the reliability and applicability of monthly MUAC together with quarterly Wt/ht in predicting change in PAM due to seasonal effects or shocks for timely warning and planning health and nutrition responses by counties. A positive outcome will reduce cost and sustainability of NDMA sentinel sites as key Nutrition information for PAM.

5. Research questions/hypothesis

The longitudinal study will provide critical evidence to understand better the connections and relative importance of the household dynamics from the NAWIRI theory of change. It will answer the following questions:

5.1 How do immediate causes of acute malnutrition vary across time and space, child and mother's age, and by livelihood zones?

5.2 How does household vulnerability linked to livelihood systems and socio-economic status vary over time and interact with other drivers of persistent acute malnutrition?

5.3 How do access and availability of water vary over time and influence hygiene and sanitation practices?

5.4 How does caregiver health-seeking behavior for various services, including Integrated Management of Acute Malnutrition (IMAM), vary over time?

5.5 How do caregiver perceptions of the quality and accessibility of services offered influence health-seeking behaviors?

5.6 How do gender identity, women's time poverty, and decision-making power, and control over resources impact the determinants of PAM? Is there a differential impact by household structure (e.g. polygamous versus monogamous households) and mother's age?

5.7 How do households experience and cope with shocks (including COVID-19, conflict, household violence, etc.)? How do shocks disrupt livelihoods and impact on nutritional status?

5. 8What lessons can we learn from the longitudinal study to improve sampling and indicators used by NDMA and other relevant government entities to effectively generate reliable surveillance data to inform decision making on addressing acute malnutrition?

6. Conceptual framework

We will use the conceptual framework for Acute Malnutrition in Africa's Drylands [1] as the basis for the study design. This conceptual framework highlights the need to deepen the understanding of underlying and basic causes of PAM beyond the traditional linear pathways, looking at synergies between factors and existing and emergent trends and patterns that vary over time. Environment and seasonality are at the base of the framework, acknowledging the

unique environmental conditions of the drylands. The conceptual framework also emphasizes the need to deepen our understanding of systems, institutions, and livelihoods, as it is hypothesized that natural hazards or climatic shocks do not cause disasters but only trigger them. Therefore, the role of social and political systems and coping/adaptive strategies and responses are essential in understanding vulnerability to shocks, their impact on food and health systems, and the ultimate effect on nutrition outcomes.

In keeping with this framework, our study will go beyond collecting information on immediate and underlying factors, such as maternal and infant and young child dietary intake and disease, household food security, health services, and water and sanitation. While understanding these immediate and underlying factors is critical, to address the systemic factors that create the conditions that enable acute malnutrition to persist, we must also gather information on a broader range of factors such as livelihoods and sources of income, gender relations and dynamics, women's time poverty, decision-making power, and control over resources. Also, it will examine the coping strategies households with children less than 3 years use to respond and adapt to shocks and stresses and provide information relevant to improving existing surveillance systems. By gathering information on a broader range of factors, we can look at interconnections and feedback loops to fully understand the complex causality of acute malnutrition.
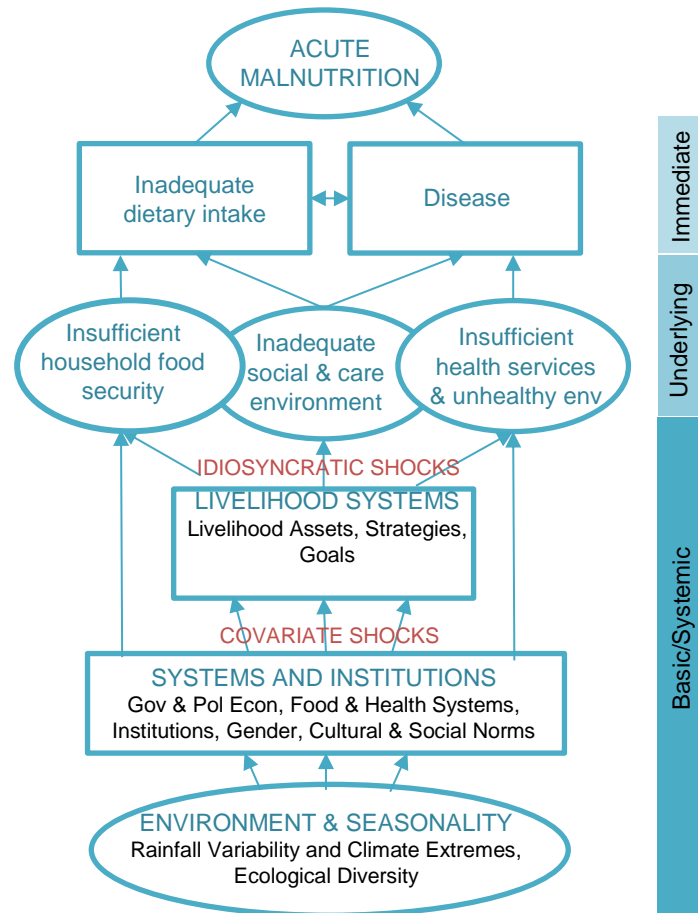
7. *Methodology*

7.1 Study population, design and sample strategy

Study Population

Quantitative survey

The participants for the survey component of the study will be mothers and/or caregivers with at least one child less than 3 years of age at enrollment. The choice to focus on under-3 children instead of under-5 or under-2 children as the sampling frame for the longitudinal study is to

reduce the risk of sampling children who will age out of the study during the 24 months follow-up (for children older than 3 years). The smaller proportion of under-2s in the population makes it difficult and expensive to reach out to this target population and obtained the required number of children. The choice of under-3, therefore, facilitates the follow-up of the entire cohort without the burden of replacing those that age out - hence less demanding and less costly. The choice of under-3 as the sample frame, however, means the population under-5 will be underrepresented during analysis within waves. However, to address this, we will guarantee that the final wave data have a sufficient number of under-5 to enhance the generalizability of the findings. Also, the focus on under-3s will allow observation of changes over time across a broader range of age groups. Additionally, for us to be able to estimate the under-five GAM prevalence in the two counties, we shall take anthropometric measurements from all under-five children from the sampled households at the baseline survey (Wave 1) and at the end line survey (if budget allows).

Qualitative survey
For the qualitative component of the study, target populations will include adolescent and adult mothers or caregivers of children less than 3 years, young and adult men, and other informants in the communities.

Study design
The study design is a 24-month longitudinal mixed methods (quantitative and qualitative) observational study of children less than 3 years and their mothers and/or caregivers. The quantitative survey data will be collected every 4 months, for a total of six survey waves. The first wave will involve the collection of baseline data in all randomly selected households with children less than three years, using both household and individual (mother) level questionnaires. In the second to fourth waves, the focus will be on child caring practices, child and maternal health issues, using an individual/caregiver questionnaires. The final and sixth wave (Endlline) will cover broader variables as in the baseline. Qualitative/participatory methods will aim at contextualizing the quantitative findings by obtaining information on how and why behaviors, outcomes, and other factors vary or are related   to one another.

Sampling strategy
Quantitative survey
The sampling strategy for the quantitative survey is informed by the nature of the study settings and the research design employed. Given the disparities in GAM prevalence rates in the two counties, sample size determination and allocation will be done per county. For each county, we shall obtain a representative sample of children less than 3 years and their mothers or caregivers using a multistage sampling approach, with survey zones as units of stratification. The survey zones were delineated based on the unique nature of vulnerability of communities in various geographies occasioned by repeated shocks and stresses associated mainly with

specific livelihoods. They have been used for all major surveys conducted in the two counties, including regular SMART surveys since 2010. Per our analysis and discussions with county officials and other experts, the survey zones cover all the livelihood zones (pastoral, agro-pastoral, fisherfolks, and formal employment/business/petty trade) and administrative boundaries of Turkana and Samburu. In Turkana, there are four survey zones, namely, Turkana Central, North, West, and South, while Samburu has three survey zones comprising Samburu West, East, and North. Table 4 shows the administrative sub-counties covered in each of the survey zones. Villages within each survey zone will be treated as clusters. Within each stratum, a random sample of villages/clusters will be drawn. A household listing will be conducted in the selected villages/clusters to identify households with children under three years, which will form a sampling frame for the final stage of the selection. From this frame, we will randomly select households to participate in the study. For sampled households with more than one under 3 children, one child will be selected at random, and the child and the mother will be included in the study. Appropriate sampling weights will be computed and stored for use during data analysis.

Although our interest lies in comparing estimates across different livelihood zones, stratification by livelihood zones would be challenging since the livelihood zones are not aligned to administrative units. Information on the number of villages within livelihood zones and respective household listing is also not readily available as population data from the Kenyan National Bureau of Statistics (KNBS) are based on administrative zones. However, we will collect information on livelihood zones during data collection and use the information to generate estimates of interest by livelihood zones by performing post-stratification analyses. This approach can generate reasonably good estimates per livelihood zones. The selection of clusters and households will be made at random and, therefore, we would expect sufficient representation for the livelihood zones in the final sample.

Qualitative survey
For the qualitative component, samples will be purposefully selected in the administrative sub-counties and villages. Key informant interviews will be conducted first in order to gather information on potential sub-counties or villages to be targeted for extensive qualitative data collection.

In *Wave 1* (baseline), the strategy for recruitment of informants will be as follows:
Community gatekeepers will be hired to recruit participants aged 15 years and over and who have been residing in the community for at least 2 years. Informants will be randomly assigned based on additional criteria for each activity.

In *wave 2* and subsequent waves, we will target issues/groups to interrogate further from the quantitative analysis.

Sample size determination and allocation

Quantitative survey

Given the significant disparities of GAM prevalence between the two counties, disaggregated GAM rates were used in the computation of sample size. We used the household survey sample size formula by United Nations Statistical Division adjusting for design effect due to stratification and clustering, and design effect due to repeated data collection on the same study participants over the 24 months period.

Turkana

The sample size was computed to estimate an expected prevalence of acute malnutrition in Turkana, assuming an under-3 GAM prevalence of 23.2% (SMART survey, June 2019). We adjusted for a design effect of 1.81 (using maximum design effect of 1.5 due to stratification and clustering based on estimates from the 2019 SMART Survey, and a design effect of 1.12 due to repeated data collection on the same individuals at 6-time points and common correction of 0.02 was assumed based on estimates from a previous study which estimated an intraclass correlation of 0.0044 for clustering of children within a household. We expect the intraclass correlation for multiple readings from the same child over time to be higher). We assumed a margin of error of ± 5 percentage points, 95% confidence level, a non-response and attrition rate of 20%, the proportion of the population targeted for the study (children less than 3 years) at 7.6% per the 2019 Kenya Census [75, 76], and the average household size of 6. Based on these assumptions, the required estimated minimum sample size is 1,544 households.

Samburu

We used an expected GAM prevalence of 12.5% (estimated from SMART survey data for Samburu). We adjusted for a design effect of 1.3 due to stratification and clustering (obtained from 2019 SMART Survey). A design effect of 1.12 is assumed to account for the repeated data collection on the same individuals at 6-time points and common correction of 0.02). We considered a margin of error of plus/minus 5 percentage points, 95% confidence level, a non-response and attrition rate of 20%, the proportion of the population targeted for the study (children less than 3 years) at 9.2% according to the 2019 Kenya Census, and the average household size of 5. Based on these assumptions, the required estimated minimum sample size is 669 households.

The number of households is allocated proportionally to the population size of each stratum, defined by the county and survey zone, as shown in Table 1. In each stratum within a county, a random sample of 10 villages (cluster) will be selected using probability proportional to the population size of the cluster. To ensure each of the households has the same probability of being selected an equal number of households will be selected from each cluster. If the target

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number of households is not achieved within a selected cluster, the spare cluster matched to the main cluster will be used to complete the target sample size for that cluster. Similarly, if no eligible households are found in a cluster, it will be replaced by a spare cluster.

Table 1. Sample size (households) allocation

County	Survey Zone	Administrative Sub Counties	Population	Villages	Proportional allocation
Turkana	Turkana Central	Central and Loima	293,100	43	488
Turkana	Turkana North	North and Kibish	101,987	34	170
Turkana	Turkana West	West	239,627	38	399
Turkana	Turkana South	South and East	292,262	41	487
Samburu	Samburu West	Samburu Central	613,942	33	542
Samburu	Samburu East	Samburu East	77,136	29	68
Samburu	Samburu North	Samburu North	66,879	46	59

7.2 Data collection methods

Data collection procedures – The quantitative data will be collected using SurveyCTO, a survey platform for electronic data-collection, based on Open Data Kit (ODK). The built-in skip and quality checks within the ODK mobile platform will increase efficiency and reduce the time needed for cleaning the data. The data will be collected by trained fieldworkers using tablets with the questionnaire loaded in ODK. After each day of data collection, the data will be uploaded from the tablets onto a safe APHRC server. The data collected will be automatically synced to a server when the tablet is in a location with network coverage. The uploaded data will be checked for quality daily by a data manager and a team dedicated to coordinate field procedures in both counties and at APHRC head office in Nairobi. A detailed description of the data collection processes for the specific topics is presented in the subsequent sections.

Training of fieldworkers **–** We will recruit and train 40 experienced female and male field workers, 25 in Turkana and 15 in Samburu. Ideally, all selected field workers will be residents of Turkana and Samburu to ensure familiarity with the local area and customs, mastery of local languages, and effective community participation in project activities. They will receive

intensive training using APHRC's training protocol, which includes both theoretical training and practical exercises. They will receive training on 1) the overall aims of the study, the study tools; 2) research ethics (including obtaining informed consent/assent); and 3) techniques in interviewing; 4) mock interviews; 5) a field-based pilot, and 6) debrief session after the pilots regarding lessons learned. They will also receive training in the use of tablet-based questionnaires and anthropometric measurement techniques. Depending on the topic, training of fieldworkers will be facilitated by principal investigators, Kenyan-based co-investigators and collaborators, the field coordinators, data manager, and software programmers as they have different roles to play. The average duration of training will be about 10 days, although this is also highly dependent on the length and complexity of the survey. There will be refresher training(s) before the start of a new wave/round of data collection. As noted below, training will include time for pre-testing data collection tools and reflect on actual field experiences. During the training, the tablet-based questionnaire will be pre-tested and reviewed following feedback from the field. Where translations of questionnaires are required, the quality will be assured by one other researcher fluent in that language and checking against the original data collection tools.

Monitoring of data quality – The co-principal investigators and project manager will be responsible for overall data quality assurance. Data quality assurance processes will occur in the field, in real-time, during data collection, data preservation and in delivery of datasets. Data quality will be assured through inbuilt quality control in the tablet-based platform, routine monitoring by the research team and periodic cross-checks against the protocols. Quality control will be ensured through discussion during the training of field workers, in-built system checks, spot checks, and observations of household visits.

Field workers will be supervised by carefully trained supervisors; with a ratio of five field workers per supervisor. Supervisors will report to the field coordinator. During fieldwork, data quality for quantitative data will be enhanced through regular spot checks and sit-ins on approximately 5-10% of each field interviewer's daily work to verify the authenticity of data collected. The field coordinator will certify the data quality through the editing of the same before they are transferred to the database. Once the data collection is completed, all inconsistencies will be resolved prior to data analysis. An automated routine to check on the data completeness, correctness and consistency will also be run on 100% of the collected data. A discrepancy report will then be generated to enable resolution of any inconsistencies or errors in the data with the responsible interviewer.

Field operations will be supervised through two layers: a day-to-day supervision by team leaders, and a weekly review of activities and data quality by the data coordination team including the two research officers who will be assigned to each of the counties, the data analyst, the software programmer, and the post-doctoral research scientist. A weekly report on issues arising from the field and discrepancies observed in data will be shared with the

research team, including the co-principal investigators and co-investigators who will advise on necessary actions to be taken. In case of critical issues arising regarding data quality, such as a high number of inconsistencies in responses or missing data, the research investigators will assess the need to call out fieldworkers and re-train on specific issues.

Monitoring of anthropometric data quality – The child anthropometry and MUAC data will be collected in accordance with WHO guidelines to ensure the quality of anthropometry data. These guidelines will be used for training of the data collectors. Thus, the data collectors will be trained on how to explain to caretakers what their role is in the measurement process and how to handle a child to render the experience less traumatic and obtain more accurate data. The training will involve standardization exercises, including comparing individual enumerator measurements to an expert's benchmark (accuracy), and their own repeat readings (precision). All techniques and field procedures learned during the training will be evaluated before data collection in a field setting through a pilot test. There will be a debriefing meeting after the pilot to share experiences and what needs to be done to improve the measurement processes. We will only start the real fieldwork after we are satisfied that the data collectors are conversant with the measurement procedures and able to take accurate measurements.

The equipment to be used for the anthropometric data collection will be calibrated as soon as they are purchased, and the procedure repeated during fieldwork. Routinely calibrating anthropometry equipment ensures that they continue to provide accurate measurements. Measurements performed during the calibration process will be recorded and checked for accuracy on each occasion. This will help to ensure that faulty equipment is quickly identified and replaced. Both the digital weighing scale and measuring board will be routinely calibrated during the anthropometric survey. The measuring board will be calibrated using piping of a known length (e.g. 110 cm), while each scale will be tested with a standard weight of 5 kg. All the above checks will be carried out before starting fieldwork, and regularly thereafter.

To prevent implausible data from being entered, the tablets to be used in the data collection will have preset ranges of plausible anthropometric measures and a data collector will not be able to advance to the next screen in ODK if an implausible value is entered.

During fieldwork, supervisors and team leaders will closely monitor the data collection exercise. The research team will pay close attention to the measurements, including how the scale is placed on the floor and provide feedback on the error measurements of any enumerator to the field supervisor, who will, in turn, inform the project manager. All issues arising from the anthropometry measurements will be addressed immediately. Further, extensive field monitoring will also be carried out by the research team to ensure data quality. Before the start of a data collection for a survey wave, a refresher training on the anthropometry measurements will be conducted for the whole team.

Methods to maximize response rate – The risk of loss to follow-up and fatigue is assessed high due to the longitudinal nature of the study. Also, a significant number of our study respondents will be nomadic pastoralists who are the hardest to reach in surveys, and for that reason, the least served populations. To ensure that all households sampled for the study have an equal chance to participate in the research, we will use strategies for prospective and retrospective contact tracing proven to be effective from past longitudinal studies conducted by APHRC and other research institutions in similar settings [77].

Qualitative survey

Overview of sampling methodology – Qualitative data will be collected at baseline and Wave 1 with mothers and/or caregivers of children less than 3 years, and other community members. Additional qualitative data collection will be undertaken in subsequent waves to obtain more detailed information on topics that emerge in earlier waves. The qualitative sample will be purposive. We will particularly target parents of children aged 3 years and below and parents of malnourished children. We will consider following a cohort sample composed of mothers (adolescents and adult) of malnourished (i.e. wasted or stunted) children less than 3 years.

The longitudinal study will seek to identify and understand in-depth the behaviors, and needs of mothers of young children, other household members and community stakeholders as they relate to child nutrition. It will also uncover underlying factors driving MIYCN and WASH practices, perceptions and utilization of health services, and gender roles and dimensions. The questions and methods used will be carefully selected to ensure that we capture robust data to achieve the objectives set out in the project. We will use key informant interviews (KIIs), focus group discussions (FGDs), in-depth interviews (IDIs) and community dialogues as data collection strategies. We will conduct the KIIs with county and national government officials, community gatekeepers, local NGOs and relevant international NGOs. The FGDs will be conducted with mothers of children under 5 years solicit communities' attitudes and perceptions, knowledge and experiences, and practices as well as their understanding of the complex causality of the drivers of acute malnutrition. We will also use IDIs to collect on mothers or caregivers of children less than 3 years. This will help us gather individual views on barriers to the translation of knowledge into optimal MIYCN practices. Data on men's perceived role in maternal and child nutrition and care practices will be collected. The IDIs will collect data on factors that influence decision making in the utilization of healthcare; and those related to acute malnutrition and how they change over time, including during shocks. We will organize community dialogue sessions with all community members. To understand communities' perception of the consequences of seasonal variations on their livelihoods, we will employ a seasonal calendar and activity profile as one of the data collection strategies.

A participatory and visual research methodology such as photovoice [78] will also be utilized in collecting data in the study. It involves the provision of cameras to participants, who are

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asked to take photos representing their own experiences with and perspectives on an issue in their lives or communities. This method ensures the active engagement of study participants and communities in research and gives them an opportunity to capture or record the conditions around them, reflect on these conditions or their experiences, feelings and needs, and develop photographic representations of these issues. Given its focus on capturing the experiences of marginalized groups, and sensitive topics [79], the photovoice methodology has been used globally to study issues affecting women and girls and is often seen as a way of empowering women, to amplify their voices through photography, identify and communicate their needs and reflect on possible solutions [80]. Photovoice allows researchers to see 'through the eyes' of study participants and communities, while the visual products of Photovoice act as effective tools for dissemination and policy engagement and tools for advocacy for social change [69]. We plan to hold photo exhibition events at the community level and to develop communication materials (e.g. photobooks; http://aphrc.org/wp-content/uploads/2020/01/Photo-book-voices-for-action.pdf). The photo exhibitions would be part of community dialogues during which local journalists would be invited to attend as a way of amplifying the discussions. These discussions will be part of our efforts to increase the level of awareness on the impact of malnutrition on development outcomes. The same method of engagement will be employed in the meetings between policymakers and community members. The communication products will be shared with the County, Sub County officials, and the community representatives during the dissemination meetings. We will also share them with community media to help inform their engagement on the malnutrition issues even beyond the project life.

APHRC has a division responsible for policy engagement and communication. The division has very experienced journalists and communication experts. In this project, two communication experts with a journalism background (Florence Sipalla and Michelle Mbuthia) will be involved in photovoice activities. These two communication experts have experience engaging stakeholders with photovoice evidence at the national, county and community levels in Kenya. They also have experience working with the local media. This relationship will make it easier to get the local media/journalist involve in our research activities, including the photovoice. However, we will ensure that the necessary consent is sought from the communities before the local journalists are allowed to participate in our

activities. APHRC and by extension, the Policy Engagement and Communication division has been doing this type of engagements over the years.

Data collection procedures – The qualitative data will be collected by trained moderators and recorders who will use tablets to key in responses while concurrently audio recording proceedings after consent is obtained from participants and/or community stakeholders. Discussion guides will be pre-loaded onto ODK for ease of facilitation and recording of discussions. All activities and discussions will be recorded, and notes will be taken throughout. Demographic information (e.g., gender, age, number of children) of participants in all activities will be captured and entered into an electronic database for use during analysis. Tailored discussion and interview guides will be developed for each activity and category of informants. For photovoice's activities, participants will receive a camera and asked to spend 1-2 days taking pictures of the critical issues they see around climatic shocks, nutrition, and food security in their communities. The photos will be reviewed by trained staff and the participants and appropriate photos will be selected by the participants for printing. The participants will then work with the research staff on the ground to provide captions and descriptions explaining what each of the photos represents. As done in previous similar projects, we will consider organizing a photo exposition by the women at the community level and invite local stakeholders for a lively and productive discussion.

Training of fieldworkers – We will recruit and train 26 experienced female and male field workers, 16 in Turkana and 10 in Samburu. Ideally, all selected field workers will also be residents of Turkana and Samburu. They will also receive intensive training on 1) the overall aims of the study, the study tools; 2) research ethics (including obtaining informed consent/assent); and 3) techniques in interviewing; 4) mock interviews; 5) a field-based pilot, and 6) debrief session after the pilots regarding lessons learned. They will receive training on the specific methodologies they will use.

Table 2: Methods and target populations for the qualitative data collection

Research method	Target population	Turkana	Samburu
Key informant interviews Only 1 focal point per livelihood zone	Community leaders (i.e. Chiefs, village elders, leaders of women groups, religious leaders, community health volunteers) Community Based Organisations	25 20	25 20

	Humanitarian Organizations NGOs (Save the Children, Caritas, WFP, UNICEF)	4	4
Total		*54*	*54*
Focus group discussion (FGDs) Note: a group will have 10-12 participants. Three (03) group events by informant type by livelihood zone	Adolescent and young mothers (15-24 years)	12	9
	Adult women (25+ years)	12	9
	Men (18+ years) with children under three years of age	12	9
	Adolescent and young mothers (15-24 years) with malnourished kids aged 2 years and below	12	9
	Adult women (25+ years) with malnourished kids aged 2 years and below	12	9
Total		60	45
In-depth interviews Note: 8 interviews per informant type per livelihood zone	Adolescent and young mothers (15-24 years)	32	24
	Adult women (25+ years)	32	24
	Men (18+ years) with children under three years of age	32	24
	Adolescent and young mothers (15-24 years) with malnourished kids aged 2 years and below	32	24
	Adult women (25+ years) with malnourished kids aged 2 years and below	32	24
Total		160	120
Photovoice Note: 10 participants per informant type per livelihood zone	Adolescent and young mothers (15-24 years)	40	30
	Adult women (25+ years)	40	30
Total		80	60
Community dialogue	Adolescent and young mothers	12	9

Note: a group will have 15-20 participants. Three (03) group events by informant type by livelihood zone	(15-24 years)		
	Adult women (25+ years)	12	9
	Men (18+ years) with children under three years of age	12	9
	Adolescent and young men (18-24 years)	12	9
Total		**48**	**36**

7.3 Ethical considerations

We will conduct this study according to the guidelines in the Declaration of Helsinki. Local research and ethical approvals will be obtained from the AMREF Ethical and Scientific Review Committee (AMREF-ESRC) and The National Commission for Science, Technology, and Innovation (NACOSTI) of Kenya. Ethical approval will also be obtained from the Institutional Review Board of RTI, which has Federal Wide Assurance (FWA).

The research team is well experienced and grounded in the local areas and aware of the ethics associated with research. The project co-principal investigator, Dr Sidze, is well trained on ethics and a member of Marie Stopes International Ethics Review Committee and will coordinate to ensure all ethical aspects of the work are appropriately handled during data collection, data management, and data analysis. Dr Lutter, a co-investigator, served for eight years on the Ethical Review Board of the Pan American Health Organization, Regional Office for the Americas of the World Health Organization (many of these years as vice-president and president).

Several measures will be taken to minimize any potential stress on our respondents during data collection. First, the training of field workers will be an essential step in ensuring that they adhere to high ethical standards, minimize any risk that may accrue from study participation, and ensure that interviews are conducted in a suitable, comfortable, and private environment. Specifically, the research team will be trained to listen and observe without displaying any judgmental attitude towards the informants or the information received. They will also be trained on the meaning and process of informed consent/assent and the importance of protecting the privacy and confidentiality of the information obtained from participants. Second, given the sensitive nature of some information to be gathered, protecting, and respecting the confidentiality of our informants will be a critical consideration throughout the study (see information below on data security). Third, study participants will be provided with information about the study before any consent to participate is sought. Participants will be adequately informed about the purpose of the study and methods to be used; institutional

affiliation of the researchers; anticipated indirect benefits, the lack of direct benefits such as material compensation, and potential risks and follow-up of the study; discomfort it may entail; the right to abstain from or to withdraw from study at any time, without reprisal; and measures to ensure confidentiality of information provided. Besides, respondents will be given the contact information for APHRC, RTI, and Mercy Corps Community Accountability Reporting Mechanism (CARM) to provide any feedback or report misconduct throughout the study.

All questionnaires and instruments used for data collection, including informed consent forms, will be translated into the local language(s). Informed consent will be obtained from all participants. Adolescent mothers, less than 18 years, will be regarded as emancipated minors and will be required to give informed consent. We will obtain signed or thumb-printed informed consent, for those mothers not able to write, from each study participant. Interviewers will be responsible for obtaining informed consent. They will read the consent form to the potential participant, explain anything she or he does not understand, and answer the individual's questions. Once a participant gives their consent, she or he will be given a copy of the consent form, and the other copy will be kept in the study records. Paper copies of data collection of informed consent forms will be stored in a locked file cabinet at APHRC. The consent forms and data will be kept until at least 3 years after the end of the study.

During interview on sensitive issues such as family planning and domestic violence, the principle of *doing NO harm* is the highest priority by ensuring safety, privacy and confidentiality of women respondents; no harm to the women respondents and the interviewers; properly training interviewers to understand these topics and establishing mechanisms and strategies to reduce any possible distress that might be caused by these data; ensure availability of services and sources of support for women respondent survivors who need support (e.g., referral or linkage with local support groups, police, CHVs, etc.). If still NOT sure about the safety and privacy of the woman respondent, the interviewer shall NOT proceed with the interview.

7.4 Data management and analysis

Monitoring of data quality – The quality of qualitative data will be enhanced through recruitment and training of qualified field interviewers with experience in qualitative data collection. Pre-testing of tools and debriefing after pre-test will be done to increase the quality of the data. The interviews will be transcribed verbatim by an experienced transcriber and double coding of about 10% of the transcripts will also be done to ensure consistency in the application of the codes. The study investigators will read a sample of transcripts at the beginning of data collection to ensure all questions are asked adequately during interviews,

and enough information has been gathered through informants' answers. Fieldworkers will be recalled and re-trained in case of poor-quality interviews.

Data entry and cleaning procedures – Survey data will be entered on preprogrammed tablets. To prevent implausible data from being entered, tablets used in the survey will use preset ranges of plausible responses to variables and anthropometric measures and not advance until corrected. After each day of data collection, the data will be uploaded from the tablets onto a safe APHRC server and checked for quality by the data manager on a continual basis, and verifications with the field team conducted, as needed. Additional information on data quality is included in the subsection above on monitoring of data quality.

Data storage – Quantitative and qualitative data will be carefully maintained and secured in line with internal and national policies on protection and security of data; AMREF-ESRC and The National Commission for Science, Technology, and Innovation (NACOSTI). Identifiers (name and residence) collected for recruitment procedures will be removed from all analytical datasets. Deidentified data (including interview transcripts) will be transferred to RTI through RTI's secure FTP server website. Because of likely problems with viruses and security and hardware challenges, data will be securely stored on APHRC server, backed up and synchronized regularly. Qualitative data will be backed up and secured by the data manager on a regular basis, and metadata will include clear labelling of versions and dates. We will establish mechanisms of protecting data while it is being processed, including the use of passwords, data encryption, and safe back-up hardware. Commitments to ensure confidentiality will be maintained by ensuring that survey data and information and transcripts from formative and participatory methods are anonymized and details that can be used to identify participants are removed from data, transcripts or concealed in write-ups. The data team will ensure the timely access of the data to USAID, other consortia partners, the government of Kenya, and the research community. Cleaned and anonymized datasets will be shared through USAID's Development Data Library by Mercy Corps.

Data security protocol – The software used will ensure that data contents are encrypted (transformed into cipher text) using a public encryption key soon after an interview is completed, and from that point forward, the data will no longer be readable without decryption. As data is transmitted using an internet network, it will be automatically encrypted by the Secure Sockets Layer (SSL), in a sense, it will be doubly-encrypted. After submission/transfer to the server/cloud, data will remain encrypted until a private encryption key is used to decrypt and download it. Access to the cloud server will be restricted, and only authorized staff will be able to login   and download data. Fine-grained access control method will be applied to the data collection software. Therefore, only people with different roles will access what is relevant to them. Data will be anonymized, and details that can be used to identify participants will be

concealed in write-ups and data portals. A firewall will also secure downloaded data (within APHRC) from being accessed by untrusted networks/internet users

Data analysis methods

Quantitative survey – The quantitative data analysis will be performed using STATA. Several stages of analyses are envisioned and dependent on the wave of data collection. Descriptive data analysis on socio-demographic variables, individual level characteristics, anthropometric indicators, and drivers of acute malnutrition will be conducted at the completion of the baseline and each subsequent wave of data collection. After at least two waves of data collection, longitudinal regression models will be conducted.

Associations between independent, mediating, and dependent variables will be conducted using statistical techniques depending on the scale of measurement of these variables. Bivariate analysis and analysis correcting for other factors will be conducted. Tests for independence and association between variables will be established using a statistical test such as Chi-square, Fisher's exact test, correlation analysis, simple ANOVA, non-parametric test, among others.

We will utilize mixed-effects regression (MER) to model the relationship between independent variables and repeated responses (outcome variables). The MER is chosen because it allows time-invariant predictors that do not change (e.g., sex) and time-varying predictors (e.g., age), and handles irregularly timed and missing data without the need for explicit imputation (15). Where possible, we will use time series models to explore the trends in more detail and possibly make forecasts of the situation of acute malnutrition in the future, which will lead to better decision making. To explore interactions between various drivers and shocks, and how they interact with each other and outcomes, we will use a structural equation model at each wave and structural equation models for longitudinal data. Harmonic regression for multiple seasonality methods will be used to study patterns of key child nutritional outcomes. Where indicated, analyses will be done at the individual, livelihood zone, and county levels. The analysis will also utilize survey weights to ensure that appropriate precision estimates are obtained to guarantee proper inference and generalization of the results.

Qualitative survey – Qualitative and participatory data will be analyzed using NVivo SQR software, using a thematic framework approach. These themes will broadly be based on interview topics. The core team will read the transcripts severally, to get a good understanding of the interview findings. The transcripts content will then be coded independently. A codebook will be developed after reading and re-reading of the transcripts. To protect the confidentiality of our respondents, the transcripts will be uploaded in a dedicated computer at APHRC, which is password protected. Identifiers will be removed from transcripts. The audio recordings will be deleted once uploaded into the computer. The anonymized transcripts will

be kept during the whole study period and in the APHRC data repository at the end of the study for further use for manuscript development for up to 5 years. Finally, data will be archived and/or stored electronically in a strict accordance to the APHRC data storage protocols.

7.5 Study limitations and risks and mitigation of the risks

We will follow guidance from AMREF-ESRC regarding adverse events. AMREF-ESRC provides a form and preset feedback for reporting adverse events, protocol violations and protocol deviations. An adverse event will be any event that has or could have a negative impact (physical, psychosocial, economic, legal, political, and/or social) on participants, researchers or the reputation on data collection and implementing institutions. The negative impact might have been anticipated and included as one of the risks of the data activity or may arise unexpectedly. As part of the informed consent process (described in detail below), respondents will be made aware of various reporting mechanisms. The potential adverse event in the study could be loss of data confidentiality putting a participant at risk of community sanction or isolation, or household violence due to a woman participating in the study when the husband does not want her to. To mitigate this risk, we will ensure that the identity of the study participants is adequately protected (see details in the ethics section).

In the context of the COVID-19 pandemic, an adverse event could also be a participant in the focus group discussion or community dialogue being infected despite safety measures being put in place. We will minimize the possibility of occurrence of these events through the following precautions:

- Full compliance with all Kenyan public health guidelines regarding COVID-19 and careful monitoring for any changes to these guidelines as well as evolving trends in COVID-19 infection rates within the survey communities.
- Regular check-ins with county public health officials at a frequency (e.g. weekly, bi-weekly) they deem necessary and appropriate to ensure we are in compliance with the latest guidelines as well as share any information on any new cases, travel restrictions or other relevant information.
- Training of fieldworkers and team leaders in compliance with COVID-19 guidelines and requiring all recommended safety measures, including equipping fieldworkers and team leaders, and respondents with PPE, hand sanitizers, and organizing group discussions and activities outdoors and observing Kenyan physical distancing guidelines.
- Closely monitoring our teams for any symptoms, and preventing any symptomatic individuals from fieldwork unless they are tested or quarantined.

If county health officials determine we should not visit a community or should cease all data collection activities, we will immediately and indefinitely postpone fieldwork. And where

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necessary and feasible, we will use virtual platforms (SMS) and phone calls, which both APHRC and RTI has extensive experience using in field research. As it is sometimes the case in studies focusing on nutrition, we might encounter cases of extreme malnutrition in households. All cases encountered warranting medical attention will be immediately referred for treatment though they will continue to be part of the study.

In addition to the standard safety measures against COVID-19 spread, this study has set a separate protocol/guidelines for field activities in an attempt to ensure the safety of both the fieldworkers and participants during close contacts including anthropometric measurements. These include:

- Check the **temperature of every research team member** each day of field work and record the temperature. If the temperature exceeds 37.6° C, the staff members should be sent home immediately and asked to contact clinic to get advice on how to proceed
  - Staff should record that a check was conducted and that health pledge conditions are met. The actual temperature reading should not be documented to minimize health information in RTI's possession.
- Use an infrared thermometer to **check the temperature** of the participant, as well as any other household members who may have accompanied them. If anyone has a temperature that exceeds 37.6° C, the participant should be kindly requested to go home and told that they will be contacted after 14 days. Participants will be advised to keep the social distancing at entry points to limit risk of infection.
  - Staff should record that a check was conducted and that health pledge conditions are met. The actual temperature reading should not be documented to minimize health information in RTI's possession.
- Eye protection (plastic face shields or glasses/googles) will be used by field research team members for high-risk studies.

- Field research team is obliged to use disposable gloves during all field activities including anthropometric measurements.

7.6 Plan for communicating the findings of the study

The goal of the research is not only to develop new interventions, but to also use the findings to adapt and contextualize existing interventions to prevent GAM, including but not limited to strengthening SBC strategies around MIYCN and WASH, community health systems, gender dynamics, livelihoods, and resilience. Further, we intend to inform improvements of the current nutrition surveillance system. To achieve this goal, the preliminary results action plan for the longitudinal study is driven by continued engagement with multiple stakeholders including:

- USAID-NAWIRI consortium implementing partners (Mercy Corps, Save the Children, BOMA, and CARITAS)

- County government technical staff from Health, Agriculture, NDMA (nutrition surveillance), social services, etc.
- The CRS-led USAID NAWIRI consortium
- USAID FFP and other relevant Mission staff
- Other relevant implementing agencies such as PREG partners, UNICEF, etc.
- Civil society, academia and the private sector convened through the multi-stakeholder forum in each county.

Given this diverse set of stakeholders with widely varying mandates, information needs, resources, capacities, and incentive structures, when and how USAID-NAWIRI engage with them under the results action plan varies considerably by stakeholder and throughout the course of the longitudinal study.

After the baseline data analysis, we will convene a stakeholder consultation in April 2021 within each County through the multi-stakeholder platform that brings together key government sectors and other actors at county level listed above; community representatives will also be included. This consultation will serve as a pause and reflect a moment, where stakeholders will engage with preliminary baseline quantitative and qualitative data analyses with the following objectives:

- "ground truth" data by discussing any surprising or counter-intuitive findings, triangulate results between quantitative and qualitative data from the longitudinal study as well as other secondary data sources, etc. If possible, this could also include preliminary comparison with CRS-led USAID NAWIRI results from Isiolo and Marsabit;
- discuss other particularly relevant findings regarding household and community experiences with and response to COVID-19, locusts and any other particularly timely and relevant analysis;
- using a systems lens, interrogate preliminary nutrition causal maps developed with community members through the qualitative research, map these onto causal chains mapping the complex causality of persistent acute malnutrition, update our assumptions, identify new information needs, and any programming implications in terms of leverage points or contextual adaptations needed to existing interventions;
- based on this review of preliminary analyses, stakeholders will be asked what, if anything, needs to be adapted in study instruments in subsequent survey rounds, recognizing if substantive changes are proposed and agreed upon, this could delay fieldwork if an IRB amendment is required; the benefit of any such proposal must be weighed against this significant cost;
- the USAID-NAWIRI team will also engage with key stakeholders on this platform (e.g. NDMA, UNICEF, County Nutrition Coordinators, and the CRS-led USAID-NAWIRI

consortium) on specific technical aspects of the research design to determine what is working, and where there are opportunities for improvement in the study implementation. This is to maintain comparability with the CRS-led consortium, and ensure that NDMA, UNICEF and County Nutrition Coordinators are deeply engaged in the technical study design and analysis to provide them the knowledge and insight they need to adapt future nutrition surveillance systems.

After the second wave of data collection and analysis (approximately September 2021), a smaller stakeholder convening will take place with all USAID NAWIRI implementing partners, and key technical stakeholders (e.g. NDMA, UNICEF, County Multi-sectoral learning Group Platform drawing membership from the MSP in line with the NAWIRI County Collaborative Framework that has been proposed for use in both counties to:

- review preliminary trends analysis and discuss any counter-intuitive or surprising results
- revisit any adaptations made to the survey instruments or overall design to determine whether further modifications are needed
- if possible, comparison with results from the CRS-led USAID NAWIRI consortium; this also serves as a coordination mechanism to ensure that we remain well aligned to facilitate subsequent formal joint analysis

After the third wave of data collection and analysis (approximately January-February 2022), the full multi-stakeholder platform and community representatives will be reconvened to:

- ground truth, triangulate and validate data
- discuss emergent trends, recognizing that while we have data from 3 points in time, it is limited to 8 months of data collection
- revisit and update nutrition causal maps of the complex causality of persistent acute malnutrition
- use problem analysis and other methods to review the results and discuss design options for Phase 2 activities; prioritize and agree upon what results need to be shared in the joint design workshop for Phase 2 aggregating research across the entire portfolio
- stakeholders will be asked what, if anything, needs to be adapted in study instruments in subsequent survey rounds
- the USAID-NAWIRI team will also use this opportunity to finalize joint analysis plans for the first 12 months of data collection with key stakeholders on this platform (e.g. the CRS-led USAID NAWIRI consortium, NDMA, UNICEF, and the County Multi-sectoral learning Group Platform drawing membership from the MSP in line with the NAWIRI County Collaborative Framework that has been proposed for use in both counties.

- Internally the Mercy Corps led USAID NAWIRI consortium will prioritize key longitudinal study results to share in an Annual Learning Event and Evidence-based design and culmination workshop
- After the fourth wave of data collection and analysis (approximately July 2022), convene the broad multi-stakeholder platform as well as national level stakeholders drawn from relevant government ministries in order to: ground truth, triangulate and validate data
- discuss trends observed over the 12 months of data collection
- revisit and update nutrition causal maps of the complex causality of persistent acute malnutrition, discuss any potential implications for existing or new activities in the counties
- if possible, share joint-analysis of longitudinal study data from both USAID-NAWIRI consortia
- have an in-depth technical meeting with NDMA, UNICEF and County Multi-sectoral learning Group Platform drawing membership from the MSP in line with the NAWIRI County Collaborative Framework that has been proposed for use in both counties and already agreed upon by USAID. discussing implications and options for future nutrition surveillance design

Results from the fifth and sixth survey waves will be disseminated to the multi-stakeholder platform, but an in-person meeting may not be warranted. For the seventh and final survey round, a full multi-stakeholder platform consultation will be convened in order to:

- ground truth, triangulate and validate data
- discuss trends observed over the 24 months of data collection
- revisit and update nutrition causal maps of the complex causality of persistent acute malnutrition, discuss any potential implications for existing or new activities in the counties
- if possible, share joint-analysis of longitudinal study data from both USAID-NAWIRI consortia, as well as plans to co-publish study results

revisit conversations with NDMA, UNICEF County Multi-sectoral learning Group Platform drawing membership from the MSP in line with the NAWIRI County Collaborative Framework that has been proposed for use in both counties discussing future surveillance designs to determine what features of the longitudinal study can be incorporated into future nutrition surveillance design.

8. *Management and organization of the Study*
African Population and Health Research Center:
The research components will be carried out   and managed by a team of APHRC researchers. This will involve participation in the study design and development of data collection tools.

Recruitment and training of data collectors, oversight of data collection and data quality management and the analysis of the data. The team composition and respective roles are as follows: Drs Estelle Sidze, Elizabeth Kimani and Dickson Amugsi, respectively, are the PI and Co-investigators; Dr Martin Mutua is a statistician leads research design, sampling and analysis. Dr Amanuel Abajobir is an expert in maternal and child health and project manager; Mrs Bonventure Mwangi is a statistician and data manager; and Ms. Caroline and Esther are research officers and will coordinate logistics and field activities. The team has been trained in research ethics. Documentation provided to the ethical review committee.

Research Triangle International:

Provides strategic guidance and direction to APHRC on all aspects of the study: design, protocol, and tools development, ethical approval, recruitment, and training of study teams, data collection, analysis, validation of results, dissemination and use of findings to inform program design. Team composition and their respective roles are as follows: Dr Faith Thuita is a Co-PI; Drs Chessa Lutter and Valerie Flax are Co-investigators; and Mr Albert Webale is Project Manager. The team has been trained in research ethics. Documentation provided to the ethical review committee.

Mercy Corps

Mercy Corps will bring its experience in resilience research and programming to focus on what matters for nutrition resilience, hitherto unexplored in the development and humanitarian contexts. Accordingly, it contributes to the development of the protocol and survey instruments, interpretation of data analysis, and report writing. Mr. Brad Sagara contributes for these tasks. He has been trained in research ethics and documentation is provided to the ethical review committee.

Government stakeholders

As stated above, this study is borne out of on-going county consultation with government and key stakeholders in Turkana and Samburu counties after an initial scoping exercise conducted in both counties on PAM. Follow-on to this initial engagement, NAWIRI co-hosted with county officials a consultation meeting to unpack and discuss the Learning agenda with a technical team drawn from multiple sectors that included Health, Agriculture, Veterinary Services, Education, Social services, Public Health, Social development and Livestock production (Table 3). The learning agenda was presented and discussed, and variable inputs were provided. There was in-depth discussion of the Longitudinal study. Subsequently, specific technical leads drawn NDMA (Drought coordinator and Information officers), Health (County Nutrition Coordinator) and the UNICEF officers reviewed draft the protocol and provided valuable feedback to NAWIRI. Feedback provided has been incorporated into the protocol and will continue engage throughout the study and its implementation.

Table 3: Stakeholder Consultation Lists

Turkana County – Stakeholder Consultation on NAWIRI Learning Agenda		
S/No.	**Name(s)**	**Title**
1	Philip Ebei Aemun	CEC - Agriculture
2	Charles Lokiyoto Ewoi	CEC - Education
3	Pauline Akai Lokuruka	Chief Officer Education
4	Paul Lokone	Director Agriculture
5	Alfred Emaniman	Director Preventive and Promotive Health.
6	Lucas Edete	County Community Health focal person
7	Javan Manga	Social Development Officer (Department Social Services)
8	Fred Esinyen	T/Central Nutrition Coordinator
9	Dr Jane Akale	Deputy Director Veterinary services
10	Josephat Lotwel	County Drought Resilience Officer (NDMA)
11	Dennis Mosioma	NDMA Deputy Director of Information
Samburu County Stakeholder Consultation on NAWIRI's Learning Agenda		
1	Erastus Sinoti	County Public Health Officer
2	Delphina Kaaman	County Nutrition Coordinator.
4	Francis Koros	Director Social Services
5	Mary Bett	County Agriculture Nutrition Officer
6	Simon Lekartiwa	County Livestock officer
7	James Kiptoon	Sub County Public Health Officer
8	Augustine Lenomouwapi	County Community Strategy Focal Point
9	Martin Thuranira	County Director of Health
10	Alex Leseketeti	County NDMA Drought Coordinator

9. Detailed Budget

The anticipated budget and LOE for the institutions involved in the study are outlined in the table below.
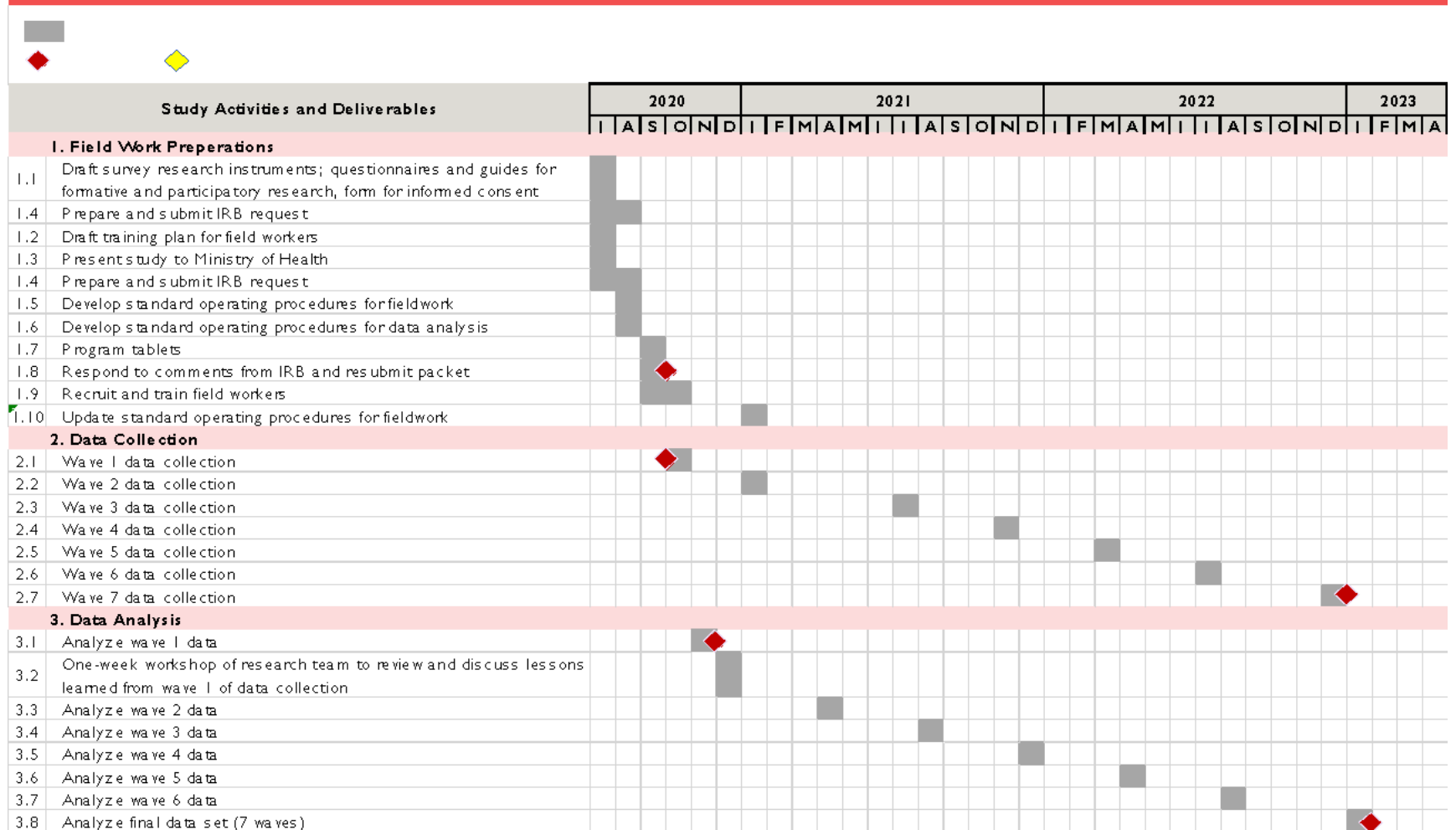
Table 4: Estimated Budget and LOE

Partner	Role (briefly described)	Key Personnel (estimated LOE %)	Other resources / activity costs	Total budget er

RTI	Technical support to and collaborate with APHRC in the development and implementation of the study. RTI will also collaborate with APHRC in the analysis of data and report writing and facilitate discussion of the results with the communities and support program and policy engagement with counties and the national government. RTI will oversee APHRC's subaward and have responsibility for final reporting to Mercy Corps and USAID.	Faith Thuita (20%) Valerie Flax (15%) Chessa Lutter (15%) Albert Webale (20%) Courtney Schnefke (20%)	Technical and administrative staff	$267,347
APHRC	APHRC will lead the development and implementation of the study, analysis of data, and development of reports. It will collaborate with RTI to facilitate discussion of the results with communities and support program and policy engagement with counties and the national government.	Estelle Sidze (50%) Dickson Amugsi (50%) Martin Kavao (25%) Elizabeth Kimani (10%) Amanuel Abajobir (50%) Caroline Wainaina (43%) Esther Anono (48%) Bonventure Mwangi (25%)	Technical and administrative staff, enumerators, field coordinators, etc.	$1,300,001
Mercy Corps	Adviser on resilience measurement, input on analysis and reporting Technical support to connect the study to learning and design of programmatic interventions that have high potential to address persistent and acute malnutrition. This includes policy/strategy, mainstreaming GYSD, institutions and systems (county/community), practices, approaches and	Brad Sagara (15%) USAID NAWIRI Key Personnel and Technical Advisors (10%)	Technical staff as needed	$101,921

	consortium partner use of research and evidence.			
Save the Children	Technical support to connect the study to learning and design of programmatic interventions that have high potential to address persistent and acute malnutrition. This includes health and nutrition advice, health institutions and systems (county/community), livelihoods and household economies	Hassan Mohamed (5%) Malini Tolat (55) Habtamu Fekadu (5%) Field Health Nutrition Advisers (20%) Household Economy Advisers (20%)		$24,400
The BOMA Project	Triangulation of LS with REAP secondary analysis and other sources Use of LS results to inform graduation pilot/activity design and adaptation Participation in stakeholder workshops throughout the LS process	NAWIRI Project Manager (10%) Research & Learning Associated (10%) Regional Technical Director (55)	Technical and or/ county staff as needed Any related travel costs	$35,041
Caritas Lodwar & Maralal	Will provide technical advice and guidance. The Caritas Lodwar and Caritas Maralal are the foremost providers of WASH services and have an extensive presence across the two counties, with a focus on water access, water system maintenance, sanitation, and hygiene, as well as livelihoods and conflict programs.		Technical advisers on WASH and conflict	$64,170

10. Project Work plan

Period of Performance/Timeline: A Longitudinal Mixed Methods Study to Support Community Driven Activity Design

Study Activities and Deliverables		2020 J A S O N D	2021 J F M A M J J A S O N D	2022 J F M A M J J A S O N D	2023 J F M A
1. Field Work Preperations					
1.1	Draft survey research instruments; questionnaires and guides for formative and participatory research, form for informed consent				
1.4	Prepare and submit IRB request				
1.2	Draft training plan for field workers				
1.3	Present study to Ministry of Health				
1.4	Prepare and submit IRB request				
1.5	Develop standard operating procedures for fieldwork				
1.6	Develop standard operating procedures for data analysis				
1.7	Program tablets				
1.8	Respond to comments from IRB and resubmit packet				
1.9	Recruit and train field workers				
1.10	Update standard operating procedures for fieldwork				
2. Data Collection					
2.1	Wave 1 data collection				
2.2	Wave 2 data collection				
2.3	Wave 3 data collection				
2.4	Wave 4 data collection				
2.5	Wave 5 data collection				
2.6	Wave 6 data collection				
2.7	Wave 7 data collection				
3. Data Analysis					
3.1	Analyze wave 1 data				
3.2	One-week workshop of research team to review and discuss lessons learned from wave 1 of data collection				
3.3	Analyze wave 2 data				
3.4	Analyze wave 3 data				
3.5	Analyze wave 4 data				
3.6	Analyze wave 5 data				
3.7	Analyze wave 6 data				
3.8	Analyze final data set (7 waves)				

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