

Maintains



Research supporting social
services to adapt to shocks

Maintains Kenya and Uganda Health and Nutrition Research Protocol: Health System Shock Responsiveness

Research Plan

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About Maintains

This five-year (2018–2023) operational research programme is building a strong evidence base on how health, education, nutrition, and social protection systems can respond more quickly, reliably, and effectively to changing needs during and after shocks, whilst also maintaining existing services. Maintains is working in six focal countries—Bangladesh, Ethiopia, Kenya, Pakistan, Sierra Leone, and Uganda—undertaking research to build evidence and providing technical assistance to support practical implementation. Lessons from this work will be used to inform policy and practice at both national and global levels.

Maintains is funded with UK aid from the UK government; however, the views expressed in this material do not necessarily reflect the UK government’s official policies.

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Executive summary

Maintaining Essential Services after Natural Disasters (Maintains) is a five-year UK Department for International Development- (DFID-) funded research programme that aims to develop an improved evidence base on how education, health, social protection, nutrition, and water and sanitation services can expand and adapt in response to shocks such as floods, droughts, cyclones, and disease outbreaks. In Maintains Kenya and Maintains Uganda, the Centre for Humanitarian Change (CHC), in partnership with Oxford Policy Management (OPM), is delivering demand-led and highly applied research on health and nutrition.

The overarching aim of this research is to answer, and develop solutions in relation to, the question: **'How can health systems be made climate shock responsive for all?'** (**Overarching theme: health system shock responsiveness**). To answer this overarching research question, the research involves answering questions clustered into four interconnected themes: (i) health system impacts of, and responses to, climate-related shocks; (ii) early warning, and health and nutrition information; (iii) financing for health system shock responsiveness; and (iv) surge approaches. Gender equity and social inclusion (GESI) is considered within each as a cross-cutting theme. This protocol harmonises research questions presented in the Country Research Plans in light of the fact that the questions developed through consultations with DFID Kenya and Uganda Offices are extremely similar. Having common themes and questions will allow us to deploy the same methods across the countries, to enable comparison, efficient use of resources, and high-impact publications that draw from both countries.

Our conceptual framework considers health systems as complex adaptive systems, with building blocks in formal and informal (including community) sub-systems, and connected systems (such as water, sanitation and hygiene (WASH), food security, and social protection) that influence health and nutrition status. It frames shock responsiveness as a sub-component of health system resilience, in that it is the outcome of the capacities of health systems to absorb shocks, learn from current and past experiences of dealing with shocks, and to adapt and transform over time to improve responsiveness to subsequent shocks. The broader concept of resilience also considers abilities to adapt to external drivers of change and internal stresses, in addition to shocks. Resilience capacities can be found, introduced, and strengthened in and across the building blocks and interactions of health systems.

Maintains' theory of change has three components that aim to ensure research is translated into practice:

- Component 1: Research activities to build a robust base of empirical evidence.
- Component 2: Targeted support to focal countries to help programmes to learn from the Maintains research.
- Component 3: Research uptake activities to ensure that findings inform policy and practice.

This research protocol guides Maintains Kenya and Uganda programme of research by detailing research themes and questions, our conceptual framing of health system shock responsiveness, the Kenya and Uganda contexts, and methodology. The research is action-

orientated, engaging development and humanitarian practitioners and national and local government stakeholders as collaborators, facilitating co-learning, and deploying several participatory methods, with new evidence from Component 1 feeding into Component 2 (targeted support) and Component 3 (research uptake). Data will be collected using mixed methods at multiple levels: national level; in three arid and semi-arid land (ASAL) counties in northern Kenya (Marsabit, Turkana, and Wajir), and the sub-region of Karamoja in Uganda; and in sub-counties and at health facilities within these; and at community and household levels.

In Component 1, research activities are organised into four work packages (WPs) that cluster methods to analyse different parts of the health system, each providing data on one or more of the research themes. WP1 involves secondary data analysis, desk review, and key informant interviews (KIIs) on the formal health system, and the health and nutrition impacts and will involve responses to recent climate variability in Kenya and Karamoja. WP2 involves participatory lessons learning about surge approaches (i.e. the Community-based Management of Acute Malnutrition (CMAM) Surge model), and social network analysis to explore information and financial flows, and leadership and governance related to health system shock responsiveness. WP3 focuses on the informal health system, collecting socially disaggregated data on community and household health and nutrition vulnerability and resilience to climate shocks through participatory focus groups and household surveys. A working paper will be produced on each of these three WPs, before WP4 synthesises findings across WPs1–3 in scientific publications and policy briefs on each of the overarching and specific research themes.

During Component 2, technical assistance will be provided to DFID and other partners, with the specific objective of adapting/developing/designing tools, approaches, and programmes to improve health system shock responsiveness in Kenya and Uganda. With agreement from partners, we envisage that these programmes will be implemented through an action research process, involving reflection on Component 1 evidence, co-design of new approaches and tools, piloting, and lessons learning, before final approaches are designed and implemented. Component 3 experimental learning and research uptake activities in-country and regionally throughout the programme.

Ethical procedures will be followed, with ethical approval obtained from ethics committees in both Kenya and Uganda, and government research permits secured. The research is quality assured through an academic and practitioner steering group, and OPM and external review of protocols and knowledge products, and regular consultations will be held with DFID and partners to ensure the research is meeting their demands and needs in Kenya and Uganda.

Table of contents

Executive summary.....	ii
List of abbreviations and acronyms	vi
1 Background.....	1
2 Research themes and questions	3
2.1 Overarching theme: Health system shock responsiveness	3
2.2 Theme 1: Health system impacts of, and responses to, climate-related shocks	6
2.3 Theme 2: Early warning, and health and nutrition information	9
2.4 Theme 3: Financing for health system shock responsiveness.....	11
2.5 Theme 4: Surge approaches.....	13
3 Conceptual framework.....	17
4 Case studies: Kenya and Uganda	21
4.1 Kenya	21
4.2 Uganda	30
5 Methodology.....	36
5.1 Research design	36
5.2 Study site selection	38
5.3 Component 1: Research activities and methods	39
5.4 Component 2: Targeted support	58
5.5 Component 3: Research uptake.....	59
5.6 Training.....	61
5.7 Data management	61
5.8 Ethical considerations	61
5.9 Governance	63
5.10 Limitations of the study	66
References	67
Annex A County case selection indices	75
Annex B Key informant interview guide (sample).....	76
Annex C Interviewee categories.....	83
Annex D Flexible coding method.....	85
Annex E NetMap focus group: facilitation guide.....	88
Annex F CMAM Surge innovation history workshop agenda	93
Annex G Innovation history interview guide	99
Annex H Participant information sheet	102
Annex I Consent form.....	106

List of tables and figures

Table 1:	Kenya and case county socio-economic, health, and nutrition indicators compared to national averages	22
Table 2:	Kenya DRF instruments	29
Table 3:	Karamoja socio-economic, health, and nutrition indicators	30
Table 4:	Proposed participatory tools for community focus groups	49
Table 5:	Indicative topics and descriptions of scientific and policy knowledge products (a scientific publication and policy brief will be written on each topic)	53
Table 6:	Summary of research activities and how they contribute data to answer the research questions.....	55
Table 7:	Key audiences for Maintains Kenya and Uganda	59
Table 8:	Primary Maintains Kenya and Uganda research team.....	63
Table 9:	Team member work package responsibilities.....	64
Table 10:	Maintains Kenya and Uganda steering group members	65
Figure 1:	Schematic of Maintains Kenya and Uganda research themes.....	6
Figure 2:	Conceptual framework for health system responsiveness to shocks	18

List of abbreviations and acronyms

ASAL	Arid and Semi-Arid Lands
CHC	Centre for Humanitarian Change
CHV	Community Health Volunteer
CLD	Causal loop diagram
CMAM	Community-based Management of Acute Malnutrition
DEWS	Drought Early Warning System
DFID	UK Department for International Development
DHIS	District Health Information System
DRF	Disaster risk financing
DRR	Disaster risk reduction
ECHO	European Civil Protection and Humanitarian Aid Operations
EDE	Ending Drought Emergencies framework
ENSO	El Niño Southern Oscillation
EWS	Early warning system
FAO	UN Food and Agriculture Organization
GDP	Gross domestic product
GESI	Gender equity and social inclusion
GIEWS	FAO Global Information and Early Warning System
GoK	Government of Kenya
GoU	Government of Uganda
HMIS	Health management information system
HSNP	Hunger Safety Net Programme
IMAM	Integrated management of acute malnutrition
IPC	Integrated Phase Classification
IPCC	Intergovernmental Panel on Climate Change
KII	Key informant interview
KNBS	Kenya National Bureau of Statistics

Maintains	Maintaining Essential Services after Natural Disasters
MoH	Ministry of Health
NDMA	National Drought Management Authority
NDVI	Normalised Difference Vegetation Index
NGO	Non-governmental organisation
NHIF	National Hospital Insurance Fund
OOP	Out-of-pocket payment
OPM	Oxford Policy Management
PI	Principal Investigator
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WASH	Water, sanitation, and hygiene
WFP	World Food Programme
WHO	World Health Organization
WP	Work package

1 Background

Maintains is a five-year research programme that aims to develop an improved evidence base on how education, health, social protection, nutrition, and water and sanitation services can adapt and expand in response to shocks such as floods, droughts, cyclones, and disease outbreaks. A central component of Maintains is understanding and identifying better disaster risk financing (DRF) practices, essential for the achievement of shock-responsive services. The overall objective of the programme is to deliver, and maximise uptake of, new operationally relevant evidence on:

- how shocks impact on essential services in low- and lower middle-income countries;
- the extent to which essential services can flex and respond as a system rather than as independent parts; and
- how essential services can prepare for, and better respond to, natural disasters.

Maintains is being implemented in five countries: Bangladesh, Ethiopia, Kenya, Pakistan, Sierra Leone, and Uganda. In Kenya and Uganda, Maintains is a collaboration between **OPM** and the think tank **CHC**. Maintains is delivering demand-led and highly applied research in collaboration with the governments of Kenya and Uganda, the DFID offices of Kenya and Uganda, and key partners and end-users of the research.

Maintains' theory of change has three components that aim to ensure research is translated into practice:

- Component 1: Research activities to build a robust base of empirical evidence.
- Component 2: Targeted support to focal countries to help programmes to learn from the Maintains research.
- Component 3: Research uptake activities to ensure that findings lead to maximum impact.

The research process will be iterative, involving research design, data collection and analysis, and operationalisation of results, with research and research uptake combined in continuous cycles.

The primary focus of CHC's work in Kenya and Uganda is health and nutrition, specifically in the ASAL of northern Kenya and Karamoja in Uganda. These sectors were selected owing to their operational relevance to key stakeholders and DFID programming, and the potential to plug critical knowledge gaps on how basic services, more widely, can better respond to shocks. The planned research outlined in this protocol will inform DFID and government and non-government organisation (NGO) partners' engagement and investment in health and nutrition services in Kenya and Uganda. Specifically, the research will explore how the Kenyan and Ugandan health systems can be strengthened in order to be more risk informed, prepared, and shock responsive, with specific reference to climate shocks, especially droughts and floods.

To this end, this overarching protocol first presents an overarching research theme, followed by four interconnected research themes and associated research questions, to be investigated across the two countries. The overarching protocol harmonises and updates

themes and research questions presented in the Kenya and Uganda Country Research Plans in light of the fact that the questions developed through consultations with DFID Kenya and Uganda Offices are extremely similar. Having common themes and questions will allow us to deploy the same methods across the countries, enabling comparison, efficient use of resources, and high-impact publications that draw from both countries. However, policy outputs will be developed for each country to ensure they meet the specific needs of partners working in these contexts, to maximise research uptake. Secondly, the protocol presents our conceptual framework, through which these themes and questions will be investigated. Thirdly, the protocol presents the health system, health and nutrition, and climate shock context of Kenya and Uganda. Fourthly, the protocol outlines the methodology for our research. This comprises the three components of the research. Component 1 involves research activities to examine the health system shock responsiveness in Kenya and Uganda, organised into four WPs that cluster methods to analyse different parts of the health system, providing data on one or more of the research themes. Research outputs (drawing from WP1-3 data) on each, and across the, research themes will be delivered in WP4. Component 2 involves targeted support and action research with partners to develop, pilot, and evaluate new health and nutrition shock-responsive approaches. Component 3 involves research uptake activities. Finally, the protocol explains the governance and communications, and the timeline of the programme of work. The annexes contain samples of ethics forms and interview and workshop guides.

This protocol is a live document that will be updated throughout the Maintains programmes as new information becomes available from the research activities.

2 Research themes and questions

2.1 Overarching theme: Health system shock responsiveness

Extreme weather events, or climate shocks, such as floods, wildfires, heatwaves, or droughts, can have major impacts on public health and nutrition status, and on the functioning of health systems in low- and lower middle-income countries. Demand for health and nutrition services grows when these events result in physical injury and psychological trauma, and increase exposure to infectious diseases and undernutrition (Hales *et al.*, 2003; Waring and Brown, 2005). The risk of contagion is heightened by reductions in the availability of clean and safe water, difficulties in maintaining hygiene practices, and the displacement of populations (Few, 2007). Climate shocks can also disrupt food production and markets, affecting food availability and affordability, and thus dietary intake (Funk *et al.*, 2019). Undernutrition increases susceptibility to infection, while infection can exacerbate undernutrition because of loss of appetite and diarrhoea (Katona and Katona-Apte, 2008; Rodriguez-Morales *et al.*, 2016). Climate shocks, therefore, aggravate this vicious cycle through their effects on disease exposure and diet. In addition to public health and nutrition impacts, climate shocks affect the functioning and service delivery of health systems by, for example, damaging infrastructure, depleting financial resources and medical supplies, and overburdening the health workforce and information and supply chain management systems (Shoaf and Rotiman, 2000; World Health Organization (WHO), 2009).

With climate change increasing the frequency and severity of weather extremes (Intergovernmental Panel on Climate Change (IPCC), 2014), and therefore the associated health system risks, there is an urgent need to improve the preparedness and responsiveness of health systems to climate shocks, so that services can flexibly expand to meet additional demands for health and nutrition services, and so that the functions of health systems can be maintained in the face of challenging circumstances, meeting the needs of all those in need. If the Global Sustainable Development Goal of good health and wellbeing (Goal 3) and universal healthcare coverage is to be achieved in the context of a changing and more volatile climate, building the shock responsiveness of health systems in low- and middle-income countries will be vital to ensure gains made in strengthening health systems, and in the health and nutrition status of populations, are not eroded by successive climate shocks.

The programme of Maintains research in Kenya and Uganda will contribute to this agenda by answering the following overarching research question:

How can health systems be made climate shock responsive for all?

Shock responsiveness is defined as the ability to scale up to meet shock-related increases in demand for health and nutrition services, whilst maintaining routine service delivery and avoiding indirect effects from service disruption (Newton-Lewis *et al.*, 2020). Health system resilience is a broader concept that considers the capacity of the system to absorb and adapt in response to all kinds of change, not just shocks, including long-term drivers of change (e.g. environmental or social change) and everyday stresses (e.g. staff absenteeism) (Gilson *et al.*, 2017). However, shock responsiveness is underpinned by resilience capacities to absorb shocks, learn from past experiences of dealing with shocks,

and adapt incrementally over time to improve responsiveness to subsequent shocks, or transform the health system if the current system is ill-suited to a changing shock context (elaborated in Section 3: Conceptual framework). The inability of the health systems of West Africa to cope with the 2014–15 Ebola virus disease outbreak has led to substantial interest in how to make health systems more resilient to shocks (Blanchet *et al.*, 2017). However, while the WHO (2015) has developed an ‘Operational framework for building climate resilient health systems’ and the Sendai Framework for Disaster Risk Reduction proposes resilient health systems for disaster risk reduction (DRR) in the health sector (Olu, 2017), there is remarkably little empirical research on what makes a health system resilient to climate shocks, and what policies and practices can actually build health system resilience (Bayntun *et al.*, 2012; Fridell *et al.*, 2020).

By being resilient, health actors, institutions, and populations can prepare for, effectively respond to and recover from shocks, maintain core functions during the shock, and learn lessons to adapt or reorganise if conditions require it (Kruk *et al.*, 2017). The key capacities that nurture resilience are: absorptive capacity, adaptive capacity, and transformative capacity (Béné *et al.*, 2012). For health systems, absorptive capacity refers to the ability to continue to deliver the same or better¹ quantity, quality, and equity of service delivery with the same resources, capacities, and approaches, despite the shock (Blanchet *et al.*, 2017). Adaptive capacity refers to the ability of the health system to learn from experience and knowledge, and adapt to changing circumstances through incremental adjustments. Finally, transformative capacity refers to the ability of the health system to recognise the current system is ill-suited to a changing context and to make fundamental changes to the functions and structure of the health system (adapted from Blanchet *et al.* (2017)).

We propose that these capacities are found in multiple parts of a health system at different levels, from individual health workers up to the entire health system, and can be strengthened through interventions. These capacities are determined by the status, characteristics of, and interactions amongst components of the formal health system, known as the WHO health system *building blocks*², and those of the informal health system. We use the term informal health system broadly to include communities, traditional medicine, and healthcare providers in households, recognising the significant contribution that community institutions and women make to the health and nutrition status of families and communities, and their vital role during times of crises, especially in places remote from formal health and nutrition service provisions. The informal and formal health systems are bridged by community health and nutrition services, such as community health volunteers (CHVs) and outreach services, which can boost supply and utilisation of formal health services within communities (Section 3). The formal and informal health systems are impacted by, interact with, and respond to external shocks, like floods, droughts, and epidemics, and internal dynamics, such as conflict, industrial action, changes in leadership, and funding delays. Yet our knowledge of these health system impacts and processes before, during, and after, or across successive, shocks is limited.

¹ For example, outreach services can be deployed during emergencies and may actually improve service delivery relative to ‘normal’ periods.

² The study will use the WHO description of six health system building blocks: health information systems; medical products, vaccines, and technologies; human resources for health; service delivery; health financing; and leadership and governance.

This research will contribute to filling this knowledge gap by building the evidence base on the resilience capacities that can be found and nurtured in health systems to build responsiveness to climate shocks, and their interaction with other shocks, such as COVID-19. These capacities will be studied through four research themes. Theme 1 explores the impacts of climate shocks on health systems and existing responses before, during, and after events, and resilience capacities that enable learning and adaptation processes for improving shock responsiveness in the future. Theme 2 investigates how early warning and health information systems contribute to health system shock responsiveness. Theme 3 is interested in financial mechanisms that can support the flexible expansion and contraction of health and nutrition services during climate shocks to meet additional and variable demand and needs. Theme 4 aims to understand how health systems can expand and scale up services – or surge – to meet extra health and nutrition demands, while not incurring any long-term consequences for the functioning and performance of the health system. These themes were selected based on a consultative process with DFID Uganda and Kenya, and partners, which produced a County Research Plan for each country, now superseded by this protocol.

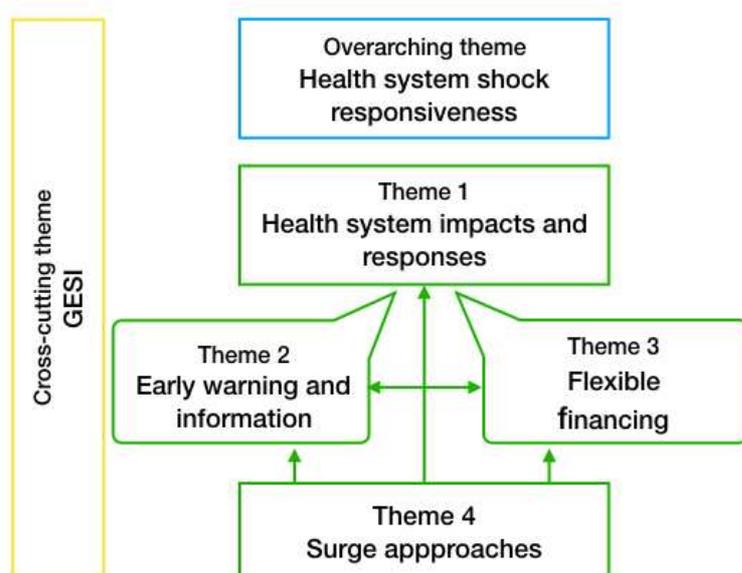
Empirical research nationally and in case study counties in Kenya and Karamoja in Uganda will provide global policy insights on how health system strengthening can be tailored to strengthen shock responsiveness and resilience. At the same time, the research outlined in this protocol will facilitate lessons learning and policy and strategy guidance for actors, from community to international level, to build capacities for shock response in Kenya and Uganda, with research uptake embedded in all stages of the research process (Section 5: Methodology).

GESI is a cross-cutting theme of the Maintains programme, in support of DFID's emphasis on ensuring that programmes clearly incorporate a 'leave no one behind' approach in line with its commitments to gender equality, challenging social barriers that deny opportunity (such as gender, age, disability, ethnicity etc.), and promoting peaceful, just and inclusive societies. This agenda cuts across each of the research themes and the research aims to contribute to building evidence to help shape equitable and inclusive shock-responsive service provision. Gender and other social characteristics (e.g. ethnicity/tribe, class, disability, disadvantage etc.) are key determinants of vulnerability to health impacts of climate extremes and the ability to access health and nutrition services, and participation in responses strategies carries different burdens for different staff and volunteers in the health system, with implications for GESI. These issues are primarily addressed in Theme 1, but Theme 2 considers how early warning and health and nutrition information can meet the needs of different stakeholders and social groups, Theme 3 considers the equity of disaster financial mechanisms for health and nutrition, and Theme 4 considers whether surge approaches deliver more equitable and inclusive outcomes compared to traditional approaches.

Figure 1 provides a schematic of the interlinkages between the research themes. Theme 1 investigates the responses to and impacts of climate shocks, considering interactions across the health system and the building blocks outlined in our conceptual framework (Section 3). Themes 2 and 3 zoom in on the information- and finance-related blocks in the health system to understand their capabilities for shock responsiveness, which were identified as critical domains of strategic interest by both DFID Kenya and Uganda because of the recognised need to strengthen them to increase national health system capacities for shock response.

There are also significant knowledge gaps in the literature on these themes, as presented in Sections 2.3 and 2.4. Theme 4 analyses a health system resilience innovation – surge approaches – to understand its potential contribution to improving shock-responsive information and financing, and shock responsiveness in general. Finally, the diagram shows DESI as a cross-cutting theme.

Figure 1: Schematic of Maintains Kenya and Uganda research themes



2.2 Theme 1: Health system impacts of, and responses to, climate-related shocks

The impacts of climate shocks are distributed unevenly in populations according to patterns of vulnerability defined by geography and social differences, such as gender, socio-economic status, disability, ethnicity, and age (United Nations Children's Fund (UNICEF), 2017a). The poorest are most at risk of disease and undernutrition, often live in areas that are most exposed to climate shocks, and struggle to cope with shocks; and elderly, disabled, and those with chronic illness (e.g. Aids) are more susceptible to disease or may have reduced appetite or ability to eat (UNICEF, 2017b). Infants and young children often have the highest levels of malnutrition during droughts, increasing incidence of wasting and stunting, anaemia deficiencies (which increases the risk of irreversible cognitive losses and poor immunity), as well as micronutrient deficiencies like vitamin A and folic acid deficiencies. Women are among the most affected as they generally eat last and least, and they have restricted access to the resources needed for coping, and their gendered roles mean they have to spend more time sourcing food, fuel, and water during droughts, at the expense of childcare, feeding practices, and time available to access health and nutrition services (Balfour and Mutuku, 2018; Geere and Hunter, 2020; Hailey *et al.*, 2018). Indeed, young children, and pregnant and lactating women, have increased nutrition requirements, yet women and girls are most likely to reduce their food consumption as a household coping mechanism. Violence against women and girls, which often increases and takes new forms during and after climate shocks, is particularly significant, both as a determinant of needs and as a barrier to delivery of, and access to, services.

Beyond the direct impacts of shocks on individuals' social, economic, and health and nutrition status, there may be indirect impacts resulting from groups' different abilities to access and utilise appropriate ongoing and shock-related health and nutrition services. Climate shocks also impact the functioning of formal and informal health system building blocks, and therefore the delivery of these services, by, for example, damaging or destroying health facilities and other medical facilities, causing stress, absenteeism, emigration, illness or deaths amongst health workers, and exhausting medical supplies (Shoaf and Rotiman, 2000). Various types of shocks have also been found to disrupt systems processes, such as procurement, supply, logistics, and health information (Ager *et al.*, 2015; WHO, 2009), and to compromise transportation and communication systems, further crippling the health system and individuals' ability to seek and access care. Individuals may be impacted differently by these effects on services, as well as experiencing different levels of service responsiveness to new needs arising from a shock (Spearing, 2019). Climate shocks can also coincide with other types of shock, such as the current COVID-19 pandemic, which can ratchet up the demands on health systems.

In addition to being impacted by climate shocks, capacities to respond to climate shocks are found in the building blocks and their interactions. For example, the workforce can help absorb increased demand for health services by staff taking on additional responsibilities during shocks (Campbell *et al.*, 2015; Hanefeld *et al.*, 2018); leaders can act as a bridge different groups within the health system to coordinate shock response (Blanchet *et al.*, 2017); and accurate and timely health information can support the detection of and preparations for shocks (Chamberland-Rowe *et al.*, 2019). Intangible software is likely to be critical for health system resilience. Social networks, for example, provide access to multiple (cognitive, material, reputational) resources that can support absorptive, adaptive, and transformative responses (Gilson *et al.*, 2017). Social capital can promote recovery following a shock by providing a sense of worth, community, and responsibility amongst health actors (Kruk *et al.* 2017). Jamal *et al.* (2020) showed, for example, that strong identification of staff with the communities they serve helps maintain services during crises and shocks. Trust and accountability can be critical in networks of actors in times of crises (Bloom *et al.*, 2015). Kieny and Dovlo (2015) showed how trusting relations with populations and communities determines willingness to use health facilities and share information about emerging health and nutrition issues. Studying social networks provides opportunities to understand the role of tangible capacities (e.g. financial flows, Theme 3) and intangible capacities (such as social capital).

But these response strategies place different burdens on staff and volunteers in the health system. For example, women often comprise the largest proportion of frontline staff, but may also have additional domestic workloads and healthcare duties during shocks, which may impact their ability to do their job. Indeed, droughts and floods increase workloads for staff, the majority of whom are women, who may then have less time to fulfil gendered roles within their own households.

Analysis of the impacts of climate shocks on formal building blocks and their interactions is severely lacking, and there is very little empirical research on the impacts on informal components of health systems, including women providers of healthcare in the home. In particular, there is very little information on the impact of droughts on health systems, according to a review by Stanke *et al.* (2013). By observing and analysing what enabled or hindered such responses to shocks it can be possible to reveal latent resilience capacities

(Adger *et al.*, 2005) that confer an ability to absorb shocks or incrementally adjust or transform the health system to make it more shock responsive in the future. An emerging health system resilience literature has begun to identify some of these capacities from studies of responses to, predominantly, disease epidemics, refugee crises, and insecurity shocks (Ager *et al.*, 2015; Alameddine *et al.*, 2019; Ammar *et al.*, 2016; Kruk *et al.*, 2015), but empirical research on the resilience capacities within and across health system building blocks that enable equitable responsiveness to climate shocks *per se* is lacking.

Under this theme, exploratory research will review the impact and responses of the entire health system, as depicted in the conceptual framework (Section 3), to identify determinants and capacities that enable health system shock responsiveness to climate shocks, including drought, floods, and locust swarms. A particular focus will be on the health workforce, governance and leadership, and the role of the informal health system and how it influences community access to and utilisation of formal health and nutrition services during droughts, with information and finance addressed in-depth under Themes 2 and 3, respectively. We seek to build additional understanding of how health and nutritional impacts of climate shocks differ based on gender and other social characteristics, including the initial impact itself and the ways health and nutrition services address ongoing and shock-specific needs during and after the shock. We also aim to explore socially-determined barriers to accessing appropriate formal and informal health and nutrition services, and the performance of existing arrangements for achieving equitable service provision in the face of shocks.

Theme 1 question: How can health system capacities to respond to climate shocks be strengthened?

1.1 How are (formal and informal) health systems impacted by climate shocks?

- How do climate shocks affect demand for and utilisation of formal health and nutrition services by different social groups (e.g. based on gender, disability, ethnicity, displacement/refugees), taking into account concurrent shocks, such as COVID-19?
- How is the quality, coverage, accessibility, cost, affordability, safety, and equity of formal health and nutrition services affected by climate shocks?
- How are informal (household, community, men/women) health and nutrition carers/providers impacted by climate shocks?
- What are the gendered impacts of climate shocks on, and responses of, healthcare workers and their families, including violence against women and girls?

1.2 How do health systems respond to climate shocks?

- How does the supply of health and nutrition services change in response to variability in demand for services?
- How do health and nutrition services address ongoing and shock-specific needs of different genders and social groups during and after climate shocks?
- How do social characteristics determine access to normal or ongoing services before, during, and after shocks?
- What are the strategies of health workers and teams for preparing for, coping with, and adapting to climate shocks?

- What is the role of health governance and leadership in supporting, enabling, and blocking these strategies?
- How do gender and social characteristics shape the delivery of essential services during shocks?
- What is the role of the informal health system in responding to climate shocks?

1.3. What enables health systems to adjust over time to improve shock responsiveness?

- How has health system shock responsiveness changed over time?
- How have internal (e.g. industrial action, leadership) and external (e.g. governance devolution) factors and strategies enabled or blocked shock responsiveness and health system change?
- What interventions and governance approaches have the potential to generate more equitable, gender sensitive, and transformative health system shock responsiveness?

2.3 Theme 2: Early warning, and health and nutrition information

Resilient health systems require robust, reliable, and timely information to predict, detect, prepare for, and respond to climate and other shocks and changing contexts (Chamberland-Rowe *et al.*, 2019). Early warning systems (EWSs) play a crucial role in this respect, by collecting information on hazards, health risks, and drivers of increased health and nutrition demand for a given location or population in order to inform timely and coordinated preparations and responses. Health EWSs have most commonly been developed to detect the outbreak of epidemic-prone diseases, especially malaria, because climate variations and disease prevalence are known to be significantly related (in Ebi and Burton, 2008). These systems remain predominantly scientific rather than integrated into operational EWSs, and predicting other climate-related diseases, such as acute diarrhoea, is challenging because of the diversity of causal pathogens (Akanda *et al.*, 2014). Numerous EWSs also exist for food security, to identify emerging droughts and famine. The most prominent and sophisticated of these are the international EWS, FEWSNET, and the Integrated Phase Classification (IPC) system, but there are also a growing number of national EWSs for drought and food insecurity, including in Kenya and Uganda (Maxwell and Hailey, 2020).

Over the past four decades, the accuracy of EWSs has improved greatly, with EWSs successfully predicting major crises months in advance (Funk *et al.*, 2019). The challenge lies in translating this information into early action and longer-term actions. To be effective, EWSs must analyse information about current events, trends, and signals and turn it into forecasts or scenario analyses that are used to take timely actions (Maxwell and Hailey, 2020). For health and nutrition, information from EWSs needs to predict potential health and nutrition outcomes, effectively communicate risks to health actors and the public, and trigger robust and timely responses that target vulnerable populations and places. However, there are often few incentives or mechanisms for early action, there is often a reluctance to take such action, and there are often critical cultural and socio-political barriers to early action that are not accounted for in the design of the system (Hillbruner and Moloney, 2012). Furthermore, organisations implementing EWSs often do not communicate with each other, and EWSs are often filtered through complex government bureaucracies and political

processes, rather than triggering rapid actions (Alderman, 2009), with limited effort to make the information relevant to and usable by the health workers, communities, and households that are at most risk (Maxwell and Hailey, 2020), and the first responders to climate shocks. There are inherent uncertainties associated with early warning information since it is based on forecasts and the integration and analysis of multiple sources of data and analysis, each with their own uncertainties and underlying assumptions (Hillier and Dempsey, 2012). Obtaining trust in EWSs can therefore be problematic.

Research under this theme will explore whether existing EWSs and health and nutrition information are reliable enough, and whether they are used to trigger early actions in health and nutrition. Specifically, we firstly aim to analyse the accuracy and reliability of early warning information for predicting surges in admissions linked to diseases and undernutrition. This will involve examining the potential to include health and nutrition in early warning bulletins. Secondly, we will explore the enablers of, and bottlenecks that constrain the use of, early warning and climate information in health system responses to climate shocks. The project will identify these barriers by studying the dissemination, sharing, and use of early warning information within social networks in (formal and informal) health systems in Kenya and Uganda. Thirdly, we will investigate how different health actors view uncertainties in early warnings, how those views affect the trust in and use of the information in decision-making, and the effects of such decisions on health system shock responsiveness. Lastly, we seek to gather perspectives on how early warning and health information systems can be made more actionable by end users (e.g. health and non-health practitioners and communities) and mainstreamed into health systems in Kenya and Uganda, to support absorptive, adaptive and transformative health system capacities.

Theme 2 research question: How can early warning and health information systems contribute to health system shock responsiveness?

- 2.1 How accurate and reliable is current early warning information for predicting and responding to increases in climate shock-related increases in demand for health and nutrition services?**
- 2.2 What enables and inhibits the dissemination, sharing, and use of early warning and climate shock-related health information within and outside the (formal and informal) health system?**
- 2.3 How do health actors at different levels perceive and react to uncertainties related to early warning, shock-related health information, and other climate information, and does this affect trust in these systems?**
- 2.4 How can early warning, climate, and shock-related health information be made reliable, trusted, and actionable by different stakeholders, genders, and social groups in health systems?**
- 2.5 What role can the informal health system play in improving EWSs and shock-related health information?**
- 2.6 How can early warning, shock-related health information and climate information support adaptive and transformative capacities in health systems?**

2.4 Theme 3: Financing for health system shock responsiveness

Climate shocks incur financial costs related to health and nutrition by increasing caseloads, damaging health infrastructure, and reducing tax revenues because of livelihood impacts. The financing of these costs can be sourced from internal health finance and disbursement systems, or households through out-of-pocket payments (OOPs) for health and nutrition services, or, in disaster situations, post-disaster and pre-arranged disaster financing.

Health finance and disbursement systems are regular budget allocations within government health ministries, development programming, and the private sector. Health system resilience literature has begun to reveal how health finance and disbursement systems become critical during periods of crisis. A limited body of research is pointing to the importance of adequate, stable, diverse, flexible, and equitable health system financing for responsiveness and resilience to a range of shocks. Hanefeld *et al.* (2018) found that *adequately* funded national health services could better withstand a range of financial, climate, disease outbreak, and refugee crisis shocks, while Oxfam (Kamal-Yanni, 2015) identified inadequate health financing as a cause of the fragility of health systems in Liberia and Sierra Leone during the Ebola outbreak. *Stable* financial resources reduce the risk of funding gaps when shocks strike (Fridell *et al.*, 2020). Ammar *et al.* (2016) studied the 2013–14 refugee crisis in Lebanon and found that stable national public spending on health allowed for effective investment planning and consistent delivery and management of healthcare services, which helped to meet higher demand for services during the crisis. In contrast, less stable sources of funding make it difficult for health providers to deal with spikes in demand caused by external shocks. For example, formal health systems that rely on employment-based contributions for healthcare are exposed to shortfalls in revenue if a shock leads to unemployment. *Diverse* and *flexible* sources of finance can minimise the risk of underfunding during crises. In this respect, international development funding running in parallel to government funding can enable rapid mobilisation and disbursement of resources, and can avoid blockages in funding from government bureaucracies, but there are few examples of cases where international funding mechanisms have successfully enabled national health systems to better respond to shocks (Hanefeld *et al.*, 2018): inflexible aid and government spending is currently most typical globally (Blanchet *et al.*, 2017). Finally, *equitable* financing of health systems may be important since OOPs may mean the poor are unable to afford healthcare costs, or engage in catastrophic spending, pointing to the benefit of universal healthcare for equitable access during shocks (Fridell *et al.*, 2020).

Indeed, one often overlooked source of health financing during climate shocks is OOPs. De Alwis and Noy (2019), for example, found that half of healthcare costs associated with droughts and floods in Sri Lanka are paid for by households. OOPs and transaction costs of travelling significant distances to health facilities may be an especially important contribution to health financing during droughts and floods in northern Kenya and Karamoja. However, the ability of households to make OOPs may be affected by the impacts of a climate shock on their livelihood, potentially making indirect sources of finance, such as social transfers, remittances, or debt, important for affording health and nutrition services and avoiding catastrophic spending during shocks. Social protection schemes, such as the Hunger Safety Net Programme (HSNP) in Kenya and Northern Uganda Social Action Fund (NUSAF) III programme in Karamoja (Section 4), release cash transfers to poor and vulnerable households when rains and harvests fail, which may help poor households to afford OOPs

during shocks. Remittances are known to increase significantly in response to shocks (David, 2011), and are known to help households maintain livelihood assets and consumption (Twigg, 2015). However, the contribution of household OOPs for health and nutrition services during shocks is rarely considered in disaster financing, alongside the role of social transfers and remittances in removing financial barriers to accessing services to shocks.

If internal health financing arrangements are unable to cope with caseloads and other financial costs of a climate shock (e.g. damage to health infrastructure), the additional funding required to cover the costs is frequently mobilised by governments and donors in an *ad hoc* way, i.e. after the shock has manifested itself, through budget reallocations, borrowing, taxation, or discretionary international aid, but this often leads to funding arriving after the time when it is most needed (World Bank, 2019). For health and nutrition, this reactive rather than anticipatory aid model is unlikely to be the most suitable approach for dealing with the messy realities of seasonal and inter-annual peaks in malnutrition and morbidity that pervade many low-income countries, which require continuous, flexible financing to scale up and down health and nutrition services. DRF, on the other hand, seeks to effectively finance the costs of responding to disasters through pre-arranged mechanisms, such as contingency funds and insurance, based on the expectation that natural hazards will occur and that it benefits to plan financing in advance. An affected country may, for example, have in place a dedicated disaster response fund or contingency budget lines to draw on. However, funds are often reprogrammed from an existing national budget line to disaster response, which tends to be a slow process and leaves funding gaps for the programmes the money was destined for originally. Thus, disaster-exposed countries have started putting in place innovative financial DRF mechanisms that can ensure funding is available faster and in sufficient quantity, using, for example, instruments such as contingent lines of credit or insurance (Clarke and Dercon, 2016). In sub-Saharan Africa, Kenya has experimented a great deal with such instruments, including contingency budgets for droughts and epidemics (Government of Kenya (GoK), 2018). Despite these advances on disaster response funding more generally, for shocks to health systems, disaster financing mechanisms have not been analysed much, and many DRF solutions have not been applied to health and nutrition.

While there is a small but growing literature that considers responsive health system financing for epidemic shocks, there is a need for empirical analysis of how health finance, OOPs, and DRF instruments individually and collectively enable and block the timely, flexible, scalable financing of health and nutrition services in response to seasonal and inter-annual 'small' and 'big' climate shocks that interact across space and time. We aim to fill this knowledge gap by, first, understanding the formal health system and related DRF institutional arrangements, financial mechanisms, decision-making processes, and relationships that determine financial allocations and flows in the formal health system during recent climate shocks. Second, we will analyse the contribution of households' OOPs to health financing during climate shocks, and the relative role of remittances, social transfers, and other income sources for health expenditure during these periods. Thirdly, we will explore how these formal and informal financing arrangements support or constrain the timeliness and flexibility of shock response financing. Lastly, we aim to draw lessons from the current system and past experiences of shock response, to consider both how to improve health financing and how to expand DRF instruments to improve shock responsiveness.

Theme 3 question: How can health system financing flexibly expand and contract in response to climate shock-related surges in demand for health and nutrition services?

3.1 How are surges in demand for health and nutrition services from climate shocks financed in the formal health system?

- How does the public health and disaster financial planning process work for funding health and nutrition response activities responding to climate shocks within and across governance levels?
- What financial mechanisms and instruments have been and are currently being used for (informal and formal) health system responses to climate shocks at multiple levels (international to household)?
- How are funds from different mechanisms released and disbursed for health and nutrition response activities responding to climate shocks within and across governance levels (international to local)?

3.2 How shock responsive is household financing of health and nutrition services?

- How do households finance OOPs for health services during climate shocks and what are the consequences for health and nutrition status?
- What are the financial barriers to households accessing health and nutrition services?
- What is the relative role of social transfers, remittances, debt, and other sources of finance for funding health and nutrition OOPs.

3.3 What are the enablers of and barriers to timely and flexible financing of shock-responsive health and nutrition services?

- What have been the perceived successes and challenges of health system financing during climate shocks?
- How do existing public and donor finance processes affect the timeliness and reliability of funding?

3.4 How can the financing of health system shock responses be improved?

- How can financing for health and nutrition services and response activities responding to climate shocks become faster, more reliable, and more cost-effective?
- How can social transfers be tailored to support household health and nutrition financing?

2.5 Theme 4: Surge approaches

Health systems can experience sudden escalations and/or intensification of demand for their services, known as ‘surges’, because of the impacts of natural hazards and epidemics. Hick *et al.* (2009) defined surge capacity as ‘*the ability to manage a sudden, unexpected increase in patient volume that would otherwise severely challenge or exceed the present capacity of either an individual facility or the wider health care system*’. Interest in surge has risen in prominence during the current COVID-19 pandemic, with technical guidelines and tools

issued by the WHO for increasing the available hospital capacity to deal with an influx of COVID-19 patients (WHO, 2020a).

There has been conceptual convergence amongst health scholars on four components of surge capacity: space, staff, stuff, systems – the ‘4 Ss’ (Hick *et al.*, 2009). Space, or structure, refers to hospitals and the potential to requisition other structures beyond hospitals, such as community centres or homes, to treat patients. Staff (or the human resources health system building block) refers to the ability to mobilise sufficient numbers of appropriately skilled staff for emergencies, taking into account shortfalls due to stress, overwork, and mental health issues. Stuff (or the commodities building block) is the required equipment (e.g. beds and ventilators) and supplies (e.g. medicines). Systems (or governance, information, finance, and other building blocks) refers to the processes and modes for decision-making, communications, teamwork, financing, and information sharing that enable the appropriate use and allocation of space, staff, and stuff (Hick *et al.*, 2009; WHO, 2020b). The same event can have significantly different outcomes depending on the current resources within a health facility and the ability to effectively and rapidly expand capacity with external resources, thereby emphasising the importance of the wider health system (Watson *et al.*, 2013). By addressing the need to accommodate escalations in patient numbers, surge capacity can be considered as contributing to the absorption of shocks by the health system, and therefore the system’s shock responsiveness and resilience.

Surge capacity research and planning tools have tended to focus on the ‘space’, ‘staff’, and ‘stuff’ components, which can be more easily quantified (e.g. number of beds) than the systems component. Yet the systems component is critical because it enables or activates the other components of surge capacity to actually improve the performance of the health system when dealing with surges. According to Watson *et al.* (2013) there is a need to understand how systems can support or be a barrier to surge capacity, and to learn from case studies of approaches or best practices. Furthermore, research on surge capacity has overwhelmingly focused on the US and Europe. Concepts of surge capacity have not informed policy in low- and lower middle-income countries, including Kenya and Uganda, despite them often being most vulnerable to epidemics and climate risks, and thus surges. In such countries, sudden escalations due to shocks can synergise with seasonal peaks – i.e. there are seasonal as well as disaster surges – requiring health systems that can flexibly scale up and down regularly. During disasters, it is often external aid organisations that provide surge capacity, working with government agencies, but assistance is too often too little too late. There is increasing recognition that spikes in acute malnutrition and disease incidence exist outside of declared emergencies, with informal and formal health systems having to deal with seasonal and inter-annual spikes that are both linked and not linked to climate variability. Currently, weak emergency planning is the norm in low-income country health systems and there is limited capacity to scale up and scale down service delivery in response to variable demands for health and nutrition services linked to climate variability (Kopplow *et al.*, 2014).

Despite the lack of diffusion of surge capacity ideas to low-income settings, an innovative approach – CMAM Surge – was established in Kenya by Concern Worldwide, to address surges in demand for nutrition services, which were effecting the performance of CMAM programmes. The CMAM Surge approach also aims to move the health system away from dependence on donor assistance during emergencies (Hailey and Tewoldeberha, 2010). It

aims to help a health system prepare for, detect, and respond to peaks in demand for nutrition services by setting capacity thresholds for caseloads, monitoring caseloads against these, and triggering actions at the health facility level and surge support from higher levels when thresholds are crossed, including the deployment of extra staff, the redistribution of supplies (stuff), and the provision of extra finance, training, and supervision. The approach also aims to make the health system adaptive to a changing context, including the frequency and severity of climate shocks, by health workers revising thresholds based on plotted admissions, promoting lessons learning, and adjusting surge support as necessary (Kopplow *et al.*, 2014). Since its launch in the county of Marsabit, GoK, with its partners, is scaling up CMAM Surge nationally, and it has been replicated in more than 13 countries, including Uganda, Ethiopia, and Niger.

CMAM Surge was designed independently of the concept of surge capacity and the 4 Ss, but intends to better allocate space, stuff, and staff to health facilities by improving systems, including information for early action, financing, and governance. By institutionalising lesson learning and revisions, it may also support health system resilience. Under this theme, the research will explore how effective CMAM Surge is at building surge capacity and shock responsiveness, and the system barriers to and enablers for implementing and scaling surge approaches. First, we will investigate whether the surge approach improves communication and information for shock response, builds capacity to sustain adequate provision of staff and stuff, and/or enhances the ability to scale up, distribute, and target finance to meet extra demand. Second, we will analyse how the bottom-up real-time monitoring of malnutrition admissions against thresholds improves the effectiveness and timeliness of responses to climate shocks compared to top-down EWSs, and whether early warning and CMAM information could be integrated to improve surge capacity. Third, the effectiveness of costed surge plans at improving the financing of responses will be assessed. Fourth, we seek to learn from system barriers to, and enablers of, implementing and scaling up CMAM Surge, which will provide contextual insights on how systems block and support the development of surge capacity. Fifth, we aim to understand the potential of CMAM Surge to be expanded to the community level to improve the timeliness of detecting surges in demand for formal health and nutrition services, and its potential to be adapted to also monitor multi-morbidity variables (e.g. malaria, diarrhoea, and COVID-19), which would increase capacity to deal with surges in total health facility workloads.

Research question 4: How can surge approaches strengthen health system surge capacity and resilience?

- 4.1 How does the timing of responses triggered by surge approaches compare to responses triggered by EWSs or regular health systems**
- 4.2 How can early warning and surge approaches be linked?**
- 4.3 To what extent do surge approaches facilitate flexible financing?**
- 4.4 What are the barriers to and enablers of the successful establishment and implementation of surge approaches?**
- 4.5 How do surge approaches support learning and adaptation to improve shock responsiveness of health systems over time (e.g. revised thresholds and enhanced capacities)?**

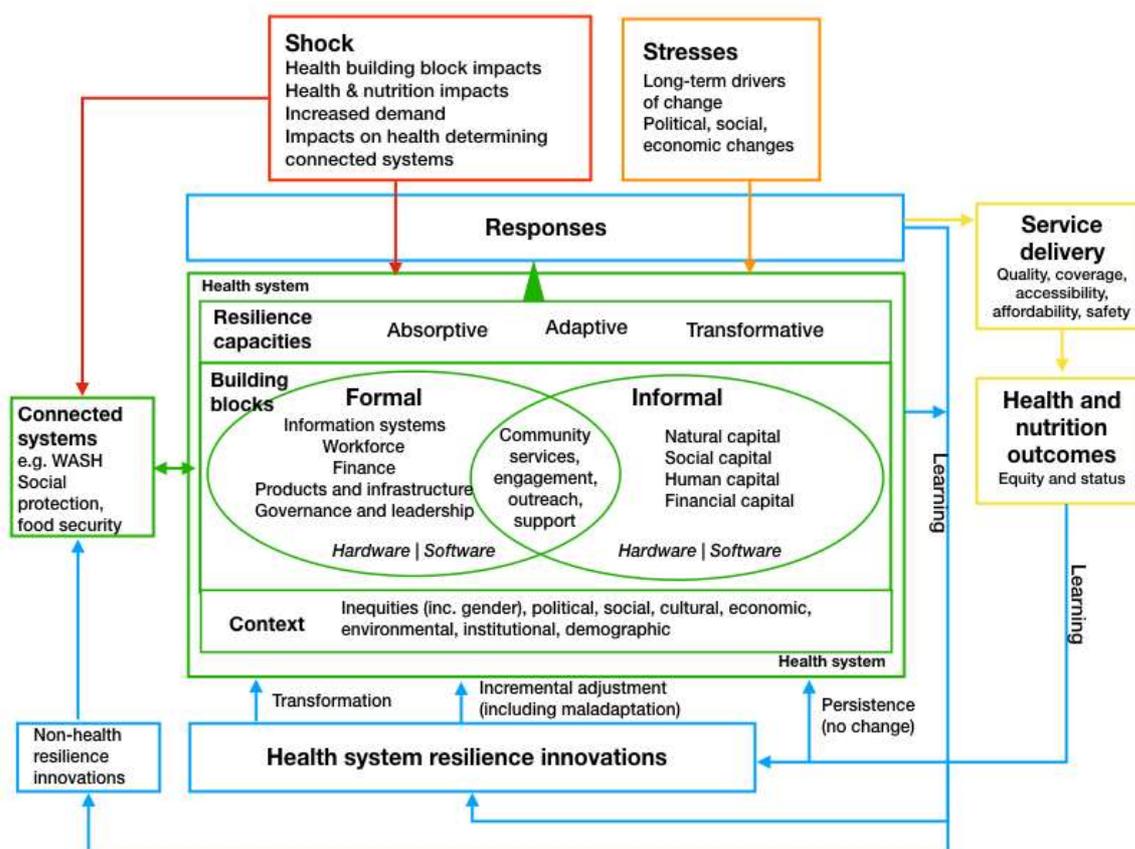
4.6 How could existing surge approaches be expanded to the community level, and be adapted to address a wider range of health and nutrition issues associated with climate variability?

3 Conceptual framework

Note: This protocol was designed based on the working conceptual framework presented below. This framework has been adopted, adapted, and integrated with other frameworks to create a Maintains programme-wide framework applicable across the five country case contexts to understand shock-responsive health and nutrition services. Thus, the framework presented below is strongly linked to the Maintains programme-wide framework but adapted for the specific context of the arid lands of Kenya and Uganda. The Maintains programme-wide framework is presented in [Working Paper: What is a Shock-Responsive Health System?](#)

The research themes and questions will be investigated through a systems lens, summarised in the following working conceptual framework (Figure 2) of health system responsiveness to climate shocks in low- and lower middle-income countries. As defined above, shock responsiveness is the ability to scale up to meet shock-related increases in demand for health and nutrition services, whilst maintaining routine service delivery and avoiding indirect effects from service disruption (Newton-Lewis *et al.*, 2020). Shock responsiveness is determined by the capacities of health systems to absorb shocks, learn from current and past experiences of dealing with shocks, and to adapt and transform over time to improve responsiveness to subsequent shocks – that is, health system resilience. These capacities can be found, introduced, and strengthened in and across the building blocks, and interactions between the various building blocks, of health systems. The following summary is substantiated with scientific literature in a forthcoming CHC Maintains publication, *‘Conceptualising health system responsiveness to climate shocks’*, which presents a full list of references.

The framework views health systems as comprising ‘all organisations, people and actions whose primary intent is to promote, restore or maintain health’ (WHO, 2007). This includes the conventional WHO **building blocks** of: 1) service delivery; 2) health workers; 3) health information; 4) medical products, technology, and vaccines; 5) health finance; and 6) governance and leadership. However, the framework also builds upon the WHO health system definition to propose that there are building blocks in informal health sub-systems (communities, households, individuals – civil society) and that community health services play a critical role in linking formal and informal health systems. The building blocks in informal health systems are found in the social, natural, physical, human, and financial capitals of households and communities. We view this as a complex adaptive system, whereby the individual components of the system, and the interactions between the components, are able to adapt themselves to internal and external disturbances (Ostrom and Janssen, 2004). Being complex adaptive systems, health systems are more than the sum of the component building blocks: they adapt over time through interactions between the blocks, and as a result of interactions amongst health workers, patients, administrators, policymakers, and wider society (Gilson *et al.*, 2017). Drawing on health system resilience literature, we propose and intend to investigate how the informal and formal building blocks can individually and collectively contribute to the shock responsiveness and resilience of the entire system.

Figure 2: Conceptual framework for health system responsiveness to shocks

Notes: The green box represents the health system, including its context and building blocks in coupled formal and informal health systems that underpin absorptive, adaptive, and transformative capacities. The red box reflects a climate shock event (e.g. drought or flood) and its impacts on health and nutrition status, on health system functioning, on demand for health and nutrition services, and on health-determining connected systems. The blue box and arrows represent the health system responses to that shock event, and the learning and innovations that incrementally adjust or transform individual building blocks, the entire health system, and even elements of its context. Finally, the yellow box represents outcomes in terms of service delivery and the health and nutrition status of populations.

The framework also captures the **hardware and software** found in both formal and informal health systems. Hardware can be defined as infrastructure, commodities, human resources, and finances. Software, on the other hand, can be subdivided into tangible software, such as knowledge and skills, and organisational systems and procedures, and the intangible software of values and norms, relationships, and power. To date, there has been a bias towards hardware, neglecting the importance of actors' agency, which is influenced by contextual power relations and political interests (Barasa *et al.*, 2017).

The hardware and software of the health system building blocks contribute to **resilience capacities**. Absorptive capacity refers to the ability to continue to deliver the same or better³ quantity, quality, and equity of service delivery with the same resources, capacities, and approaches, despite the shock (Blanchet *et al.*, 2017). Adaptive capacity refers to the ability of the health system to learn from experience and knowledge, and to adapt to changing

³ For example, outreach services can be deployed during emergencies and may actually improve service delivery relative to 'normal' periods.

circumstances through incremental adjustments. Finally, transformative capacity refers to the ability of the health system to recognise that the current system is ill-suited to a changing context and to make fundamental changes to the functions and structure of the health system (adapted from Blanchet *et al.* (2017)). The health system and its capacities are underpinned by the political, cultural, environmental, economic, and demographic **context** of the health system, including norms underpinning gender inequity and social inclusion in the health system. The shock responsiveness and resilience of a health system are also influenced by **connected systems**, such as water and sanitation, since health and nutrition status is determined by the responsiveness of these systems to climate shocks too.

Resilience capacities can be observed by studying responses to specific or multiple interacting shocks. **Shocks** to health systems impact the building blocks by increasing demand for and utilisation of health and nutrition services, disrupting the supply and functioning of formal and informal building blocks and impacting connected health and nutrition-determining systems. Responses can involve planning and preparing for expected shocks, and expanding or contracting health and nutrition services to absorb demand surges, through, for example, timely early warning information, the release of funds, prepositioning of commodities, or redistributing resources. The performance of these responses will shape outcomes for health and nutrition service delivery in terms of coverage, quality, accessibility, safety, and affordability. This in turn will determine the equity and status of health and nutrition outcomes of peoples with different social characteristics.

Learning (or lack of) outside of, during, and after shocks from responses and outcomes either results in persistence of the current health system configuration (no change to the status quo), or feeds into **health system resilience strengthening interventions**, such as the CMAM Surge approach, that result in incremental adjustment or transformation of formal and/or informal building blocks and their interactions, or of the context in which the system is embedded (e.g. addressing social norms and gender and other inequities). These adaptations can either improve or erode shock responsiveness. Evaluation and learning may also result in **resilience innovations** in connected systems to improve shock responsiveness, which in turn can improve health-determining conditions (e.g. WASH), reducing pressure on the health system.

The framework has been largely informed by practical experience of the CHC research team and the health system resilience literature, and represents a context-specific framework for the arid lands of East Africa. The process of developing a Maintains programme-wide framework has influenced this framework and significantly reinforced its links to the overall research objectives of Maintains in health and nutrition shock responsiveness. There is limited empirical research on determinants of health system resilience to climate shocks *per se* and on the role of informal health systems. The framework is therefore intended to be a starting point. While it frames our research design, the findings of the research will be used to further refine (adjust or transform!) the framework over the duration of Maintains.

For Research Theme 1 ‘impacts and responses’ we seek to understand the health system impact pathways and responses to climate shocks. By studying impacts and responses, we will reveal otherwise hidden resilience capacities and the equity of shock-responsive health and nutrition services. For Research Theme 2, ‘early warning and health information’, and Research Theme 3, ‘shock-responsive finance’, we will examine the health information and finance building blocks, while exploring their interactions with other building blocks and

system components. Surge approaches (Theme 4) are a type of resilience strengthening innovation that we will study to understand their potential to adapt or transform the health system to make it more shock responsive. By setting our research questions within this conceptual framework, we seek to ensure that we capture interactions, indirect casual pathways, feedbacks, learning, and adaptation to improve shock responsiveness. By strongly linking the above conceptual framework, designed specifically for the East Africa context, to the [Maintains programme-wide framework](#) we aim to ensure that the research from Kenya and Uganda is compatible with related research from other countries. This will enable global comparative analysis, while ensuring the contingencies of place and context are integrated into the research design for Kenya and Uganda.

4 Case studies: Kenya and Uganda

4.1 Kenya

In Kenya, the research considers health system shock responsiveness nationally, and specifically the counties of Marsabit, Turkana, and Wajir in the northern ASAL. Kenya is classified as a lower middle-income country and has a 2030 development vision to become a middle-income country by 2030. The country has continued to experience steady economic growth, averaging around 5.5% per year since 2008. In turn, the poverty rate⁴ fell by over 10% between 2006 and 2016, although it remains higher than in neighbouring countries. This reduction has primarily been driven by a reduction of poverty in rural areas, home to almost two-thirds of Kenya's population. However, inequality remains high in Kenya – the top income quintile accounts for 59.4% of consumption expenditure (KNBS 2018a, 2018b). There is also substantial inequality geographically, with the ASAL having the highest levels of poverty and the lowest access to public goods and services in Kenya (Table 1). The ASAL are also the most prone to drought and have the highest levels of undernutrition nationally, providing an extreme example through which to explore health system responsiveness to climate shocks.

4.1.1 The Kenyan ASAL context

The ASAL account for approximately 89% of Kenya's land mass, one-third of its people, and 23 of its counties. Table 1 illustrates how the ASAL counties perform worse on most socio-economic, health, and nutrition indicators, taking the case study counties of Marsabit, Turkana, and Wajir as examples. The ASAL are mainly sparsely populated (with two people per km² in parts of Turkana and Marsabit) but have experienced significant population growth relative to other parts of the country as a result of in-migration and high fertility rates (Njoka et al., 2016). Pastoralism is the dominant livelihood, with some crop farming in arid lands, while agro-pastoralism is most common in semi-arid lands. The pastoral economy accounts for 95% of household income in the ASAL (GoK, 2015). The mobility of pastoralists has enabled them to cope with climate variability and changing vegetation cover over thousands of years, but there is a trend towards sedentarisation and farming as result of insecurity, the degradation of pastures, and national policy incentives such as food aid and the provision of social services. However, the new settlements are generally poorly planned (Njoka et al., 2016).

Pastoral households and communities have strongly defined gender roles and responsibilities. Women play central roles in livestock-keeping, income generation, and childcare, but have limited control over productive resources such as livestock and land, or access to healthcare, family planning, and education. Minor differences between the role of men and women across counties is linked to the influence of Islam, e.g. stronger in Wajir compared to Turkana. Men have more influence/status in households than women (Dometita, 2017), but environmental and socio-economic change is disrupting gendered traditions. For example, the migration of men for work in urban areas is leaving women to

⁴ The poverty rate is defined as the ratio of the number of people (in a given age group) whose income falls below the poverty line (<https://data.oecd.org/inequality/poverty-rate.htm>. Accessed 28 March 2019).

assume head of household roles, creating additional workloads. Drought exacerbates these burdens by forcing girls and women to travel further for water, for example.

Table 1: Kenya and case county socio-economic, health, and nutrition indicators compared to national averages

Socio-economic, health, and nutrition indicators	Marsabit	Turkana	Wajir	National
Population	316,000	1,084,000	459,000	52,573,973
% overall poverty estimates, households (% hardcore poverty)	55.8 (20.4)	70.8 (43.6)	54.6 (8.8)	27.4 (6)
% food poverty, households (%)	46.3	55.9	35.1	23.8
% population literate	37.8	39.6	35.8	84.5
% households received cash transfers	38.7	64.2	36.2	33.5
% population sick/injured	6.1	23	6.5	21.5
% children that had diarrhoea	4.1	8.7	2.1	8.5
Undernourished children (6–59 months), weight-for-age, % below -2SD	30.9	25.5	16.1	13

Source: Kenya National Bureau of Statistics (KNBS) (2018a, 2018b)

4.1.2 Kenya health system

Since 2013, devolution of decision-making power to 47 county governments in Kenya has made county officials responsible for health and nutrition service delivery. Healthcare is organised into four tiers: community (Tier 1); primary care, including dispensaries, health facilities, and clinics (Tier 2); secondary referral county hospitals (Tier 3); and tertiary referral national hospitals (Tier 4). Despite devolution, the national government has retained responsibility for health policy and regulations. There are about 5,000 health facilities nationwide, which equates to about 2.5 per 10,000 people. CHV act as a link between the informal community system and the formal health system. CHVs are situated in communities and are organised into community units supervised by Community Health Extension Workers at Tier 2 health facilities. Other health extension work is managed through an outreach system, staffed by health facility staff, with support from CHVs, to bring health and nutrition services to communities located at a distance from health facilities and to provide for local participation in the formal health system. Furthermore, the GoK ASAL Policy emphasises the privileging of community-based health systems that take into account the mobility of pastoral communities (Odhiambo, 2013), but it is not clear whether this has been achieved in practice.

Since independence in 1963, GoK has initiated many policy reforms, with the ambition of achieving universal health coverage by 2022. Access to reproductive health and emergency medical treatment was declared as a right in the Health Bill of 2015 (Okech and Lelegwe, 2016). Standards of care vary widely across the country, with the northern ASAL being especially under-serviced. Devolved healthcare has made health facilities and services more accessible to citizens compared to before, with improvements in the quality of health services (Yarow *et al.*, 2019). Since devolution, however, the health system has experienced

a series of resourcing crises, especially in regard to human resources, due to high levels of attrition related to poor remuneration, sub-optimal work environments, and other issues (MONDKAL and IntraHealth, 2012). Most notably, in 2017, 45,000 nurses staged nationwide industrial action over pay, with significant consequences for healthcare. Financing of the health system is discussed below.

4.1.3 Health and nutrition status and progress

While there has been some general improvement in the overall population's health status in recent years, some challenges remain. For example, in 2003–2014, under-five and neonatal mortality rates fell from 115 to 52 and from 33 to 22 deaths per 1,000 live births, respectively, but maternal mortality saw no significant decline over the same period, remaining at 488 maternal deaths per 100,000 (UNICEF, 2018). In 2016, the highest rates of under-five and neonatal mortality were in the northern ASAL counties and urban informal settlements. Cholera is endemic in Kenya, and in 2016 and 2017 there were extensive outbreaks. Kenya has made progress on prevention and control of malaria, incidence of which has fallen from 11% in 2010 to 8% in 2015, but incidence in the ASAL remains high (WHO, 2017).

Kenya has also made significant progress in reducing stunting, wasting, and underweight children, but undernutrition remains a significant national problem. Kenya has an enabling national policy framework and has scaled up high-impact nutrition interventions over the past decade, which has involved capacity development of the Ministry of Health (MoH), the integration of nutrition information into the MoH's District Health Information System (DHIS), and improved coordination and planning through nutrition coordination forums and county nutrition action plans. Integrated management of acute malnutrition (IMAM) has been integrated into the health system.

However, food insecurity is still a major challenge, with 3.4 million people experiencing acute food insecurity in 2017, the year of the most recent severe drought. Undernutrition remains especially prevalent in the northern ASAL, where the health system is beset by challenges, including a shortage of health workers, supplies, and equipment, poor health worker competencies, and weak referral systems. The nutrition status of pastoralists in the ASAL varies by season, but recurrent droughts, high costs of domestic food production, high global food prices, low purchasing power, and displacement have all contributed to lower health and nutrition statuses (United States Agency for International Development (USAID), 2018a). In addition to chronic undernutrition, the population of the ASAL have a high disease burden, especially malaria, respiratory tract infections, and diarrhoea, with waterborne diseases common due to the lack of safe drinking water (Wayua, 2017).

4.1.4 Dominant climate shocks and climate change

Kenya is prone to numerous shocks, including political and ethnic conflicts, and slow-onset (e.g. droughts) and rapid-onset natural hazards (e.g. floods, land/mudslides, and disease outbreaks). The ASAL are regularly affected by drought, which causes food, nutrition, and water insecurity, increased incidence of malnutrition, morbidity, and death, and disruption of livelihoods (Development Initiatives, 2017). Northern and eastern Kenya are particularly vulnerable to drought, with greater than a 40% annual probability of moderate to severe

drought during the rainy season (USAID, 2018b). There were 12 droughts in Kenya between 1990 and 2019. Droughts between 1990 and 2015 each affected 4.8 million people on average (GoK, 2018).

Flood events occur more frequently but tend to be less severe and affect fewer people. The western lowlands around Lake Victoria, the coastal lowlands around the Indian Ocean, the ASAL, and localised areas with poor surface water drainage are especially prone to flooding, which can result in loss of life and property, and outbreaks of waterborne human and animal diseases like cholera and Rift Valley fever. Between 1990 and 2015 there were 43 flood disasters, each affecting 68,000 people on average (GoK, 2018). Global and regional climate variability associated with the El Niño Southern Oscillation (ENSO) and the Western Indian Ocean Dipole influences monthly and seasonal rainfall patterns in East Africa. Kenya tends to experience increased rainfall during the rainy seasons and is prone to flooding during El Niño episodes (Li *et al.*, 2016; Mutemi, 2003; Muthama *et al.*, 2014). Heavy rainfall events caused landslides in 1997–1998 in several areas of Kenya.

Most recently, a drought in Kenya in 2018–19 became the latest in a series of droughts affecting the north and northeast of Kenya. Two rainy seasons failed in 2010–11 and 2016–17, resulting in the two most severe droughts in recent years. The effects of the 2018–19 drought have been at the local level, rather than widespread, and variable over the year, with improvements in conditions in mid-2019, before worsening again, with a peak number of 2.6 million people estimated to have been in need of food assistance in September 2019. These droughts were then followed by heavy rains, an extended rainy season, and widespread flooding in the last quarter of 2019. This climate variability provides a window of opportunity to study health system climate shock responsiveness in Kenya, to be researched in WP1 (see below).

Changes in rainfall and temperature patterns have been observed in Kenya since the 1960s, with seasonal rainfall becoming irregular and unpredictable. In the ASAL, there has been significant temperature increases and greater rainfall in the October and December short rains, while the long rains have been increasingly unreliable (Parry *et al.* 2012 in Njoka *et al.*, 2016). Ouma *et al.* (2018) found that maximum and minimum temperatures have increased, and rainfall has decreased during the long rains (March–April). Huho and Mugalavai (2010) and Nkedianye *et al.* (2010) observed that Kenya has experienced an increase in drought frequency from once in every 10 years in the 1960/70s to once in every five years in the 1980s and to once in every two to three years in the 1990s. Today, every year tends to have at least seasonal extreme dry periods. Drought has become the norm in Turkana, with ‘good’ or ‘normal’ years being abnormal (Dometita, 2017). The IPCC (2014) reports that drought risk will continue to increase in East Africa up to 2050.

4.1.5 Health and nutrition impacts of climate shocks

Pastoral and marginal agricultural areas are particularly vulnerable to climate shocks and the changing climate. Droughts are associated with water stress, lower livestock productivity, and reduced yields from rain-fed agriculture, and increased food insecurity and malnutrition (Okoti *et al.*, 2014; Thornton and Lipper, 2014). Changing rainfall patterns interact with other drivers of vulnerability in the ASAL, such as price volatility, disease outbreaks, population growth, intercommunity violent conflict, and restrictions on pastoral mobility by privatisation fragmenting land in the ASAL (Catley *et al.*, 2013). Extended periods of drought erode

livelihood and community resilience in the ASAL, leading to undesirable coping strategies that damage the environment and impair household health and nutritional status (GoK, 2013). For example, 11.8% of Kenyan households that experience drought or flood impacts cope by reducing food consumption (KNBS, 2018a).

Malnutrition is one of the key areas of concern during drought. Increased food prices, livestock mortality, worsened livestock/food/work terms of trade, and reductions in the availability of water and increases in the price of water, and thus lower household incomes or household production, result in a higher number of poor households being unable to meet their minimum dietary needs. Using 2014 Demographic and Health Survey data, Harison *et al.* (2017) found that temperature variation, followed by vegetation cover (Enhanced Vegetation Index), had the strongest association with child malnutrition compared to other risk factors (e.g. poverty, illiteracy) in the North Rift ASAL counties of Kenya. A one-unit increase in temperature was associated with a 31% increase in malnutrition. Similarly, Bauer and Mburu (2017) showed a strong negative effect of drought on child malnutrition in Marsabit.

Causal factors for malnutrition associated with drought include poor access to safe drinking water and age-specific food, drought increasing women's workloads to the determinant of child and maternal health (Manners *et al.*, 2015), women sacrificing their dietary intake for children to eat, and skipping and reducing the size of meals (Dometita, 2017). Furthermore, in some parts of Kenya, up to 80% of households rely on seasonal (and/or surface) water sources (Balfour, 2018). Once these dry up, women have to travel further and spend more time reaching alternative sources. Sourcing clean water from reliable, improved water supplies (usually pumped from boreholes) is unaffordable for many households, especially in a drought, leading to the spread of diseases from consumption of unclean water.

Floods in Kenya cause disease outbreaks, such as malaria, typhoid, Rift Valley fever, dysentery, and cholera, increasing demand for health services. The economic cost of Rift Valley fever in East Africa exceeded US\$ 60 million during the 2006–07 El Niño event (Anyamba *et al.*, 2009). Floods can disrupt access for both staff and patients of health facilities by damaging transport and medical infrastructure. Furthermore, floods can displace people into overcrowded camps with poor sanitation facilities, providing fertile ground for disease contagion. During severe flooding, temporary food shortages frequently arise due to displacement and loss of food stocks, and households may experience food insecurity beyond the flood period due to crop damage. Since a large proportion of Kenya's population rely on agricultural and livestock production, incomes can be heavily impacted, impinging on households' ability to provide nutritious food for children, maintain care practices, and use basic services, such as purchasing water, which increases in cost. Additionally, livestock disease outbreaks and livestock mortality after periods of heavy rain have an indirect impact on nutrition due to loss of milk production and income.

Nationally, the economic impact on the health sector of climate shocks is significant. For instance, the 2008–11 drought in Kenya caused a loss of Kenya shillings (KSH) 4.75 billion (US\$ 44.4 million) (GoK, 2018). Maintaining service coverage in Kenya can be problematic because of drought (La Rue *et al.*, 2012), but there is a lack of literature on the effects of drought on service delivery in the ASAL.

4.1.6 Institutions for health system climate shock response

The Kenyan Government has developed a legal and policy framework aimed at addressing climate risks and disasters. Resilience programming and disaster risk management is a key component of the national Mid-Term Development Plan (MTDP III) and the national Ending Drought Emergencies (EDE) framework. The EDE has an integrated focus on basic social services, including health and nutrition, and recognises the need to address the needs of drought-prone communities in the design of these services. Importantly, it seeks to strengthen systems that allow earlier responses to threats before a full-scale emergency arises (Dolan and Shoham, 2017). Guided by the EDE, the National Drought Management Authority (NDMA), a statutory body, has offices at the county level headed by drought monitoring officers, who are responsible for the coordination of drought risk reduction, preparedness, and response. The NDMA has made drought preparedness and response better organised and coordinated than that for floods and disease. The Kenya Red Cross Society also plays a very prominent role in disaster risk management in Kenya, being mandated to implement government responsibilities for coordination and action in some instances, including in the delivery of health and nutrition services, especially outreach clinics in remote areas.

Since a major drought in 2005–06, there has been a transition from international aid support towards government-led drought response, social protection (HSNP, see below), and EWSs. The response to the 2011 drought was considered late and weakly coordinated, and resulted in high levels of acute malnutrition and child mortality. The most recent severe drought emergency in 2016–17 came soon after devolution in 2013, which meant that county governments took more of a lead in the response than was the case in previous events. Devolution increased the number of stakeholders participating in drought management, but created challenges as a result of immature leadership and coordination mechanisms. Nevertheless, the government response to the drought of 2016–17 was assessed to be a significant improvement on the response of 2010–11, with high levels of global acute malnutrition but lower mortality rates. This improvement was partly attributed to the scale-up of IMAM and its integration into the health system, stronger government leadership, devolution to counties, initial implementation of the EDE, and establishment of a surge model and scalable social protection (see below) (Dolan and Shoham, 2017). However, a real-time evaluation of drought response by Hailey *et al.* (2018) identified gaps in capacity and weak coordination between national and county departments. Now that the devolved governments have had several years of system strengthening, the 2018–19 drought provides an opportunity to assess whether lessons from 2016–17 have been absorbed and systems adapted to improve shock responsiveness.

To date, there has been limited analysis of how the disaster and climate institutional arrangements support health system shock responsiveness and resilience. Nutrition is a cross-cutting concern and stunting is one of the key indicators for monitoring EDE progress. Nutrition policy, planning, and coordination is the responsibility of the nutrition unit in the MoH. The influence on health and nutrition in national frameworks is also considered to be limited, with nutrition and health outcomes often viewed as outcome indicators for social protection and humanitarian-development policy and programming, rather than a focus for intervention (Dolan and Shoham, 2017). Devolved county structures provide for pre-crisis planning and early response to meet local needs without having to wait for national or

emergency responses, but it is unclear how central health and nutrition concerns are in responses. Today, capacities to predict and respond to the health and nutrition effects of droughts are considered to be weak. The need for an emergency response plan in the health sector, with clear communication and roles and responsibilities, has been proposed by studies (for example, Hailey *et al.*, 2018; Reid *et al.*, 2008) but there is little evidence of this recommendation being taken up. Several studies have identified options for building health system resilience. For example, the Resilient and Responsive Health Systems (RESYST) programme suggests that capacity building should expand from developing technical knowledge towards developing 'soft skills' in leadership, negotiation, communication, and management to build resilience to day-to-day crises, which can overwhelm their capacity to cope, and build resilience to shock events. It also identified a gap in understanding regarding how health staff could learn and adapt through experiential learning. This has informed our focus on software, such as social networks, and learning and adaptation in Theme 1, and our choice of methods (e.g. social network analysis, Section 5.3.2).

4.1.7 Early warning and health information systems

Major investment in national EWSs in Kenya over the past two decades has improved the quality of available information for early action (Hillier and Dempsey, 2012). The NDMA operates a sophisticated drought monitoring system, developed over the past 20 years, that uses surveillance sites (up to nine in each county) and remote sensing to generate a monthly drought bulletin, seasonal forecasts, and analyses of long-term trends in, for example, vegetation cover. The bulletins include outcomes for food security, markets, water and nutrition, and climatic-related indicators, but there are no indicators clearly linked to the health system. Locally measured drought indicators are often incomplete and it is unclear how climate indicators correlate with health and nutrition outcomes (Bauer and Mburu, 2017). Communities tend to rely commonly on traditional indigenous weather knowledge and observation rather than national EWSs (Ochieng *et al.*, 2017), and this knowledge is not integrated into formal monitoring systems (Speranza *et al.*, 2010). Kenya has a DHIS that databases admissions data from health facilities, but delays in collecting information do not make this appropriate for surveillance of demand surges for health and nutrition services.

According to an assessment of Kenya's preparedness by Development Initiatives (2017), information is not a challenge as there are several sources of data. However, according to Maintains Phase 1 consultations, early warning bulletins fail to provide information that is actionable by the health and nutrition sectors, and drought monitoring data are very poorly understood, and are not properly used or trusted by the line ministries and the county technical departments that deliver health, nutrition, and other social services in the counties. Research under Theme 2 will contribute to understanding how available early warning and health information can be disseminated and communicated to strengthen the shock responsiveness of essential services in Kenya.

4.1.8 Financing

The purchase of healthcare services in Kenya occurs in the following ways (Barasa *et al.*, 2018):

- National and county governments' supply-side subsidies to public facilities provided in line budgets, financed by public sources (37% of total expenditure in 2015–16) and donor funding (23.4%).
- The National Hospital Insurance Fund (NHIF), which pays public and private healthcare facilities in Kenya for services provided to its enrolled members.
- Private health insurance companies that contract private healthcare facilities and pay them for services provided to their enrolled members.
- OOP spending by citizens at the point of care (26.1%).

The GoK spends about US\$ 2.7 billion on healthcare annually (Appleford and RamaRao, 2019), or about 2.2% of GDP, yet the WHO recommends at least 5% be spent on health. The NHIF is one of the key strategies for scaling up population coverage: it is mandatory for formal sector workers to join the scheme but voluntary for informal sector workers, who represent 80% of the total workforce. NHIF coverage remains low (16% of Kenyans), and private insurance covers only 1% of the population, which has led to several reforms of the NHIF, including the Health Insurance Subsidy for the Poor (Barasa *et al.*, 2018).

Without insurance or adequate funding of public health services, there remains a dependence on OOPs for a quarter of total health expenditure. Barasa *et al.* (2017) estimated that OOPs result in catastrophic expenditures (when OOPs exceed 40% of annual non-food expenditure) for 4.5% of households in Kenya, or 6.6% when the costs of transport to facilities are included. With the livelihood impacts of drought in the ASAL, the highest levels of poverty, and remoteness from health facilities, OOPs are likely to be a major deterrence to using formal health and nutrition services, or result in catastrophic expenditure. Of all the Kenyan counties, Turkana has the highest incidence of catastrophic expenditure (17.3%) (Barasa *et al.*, 2017). However, the links between OOPs and drought in the ASAL have not been analysed to date.

The Kenya HSNP, a social protection programme established in 2009 by the GoK with the support of DFID, provides regular unconditional cash transfers to 100,000 households in four ASAL counties in northern Kenya: Marsabit, Mandera, Turkana, and Wajir. In addition, emergency payments are made to the rest of the population during severe or extreme drought. An evaluation of Phase 1 of HSNP found that participation had a small but significant positive effect on households' health expenditure, but no significant impact on child nutrition (Merttens *et al.*, 2013). Evidence of increased health expenditure was mixed in a later evaluation of Phase II. More research is needed to understand the role of emergency cash transfers from the HSNP for health expenditure during climate shocks, and whether it reduces catastrophic expenditure or encourages use of formal health and nutrition services.

Funding for disaster management in Kenya comes from international aid, the national drought disaster fund and national disaster management contingency fund, among others. While primary responsibility for health and nutrition service delivery is at the county government level, the national government controls much of the access to disaster finance, including drought contingency funds and livestock insurance. At times, county governments do make some funds available for the response but there is very little transparency on amounts and how the funds are used. The weak coordination between different parts of the system observed during the 2016–17 drought response raised questions about the efficiency and accountability of finance flows. Overall, drought response financing is more developed

for social protection responses than for health system responses. The GoK has begun to strengthen its capacity to respond to emergencies and is developing a National Drought Emergency Fund for shock-responsive financing. More recently, a national Disaster Risk Financing Strategy (GoK, 2018) was established to strengthen the GoK's capacity to manage residual risks from disasters by 'developing pre-agreed response plans backed by pre-arranged financing that enhance preparedness and ultimately reduce the impacts of disasters on the economy and the Kenyan people' (p. 7). The strategy reviews existing DRF financial instruments available in Kenya, a selection of which that are relevant to health and nutrition financing are presented in Table 2.

Table 2: Kenya DRF instruments

Financial instrument	Description	Max. annual budget	Geographic coverage	Admin.
Contingencies Fund	National-level fund to respond to emergencies	KSH 10 billion cap	National	National treasury
County Emergency Funds	County-level funds to respond to emergencies	Active in 19 counties (2015–16)	County	County governments
National Drought Emergency Fund (not active)	Finance preparedness and response during drought	No prescribed maximum	23 ASAL counties	NDMA, county gov., and development partners
Scalable component of HSNP	Cash transfer to reach up to 272,450 households	US\$ 63 million	Turkana, Marsabit, Wajir, and Mandera	County government, NDMA, DFID, European Union
African Risk Capacity (under review)	National drought insurance to finance relief efforts	US\$ 60 million	23 ASAL counties	National treasury, NDMA, African Risk Capacity agency

Source: GoK (2018)

4.1.9 Surge approaches

In 2012, Concern Worldwide and government nutrition teams in Marsabit County developed the IMAM/CMAM Surge approach, which is now being rolled out to all health facilities and counties in the ASAL of Kenya. The approach is showing promise in delivering improved nutrition services during periods of heightened acute malnutrition prevalence, while also contributing to health system strengthening. The use of the CMAM Surge approach during the 2017 drought allowed for timely monitoring and advocacy on the deteriorating nutrition situation and was seen as a cross-sector solution to the typical 'siloed' and linear view that pervades development and emergency programming in Kenya (CHC, 2018). Several

evaluations and learning reviews have indicated that, in addition to its primary objective of delivering nutrition services during acute malnutrition periods, the CMAM Surge approach has also contributed to health system strengthening and guided local response to drought (Concern Worldwide, 2016). However, community mobilisation and outreach during the initial ‘surge’ process has not been maintained in many instances (Dolan and Shoham, 2017). Stronger evidence is needed on how this approach has worked in response to the shocks experienced in Kenya, on whether its delivery is timely, adequate, and capable of scaling up services to meet demand, and on its potential to address shock response deficiencies in the wider Kenyan health system.

4.2 Uganda

The research in Uganda will be conducted in Karamoja, a sub-region in the northeastern part of Uganda, bordering Kenya to the east and South Sudan to the north – making it part of the larger pastoral corridor of East Africa. Karamoja has nine districts: Kaabong, Abim, Kotido, Moroto, Amudat, Napak, Nakapiripirit, Karenga, and Nabilatuk. Ethnically, it is mainly made up of the Karamojong (Pian, Bokora, and Matheniko), as well as the Jie, Tepeth, Dodoso, and Pokot. The sub-region is classified as one of the most impoverished in the country, with 61% of the 1.2 million people living in absolute poverty. Overall, Karamoja performs worse than national averages for most socio-economic and health indicators (Table 3). Karamojong practise agro-pastoralism across the semi-arid and arid plains of this region, with cattle playing a vital role in livelihood strategies, although the Government of Uganda (GoU) has promoted the practice of agriculture in recent history. Karamoja is a perpetually crisis-stricken state due to conflict. The local practice of cattle-sharing has led to violent raids to steal livestock from other groups. In addition, Karamoja was adversely affected by the civil war that raged across Northern Uganda between 1986 and 2006, leading to a series of disarmament campaigns. These conflicts have been exacerbated by the impact of drought in the arid environment of much of Karamoja (see below).

Table 3: Karamoja socio-economic, health, and nutrition indicators

Socio-economic, health, and nutrition indicators	Karamoja	National average
Population living below poverty	61%	21.4%
Maternal mortality rates (per 100,000 live births)	588	366
Infant mortality rate (per 1,000 live births)	72	43
Child mortality rate (per 1,000 live births)	102	64
Healthcare access withing 5 km radius	17%	86%
Life expectancy	59.2 years	47.7 years
Literacy rate	28.8%	73.5%

Source: MercyCorps (2016), UNFPA (2018), UBOS (2017)

4.2.1 Uganda health system

Uganda’s formal health system is multi-levelled and decentralised. At the national level, the MoH is responsible for overall policy formulation, quality assurance, and resource

mobilisation, while district governments are responsible for the same within their jurisdiction. National and regional referral hospitals report to the MoH, while the general hospitals and health centres II, III, and IV report to the district local government. Village health teams play a complementary role by providing first-line treatment for common ailments, such as malaria, and making appropriate referrals to the nearest health facility. The different levels of health facility have differing levels of capacity to handle health conditions; thus, if one level cannot handle a case, it is referred to a health facility at the next level up. At the district level, the healthcare systems are further divided into health sub-districts, which are administered at health centre IV level, which then reports to the district. The health sub-districts are responsible for the planning and management of health services, supervision and quality assurance, procurement and supply of drugs, and provision of technical, logistical, and capacity development support to health facilities within their jurisdiction (GoU, 2016).

The Uganda Health Financing Strategy (2016) notes that decentralised healthcare delivery faces many challenges, including inadequate financial and human resource capacity. Health services in Karamoja lag behind the rest of the country: of the 126 health centres in the region, 63% are lower-level health centre IIs, and the sub-region only has four general hospitals and one regional referral hospital. Furthermore, only 65% of the established staff positions within the region are filled and staff retention remains low due to the sub-region's remoteness, poor infrastructure, and limited electricity. Only 17% of the population in the region can access healthcare within the recommended radius of 5 km, compared to the national average of 86%. The majority of the population walk 20–30 km to access referral health services. Given the low coverage of health services in the region, there are 20,000 people per health unit, 50,000 people per doctor, and 16,882 people per midwife or nurse, far below the WHO recommendation of 1 midwife for every 175 deliveries (UNFPA, 2018). As such, most people in Karamoja rely on traditional medicine and the village health teams as the first line of treatment, and only refer to formal health services in the case of persistent or complicated illnesses. Despite having the worst health indicators in the country, government investment in Karamoja's health sector has remained glaringly low in the past decade (Initiative for Social and Economic Right, 2018). In the past, service delivery and other interventions in Karamoja by the GoU and the donor community were greatly hampered by the insecurity there. However, disarmament operations, first in 2001 and more successfully in 2006, have ushered in a period of peace and security. As a result, there is improved service delivery and increased interest from the donor community and civil society to support service delivery and other livelihood programmes.

4.2.2 Karamoja climate shocks

Karamoja is the driest region in the country, with only one rainy season, characterised by poor, uneven, and erratic rainfall, ranging from 500 to 750 mm per annum, and recurrent droughts. Climate change is increasing the frequency of drought (Asfaw *et al.*, 2015): severe droughts previously occurred on average every five years but they are experienced every two to three years today (Chaplin *et al.*, 2017). Over the past two decades, the sub-region has experienced droughts in 2006, 2007, 2009, 2010, 2014, 2015, 2016, and 2017. The sub-region is also prone to floods. Despite the increased frequency of droughts, the long-term average monthly rainfall in the sub-region has increased over the last 35 years and the rainy season is now longer by two months. However, rainfall is increasingly variable in volume and

such unpredictability undermines agricultural and livestock production and increases food, nutrition, health, and water insecurity in Karamoja (Chaplin *et al.*, 2017).

Most recently, in early 2019, the sub-region experienced a drought that lasted for up to five months, followed by an episode of flooding in July 2019. The latest report (16 January, 2020) by the Global Information and Early Warning System (GIEWS) of the United Nations Food and Agriculture Organization indicates that the April–September 2019 rainy season was not fully established until mid-May, which substantially delayed planting, and this was followed by torrential rains in June, which hindered ploughing and sowing activities in some areas. As a result, the planted area declined to below-average levels, also due to the limited amounts of cereal seeds that most households were able to retain from the poor 2018 harvest. The region then experienced unseasonal rainfall in October and November that disrupted cereal harvesting, drying, and storage. Eventually, the harvest of sorghum, the main cereal grown in the area, was concluded in several areas in December, with about two months of delay; production was consequently estimated to be 20–30% below average (FAO, 2020). Like in Kenya, this recent climate variability provides an opportunity to study Karamoja’s health system’s shock responsiveness.

4.2.3 Health and nutrition status and climate shock impacts

In 2014, 32% of children were reportedly undernourished, 7% wasted, and 45% stunted (GoU and UNICEF Uganda, 2014). The January 2018 Food Security and Nutrition Assessment recorded global acute malnutrition as affecting 9.6% and severe acute malnutrition affecting 1.7% of under-fives. Stunting was found to be 34%. Studies suggest that poor feeding and hygiene practices, primarily as a result of high workloads for caregivers, result in poor nutrition for infants and children. This situation is exacerbated by climate shocks like floods and droughts, which reduce the productivity of agriculture and livestock, reduce water security, and increase the incidence of human morbidities, and often increase caregivers’ workloads. Karamoja children suffer from anaemia deficiencies (which increases risk of irreversible cognitive losses and poor immunity) as well as micronutrient deficiencies like vitamin A deficiencies (impacting the immune system) and folic acid deficiencies (increasing risk of neural tube defects in birth) (MercyCorps, 2016). Recent droughts in the region have caused boreholes to dry up and have wiped out between 50% and 100% of crop yields for affected households, resulting in a loss of productive assets. High levels of acute malnutrition are frequently observed in Karamoja following droughts (GoU, 2017). The spread of climate shock-related animal diseases also affects the nutrition and health status of the population of Karamoja by resulting in market closures, a reduction in livestock productivity, and even the death of animals, which are a major source of quality diets. The closure of the livestock markets further denies the Karamojong the opportunity to trade their animals to acquire foodstuffs in times of drought and famine.

Diarrhoea is a major cause of morbidity, malnutrition, and mortality among young children during drought and floods. Stagnant pools of water are common during the rainy season, and in times of flood support mosquito breeding and the spread of malaria (USAID, 2017). Climate change and population increases are making viable areas – where water and pasture are available – scarcer, leading to more concentrated settlements, and intensifying overgrazing and the spread of diseases. Difficulties in accessing safe water, sanitation, and

health services increase during dry periods, which is reflected in the seasonal pattern of malnutrition (USAID, 2011).

Nutritional challenges are disproportionately felt by women and girls, because droughts increase travel times and effort spent in collecting water and fuel, and because of the tendency for women to reduce their food consumption first as a household coping strategy (MercyCorps, 2016). Climate shocks in the region have also been linked to outbreaks of diseases like cholera (2006, 2010, 2015), meningitis (2006, 2007), and hepatitis E (2009–12).

4.2.4 Institutions for health system climate shock response

Since the 1980 famine, the Karamoja sub-region has been the recipient of food aid from the World Food Programme (WFP) (Cullis, 2018). However, the Karamoja Multi-sectoral Nutrition Implementation Strategy (2015–2020) highlights the need for long-term and multi-sectoral programmes to support resilience-building that addresses all the causes of undernutrition whilst, at the same time, improving the readiness of health systems to respond to drought conditions. The strategy outlines a range of key priority nutrition issues to be addressed holistically across the key sectors of health, agriculture, water, environment, education, gender, and trade and industry.

In an attempt to address climatic and other shocks facing the country, Uganda has made commitments to several regional and international DRR frameworks such as the Sendai framework. It has also created the national policy on DRR in the Office of the Prime Minister under the National Emergency Coordination and Operation Centre. Despite these efforts, a national law on DRR and a framework to localise regional and international commitments are lacking. In addition, DRR management mainly focuses on response and not risk reduction measures. Arrangements specifically aimed at health systems are absent, but there is increasing interest amongst health and nutrition actors to make services more shock responsive.

4.2.5 Early warning and health information

A range of different data are collected in Uganda that are used or could be used to support adaptive programming during times of shock. The Health Management Information System (HMIS) collects data on several different variables that allow for monitoring of the utilisation of the health system. The HMIS starts at the community level and graduates its analysis to the national level. The analysis consists of totalling numbers and averaging percentages by district; no multi-level or trend analysis is carried out. Weekly, monthly, and annual reports detailing morbidity prevalence and healthcare centre utilisation are distributed to the MoH, the Ministry of Agriculture, and the Nutrition Working Group, to be used for decision-making in the health and nutrition sectors, both at the national and district level. Karamoja also has a Drought Early Warning System (DEWS), funded by DFID through the FAO, which produces monthly drought bulletins to provide communities, district leadership, and development partners with timely warning of increased risk of drought to trigger drought preparedness measures. These bulletins report on the current situation, advise on mitigation measures, and forecast the duration of an event. DEWS is implemented largely by district governments, with support from partners (Swidiq, 2013). Other EWSs in use in Karamoja include: the

Intergovernmental Authority on Development (IGAD) Climate Prediction and Applications Centre (ICPAC); the FAO's GIEWS, which is housed in the Ministry of Agriculture; USAID's FEWSNET; and the WFP's Vulnerability Assessment Mapping programme. The systems use similar data sources but have been designed to interpret the data and make relevant recommendations that meet their respective donor requirements and standards; they are not connected to health and nutrition early warning.

Despite the availability of information, challenges remain around the way in which the data are collected, coordination between the different actors, and the harmonisation and integration of the different systems. Several studies indicate that access to timely and appropriate weather and climate information in Karamoja is still very limited (Carabine *et al.*, 2017). As a result, the Karimojong continue to rely on their local knowledge (which has its own shortcomings) to predict weather patterns. In addition, it is unclear how or whether the available data are being used to inform the health system responses, and how this is systematically linked to initiatives that aim to strengthen the health system and make it more shock responsive. There is a need to understand how this information can better inform early actions.

4.2.6 Financing health system responses to drought

Uganda is one of the pilot countries for the Forecasts for Anticipatory Humanitarian Action (FATHUM) programme, implemented by a consortium led by the University of Reading. Forecast-based financing systems automatically trigger action based on climate forecasts or observations. The system matches threshold forecast probabilities with appropriate actions, and disburses required funding and mandates actions when thresholds are exceeded. A forecast-based financing response was triggered by forecasts of heavy rain in November 2015. As a result, the Uganda Red Cross Society distributed just under 5,000 preparedness items to flood-prone communities in the Kapelebyong sub-county. In addition, the World Bank, together with Office of the Prime Minister, is setting up a Displacement Response Crisis Mechanism dashboard for education, water and health, which will track certain indicators (e.g. number of students per teachers). Once these indicators breach certain thresholds, funds will automatically be disbursed through GoU channels in order to provide additional funds for community investment projects. This is similar to the DRF scheme that is operating in Karamoja as part of the World Bank-funded Labour-Intensive Public Works Programme. In response to early warnings of disaster, the fund can release additional amounts for cash-for-work projects in affected areas. However, similar flexible financing arrangements for health systems do not appear to exist. Instead, decentralised healthcare delivery has very limited financial flexibility since most central government allocations are earmarked, and are therefore likely to impede the ability of health and nutrition services to flex in response to climate-linked variability in malnutrition and morbidity rates.

4.2.7 Health and nutrition surge approaches

There is currently no surge approach in operation in Uganda for health and nutrition services. CMAM Surge was established in Karamoja in 2012 by Concern Worldwide, but support was later reduced and only a few health facilities continue to use the approach, with little to no support from district governments. According to an independent evaluation of CMAM Surge in Karamoja (Muwaga, 2016), 'the approach has been implemented "on" and

“off” since 2012 primarily in two districts, Moroto and Nakapiripirit’. Surge is presented in IMAM guidelines but has not been rolled out by the GoU. However, there is interest from UNICEF and the GoU in developing surge approaches in the future.

5 Methodology

5.1 Research design

5.1.1 Action research

In line with the aims of Maintains to deliver demand-led and iterative cycles of research and research uptake, we have adopted an action research methodological approach. Action research essentially involves a researcher/s working with stakeholders/practitioners in a context of practice to generate knowledge and potentially enact change (Castree *et al.*, 2013). It typically involves cycles of reflection-action-reflection-action (Wicks *et al.*, 2008). Argyris *et al.* (1985) refer to this process as 'learning loops', whereby stakeholders participate in cycles of collecting, making sense of data, and deciding upon actions. In addition to making the research operational, the action research methodology will enable and build the capacities of practitioner partners in social learning and adaptation within the health systems of Kenya and Uganda, thus contributing to resilience building.

Instead of reflective knowledge being the privilege of outside experts, action research credits stakeholders with having in-depth knowledge acquired from their extensive experience in a situation and their personal reflection on this experience (Herr and Anderson, 2005). Action research differs in regard to the degree and type of participation of partner stakeholders. For Maintains Kenya and Uganda, the CHC research team and steering group (outlined in Section 5.9) have both 'insider' practitioners with decades of in-country and regional experience and outsider academics with technical knowledge and research skills. The project involves partners in DFID country offices, national and sub-national governments and agencies, and development and humanitarian partners (Section 5.9) as collaborators. Consultations with these informed the demand-led research themes outlined in Section 2 and they will continue to be engaged in periodic *learning workshops* to validate findings, reflect on their significance, consider solutions, and guide future focuses in subsequent stages of the research programme. As such, these workshops will facilitate learning loops to ensure the research meets partner demands and is adaptive according to the discoveries it makes and research frontiers it moves forward. Furthermore, several of the methods are participatory, whereby participants are asked to reflect on the findings themselves as part of the method. Knowledge will therefore be co-created amongst a diversity of colleagues, both in-house at CHC and through steering group, partner, and participant interactions.

The research has an explicit aim to influence policy and practice by engaging service providers and implementing agencies in learning from successes and failures with current approaches during the research, and communicating final recommendations. To this end, the research programme is structured in three components. In Component 1, research activities, organised into four WPs (organised by health system sub-systems and methods rather than research themes, see below), will generate in-depth insights on the existing shock responsiveness of the health systems in Kenya and Uganda. Working with DFID and partners, Component 2 will facilitate the co-production of new or enhance existing approaches and models of, and resilience capacities for, health system shock response. For example, in Kenya this may involve the expansion of the CMAM Surge approach from only addressing malnutrition caseloads and capacity thresholds at the health facility level towards

recording cases in the community, improving the accessibility of surge data, and addressing morbidity surges, including COVID-19. In Uganda, the project could facilitate the design, adaptation, and adoption of surge approaches, learning from the lessons of Kenya and also Maintains research on existing resilience capacities in Uganda. In both countries, research findings could support the development of health and nutrition-specific early warning communications. In this second component of the project, the piloting of these approaches would be evaluated and learning integrated into the innovations, to make the models ready for full implementation and scale-up. Component 3 will involve research uptake activities that will influence key actors in the region to incorporate findings, recommendations, and new approaches into health systems strengthening work to build the resilience of health systems in Kenya and Uganda.

Two concerns and critiques levelled at action research are its validity and generalisability. As an interpretivist mode of study, action researchers argue that it is not possible to control external variables that confer biases as all research is influenced by individual framings and politics. Validity (or 'trustworthiness') is instead determined by the consistency of the context, through rigorous data collection, analysis, and interpretation, triangulation of methods, and participant validation (Adams, 2010). These are accounted for in the design of the methods below and the composition of the country teams to ensure there is in-depth knowledge of the local context.

5.1.2 Multi-level approach

Health systems are not bounded at a single level: processes at local, sub-national, national, and international levels interact to determine the shock responsiveness and resilience of health systems. In this research, data collection will be undertaken at the national level with national and international actors, in three counties in Kenya and in the sub-region of Karamoja in Uganda, in districts and sub-counties, at health facilities within these areas, and at community and household levels. By taking this multi-level approach we seek to collect data on both the informal and formal health systems, and their interactions during climate shocks, as defined in our conceptual framework. Systems thinking promotes multi-level and multi-actor approaches and methods to understand systems behaviours, reflecting the challenge of defining the boundaries of a health system (Willis *et al.*, 2012). Systems thinking also points to temporal dimensions of shocks and health systems. We will analyse seasonal and inter-annual variability in climate and health and nutrition indicators, the expansion and contraction of health and nutrition services in response to this variability, and health system adjustments made over time to improve shock responsiveness, to provide insights on health system resilience capacities.

5.1.3 Intersectionality, gender, and social inclusion

Our cross-cutting research theme of gender and social inclusion demands that we consider social difference and intersectionality in our research design. Wherever possible, we have considered how to disaggregate data by, for example, gender, class, tribe, disadvantage, and other social characteristics, to enable us to understand how impacts and responses are experienced differently by different people. For example, community focus groups will be gendered, and household surveys will record data on the characteristics of the respondents, and interview questions will seek to explore these differences. Our sampling aims to capture

and triangulate the perspectives of a diverse range of stakeholders and social groups, and our ethics procedures (Section 5.8) will ensure GESI sensitivity in the selection of participations and the application of the methods, to remove barriers to accessing the research process.

5.1.4 Mixed methods

The study will use a mixed methods approach. Qualitative methods can help reveal complex interactions in health systems, such as why actors behave in a certain way, perceptions of what works and what does not work in current approaches, and enablers of and barriers to programme implementation (Swanson *et al.*, 2012). Our quantitative analysis of secondary climate, biophysical, health, nutrition, and financial data will enable understanding of resource allocations, and disease and malnutrition patterns, while descriptive and statistical analysis of household survey data can identify patterns of impacts and responses to be analysed in relation to respondent intersectional identities. Triangulating findings from multiple methods will strengthen the robustness and validity of our findings. Triangulation will be achieved by:

- similar thematic questions being asked in different methods, e.g. governance questions in desk review, KIs, NetMap analysis, and community focus groups;
- the participation of three coders in qualitative analysis – the country researcher present during the interviews, a specialist coder, and the lead researcher, who will oversee and write up the analysis (see Section 5.9); Annex D outlines the coding methodology; and
- during the writing up of results in publications, presenting variant findings alongside each other to offer triangulated points of view and to highlight irregularities.

Triangulation of multiple methods offsets the weaknesses of each method, provides a more rounded understanding of a problem than a single approach, and maximises the reliability of findings (Creswell and Clark, 2007; Clifford *et al.*, 2010; and Guest *et al.*, 2013). A statistical analysis of climate, health, and nutrition data, and household survey data, will reveal *what* is happening, while qualitative analysis will give meaning to these findings by explaining *why* it is happening by exploring decision-making processes, social relations, and politics. The use of participatory methods will facilitate preliminary analysis of the meaning of findings by participants. This will complement the ‘outsider’, objective quantitative analysis and interpretation of secondary and household survey data. Systems methods, i.e. social network analysis (NetMap), and systems analysis processes, i.e. causal loops diagrams, will enable cross-analyses of linkages and dynamic feedbacks amongst health system components.

5.2 Study site selection

Within Kenya, the northern counties of Turkana, Marsabit, and Wajir were selected, and in Uganda, Amudat, Kaabong, and Abim districts in Karamoja have been selected, based on the fulfilling the following criteria:

- ASAL highly exposed to climate shocks, particularly droughts but also floods. In Kenya, the selected counties experience medium or high drought impact (calculated based on a combined index of food security, drought impact, and nutrition drought impact, according

to emergency score data; see Annex A). DFID selected Karamoja sub-region because it is the location that is most affected by droughts in Uganda and the most in need of building climate resilience.

- Counties/sub-regions of strategic interest to DFID funded programming, with the study areas verified by DFID Kenya and DFID Uganda.
- In Kenya, the selected counties represent different health system response strategies both within and between counties, to enable comparison between high and low CMAM Surge capacity counties. Marsabit has high CMAM Surge capacity (based on investment in and percentage of health facility coverage), while Turkana and Wajir have low CMAM Surge capacity. Wajir, however, is recognised as being progressive in the use of early warnings, enabling comparison between good practice of early warning-informed actions (Wajir) and good practice of CMAM Surge approach (Marsabit).
- In Uganda, the selected districts each represent one or more of the main livelihood zones in Karamoja – Western Mixed Crop Farming Zone, Central Sorghum and Livestock Zone, Southeastern Cattle Maize Zone, and Urban Zone (as defined by FEWSNET, 2013).

Within each county/district, the sub-counties in Kenya and counties in Uganda will be selected based on:

- being the most climate shock-exposed and/or most affected by a recent climate shock;
- diversity of contexts and livelihood zones, to account for likely socio-economic and environmental differences that influence health and nutrition vulnerability to climate shocks; and
- being (in Kenya) sub-counties where CMAM Surge is implemented – or where CMAM Surge is not implemented – at health facility level.

Within each sub-county or district/county, health facilities and communities will be selected according to:

- existing relationships with gatekeeper partners to enable access;
- urban and rural contexts, in recognition of the significant differences in climate-related health and nutrition issues; and
- (in Kenya) being a mixture of CMAM and non-CMAM Surge health facilities and serviced communities.

5.3 Component 1: Research activities and methods

While research and policy outputs will be generated for each of the research themes, in terms of methodology the themes will not be investigated independently, in order to make the research efficient and to minimise the risk of participant fatigue. Thus, the research activities are organised into WPs to collect data on the formal health system (WP1) and informal health system (WP3), and participatory lessons learning about CMAM Surge and participatory social network analysis (WP2). Each WP will collect data relevant to more than one research theme. Table 6, at the end of Section 5.3, summarises the methods and how they answer the research questions under each theme.

The WPs are phased. WP1 will review current literature on the research themes in each of the case countries and will involve broad exploratory interviews with key formal health system actors. This will then inform discussion topics during the WP2 participatory methods (e.g. finance, information, and governance issues identified in interviews will be discussed during NetMap focus groups from the perspective of the network of actors and their relationships). WP1 and WP2 perspectives from formal health actors will be explored and hypotheses tested through community focus groups and household surveys in WP3's analysis of the informal health system. Finally, WP4 will draw from data across WPs1–3 to produce scientific publications and policy briefs. While the order of WPs will be somewhat chronological, there will be significant overlap in their scheduling.

Our methods of data collection will include desk review, secondary data analysis, in-depth KIs, participatory focus group discussions, and household surveys, as well as discussions of findings with health and nutrition partners at learning workshops. Our data will therefore comprise desk review syntheses, plots of climate, health, nutrition and finance data, interview transcriptions, notes from focus groups and workshops, and reflective field notes and internal meeting minutes.

5.3.1 WP 1: Formal health system

Desk review and secondary data analysis

Literature on the following topics will be reviewed, including scientific literature, early warning bulletins, meeting minutes, online news articles, and government and humanitarian sector reports and bulletins. Secondary data will be supplied by study partners or accessed from online repositories, such as national HMISs and agencies.

Context

- Desk review of *background context*, including socio-economic indicators, livelihoods, gender and social inclusion issues, displacement, politics, and environmental change.
- Desk review of *health and nutrition status and status of health system* building blocks and performance, and existing knowledge on the role of the building blocks in responding to historic shocks in Kenya and Uganda.
- Desk-based *institutional analysis* of laws, policies, and strategies related to national and local disaster management, health system emergency planning, GESI issues, and key actors.
- Desk review of the *shock profile* of Kenya and Uganda, and the respective study sites, based on review of grey and scientific literature on climate shocks and climate change, and interactions with other shocks and stresses (e.g. conflict, demographic, socio-economic, environmental etc. trends).

Impact of climate shocks on health and nutrition in ASAL (Theme 1, feeding into Theme 2)

- Desk review of 2018–19 drought, floods, and locust swarms in Kenya, to *characterise the recent climate shocks*, including variability in precipitation and vegetation condition.
- *Rainfall, temperature, and vegetation data* will be accessed from the national meteorological departments and/or other government agencies (e.g. the NDMA in

Kenya), and publicly available remote datasets, including GIEWS, which collects rainfall data at district level in Karamoja or the Global Precipitation Climatology Centre (GPCC)⁵, and Normalised Difference Vegetation Index (NDVI) from the NASA MODIS data portal⁶. These will be compared to long-term averages to analyse temporal changes nationally and in the county/district study sites.

- Health and nutrition data will be accessed from national HMISs to analyse indicators of basic service utilisation (aggregated from health facility registers), including nutrition data (admissions, cured, defaulters, and mortality) and morbidity data on climate shock-related diseases (e.g. diarrhoea, malaria, fever), at national and county/sub-region levels. This will draw on Demographic and Health Survey data in Kenya.
- The significance of the relationship between climate/biophysical variability and health and nutrition indicators will be tested statistically for the three counties in Kenya and Karamoja using a mixed model linear regression analysis. This will demonstrate the extent to which climate variability influences health and nutrition outcomes. This analysis will help identify opportunities for the use of climate data for early warning of climate shock-related health and nutrition service demand surges.
- Government admissions data only capture utilisation of formal health services, rather than incidence of undernutrition and climate-related morbidities. However, in Kenya, household SMART Surveys⁷ are conducted annually in Marsabit, Turkana, and Wajir. Unlike monthly admissions data, this information is collected once annually.

Reliability of early warnings (Theme 2)

- Early warning bulletins in Kenya and Uganda are essentially the presentation of surveillance data on several variables such as precipitation and NDVI, while seasonal forecasts aim to predict upcoming meteorological conditions. To analyse the accuracy of early warnings, associations between seasonal forecasts of rainfall, temperature and vegetation cover and the data recorded in early warning bulletins will be analysed.
- To analyse associations between early warnings and health and nutrition outcomes, we will test correlations between health facility admissions data and (i) short- and long-range seasonal rainfall forecasts, and (ii) early warning classifications in bulletins.

Climate variability relationships with demand surges and thresholds (themes 1, 2, and 4)

- CMAM Surge dashboard data from participating health facilities record severe acute malnutrition admissions⁸ and moderate acute malnutrition admissions⁹. They monitor these admissions against alert, alarm, and emergency thresholds, determined by the health facility itself in accordance with its (surge) capacity to accommodate patients.
- The temporal relationships between the number of health facilities passing CMAM Surge thresholds and (i) rainfall and temperature data, and (ii) early warning bulletin IPC

⁵ Downloadable from www.esrl.noaa.gov/psd/data/gridded/data.gpcc.html

⁶ Downloadable from <https://modis.gsfc.nasa.gov/data/dataproduct/mod13.php>

⁷ Downloadable from: www.nutritionhealth.or.ke/reports-capacity-assessment-reports/smart-survey-reports/SMART

⁸ Severe acute malnutrition is identified by severe wasting weight for height.

⁹ Moderate acute malnutrition is identified by moderate wasting weight for height – 3 z-score for children 0–59 months (or for children 6–59 months, mid upper-arm circumference of 115 mm).

classifications will be analysed statistically. By understanding the degree of correlation between these variables, we will be able to assess whether early warning phase classification and/or long- and short-range forecasts can be used to warn of potential widespread health facility thresholds being passed. This could inform Component 2, technical assistance, to: develop alert, critical, and emergency thresholds at county level based on the capacity of county governments to provide surge support to health facilities that pass their thresholds; and integrate surge thresholds into early warning bulletins so that the national government and international actors receive warnings to trigger early actions if widespread passing of county surge thresholds is expected.

Responses

- Assessment of the timeliness of *decisions made and actions taken* related to health and nutrition, based on meeting minutes of national disaster management committees, media announcements and government, development, and humanitarian organisational announcements and reports.
- Review of government and partner reports to record any programming responses.
- Review of early warning and climate information arrangements (Theme 2).
- Literature review of early warning, climate information, and health surveillance information availability, use, and governance arrangements.
- Assessment of the timeliness of early warnings, and decisions and actions taken in response to them by national and international organisations, based on early warning bulletins, partner reports, and the meeting minutes referred to above.
- A cross-analysis of these data will be undertaken during the development of a seed casual loop diagram (CLD) (WP2).

Shock-responsive finance analysis (Theme 3)

- Review of laws, policies, and other institutional arrangements governing government and partner budget process governing the funding of health and nutrition response activities responding to droughts and floods, as well as review of current actual practice.
- Mapping of health system financing and existing and planned financing instruments for health and nutrition response activities responding to droughts and floods – covering structures, amounts available, rules governing access, and budget execution.
- Review of past and current DRF arrangements in Kenya and Uganda, including sources of financing, financial mechanisms, triggers for releasing funds etc.
- Review of household expenditure on healthcare in national census statistics (e.g. Kenya Integrated Household Budget Survey 2015–16) and literature on OOPs and catastrophic health expenditure in Kenya and Uganda.
- Review of published evaluations of financing of past climate shock/disaster responses.

CMAM Surge effectiveness (Theme 4)

- A meta review of evaluations and studies related to CMAM Surge in countries where it has been implemented to extract information on lessons learnt.
- Analysis of CMAM Surge health facility ‘risk analyses’ of the drivers of increased caseloads. This will provide background information on the malnutrition context of each health facility, what is considered a ‘normal’ caseload, and why, when, and to what

degree spikes occur. The analysis will include supply and demand factors, ranging 'from seasonal impediments to health seeking behaviour, such as women's workloads or festivals, to health systems issues, such as absent health workers or a lack of commodities' (Kopplow *et al.*, 2014).

- Collection of secondary data from sampled CMAM Surge health facility dashboards in Kenya to analyse plots of malnutrition caseloads, the frequency and timing of the passing of thresholds seasonally and interannually, and CMAM quality indicators; this information will be collected from health facilities when conducting KIIs.
- Analysis of CMAM Surge budgets in county surge plans and available data on funding disbursements for surge support, and whether this met the needs identified by the dashboards.

Analysis: Desk study reports will synthesise literature on the above topics for inclusion in working papers and scientific papers (WP4). *Descriptive and statistical analysis* of secondary data will be undertaken using statistical analysis software, Excel, SPSS, or R, depending on the preference of the analyst. Output graphs will then be integrated into working papers and final publications that will draw on the findings of the mixed methods.

KIIs

KIIs, semi-structured by a schedule of questions in an interview guide (Annex B), will be held with key informants at national, county, and sub-county levels in Kenya, and at national, district, and sub-county levels in Uganda, each lasting approximately 50–90 minutes in duration. Annex C lists types of interviewee that will be interviewed. The research team will establish trustful relationships with stakeholders and will facilitate generative dialogues rather than formal interviews. The schedules of interview questions are semi-structured by the research questions and the conceptual framework to ensure a degree of coherence, but a high level of flexibility and openness to the ideas and interests of informants will be maintained in conversations.

Sampling:

- At the national level, approximately 15–25 key informants will be purposefully selected in each of Kenya and Uganda to represent all of the key health system actors identified during country stakeholder analyses conducted in the inception phase of Maintains. The individuals selected within each organisation will be senior members of staff with the most relevant knowledge to the research themes. They will be key senior professionals working on health and nutrition issues and/or drought and flood early warning, financing, preparedness, and response from government ministries and agencies and development and humanitarian organisations (see Annex C for a list of the types of interviewee in each country).
- At the Kenya county and sub-county levels and at the Uganda district and sub-county levels, approximately 15 key informants will be interviewed at each level, including county/district- and sub-county-level health, nutrition, and social protection officers, health facility staff, and NGO staff – totalling about 60 in each country. In Uganda, staff at health facilities at each of the levels (health centres II, III, and IV, and at hospital level) will be interviewed.

- At the health facility level, we will select 'facility in charge' nurses that are directly involved in healthcare delivery and, if present, CMAM Surge implementation.
- The categories of interviewee were selected based on field knowledge of the research team and consultations with Maintains partners, who will provide gatekeeper support to access interviewees.
- To account for the potential incompleteness of the stakeholder list, snowballing sampling will also be employed, whereby participants will be asked to recommend other relevant stakeholders for interview. For example, women who were forced to stop work as health workers due to pressures on them/their families due to the drought may be interviewed if they are discussed in interviews with health facility staff.
- The sampling will seek to ensure that the perspectives of all relevant stakeholders are captured.

The topics covered in the interviews will include the following, but questions under each topic will be selected or customised to the specific knowledge, experience, and expertise of the interviewee (e.g. disaster finance questions asked of Ministry of Finance respondents):

- *Impacts*: On health and nutrition demand and utilisation; medical supply pipelines and infrastructure; budgets following shock; service quality, coverage, accessibility, equity; and the health and nutrition workforce (men and women).
- *Governance and leadership*: Legal framework, policies, strategies, coordination mechanisms for disasters and health and nutrition emergency response; and whether they are implemented and effective; leadership roles.
- *Response strategies*: Preparations before, and responses during and after, shocks; workforce coping strategies; informal health system responses; gaps in response (e.g. geographical, exclusion of social groups); influence of factors external to the health system – such as sectoral programming, political issues, and systems strengthening initiatives – on response strategies.
- *Early warning and health surveillance (Theme 2)*: Source, reception, transmission of early warning information; limitation and issues with information – timeliness, quality, relevance; use of early warning information.
- *CMAM Surge (Kenya)*: Detection of shocks; use of CMAM Surge information for surge support and decision-making; performance and efficiency of scaling up and down services; institutional arrangements that enable or hinder.
- *Finance (Theme 3)*: Financial mechanisms, including contingency budgets, reserves, and insurance, and specifically for health and nutrition; coordination of financing; amount spent during case study shocks; timeliness and distribution of finance for different users; funding gaps.
- *Learning and adaptation*: Lessons learnt from case study shocks; CMAM learning and adjustment; strengths and weaknesses of existing financial mechanisms and information systems, and opportunities to improve; overall perspectives on improving health system shock responsiveness and CMAM Surge.

These interviews are intended to be exploratory, allowing respondents to express their perspectives on this broad range of topics. Following analysis of these data, follow-up interviews with purposefully selected respondents will be conducted as necessary to probe

deeper on specific topics identified as important in the analysis. Many of the topics will be investigated in more depth during the NetMap (governance, information and early warning, and finance) and the innovation histories of CMAM Surge, with overlap of participants, providing further opportunities to fill data gaps. Learning workshops will also be an opportunity for holding group discussions about specific themes, and for the research team to fill gaps in the data.

Analysis: Interviews will be undertaken and audio recorded in English, Kiswahili (Kenya), Karamojong (Karamoja), Pokot (Amudat, Karamoja), and local languages, and then later transcribed and translated into English verbatim. In addition, the researchers will take field notes. At the close of each day, all audio recording will be transferred by researchers to an encrypted external drive for safe-keeping and labelled appropriately. Transcriptions will be checked for accuracy and then imported into qualitative data analysis software, NVivo 12, for coding.

For the qualitative analysis, 'a flexible coding' approach will be used that will combine inductive and deductive coding, as outlined in Annex D. This will involve index coding in NVivo by the key topics outlined above before conducting analytical coding within each of the index codes inductively in a cyclical process of open coding key words, categorising under common themes, considering these themes in relation to theory, and re-categorising to develop a framework of thematic ideas that answer the study's research questions. This cyclical process will involve going back and forth between phases of data analysis as needed until satisfactory final analytical themes have been identified for inclusion in knowledge products (WP4). This process will ensure that the perspectives of the different stakeholders are compared, contrasted, and triangulated.

Cross-analysis: A cross-analysis of the KIIs, desk review, and secondary data analysis will be conducted qualitatively using CLDs. CLDs are qualitative models used to conceptualise complex problems or relationships visually (Sterman, 2000). Building on the method of Chand and Loosemore (2016), CLDs will be created by the research team to integrate the complex relationships between overall themes and sub-themes coded in NVivo with formal (e.g. decision-making) processes identified in document analysis, and relationships analysed statistically (e.g. between climate variability and health). In this way, the CLDs will map interactions amongst health system components, depicted in the conceptual framework. Arrows, where appropriate, will be assigned a (+) or (-) sign to indicate the suggested relationship between the linked variables. Variables that change in the same direction will be linked by arrows of positive polarity, e.g. as staff workload increases, staff stress also increases. Arrows assigned a negative polarity will denote an inversely proportional or negative relationship (Witter *et al.*, 2020) (e.g. as financing of COVID-19 preparations or treatment increases, spending on nutrition services decreases). These CLDs will be presented and validated at learning workshops, and further updated as new data and findings are generated in WPs 2 and 3.

5.3.2 WP2: Participatory social network analysis and CMAM Surge innovation history

Participatory social network analysis (NetMap)

Many public, private, and civil society actors are involved in a health system. The structure of social networks, and the type of relationship or link between actors, has been found to influence the resilience of systems. We seek to analyse health system social networks to understand how tangible and intangible software (including trust, power, and informal leadership) influences shock responsiveness and resilience (Theme 1); sources, flows, and blockages of early warning, climate, and health information (Theme 2); and flows of finance between actors during climate shocks (Theme 3). We aim to analyse power within the system to understand who has more or less influence over decision-making processes during periods of shocks. People or organisations can be influential because they have control over resources (e.g. financial or human), such as donors and government agencies, or because they have an important job or position, such as an elected official or community leader. Others are influential because they are a trusted source of information or advice, or simply because they are liked or respected. Through this social network analysis we aim to generate knowledge of how actors within the health system and within other health and nutrition-determining systems are linked and can inform or enable the mitigation of delays in responses (Blanchet *et al.*, 2017)

NetMap is a tool that ‘helps people understand, visualise, discuss, and improve situations in which many actors influence outcomes’ (Schiffer, 2007, p. 3). It is a step-by-step process for mapping out relationships and understanding the differential influence of actors on a policy domain, which in this case is health system shock responsiveness. Understanding the relationships between actors can help explain trust in health systems and why certain individuals or organisations play leadership roles, and therefore can help explain the role of leadership in health system shock responsiveness and resilience. The method maps the influence of actors on health system shock responsiveness, which in this case can help the Maintains project to identify key barriers and potential allies and influencers to recruit in support of actions undertaken in components 2 and 3 of the research (Section 5.4 and 5.5).

Annex E outlines the steps involved in implementing NetMap. Essentially, focus groups will be held at national and county levels with 6–12 participants. Participants will be selected purposefully from the aforementioned list of stakeholders developed at inception according to their knowledge of the health system, and information and financial flows in particular.

Participants will use pens and paper to draw a network of who is involved or affected, how they are linked to each other, and their influence on how the health system responds to climate shocks. In applying NetMap in this project, we will ask participants to map the network as it is during a climate shock, and focus on four types of link: (i) advice and coordination links between actors, which will be mapped in order to explore leadership and governance; (ii) information sharing, in order to explore early warning and other types of climate and health information flows (Theme 2); and finance/resources, in order to trace financial flows (Theme 3) between actors in a health system to respond to climate shocks. By visualising the social network, discussion can be stimulated amongst participants about important, challenging, and absent relationships/links for disseminating information and expanding and contracting finances, and potential solutions can be deliberated. Questions in

the discussion will probe deeper on themes identified in WP1, including governance issues that constrain and enable health system shock responsiveness. While participants will be required to create a consensus NetMap, dissent and discussion will be recorded in notes and digitally to capture different perspectives.

Participant selection: Because social networks in health systems have multiple levels, NetMap workshops will be held at both the national and county/district levels in Kenya and Uganda (i.e. four one-day workshops in each country). Participants will be purposefully selected to represent a diversity of health system actors from government, the private sector, and civil society, ensuring that there is adequate representation of actors with knowledge of health information, early warning, finance, and disaster response. Individual participants will be selected based on seniority and relevant knowledge of these topics in their respective organisation. More than one representative may be selected from the same organisation to represent different areas of thematic knowledge and experience (e.g. finance officers and health advisers).

Analysis: Workshops will be digitally recorded and/or notes taken on discussions. Straight afterwards, the notes and recollections of the facilitation team will be recorded in an analysis form, which will include a photograph of the drawn NetMap and written descriptions of flows of information and finance, and key discussion points. Later, for in-depth analysis, digital recordings of the workshops will be transcribed verbatim within one week of the interview or workshop, and then thematically coded in NVivo.

History of the CMAM Surge innovation

The development and implementation of a new approach like CMAM Surge can be regarded as a process, involving negotiation, problem solving, and learning amongst stakeholders over an extended period of time. Such processes can be described as innovations, whereby new ideas are adopted and spread within society or to new places (Mulgan *et al.*, 2006). The innovation histories method (Douthwaite and Ashby, 2005) involves recording and reflecting on an innovation process. People who participated in the establishment, implementation, and roll-out of CMAM Surge in Kenya, and the temporary piloting in Uganda, will be asked to construct a detailed written and visual account based on their memories and available documents. The preparation of the history will stimulate discussion, reflection, and learning amongst stakeholders.

The method will aim to enable those that were involved to reflect on their own actions and experiences, how these linked to the actions of other people and organisations, and how they can use their experiences to improve the performance of CMAM Surge in Kenya and inform the potential development of a similar or alternative surge approach in Uganda. The innovation history of CMAM Surge will identify factors in and enablers of success, as well as institutional and social-political obstacles, barriers, and sources of resistance. Organisations in Uganda, other Maintains countries, and elsewhere will be able to learn from the history of CMAM Surge in Kenya to be inspired, understand how to avoid mistakes, and maximise the chances of success of their own initiatives.

The innovation histories process involves recording and explaining a timeline of key events in the innovation's history (see Annex F for a sample of the workshop agenda). Key events can include, for example: important decisions, important meetings, actions and activities,

changes in relationships, when something new was learnt, problems and challenges, and when something unexpected happened. The first draft of the timeline will be constructed during workshops. Participants from each stakeholder group will: (i) post key events onto a timeline; (ii) discuss who the event involved; (iii) discuss which were the most important events; and (iv) reflect on important themes and lessons learnt that they want to investigate further.

Follow-up interviews (see Annex G for interview guide) will be held with a selection of participants at the workshops and those identified as important but not in attendance. The interviews will involve a discussion of the timeline developed at the workshop. The interviewer will ask for: (i) the identification of new events to add to the timeline; (ii) and more information about the events. Questions that can be asked to prompt discussion when a new event is added will include: Why was the event important? Who was involved? Why were they involved? How did they contribute or participate? What were the results? Who disagreed with, opposed, or lost out? Lastly, the interviewee will be asked what, in their opinion, were the top three most important events and why. This will help to identify key turning points or factors in the innovation history that enabled or hindered CMAM Surge's successful implementation.

Participant selection: CMAM Surge was developed in Kenya, where it has the most extensive history, which will be recorded and analysed. However, Concern Worldwide did implement the approach in Uganda for four years before it closed its programmes in the country in 2016. Thus, in Kenya, the innovation history of the approach will be studied at national level and county level in Marsabit and Turkana, with participants purposefully selected based on their knowledge and experience of designing, implementing, and scaling up CMAM Surge. Approximately 10 participants will be invited to the national workshop and about 10–15 to each county workshop. In Uganda, since CMAM Surge approach implementation operations were closed, those involved during the implementation will be invited to a single national workshop.

Analysis: Notes from the workshops will be written up and audio recordings of interviews transcribed. The information collected from the workshops, interviews, and other methods could be written up in a two-column learning history report, an example of which can be viewed in Douthwaite and Ashby (2005). An event in the timeline would be introduced. After this, the text would be split into two columns. In the right column, interesting quotes and paraphrases from interviewees about the event would be recorded. In the left column, the reflections of the core team would be recorded, including: (i) why a particular quote was chosen; (ii) giving meaning to what was said; (iii) giving a larger perspective, e.g. what it tells us about the factors that supported or blocked the implementation of the CMAM Surge approach. The same format would be repeated for the next event.

Writing up: From the learning history report, a brief summary of the history of the CMAM Surge, the identified enablers of and barriers to its successful establishment and implementation, and lessons learnt will be written up as scientific and policy knowledge products (WP4).

5.3.3 WP3: Informal health system (including community)

Community focus groups

The CMAM Surge approach for analysing health facility risks and thresholds will be adapted to make it applicable to understanding community health and nutrition vulnerability and resilience to climate shocks. This will be achieved by integrating and adapting tools used in gender-sensitive climate vulnerability and capacity analysis (CARE, 2019) and participatory epidemiology. Such bottom-up participatory methods are increasingly used to identify local level determinants of vulnerability based on people's experiences, rather than assuming them beforehand (e.g. Ford and Smit, 2004; McCubbin *et al.*, 2015). The climate vulnerability and capacity analysis can consider GESI by exploring differences in the impact of climate shocks on different groups' health and nutrition, and how their characteristics influence their resilience. Identification of these issues can ensure the specific circumstances, challenges (e.g. with access), and priorities of women and men are taken into account in the design of shock-responsive health and nutrition services.

At gendered focus groups, community representatives of a range of social groups will use these tools to identify: (i) health and nutrition risks faced by the community in relation to climate shocks; (ii) who and what is sensitive to them; and (iii) capacities and thresholds within the community for dealing with spikes in malnutrition and morbidity rates. Table 4 summarises how we will adapt the proposed tools, but the final process will be designed following WP1 learning workshops, to ensure findings feed into subsequent WPs.

Once participants have identified the key formal and informal health system actors during a Venn diagram activity (Table 4), participants will discuss Theme 2 topics, including what climate and health information they receive, from whom/what, and how they use this information in their decision-making, with specific reference to health and nutrition preparations. They will also be asked for their perspective on how information could be improved to better meet their needs.

Table 4: Proposed participatory tools for community focus groups

Tool	Description	Insights
Hazard assessment matrix	Participants will identify the hazards (including every day, irregular, and large-scale) facing households and the community, the frequency of their occurrence, and the degree of impact on different domains of their wellbeing (e.g. water, sanitation, livelihood) that influence nutrition and health outcomes. Participants will discuss how the hazards interact to affect their health and nutrition, and the strategies they use to cope with these effects.	Range, importance, and interactions of different exposures. Impact on and sensitivity of health and nutrition. Health and nutrition coping strategies.
Seasonal and epidemiological calendar	A seasonal calendar matrix will be constructed, with months on one axis and climate shock-related diseases, malnutrition, vulnerabilities, and capacities on the other. Seasonal factors and variability/events (e.g. rainfall, livestock condition, festivals) that have	Difficult times of year and factors that affect ability to cope with health and nutrition spikes and access different forms of healthcare.

	an effect on malnutrition and morbidity in the community, and factors that affect whether and where people seek healthcare, will be recorded in the calendar. Discussions will take place about how the seasons have changed, and how this has affected morbidity and malnutrition. Differences between a typical year and the case study climate shock period will be discussed.	Seasonal variability in malnutrition and morbidity. Additional burdens of climate shocks.
Historical timeline	Creating a timeline of key hazards events and the health and nutrition impacts of these, and historic socio-economic and environmental changes that have strengthened or weakened capacities to deal with health and nutrition impacts of climate shocks. Participants will also record on the timeline their perception of how cases of malnutrition and morbidity have changed over time.	Past shocks and trends (exposures) and changes in their intensity, behaviour, and health and nutrition impacts. How community sensitivities and capacities have changed over time.
Venn diagram	Diagram showing key formal and informal health system actors, their relative importance, and the closeness of their relationship with the community. Discussion of their role generally and in relation to supporting the community with health and nutrition services during hazard events, and about financing and access to, and the quality, coverage, and affordability of, different sources of health and nutrition services during climate shocks.	Ranking of importance of community (informal) and external (formal) health system actors. Discussion of importance of social transfers, remittances, and other sources of external support during climate shocks. Discussion of health and nutrition services access barriers, including for marginalised groups, like refugees. Sources of information about climate shocks (Theme 2), and finance and resources (Theme 3) during crises.
Identifying thresholds	Using a dashboard, thresholds will be set for four phases – normal situation, alert, serious, and emergency phase – to identify the prevalence of malnutrition and morbidity in the community against identified thresholds for capacities and available resources/services (including OOPs) before additional support is needed.	Self-assessment of community and CHV capacity to cope with shocks and events. Self-assessment of what are the priority needs for support as capacities become overwhelmed.

Sampling: Four communities will be selected within each study site county/district with the support of local partners: 12 communities in total in each of Kenya and Uganda. Separate focus groups will be held with men and women in each community and each group will represent various characteristics, including age, disability, social status and wealth, and roles within the community, such as CHVs. The 24 focus group discussions will be facilitated in the appropriate local language.

Data recording and analysis: Note-takers will record in as much detail as possible the discussions had by the participants during the implementation of each tool and key discussions will be audio recorded for later translation and transcription. In the evening, facilitators will submit a brief with bullet points summarising their notes in English and images of the focus group visual outputs (seasonal calendar etc.) to discuss with the lead or country researcher. The country lead researcher will then write summary reports for each community, from which key qualitative themes will be identified by the research team related to the project's research questions.

Household survey

Households are a critical but under-examined component of the informal health system in relation to shock responsiveness. Because not all health and nutrition impacts of climate shocks will be treated by formal health and nutrition services (especially in remote areas), and therefore recorded in admissions data, it is important to understand unmet demand, the range of treatments sourced in and outside of the community, household coping mechanisms, and their knock-on effects and feedbacks, and service access barriers. The household survey will be the key source of data on informal financing of health responses to shocks through OOPs. We will examine how these payments are financed, including the role of remittances and social transfers. Importantly, the household survey will complement the focus groups by providing data that can be disaggregated by social characteristics, to provide insights for our overarching research theme on gender and social inclusion.

The household survey will be a one-off and cross-sectional interview, providing data disaggregated by social characteristics on a range of variables pertinent to our research questions over a recall period of one year, including:

- household identity characteristics – number of occupants, gender, age, occupation, disability, tribe or ethnicity, etc.;
- health and nutrition status indicators;
- impacts of climate shocks over the past year on their wellbeing – livelihoods, water, health etc.;
- climate-related health and nutrition ailments during the period (demand);
- how and where they treated the issues first, second, and third – home, community, traditional healer, CHVs, outreach services, medical facilities (utilisation);
- outcome of treatment;
- issues experienced in accessing health and nutrition services (access and coverage);
- experience using services – quality, affordability, safety, distance, degree of welcome received;
- sources and uses of climate and health and nutrition information; and
- household financing, including total household income, sources of income (including remittances), OOPs and catastrophic health expenditure during climate shocks, transaction costs; the impact of that expenditure on household wellbeing, finance as a barrier to accessing health and nutrition services; health insurance; whether the household receives social transfers and how this affects health expenditure during a shock; how decisions on health spending are made in households, including by whom.

These variables will each be operationalised in one or more closed- and open-ended questions. The household survey will be fully designed following analysis of the WP1 findings, to ensure learning is integrated into its design before implementation in Year 3. The questionnaire will be reviewed by the Maintains Kenya and Uganda steering group and piloted with 10 respondents to ensure the questions are understandable and that the duration of the survey is no longer than one hour. The household survey will then be updated. A gender-balanced team of enumerators will be trained in the household surveys and overseen by the country lead researcher to ensure accurate and culturally and gender-sensitive implementation. Guarantees of anonymity and confidentiality, and the need for honest responses, will be emphasised at the start of the interviews. Survey responses will be recorded on paper, with responses to answers recorded immediately, and each respondent will be assigned an identification number.

Sampling: The sampling strategy will be finalised before the implementation of the household survey in Year 3 of the programme. A three-stage cluster sampling process will be used. Stage 1 will involve a proportionate random sample of villages/sub-locations/health facilities in each county/district from a sample frame of villages listed by the national government (e.g. the KNBS), stratified by rural and urban contexts. We will need to confirm that our sample frame includes villages that are remote from health facilities. Stage 2 will involve a random sample of households within each of the sampled villages. We are in the process of identifying sample frames, including lists of households in the village/cluster held by village elders or existing sample frames of partners, if they are up to date. Depending on the sampling frames at village level, it may be possible to stratify by mutually exclusive characteristics, such as female-headed households, refugees, and social transfer recipients. To ensure gender dimensions are captured, within-household sampling will involve questioning the head of household and the oldest household member from the opposite sex. Sample ratios and sizes will be decided by the research team once sample frames have been established at each level. Researchers will administer a minimum of six to eight household questionnaires per day, with the interviews estimated to take approximately one hour.

Data entry and analysis: household survey data will be entered into a computer using a pre-prepared data entry mask (EpiData software) at the end of each day, under the supervision of the country lead researcher. To ensure data quality control, enumerators will double-check the data they have entered and the country lead researcher will carry out spot checks. In-depth quantitative analysis will be done in SPSS, a computer program for statistical analysis.

5.3.4 WP4: Research outputs

Working papers

Working papers will be published following each of WPs 1–3 to synthesise the results for Kenya and Uganda. These working papers will cover analysis related to multiple research themes, which will then inform the final overarching and research theme-specific scientific and policy knowledge products outlined below. The working papers will be distributed prior to learning workshops to invite feedback and discussion about the findings at the learning workshops. By involving partners in this way, we will increase the robustness of our analysis,

explore the policy implications, and begin to design solutions to feed into Component 2 of the project. We anticipate producing the following working papers:

- **WP1: analysis of the impacts of, and responses of the formal health system to, climate shocks.** For Kenya, this will be a case study of the responsiveness of the Kenyan formal health system to the 2018–19 climate variability (as requested by DFID Kenya, and presented in the Country Research Plan).
- **WP2: (i) social network analysis** of the Ugandan and Kenya health systems related to climate shock responsiveness; and **(ii) lessons learnt from the CMAM Surge approach innovation history.**
- **WP3: analysis of informal health system impacts from, and capacities to respond to, climate shocks.**

Scientific and policy knowledge products

Maintains Kenya and Uganda research will generate high-impact, peer reviewed journal articles on each of the specific and overarching research themes, drawing from Kenya and Uganda data collected in one or more of the above WPs. Additionally, non-technical policy briefs will be produced for each theme to communicate the key policy and programmatic insights and recommendations from the research and learning. Unlike the scientific articles, the policy briefs will be written for Kenya and Uganda separately to ensure they meet the specific needs of partners working in these contexts, in order to maximise research uptake (Component 3). Table 5 presents an indicative list of the publications that we aim to produce. The final titles will be decided based on the key findings that are revealed from the research and tailored to the scientific, policy, or practitioner audiences of each product. Table 6 summarises research activities, how they will contribute data to answer research questions, and the associated knowledge products.

Table 5: Indicative topics and descriptions of scientific and policy knowledge products (a scientific publication and policy brief will be written on each topic)

Theme	Tentative product title	Description
Overarching	Building climate shock-responsive and resilient health systems	A journal article will synthesise the findings on each theme from a dynamic systems perspective to shed light on how to build health system capacities to absorb, adapt, transform, and learn in response to climate shocks. The policy briefs will provide recommendations for how programming and policy can shift the health systems of Kenya and Karamoja towards being more shock responsive and resilient, based on the findings of Maintains Kenya and Uganda, respectively.
Overarching/ GESI	Towards gender and socially equitable shock-responsive health and nutrition services	Analysis of gendered and socially differentiated impacts and responses to climate shocks in and across formal and informal health systems, and how health systems can be both more equitable and resilient, in terms of governance, disaster and health finance, EWSs, and surge approaches. Policy briefs will recommend practical steps for mainstreaming gender and social inclusion in health and

		nutrition services in Kenya and Karamoja during and outside of climate shocks.
Theme 1	How can health system capacities to respond to drought be strengthened?	Analysis of how the supply and demand for health and nutrition services are affected by and respond to droughts (and floods), existing formal and informal health system capacities for dealing with impacts, and recommendations on strengthening health and nutrition services to be more responsive to droughts in Kenya and Uganda.
Theme 2	How can early warning and health information systems contribute to health system shock responsiveness?	Analysis of the perspectives and experiences of health system actors in regard to using early warning information systems to generate practical insights on how early warning information could be better trusted, used, and communicated to inform health and nutrition service delivery in Kenya and Uganda.
Theme 3	How can health system financing flex, expand, and adapt in response to climate shocks?	Insights on how health system and disaster financing can be more flexible and adaptive for health and nutrition services during shocks. Recommendations on flexible, adaptive financing for health and nutrition services in the face of climate variability. This will feed into the development of financing solutions that can scale up and down service delivery ahead of, during, and after shocks.
Theme 4	How can surge approaches strengthen health system shock responsiveness and resilience?	Lessons learnt from the CMAM Surge approach for enhancing, scaling, and replicating health system surge approaches, and recommendations on how to improve, adapt, scale up, and replicate surge approaches for implementation in Kenya and Uganda. The products will outline how the approach could be replicated in other parts of Kenya, and how it could feed into the development of surge approaches in Uganda. Analysis will also provide globally significant insights on the potential role of surge approaches in building health system resilience to shocks.

Table 6: Summary of research activities and how they contribute data to answer the research questions

	Sample sizes	Theme 1: Impacts and responses	Theme 2: Early warning and health and nutrition information	Theme 3: Finance	Theme 4: Surge approaches	Working papers
WP1						
Desk review and secondary data analysis	N/A	<ul style="list-style-type: none"> • Health and nutrition, institutional, and shock context • Focal climate shocks • Health and nutrition impacts • Responses 	<ul style="list-style-type: none"> • National early warning and climate information arrangements • Early warning bulletins and meeting minutes of decisions and actions taken • Nutrition surge dashboards • DHISs 	<ul style="list-style-type: none"> • Review of laws, policies, and other institutional arrangements • Mapping of financing instruments • Descriptive analysis of household health expenditure data • Review of disaster financing evaluations 	<ul style="list-style-type: none"> • Review of evaluations and studies related to CMAM Surge • CMAM Surge plan financial arrangements • Health facility CMAM Surge dashboard analysis 	Impacts of, and responses of the formal health system to, climate shocks
KIIs	15–25 national and 60 county-level in each country	<ul style="list-style-type: none"> • (Gendered) Impacts • Governance and leadership • Response strategies • Learning and adaptation 	<ul style="list-style-type: none"> • Use of early warning information in health and nutrition • Limitations and issues • Learning and adaptation 	<ul style="list-style-type: none"> • Financial arrangements for health and nutrition response to droughts and floods • Financial sources, mechanisms, and disbursements • Budgeting and post-shock budget execution processes • Learning and adaptation 	<ul style="list-style-type: none"> • Timeliness of detection of shocks • Use and effectiveness of CMAM Surge information • Use of CMAM Surge to trigger surge support • Performance and efficiency of scaling up and down services • Enabling and hindering institutional arrangements • CMAM learning and adjustments 	
WP2						
Participatory Social	Four workshops	<ul style="list-style-type: none"> • Actor roles and coordination 	<ul style="list-style-type: none"> • Sources, flows, and blockages of information and early warnings 	<ul style="list-style-type: none"> • Sources of financing in health systems for climate shock response 		i) Social network analysis of the Ugandan and Kenya

	Sample sizes	Theme 1: Impacts and responses	Theme 2: Early warning and health and nutrition information	Theme 3: Finance	Theme 4: Surge approaches	Working papers
Network Analysis	in each country	<ul style="list-style-type: none"> • Role of social capital and trust in formal health system responses to climate shocks • Informal and formal leadership • Conflicts and challenging relations that inhibit shock responsiveness • Weak connections between actors • Governance enablers and barriers 	<ul style="list-style-type: none"> • Actors disconnected from information channels • Issues and challenges • Reflections on how dissemination and use of information could be improved 	<ul style="list-style-type: none"> • Financial flows and blockages during climate shocks (including importance of flows) • Perceived issues with current financing arrangements • Reflections on how financing could be more shock responsive 		health systems related to climate shock responsiveness, and (ii) lessons learnt from the CMAM Surge approach innovation history
CMAM innovation history	In Kenya: one national workshop; three county workshops; 6–10 interviews. In Uganda: one national workshop				<ul style="list-style-type: none"> • Lessons learning on CMAM Surge to date • Enablers of and barriers to the successful establishment and implementation of the approach • Sources of resistance and strategies to overcome resistance • Capacities that supported its successful implementation (e.g. leadership) 	
WP3						
Community focus groups	Four communities in each	<ul style="list-style-type: none"> • Changes in health and nutrition risks from climate variability and 	<ul style="list-style-type: none"> • Sources of climate and health information used by the community 	Sources of financing and resources within and outside the community	<ul style="list-style-type: none"> • Community health service and community capacity 	Analysis of informal health system impacts from, and capacities to

	Sample sizes	Theme 1: Impacts and responses	Theme 2: Early warning and health and nutrition information	Theme 3: Finance	Theme 4: Surge approaches	Working papers
	county/district, totally 12 focus groups in each country	interactions with other stressors and shocks <ul style="list-style-type: none"> • Community health and nutrition impacts from drought • Community vulnerabilities to health and nutrition impacts from droughts • Community responses and coping capacities • Adaptive and transformative capacities • Gendered impacts 	<ul style="list-style-type: none"> • Use of information to prepare for, respond to, and recover from droughts 		thresholds for malnutrition and morbidity <ul style="list-style-type: none"> • Insights on the applicability of the approach in informal health systems 	respond to, climate shocks
Household surveys	To be decided once sample frame established	Identity characteristics for disaggregated analysis of health and nutrition status and climate shock impacts, sources of treatment, access barriers, and experiences of health and nutrition services during drought	Sources of climate and health information used by households	<ul style="list-style-type: none"> • Household sources of financing of health and nutrition services • OOPs, transaction costs, and catastrophic spending during climate shocks • Insurance, remittances, cash transfers • Household financial decision-making 	Comparison between experiences of households that used health facility services under CMAM Surge and those of households using health facilities not operating CMAM Surge	
WP4						
Scientific and knowledge products	N/A	How can health system capacities to respond to drought be strengthened?	How can early warning and health information systems contribute to health system shock responsiveness?	How can health system financing flex, expand, and adapt in response to climate shocks?	How can surge approaches strengthen health system shock responsiveness and resilience?	N/A

5.4 Component 2: Targeted support

In Component 2, technical assistance, will be provided to DFID and other partners with the specific objective of adapting/developing/designing new tools, approaches, and programmes to improve health system shock responsiveness in Kenya and Uganda. The following paragraphs outline a series of indicative steps that might be undertaken to develop this technical assistance. We envisage that these programmes would be implemented through action research so that they can be piloted, and lessons learnt, before the final approaches are designed.

Lessons learning and design conferences and workshops

A series of conferences and workshops will be organised for key national and international partners to co-design new or adapt existing approaches for building health system shock responsiveness and resilience:

1. The Maintains Kenya and Uganda Component 1 findings will be presented at conferences for policymakers, practitioners, and scientists in each country, most of whom would have previously been participants in one or more of the activities in Component 1. Reflections from the participants on what is working, what is not working, and what could be done differently will be collated
2. A design workshop will be held with key technical staff from partner organisations in Kenya and Uganda to develop a theory of change to move towards shock-responsive health systems, including intended outcomes, required system behaviour changes, and potential interventions to build resilience capacities
3. A core group of CHC and partner technical staff will develop a series of innovations to be piloted in northern Kenya and Karamoja: for example, new multi-morbidity, total workload, and community surge approaches¹⁰.

Development of tools and processes

[To be defined.]

Piloting

[To be defined.]

Monitoring, evaluation, and learning

[To be defined.]

Refinement of models and approaches

[To be defined.]

¹⁰ Interest has already been expressed by Concern Worldwide in collaborating on this example.

5.5 Component 3: Research uptake

5.5.1 Strategy and aims

The research uptake strategy for Maintains Kenya and Uganda is described in a separate document and is summarised here. The action research methodological approach involves experiential learning, whereby key stakeholders and influencers are engaged during the research and participate in workshops to discuss emerging findings, as well as taking part in action research where possible. Through this approach, there is less need for an independent 'uptake' phase after the completion of the research because results and learning are already embedded in adapted programmes. Key stakeholders in each country need to be engaged from the start of the programme in order for the action research approach to be effective. The research team will put time and effort into getting this 'buy-in' early in the programme, both through formal events and informal discussions.

The concept of shock responsiveness is relatively new and not well understood within the established health systems in Kenya and Uganda. The prevailing conceptual understanding is of separate 'normal' service delivery and 'emergency' response. This understanding will take time to change, partly because health service shock responsiveness has not been seen as being a basic role and responsibility of government.

The action research approach of Maintains Kenya and Uganda means that learning workshops will be scheduled throughout the research cycle to keep stakeholders engaged and participating in the research – see the schedule of learning workshops in the timeline (Section **Error! Reference source not found.**). Learning workshops will be held at the end of each WP at national and county levels for participants to reflect on findings and discuss how to improve the shock responsiveness of the health system. Learning workshops will use an approach based on Kolb's Learning Cycle (Kolb *et al.*, 1984). Participants will reflect on the research findings, conceptualise how the findings fit into their experience of what works in the context of ASAL and Karamoja, and make a plan regarding how the new knowledge and learning will be put into action.

In line with the overall objectives of Maintains and the specific objectives of the Kenya and Uganda health and nutrition research, the research uptake strategy aims to:

Influence key actors in the region to incorporate shock-responsive innovations in health systems strengthening work so that health systems are more resilient

Table 7: Key audiences for Maintains Kenya and Uganda

Audience	Key influencers	Needs/mechanisms
Audience 1: Global and regional policy makers, UNICEF, and regional and high-level consultants who can	DFID global and country level – Chris Porter, Kenya Country Office, Uganda Country Office, Somalia Country Office, European Civil Protection and Humanitarian Aid Operations (ECHO) Somalia – ECHO regional and global	Credible evidence that shows the benefits of a shock-responsive systems approach in health – beyond nutrition Materials to empower their programme/decision makers to try it out Paper – email – follow-up calls Policy briefs

influence donors	technical advisors, UNICEF global, regional and country offices Kenya, Uganda, Somalia, USAID – Office of Food and Peace	
Audience 2: Programmes and donors in country	Patrick, Tewolde, Rose UNICEF – Kenya, Cecilia UNICEF – Uganda, USAID Feed the Future (Jennifer), Food for Peace (Mary Martins), OFDA Kenya (Emily Gish), DFID Kenya – Tessa, DFID Uganda – Rita and David	Compelling arguments that shock response systems are desirable and possible 'How to' guides to assist in adapting health systems strengthening programmes Face-to-face discussions Learning events Online resources
Audience 3: Early adopters and county health teams (Kenya)	Concern and Save the Children; county health coordinators (tbc); NGO and donor audiences interested in health system surge approaches	They are adopters of the nutrition surge model and they need compelling arguments and guidelines to consider a broader health system approach Face-to-face discussions Learning events Accompanying pilots
Audience 4: Potential adopters (other health NGOs and actors)	County health teams, Kenya; district health management teams, Karamoja, MoHs Uganda and Kenya, Office of the Prime Minister, Uganda	Evidence to show why they should be interested in health system shock responsiveness Materials to overcome resistance to change Face-to-face discussions Learning events Policy briefs Accompanying pilots
Audience 5: SURGE Steering Group		Credible arguments to get health systems strengthening onto their learning agenda Material to support their strategic objectives Presentations at key meetings Policy briefs

5.5.2 Uptake opportunities

There are a number of opportunities for research uptake for Maintains in this region. Key people in organisations such as DFID, UNICEF, Concern, Action Against Hunger and Save the Children are already engaged in pilot programmes and policy development around shock-responsive nutrition and health systems and have an interest in the findings of Maintains. Specifically, the new USAID Food for Peace-funded programme, NAWIRI, includes health system strengthening in its learning agenda, with opportunities for collaboration in applying the results of Maintains to programming in northern Kenya. CHC are partners on this programme, offering opportunities to share desk review materials and learning. Similar programmes are ongoing in Karamoja, where DFID, UNICEF, Mercy Corps, and Catholic Relief Services will be particularly important partners.

Nairobi is a global hub for drought management and resilience thinking so there are opportunities to influence global as well as national and regional policy and practice. The NDMA in Kenya is a regional leader in drought monitoring, EWSs, and disaster financing, and has the capacity to adopt new approaches based on credible evidence from Maintains.

Drought events (and other shocks, such as COVID-19) during the lifetime of the Maintains programme provide both an opportunity to raise awareness of the importance of shock-responsive systems and a potential barrier to system strengthening. Health systems are in stress during shocks and may not have the capacity to take on changes in the system, but immediately after the event there is an opportunity to reflect on the way the system responded while the strengths and weaknesses are fresh in people's minds.

5.6 Training

All Kenya and Uganda Maintains' researchers (Section 5.9) and research assistants are involved in the development of the methodological tools and will be mentored by the lead researcher for the first round of implementing each method. At the end of each day in the field, research teams will discuss findings and reflect on how to improve technique, and weekly remote meetings will be held with the lead researcher to discuss any issues and emerging findings. Specific guidance will be given on ethical considerations (Section 5.8).

5.7 Data management

Data will be stored on a secure, encrypted computer in the possession of the Kenya and Uganda country researchers. The research will comply with the Data Protection Act (2019) in Kenya and the Data Protection and Privacy Act (2019) in Uganda, which regulate the collection and processing of personal data in the respective countries. It will also adhere to DFID ethics guidelines (DFID, 2019), which stipulate that all primary data must be kept in a secure location for the minimum period necessary for the research. All data will be destroyed five years after the termination of Maintains. All participants will be informed of how the data will be managed in participant information sheets.

5.8 Ethical considerations

Ethics are important in social research to protect the rights of participants and others that may be affected, to ensure data are collected with integrity, and to provide critical reflection on the views and values of the researcher (DFID, 2019). In accordance with DFID ethics standards, the research will be conducted under the following principles:

- The research will be introduced to, and permission to proceed received from, research participants. Meetings with county officials and each community will be held to introduce the research at the local level.
- The purpose of, and information about, the research will be outlined in invitation emails or letters, and participant information sheets (Annex H).
- All data will be pseudonymised and confidential. The data will no longer be attributable to a participant without the use of additional information about the participants, which will be kept separately, safely, and securely on encrypted computers, and participants will be

made aware of this. If there is a circumstance in which it proves difficult to be confident of maintaining the anonymity of a participant, the quote or perspective will be cited in general terms (e.g. the sector or organisation, rather than a position). If using a broader term loses significant meaning/emphasis in the data/argument, a participant will be re-contacted to confirm permission to use the data.

- Written consent to join the research (Annex I) will be sought from participants at national and county/district levels, and verbal consent will be sought at community and household levels, and the participants will be made aware that participation is entirely voluntary and that they can end their participation in the research at any stage.
- The research team will ensure there are no implications regarding the physical or mental health of participants ('do no harm'). The burden on participants' time will be kept to a minimum for each research activity.
- It will be clearly communicated to participants that it is independent research, and is not linked to the provision of health assistance or other forms of aid. Participants that are found by the research team to be in need of medical or nutritional assistance, or in need of assistance with cases of violence against women and girls, will be referred to the appropriate local facility or service.
- Findings from the study will be disseminated to beneficiaries in appropriate media, such as policy briefs and orally through county-level learning workshops.

We do not believe that taking part in this research will have any foreseeable risks for participants. Participants may discuss current inadequacies with the existing health system, but these will not be attributed to individual participants or organisations, and will be sensitively dealt with in any publications. There will be no financial incentives offered to participants, except expenses paid for travel and subsistence to workshops and focus groups.

We will ensure venues for research activities accommodate participants with disabilities, and we will ask participants if they have any special requirements beforehand. Research activities will be timed to minimise disruption to livelihood activities, especially amongst disadvantaged groups.

The first stage of ethical review was provided by the Maintains Kenya and Uganda academic and technical steering group, with their comments integrated into this protocol. Members of the group include academics from reputable universities, and local and international health and research experts. The research protocol will then be submitted for formal ethical clearance through Pwani University ethics board in Kenya and Mildmay Uganda Research and Ethics Committee (MUREC) in Uganda. The protocol will then be submitted for government permits to the National Commission for Science Technology and Innovation (NACOSTI) and Uganda National Council of Science and Technology (UNCST) in Kenya and Uganda, respectively.

5.8.1 Reflexivity

Critical self-reflection regarding the subjectivity and biases of an action researcher is an important component of both research ethics and validating research. Recognising these from the outset can limit their influence on the research design process and, ultimately, outcomes (Herr and Anderson, 2005). As a research team, we are not value free. We have

an interest in building shock-responsive and resilient health systems that produce more equitable outcomes for communities in the ASAL of Kenya and Uganda, and we are aware that the status quo of reliance on aid models does not work, based on members of the team having substantial programme management experience in this context. The principal investigator (PI) of the team takes the position that surge approaches are a promising way to improve shock responsiveness, and was in fact one of the initiators of the approach. With this bias in mind, our research team involves both those with extensive experience working in Kenya and Uganda and with partners, and external researchers that have not been involved in surge approaches before and/or do not have close relationships with partners. We recognise and expect that research participants will have a variety of views on the research questions, some of which we may disagree with. We will proactively avoid this affecting how we interact with different research participants by treating them equally, not promoting some (e.g. pro-conservation) voices over others in the research, and respecting all opinions and perspectives.

There will also be a relation of power and privilege between some research participants and the team. We may be viewed as the outside experts or a potential source of future funding. We are a mixed race team, who have all received privileged education and opportunities. We will break down divides by socialising with participants, getting to know them outside research activities, and making research activities as informal and relaxed as possible. We will also make clear at the beginning of the activities that research does not mean there will be future project funding from DFID or other partners associated with Maintains.

5.9 Governance

The PI for this study is Peter Hailey, who has overall responsibility for the management of the study. Under the supervision of the PI, the lead researcher, Matt Fortnam, will be responsible for designing protocols, training and mentoring lead country researchers in data collection, and overseeing analysis and publication authorship. In Kenya, the country researcher is Emily Mbelenga, while the country researcher in Uganda is Teddy Atim. They will be the operational focal points for implementing the research plan in-country, and for coordinating and undertaking data collection and overseeing field assistants. Table 8 summarises the key experience and expertise of the team members. In line with DFID's 2009 *Guidance on Gender Mainstreaming and Social Exclusion in Research*, we have sought to have gender balance in our research team, and to have a mixed race, nationality, and aged team, with international, Kenyan, and Ugandan team members, and with GESI expertise within the research team and our steering group.

Table 8: Primary Maintains Kenya and Uganda research team

Role	Name	Relevant expertise
Country lead	Nancy Balfour	Policy and strategy guidance, learning facilitation, research coordination and uptake, with over 30 years' experience working in ASAL systems and on climate resilience
PI	Peter Hailey	Policy and strategy guidance; learning theory and strategy; health system strengthening; EWS and health and nutrition information systems; CMAM Surge approach, and quantitative, qualitative, and participatory research methods

Lead researcher	Matt Fortnam	Climate resilience, mixed method research design, analysis, and academic and policy-relevant publications
Kenya researcher	Emily Mbelenga	Health and nutrition in Kenya, qualitative research tools and data collection, support to analysis and publications
Uganda researcher	Teddy Atim	Humanitarian emergency programming, research design, analysis and writing on basic services in post-humanitarian emergency contexts for policy, programming, and academic publications

To reflect our mixed methods approach, the primary researchers will oversee teams of data collectors and specialist qualitative and quantitative analysts recruited and trained for specific tasks by country researchers, with the support of the lead researcher and PI. Table 9 summarises the roles of different team members for each WP.

Table 9: Team member work package responsibilities

Team member	WP1	WP2	WP3	WP4
PI	Technical backstopping Overall coordination Working paper co-authorship	Technical backstopping Overall coordination Workshop facilitation Working paper co-authorship	Technical backstopping Overall coordination Working paper co-authorship	Technical backstopping Overall coordination Publication co-authorship
Lead researcher	KII guides Overseeing desk review, secondary data analysis, and KII and NVivo analysis Training/mentoring data collectors WP1 working paper authorship	Methods guides Training of country researchers Workshop facilitation Overseeing analysis Working paper co-authorship	Focus group and household survey design Training of country researchers Overseeing analysis Working paper co-authorship	Publication co-authorship
Kenya and Uganda researchers	Desk review KII guides Conducting KIIs and overseeing research assistants in field NVivo coding WP1 working paper authoring	Workshop facilitation and/or note taking Conducting follow-up interviews Data collection logistics Qualitative analysis Workshop report	Focus group facilitation Training and overseeing research assistants' collection of survey data	Publication co-authorship
Research assistants	Conducting KIIs Field support	Workshop note-taking Conducting follow-up interviews	Focus group note-taking Household survey data collection	

			Data entry	
Ad hoc analysts (statistical)	Secondary data analysis (e.g. climate, health, nutrition, finance data)	CMAM Surge dashboard data analysis	Statistical analysis of survey data	
Ad hoc analysts (qualitative)	NVivo coding		NVivo coding of focus group and survey qualitative data	
Admin staff	Logistics	Logistics	Logistics	

DFID Kenya and DFID Uganda worked closely with the country lead and PI during the inception phase of Maintains to define priorities and shape the study approach, and will be consulted regularly for input to ensure the research meets their needs. The CHC research team will monitor progress and deliver outputs as outlined in this research protocol. The PI will provide regular feedback to DFID country offices and key partners on the progress and outputs of the study to ensure that the agreed-upon plan and outputs are being delivered, and to highlight any additional factors for consideration. DFID will also ensure that its partners make all documentation related to the study available to the research team. Quality assurance throughout the study period will be provided by the Maintains Kenya and Uganda academic and technical steering group, members of which are presented in Table 10. The steering group includes experts in health system resilience, nutrition, and GESI.

Table 10: Maintains Kenya and Uganda steering group members

Name	Affiliation	Relevant expertise
Dr Edwine Barrasa	KEMRI Wellcome Trust Research Programme	Health system strengthening and health system resilience
Dr Lanoi Maloiy	Independent consultant	Gender and health research
Dr Andy Seal	University College London	Nutritional problems in populations affected by humanitarian emergencies caused by conflict or disasters
Prof. Sophie Witter	Queen Margaret University	International health financing and health systems, including in fragile and shock-affected settings
Amanda Yourchuck	Concern Worldwide US	Nutrition and health adviser

The following collaborators to this study will be consulted regularly about the study:

- UNICEF
- MoHs and county ministries of health
- National treasury and county ministries of finance
- NDMA
- Concern Worldwide

- Food for the Hungry
- Save the Children
- Development Initiatives

The staff at these partner organisations who will be engaged in Maintains research will have specialisms in health, nutrition, early warning, disaster finance, and GESI.

5.10 Limitations of the study

1. Generalisability. The research will draw global, national, and sub-regional/ASAL conclusions predominantly from research at the national level, and in three case counties in Kenya and one sub-region in Uganda. Case studies allow an in-depth investigation of phenomenon in a place in order to generate unique and detailed information (Mitchell, 1983; Castree, 2005). A major critique of the case study approach is that, while it provides detailed information, the generality of the case cannot be determined (Yin, 2006). However, the findings of an intensive case study can reveal structures or relations that could be missed through extensive quantitative methods, and can validate theory.
2. Breadth versus depth. The research covers many topics, aiming to capture many elements of health system shock responsiveness and resilience captured in the conceptual framework. This breadth may come at the expense of depth of analysis. For instance, financing or early warning alone can consume the work effort of similar budgeted research projects.
3. Limited research on shock-responsive health systems. This makes the research both highly novel and exploratory. It may mean that certain questions are not asked that we will later wish we had asked in interviews or focus groups. We have mitigated this risk by WPs building upon and informing each other, providing opportunities to address gaps in data. We must, however, be prepared to adapt our questions and methods as new knowledge emerges during the phased WPs.
4. Possible limitations of the research team. We may unconsciously have cultural and other biases, based on our backgrounds and past experience. When reviewing our research outputs, we will be critical of how we have stated problems, and selected data and analysis to be included, and the way in which events and arguments are structured and conveyed.
5. Financial analysis focused on mechanisms, decision-making processes, and bottlenecks, rather than liabilities and funding gaps. DRF diagnostic methodologies (Alton *et al.*, 2017) provide for a detailed analysis of historic expenditure on disasters to identify liabilities and funding gaps. We decided not to undertake such an analysis because of issues with data transparency and budget constraints, and the fact that it did not answer our finance research question on flexibility and shock responsiveness. The secondary financial data we do analyse will be limited by issues of data transparency.

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Annex A County case selection indices

County	Drought Impact			Livelihoods	Surge Capacity
	2019 Drought F/S Impact	Nutrition	Combined Impact Red = 4, Orange = 2, Green = 1		
Garissa	High	High	8	High	V. Low
Tana River	Medium	Medium	4	High	Low
Wajir	High	Medium	6	Low	Low
Mandera	Medium	High	6	Medium	Low
Marsabit	High	High	8	Low	High
Turkana	Low	High	5	Low	Low
Kilifi	Low	Low	2	High	V. Low
Isiolo	Medium	Low	3	Medium	High
Samburu	Low	High	5	Low	Medium
Baringo	Low	High	5	High	V. Low
West Pokot	Low	Medium	3	Low	Low

Notes:

Drought Food Security (F/S) impact: High = NDMA score at emergency at least one month this year. Medium = NDMA score at alarm at least four months since October 2018. Low = Alarm at least one month since October 2018.

Nutrition: High = At least two assessments at extremely critical or critical since February 18. Medium = At least one month at critical and one month at serious. Low = No months.

Existing surge activity: High = major investment in CMAM Surge (or similar) and rolled out in >75% health facilities. Medium = some investment in CMAM Surge, rolled out in 50–75% facilities/ Low = limited roll-out in 30–50% of facilities, V. Low in 10–30% of facilities.

Annex B Key informant interview guide (sample)

1. Context and purpose of research

Thank you for offering your time to take part in this research. I'd like to begin by recapping the context and purpose of this research.

The Maintaining Essential Services after Natural Disasters (**Maintains**) programme is commissioned by UK aid (the Department for International Development, DFID). Maintains is being conducted in six countries: Pakistan, Bangladesh, Ethiopia, Sierra Leone, Uganda, and Kenya.

The aim of the programme is to develop an improved evidence base on how education, health, social protection, nutrition, and water and sanitation services can adapt and expand in response to shocks such as floods, droughts, and disease outbreaks.

Maintains is specifically investigating:

- how shocks **impact on essential services** in developing countries;
- the extent to which **essential services can flex and respond as a system** rather than as independent parts; and
- how essential services can best prepare and respond to natural disasters.

In Kenya, Maintains is a collaboration between **Oxford Policy Management (OPM)** and us, the **Centre for Humanitarian Change (CHC)**, in collaboration with the Government of Kenya and the DFID Kenya Office.

Health and nutrition are the primary focus areas for Kenya as they were identified as being of high interest to stakeholders and DFID. Specifically, we are exploring how the health system can be more risk informed and shock responsive.

The research will learn about the impacts of drought and floods on the health system in the counties of Turkana, Marsabit, and Wajir, and will explore how the health system can be strengthened to build resilience to future shocks.

Today, I would like to talk to you about the information you received about, and preparations that were made for, dry periods or droughts in 2018–19; the impacts of drought on the health system in [Turkana/Marsabit/Wajir], responses and strategies in the county to cope with these impacts, and wider lessons about how the health system could better respond to shocks like droughts and floods in the future.

We'll ask you questions on these themes but the interview will be conversational rather than following a rigid structure.

Do you have any questions about the research?

2. Guarantees of confidentiality and anonymity

[This can be skipped by sending the participant an info form and getting the consent form signed before the interview.]

I'll now run through your guarantees of confidentiality and anonymity and what they mean in practice. Please feel free to ask questions at any point.

Everything you say during this interview is potentially usable in our research.

You have a right to anonymity throughout the research. If we wanted to specifically attribute some data to your name, we would contact you to confirm you are happy for us to do so.

I need to gain your permission to digitally audio record the interview. The recording allows me to record what you say accurately, and to focus on talking with you, instead of taking notes. It also ensures you will be heard, speaking in your own voice, in the research. This recording will be treated as anonymous and will only be heard by a transcriber.

To summarise, nothing from this interview will be repeated with your name attached, and nothing will be shown to anyone, besides those on our research team, before you have a chance to approve it.

If you are happy to proceed with the interview based on the ground rules just covered could I please ask you to sign two copies of the form? One copy is for you to keep and the other copy is for me to keep.

Do you have any questions before we proceed with the interview activities?

2. Schedule of questions

This is an indicative list of questions that can be adapted according to the interviewee. For example, for those involved in CMAM Surge, more time should be dedicated to discussing questions related to it. The questions are sequenced in terms of the timeline of a drought, but it is OK if you jump between questions, but ensure questions in bold have been answered at the end of the interview. Questions not in bold are there as prompts and you may not need to ask all of them if the interviewee discusses them when answering the broader questions; they are there for inspiration to probe deeper.

The shock and early warning

Has [Turkana/Marsabit/Wajir] experienced dry periods, droughts, or floods since 2018?

Where?

When?

How severe were they compared to previous years?

Did you receive any early warning information about them?

Where from?

Did you use the NDMA early warning?

Did the NDMA early warning information detect the onset of the drought?

Did you use any other early warning?

Did you provide any information about the [drought/floods/extreme dry conditions] to anyone else?

What information?

To whom?

How did they use it?

Were there any issues or limitations with the available information?

Preparations

How did you use early warning information to inform health and nutrition service preparations for the drought?

Did you use any other information?

Health and nutrition information?

What preparations were made for potential increases in demand for health and nutrition services?

Did CMAM Surge health facilities detect the onset of drought?

Did non-CMAM Surge health facilities detect the onset of drought? If yes, how?

What assistance did the county receive to prepare?

From whom?

When?

Was it helpful?

How were preparations financed?

Who provided the finance?

When was it received?

What did you do with it?

Was there coordination of preparations and financing?

Between whom?

Who led it?

How?

Was this useful/effective?

Was there a drought contingency plan? Tell me about it. Did it help?

What policy or strategy documents guided these preparations?

Health system impacts

How were your programmes/work affected by the [extreme dry conditions/drought/floods]?

How?

What programmes and places were most affected?

What ongoing effect did this have?

Did you detect increases in demand for nutrition and health services in [Turkana/Marsabit/Wajir]?

Where?

How did you detect it?

Have you collected information on how much caseloads increased and when?

How did these impacts affect health and nutrition services?

How were health workers affected?

Were women and men health workers in the county affected differently? How?

How was the quality and delivery of services affected?

How were budgets affected?

Were there breaks in the pipeline?

When did that happen?

Why?

What was done about them?

During the shock

How did the health system in [Turkana/Marsabit/Wajir] cope with the increased demand for services?

What role did your organisation/department play in the response?

How did you coordinate your activities with others?

Did you need additional finance during this period?

Where did it come from?

Why did you need it?

When did you receive it? Was that in good time?

What was the international response?

Did you give extra funding or resources to anyone?

Who?

When?

Is this normal?

How have your ongoing budgets been affected by the drought/dry period/floods?

How did the CMAM Surge approach perform during this period? [For counties using the CMAM Surge spend significant time on this question; don't ask for those that don't use it.]

What difference did CMAM Surge make to nutrition responses to the drought/floods?

Did information from CMAM Surge inform your county/sub-county responses to the drought?

How did other actors, such as the government, use the CMAM Surge information to inform their response?

Were responses under the approach timely?

Have you evaluated how services scaled up and down across the CMAM Surge health facilities?

How did CMAM Surge responses compare with responses triggered by other early warning systems?

CMAM Surge lessons (ask if relevant)

Compared to other early warning systems, what difference has the CMAM Surge approach made to health and nutrition services being able to respond to shocks, like droughts and floods, in the county?

How has it affected financing of responses?

How has it affected human resource management?

How has it affected the way communities and health facilities work together?

How has it affected the timeliness of responses to shocks?

What challenges are being faced with implementing CMAM Surge?

What's not working?

What's the coverage of CMAM Surge like in the area where you work?

Have there been any barriers or resistance to its implementation or its scaling up?

Who is benefiting most from the approach? Are there groups of people it doesn't reach?

What are the key ingredients/factors for the successful implementation of the CMAM Surge approach?

Have any improvements been made to the approach based on experience?

What changes?

Why were they made?

How could the approach be improved in the future?

Financing?

Human resourcing? Leadership?

Policies and legislation?

Do you think the approach could be adapted to implement it in other sectors, such as water, sanitation, and hygiene (WASH)?

How?

What would need to change?

What would be needed to do that?

What problems do you foresee?

What aspects of the approach wouldn't work?

Wider lessons

What worked well with the health system's responses in Turkana/Marsabit/Wajir to the drought and floods?

What didn't work well?

What are the gaps and weaknesses?

What do you think needs to be different in future?

How could financing be improved?

How could information better meet your needs?

Did you do anything differently in 2018–19 compared to previous droughts, such as the 2016–17 drought?

What did you need to effect this change?

When did you start effecting the change?

Why has it changed?

How has that improved your ability to respond?

How has the capacity of the county's health and nutrition services to respond to shocks like droughts changed over the years?

What are key ingredients or factors needed to make the health system responsive to shocks?

How effective is the existing legal framework, and how effective are the policies and coordination mechanisms, for disasters and emergency response? Are laws and policies implemented?

What factors outside the health system influences its ability to respond to shocks like droughts and floods?

Are there barriers to coordination with other organisations and sectors?

What needs to happen to improve coordination?

What are the current funding gaps?

VI. Interview close

We're at the end of the interview now. However, there is always a chance that my list of questions may not have reflected everything you wanted to, or could have, said. So:

Is there anything you would add to what has been discussed so far?

Are there questions I should have asked?

Is there anything else you'd like to say?

VII Future interviewees

I hope to conduct this interview with a number of additional people to get a comprehensive understanding of the ways international conservation and development organisations are identifying and managing trade-offs in the region. Who would you recommend I contact for an interview within your organisation and your counterparts at other organisations working in Turkana/ Marsabit/ Wajir?

Annex C Interviewee categories

Kenya

National

- Humanitarian organisations
- Donors
- MoH
- NDMA
- National treasury

County

- MoH, including county health officer, county nutrition officer, county records officer, county health strategy, county public health officer, county community strategy
- NDMA county drought officer
- Kenya Red Cross county operations focal person/lead
- NGO county programme officers, monitoring and evaluation officers, and gender officers (World Food Programme, Concern, Save the Children, UNICEF)
- County Department of Finance

Sub-county

- Sub-county health officer
- Sub-county nutrition officer
- Health facility officers
- Sub-County Department of Finance

Uganda

National

- Humanitarian organisations, such as UNICEF, WFP, FAO, MercyCorp, USAID funded health programmes working in Karamoja, if any
- Uganda Red Cross National Office
- Donors, including DFID Uganda, European Union etc
- MoH – HMIS, Nutrition Working Group lead at the MoH
- Office of the Prime Minister – Disaster Risk Preparedness and Response Unit, Ministry of Karamoja Desk
- Office of Prime Minister Nutrition Team, coordinating nutrition activities under the Uganda Multi-sectoral Nutrition Action Plan
- Ministry of Finance, Planning and Economic Development

District

- District health officer, including health inspectors, nutrition officers at regional referral hospitals, HMIS records officer, district public health officer
- District DRR focal point
- Uganda Red Cross Karamoja field office / lead
- NGO staff based in Karamoja programme officers, monitoring and evaluation officers, and gender officers (WFP, Save the Children, UNICEF, MercyCorp, KRSU, and local organisations based in the region etc)
- District EWS data collection officers or contacts
- District Ministry of Finance

Health centres IV, III, II

- Health centre IV medical officer, health officers, midwife and HMIS staff
- Health centre III clinical officer, nursing officer, midwife etc
- Health centre II clinical officer, nursing officer and/midwife etc
- Sub-county DRR focal point person/sub-county development officer
- Sub-county records officer

Parish Development Committee and Village Health Team members

Annex D Flexible coding method

Step-by-step guide to NVivo analysis of interview data

A 'flexible coding' approach will be used that combines inductive (letting the data do all the talking – grounded theory) and deductive coding (driven by theory and answering specific hypotheses).

1. Read the research protocol

2. Transcripts

Create a table that lists the interviewees' names in one column and the job title/category of interview in another, and then provide a pseudonym for the interviewee in the third column, e.g. for county health officer in Turkana you may write CHO1_T. Keep this document in a separate folder to your data.

Create another table in a separate document that shows the job title/interviewee category and codes. This can be kept in the same folder as your data.

Title each transcript document by the pseudonym and the initials of the interviewer, e.g. CHO1_T_EM

2. Creating cases and assigning attributes

Cases are a list of all the individuals you spoke to.

- a) Open the NVivo project
- b) Click files
- c) Right click>Import>Documents and then select all the transcripts to import them
- d) Select all the files in list view > open create tab>Create as cases
- e) Click on Cases to see a whole list of the cases
- f) For each case, right click on it, and select Get info
- g) Where it says classification, select person
- h) You will then see attributes (gender, county); for each, select what describes the interviewee
- i) Complete for all the interviews

3. Index coding

For the first time reading through the transcripts, code for the main topics we are interested in. I have created these codes, including early warning, finance, CMAM Surge. This is called index coding, and aims to organise data around some of our key themes.

- To code, click on the file. The transcript will then appear

- Read each sentence and paragraph and decide which broad theme it relates to
- Select the text and then click Code (top right)
- You'll see a list of the codes or can search for it, then click Code
- If a sentence/paragraph/extract is relevant to more than one code, you can either do the same again, or:
- Right click> Select Code selection > At existing node>You can then tick box more than one node; or drag and drop into node in the node navigation menu
- If something doesn't fit these broad topics, create another code

You can do half of the interviews each until they have all been index coded.

3. Memos

Memos record your emerging thoughts on the story in the data. You already started to develop ideas about what is important in the data when compiling your preliminary findings.

As you are reading the transcripts and code, use these memos (and add more) to record your thoughts about the story that is emerging from the data. Write down anything that you think is interesting across what you have read.

These memos will be really important for me to see what is emerging and what looks interesting, to then be targeted further in looking at the data. This is basically the same as jotting down thoughts under sub-headings in a Word document.

4. Analytical codes

Through the process of indexing transcripts and writing respondent and cross-case memos, there will be several ideas about key findings from the data that emerge.

We will discuss your memos and consider potential analytical themes, and we will create these as child nodes of the main index nodes.

You will then each work on separate index nodes to code sentences within them analytically. This is where it gets a little trickier and it will take a little practice. You can try coding one of the index nodes and then I can check it to make sure you are on the right track.

This will partly involve coding text against the nodes we have developed based on your memo notes, using the same process as described for index nodes.

However, there will also be many findings that are outside these, requiring you to create new nodes. To do this:

- Select the text
- Click Code
- Select Code at New Node
- Under Name, write a few words that identify the new theme/finding/code
- Where it says Location:Nodes, click the arrow to pull down your list of nodes, find the topic you'd like to organise it under (e.g. CMAM Surge>Lessons learnt); or use the node navigation to drag and drop

4. Great quotes

When a respondent is particularly concise, articulate, or poignant, code the text as 'great quote' so that it can be easily retrieved later on. You'll later be able to use the query function to find when a great quote overlaps with an analytical code. You'll see 'Great quote' under the top-level nodes. Categorise under the analytical code/node as well as Great quote by following the same process as above:

- Right click
- Select Code selection > At existing node
- You can then tick box the analytical node and 'Great quote' node

Annex E NetMap focus group: facilitation guide

Introduction

We would like to talk to you about the relationships amongst people and organisations that are involved today in coordination, financing, and information for health and nutrition responses to droughts and other climate shocks. By today, I mean people and organisations who are currently involved, not those that are no longer involved. We are interested in how people collaborate, share health and early warning information, and how preparations, responses and recovery is financed in [Kenya/Uganda/county/district].

We will use this sheet of paper and these pens to map a network of who is involved and affected, how they are linked to each other, and their ability to influence how successfully the health system is able to respond to drought.

Who are the key organisations and people involved in the health system and responses to droughts in [Kenya/Uganda/county/district]?

- a) I would like you to write the names of the organisations and key people that are involved in or influence **the health system and responses to droughts in [Kenya/Uganda/county/district]** on these cards. Write the names of anyone that comes to mind, including those with no formal decision-making role. You may add additional names at any point during the focus. Remember, I only want you to list people who are currently involved.
- b) Spread out the cards on the sheet. You may group similar people and organisations.

Key people and organisations may include:

- elected government officials
- local government
- national agencies and departments
- international organisations
- information providers
- funding bodies
- civil society organisations
- research organisations
- community health services
- other community health actors
- individuals

Remember to include people who do not have any formal role in making decisions but who you believe are important in the network.

How are they linked?

I would like to find out how these people and organisations are linked.

Using these coloured pens, I would like you to draw arrows between the people and organisations. Each colour represents a different way the people and organisations are related:

- Giving advice and coordination (blue)
- Flows of funding and resources/materials (green)
- Flows of early warning and health information and data (red)

Rules

- The direction of the arrow represents who gives and who receives – for example – the advice. If it flows in two directions (e.g. coordination), use a double-ended arrow (**draw an arrow as an example**).
- If two actors exchange more than one thing, arrow heads of different colours can be added to arrows (**draw example**).
- Only draw an arrow if you know the relationship exists. If you are unsure, you do not need to draw an arrow.
- You are not looking at how links should or will be, or how they were in the past, but how they currently are, TODAY.

One person from the group, summarise:

- how health and nutrition responses are coordinated;
- the sources and flow of finance before, during, and following a drought; and
- the sources and dissemination of relevant early warning and health information before, during, and following a drought.

What links are crucial, problematic, or absent? Why?

Write symbols on the map to represent links that are:

- (i) most important (symbol = !!)
- (ii) challenging (x)
- (iii) absent but needed (?)

Questions:

1. Which relationships are most important for the success of health and nutrition responses to drought? Why?
2. Which relationships/links are the most problematic or challenging? Why?
3. What relationships or links are missing but would be beneficial?

How influential are they?

I would like to find out the ability of the people on the map to influence health and nutrition responses to drought.

How would you define influence in this context? [Have a discussion about what influence means and ensure they recognise that influence is not just about formal hierarchies or the influence of an actor in general, but about their influence specific to the governance innovation.]

There are many sources of influence, including the power to make decisions, the ability to influence decisions, influence through giving advice, the power to give and take away funding, or bending or breaking rules.

Steps:

1. I would like you to now create *influence towers* using *tower pieces*:

- The more influence an actor has, the higher the tower.
- The tower can be as high as you want.
- Two or more actors can have towers that are the same height.
- If an actor has no influence, they will have no influence tower.
- Influence can be both positive or negative.
- It is the relative difference in the height of the towers that is important.

2. Please indicate with an X those organisations/people whose influence is negative.

3. Check that they are happy with the heights of the influence towers by summarising the differences: You think [name of organisation/person] is the most influential and these are the second and third most influential on health system responses to drought; that these [name organisations/people] have no influence, etc.

3. Question:

- Why is this [organisation/person] the most influential?
- Why are these [organisation/person] second and third most influential?
- Why do these [organisation/persons] have no or little influence?

Discussion about NetMap [Questions will be refined and reduced in number, based on WP1 results.]

Semi-structured questions will be asked of participants to facilitate reflection about the current network and how it could be improved.

Coordination

1. What are the role and strategies of key actors in the network during a drought?
 - How about the strategies of community actors?
2. How do existing governance and leadership support or hinder these strategies?
3. What are the strengths of existing coordination approaches during droughts?

4. How do government health and nutrition services connect with community and household strategies and services?
5. How do problems and conflicts amongst actors affect the ability of the health system to respond to droughts?
6. How do the differences in influence between actors affect the ability of the health system to respond to droughts?
7. (Kenya) What difference does CMAM Surge make to relationships and links in this network?
8. How has the network changed over the past two decades? Why did these changes happen? How have these changes improved or decreased the delivery of health and nutrition services during droughts?
9. Looking to the future, what changes to the network are necessary for successful health and nutrition service delivery during droughts?
 - Who should have more or less influence than they currently have on decision-making? Why?

Early warning and health information

1. What are the strengths and weaknesses of early warning and health information in Kenya/Uganda/county/districts?
 - How timely is the current dissemination of information?
2. What enables and inhibits the dissemination, sharing, and use of early warning information?
 - Where are there blockages in the network?
3. Who are the key users of this information? What issues do they face using it?
4. Who should be using this information but is not currently? Why not?
5. What is the role of community actors in early warning and health information dissemination and use?
6. How has the network of information sharing changed over the past two decades? Why did it change? How have these changes improved or decreased the delivery of health and nutrition services during droughts?
7. How early warning information and health information be made more relevant and actionable?
8. What difference does CMAM Surge make to information sharing and drought/flood response?

Finance

1. How do the current disaster and health financing arrangements affect the capacity of the health system to respond to drought?
 - How timely are disbursements?
 - How cost-effective are they?
 - How equitable are they?
2. How has the financing of drought responses-related health and nutrition services changed over the past two decades? How have these changes improved or decreased the delivery of health and nutrition services during droughts?
3. How has CMAM Surge affected the health and nutrition financing during droughts?
4. How could they be improved?

Annex F CMAM Surge innovation history workshop agenda

Date:

Venue:

Participant list

Participant name	Organisation	Telephone number	Allowance paid?

Objectives:

1. Capture the key events and their significance, and actor roles in the history of CMAM Surge approach implementation in [country/county].
2. Identify enablers of progress and mechanisms for overcoming challenges and obstacles.
3. Facilitate shared learning amongst participants from past experiences in order to plan for the future.

Outputs:

- Timelines of key events in the history of CMAM Surge approach.
- Lessons learnt and research themes for further investigation.
- Facilitation team trained in innovation histories method.

Agenda overview

- Introduction.
- Timeline creation.
- Identifying most important events.
- Identifying critical challenges and strategies.

- Lessons learnt and themes.

Roles and responsibilities

The people who will play these roles must be identified before the workshop and participants should know who they are.

Workshop owner and chair [a key individual from a partner organisation who is in a position to act upon the findings]:

- who invites people and will use the results to inform the future work of [name of organisation(s)/programme];
- the person with the final say about what can or can't happen.

Process adviser (Matt Fortnam, lead researcher, CHC):

- providing advice and content based on experience running previous workshops.

Lead and co-facilitator (Peter Hailey, PI, and/or lead researcher):

- responsible for delivering the process that will achieve the objectives agreed with the workshop owner and process adviser;
- introducing process, facilitating steps in process;
- supervising other team members; and
- asking semi-structured questions about interesting events.

2 x note-takers (note-taker name):

- taking notes during plenary; and
- responsible for delivering the workshop report and organising others to help (the group facilitators).

Room requirements and layout

- The workshop room should be large enough to comfortably fit [number of participants].
- Put three large tables together, long enough to lay several sheets of flipchart paper to create the blank timeline.
- Set up room with PowerPoint projector and screen at the front.

Materials

[Change number of units according to number of participants]

- PowerPoint projector and white wall or screen to project onto
- Extension cables for projector and for people to work on laptops (five should be sufficient)
- Name stickers
- Flipchart paper (50 pieces)

- Sticky tape to stick flipchart paper together to form timelines
- Event slips (300)
- Blue-tac to stick event slips to timeline
- Biro pens (40)
- Assorted marker pens (24)
- Summary of event types for tables (four for each table)
- Post-it notes
- Workshop evaluation forms (40)
- Certificates of attendance (issued at close of workshop) (30)
- Research consent forms (40)

Facilitators' detailed workshop agenda

Facilitators' pre-workshop meeting to review preparations (venue, materials), workshop objectives and agenda, and run practice session.

Start time	Activity	Purpose	Responsible
0800	Registration	Register attendance and provide name label Handing out of research consent forms Showing to table and ensuring seated at correct group table [if sub-groups]	
	1	Welcome, scene-setting, and research purpose	
0900	Welcome by chair	The chair will welcome participants on behalf of themselves and the [organisation/programme they represent]	
0920		[Any customs, such as prayers, national anthem etc.; this might come before welcome]	
0930	Introduction: Putting the workshop in context	About Maintains programme; scene-setting; purpose of research Learning from the past provides important lessons for the future; guarantees of confidentiality	PI
0950	Objectives and overview of workshop agenda	Short presentation followed by Q&A, including purpose of workshop, expectations of participants, and overview of agenda	Lead facilitator
	2	Creating timelines	
1000	Introduction to activity	What have been the key events in the emergence and evolution of CMAM Surge	Lead facilitator

		approach in [country/county]? Explain the different types of event	
1010	Task A: Write events on event slips	<p>1. Ask participants to individually write down positive and negative events that they think were important in the initiation, implementation, and evolution of the CMAM Surge approach on event slips</p> <p>2. Point them towards the different event types listed on the printed sheets¹¹</p> <p>3. Support those that are unsure or quiet by asking them questions such as:</p> <ul style="list-style-type: none"> <input type="checkbox"/> When did you first hear about the idea of the CMAM Surge approach? <input type="checkbox"/> What was the first event you were involved in? <input type="checkbox"/> What has happened since then? <input type="checkbox"/> What has influenced the CMAM Surge approach (e.g. from the past or from outside country/county)? <p>4. Ask participants to stick the key events to the timeline</p> <ul style="list-style-type: none"> <input type="checkbox"/> Go from start to finish of the timeline, asking participants to stick their events on the timeline <input type="checkbox"/> Stop on each event and ask them why it was important <input type="checkbox"/> Ask the participants to consider what events are missing as you go along the timeline and add event slips where necessary <p>5. Asks questions to get more details about the events, such as:</p> <ul style="list-style-type: none"> <input type="checkbox"/> What happened? <input type="checkbox"/> When did it happen? <input type="checkbox"/> Why did it happen? <input type="checkbox"/> Who was involved? Who played the most important role? <input type="checkbox"/> How did you feel about it? Was it good or bad? <input type="checkbox"/> What were the obstacles? 	<p>Group facilitators</p> <p>Note-taker(s) record discussions and disagreement, such as why they said an event was important</p>

		<ul style="list-style-type: none"> <input type="checkbox"/> How did you overcome problems? <input type="checkbox"/> Who disagreed with it? <input type="checkbox"/> Who benefited? Who lost out? <input type="checkbox"/> What could have been done differently? <input type="checkbox"/> What did you learn? <input type="checkbox"/> What were the outcomes 	
1100		Snack break	
	3	Task B: Most important and challenging events	
1120	Introduction to task		Lead facilitator
	Rank most important events	<ul style="list-style-type: none"> <input type="checkbox"/> Ask your group to review their timeline <input type="checkbox"/> Using post-it notes (labelled 1–5), ask the group to rank the five most important events on the timeline <input type="checkbox"/> Ask them to explain each of the important events and why they were important 	Facilitators
	Rank most challenging events	<ul style="list-style-type: none"> <input type="checkbox"/> Using different colour post-it notes, ask the group to rank the five most challenging events <input type="checkbox"/> Ask them to explain why each of them were challenging 	
	4	Lessons learnt and emerging themes	
1145	Introduction		Lead facilitator
		<p>1. Ask the group to review the timeline and discuss the following questions:</p> <ul style="list-style-type: none"> a) What have been the key factors and strategies for (i) starting and (ii) implementing the CMAM Surge approach? b) Who were the most important people/organisations in the history of the CMAM Surge approach? Why? c) What were the biggest challenges and obstacles to (i) starting and (ii) 	Group facilitator

		<p>implementing the CMAM Surge approach?</p> <p>d) Who resisted the CMAM Surge approach? How did they resist? Why?</p> <p>e) Who has benefited most from the CMAM Surge approach? Why?</p> <p>f) Who has been negatively affected by the CMAM Surge approach? Why?</p> <p>g) What are the main lessons you have learnt from the history?</p> <p>h) How could the CMAM Surge approach be improved in the future?</p> <p>i) What do you want the research project to investigate further?</p> <p>2. One person from each group present back the history and the key reflections of the group [if sub-groups]</p>	Film presentations
1240		Ask participants to complete workshop evaluation forms	
1250		Lunch or close of meeting (discuss next steps)	

After workshop (same day preferably, while fresh in mind)

1. Complete preliminary analysis form as facilitation group.
2. Type up all notes and include your thoughts/reflections in different colours or in square brackets.

Annex G Innovation history interview guide

This interview guide is indicative. It will be adjusted according to the country and the interviewee's knowledge and expertise, and whether they have already been interviewed during WP1.

1. Context and purpose of research

Thank you for offering your time to take part in this research. I'd like to begin by recapping the context and purpose of this research.

The Maintaining Essential Services after Natural Disasters (**Maintains**) programme is commissioned by UK aid (Department for International Development, DFID). Maintains is being conducted in six countries: Pakistan, Bangladesh, Ethiopia, Sierra Leone, Uganda, and Kenya.

The aim of the programme is to develop an improved evidence base on how education, health, social protection, nutrition, and water and sanitation services can adapt and expand in response to shocks such as floods, droughts, and disease outbreaks.

Maintains is specifically investigating:

- how shocks **impact on essential services** in developing countries;
- the extent to which **essential services can flex and respond as a system** rather than as independent parts; and
- how essential services can best **prepare and respond to natural disasters**.

In Kenya, Maintains is a collaboration between **Oxford Policy Management (OPM)** and us, the **Centre for Humanitarian Change (CHC)**, in collaboration with the Government of Kenya and the DFID Kenya Office.

Health and nutrition are the primary focus areas for us in Kenya as they were identified as being of high interest to stakeholders and DFID. Specifically, we are exploring how the health system can be more risk informed and shock responsive? The research will aim to learn about the impacts of drought and floods on the health system, and explore how the system can be strengthened to build resilience to future shocks.

In this part of the project, we are exploring how CMAM Surge emerged and evolved over time, and how this has affected the capacity to scale up and down health and nutrition services in response to changes in demand related to droughts and other climate shocks. We are particularly interested in factors that enable and block progress in implementing CMAM Surge in [country/country] so that we can learn lessons to improve its implementation and overcome challenges when replicating it in other places.

We aim to provide an opportunity for you and other people with an interest in the CMAM Surge approach to look back at what has happened so far, learn from past experiences, and find ways to strengthen health systems in the future

Introduction

Timelines of the CMAM Surge approach were developed at the workshop [*present simplified timeline from workshop*]. We'll use this to guide us through the first part of the interview.

I would like us to review the timeline to:

- (i) identify events that are absent from the timeline;
- (ii) rank the most important events; and
- (iii) discuss your experiences of the events.

As I ask you questions, I will annotate the timeline with some of the key points and events from your interview. If you would find it useful to annotate the timeline instead of me, or together with me, please feel free to do so.

I have pre-prepared a few questions that I would like to ask you, but expect the interview to feel more like a conversation than a formal interview.

Activities

- a) I would like you to spend several minutes reading the timeline to consider whether it is missing (i) important events in the story of the CMAM Surge approach and (ii) wider influences on its development [*give interviewee several minutes to review and present list of key event types, discussing what each type of event means in turn*].
- b) From your perspective, which of the events on the timeline were the most important [*highlight events with pen*]?
- c) I'd now like us to talk about the timeline in more depth, focusing on the key events you have identified and some that I would like to know more about [*use the semi-structure to ask questions about events identified as important at the workshop and during the interview*].

Interview semi-structure

Ask questions about the important events by adapting the following questions according to the type of event:

- What happened?
- When did it happen?
- Why did it happen?
- Who was involved? Who played the most important role?
- How did you feel about it? Was it good or bad?
- What were the obstacles?
- How did you overcome problems?
- Who disagreed with it?
- Who benefited? Who lost out?
- What could have been done differently?
- What did you learn?

- What were the outcomes?

Future interviewees

In order to help me develop a representative story of the group's experiences I hope to carry out this interview with a number of additional people. From the people we have just discussed can you please recommend up to five who I should contact for interview?

- Name?
- Reason for selecting?
- Happy to share contact details?

Interview close

We're at the end of the interview now. However, there is always a chance that my list of questions may not have reflected everything you wanted to, or could have, said. So:

- Is there anything you would add to what has been discussed so far? Anything that needs to be said?
- Are there questions I should have asked?
- Is there anything else you'd like to say?

Participant details for quote checking

- How should I reach you for quote checking?
- Can I call if there are questions or clarifications that come up later?

Name	
Address	
Telephone	
Email	
Times unavailable for quote checking	

Annex H Participant information sheet



UKaid
from the British people

Participant Information Sheet

Maintaining Essential Services after Natural Disasters (Maintains) programme

Researcher names: Emily Ebelenga (Kenya Lead Researcher), Peter Hailey (Principal Investigator), and Matt Fortnam (Lead Researcher)

Invitation and brief summary

Maintaining Essential Services after Natural Disasters (Maintains) is a five-year research programme that aims to develop an improved evidence base on how education, health,

social protection, nutrition, and water and sanitation services can adapt and expand in response to shocks such as floods, droughts, cyclones, and disease outbreaks. Maintains was commissioned by UK aid (Department for International Development, DFID) and is being conducted in six countries: Bangladesh, Ethiopia, Kenya, Pakistan, Sierra Leone, and Uganda. The overall objective of the programme is to deliver, and maximise uptake of, new operationally-relevant evidence on:

- how shocks **impact on essential services** in developing countries;
- the extent to which essential services can **flex and respond as a system** rather than as independent parts; and
- how essential services can **prepare and respond** to natural disasters.

In Kenya, Maintains is a collaboration between **Oxford Policy Management (OPM)** and the think tank the **Centre for Humanitarian Change (CHC)**. Health and nutrition are the primary focus areas in Kenya as they were identified as being of high interest to stakeholders and DFID. Specifically, we are exploring how the Kenya health system can be more risk informed and shock responsive. The research will learn about the impacts of drought and floods on the health system, and explore how the system can be strengthened to build resilience to future shocks.

We thank you for considering being interviewed for this research and for your interest in Maintains. Please take time to consider the information below carefully and to discuss it with colleagues if you wish, or to ask the researchers questions.

Purpose of the research

We aim to answer the following research questions:

1. How did the Kenyan health system respond to the drought in 2018–19?
2. How can the CMAM Surge approach lessons be replicated in the wider health system and other shock contexts?
3. How can early warning systems strengthen health and nutrition system shock responsiveness?
4. How does financial planning and disbursement affect the efficiency and effectiveness of health and nutrition system shock responsiveness?

Why have you been approached?

We are interviewing key professionals working on health and nutrition issues and/or drought and flood early warning, preparedness, and response in Kenya. Information will be collected on their experiences of the shock responsiveness of the health system in Kenya, and their perspectives on how it could be improved in the future. You have been identified as a relevant person at your organisation, with relevant knowledge.

What would taking part involve?

The interview will last for approximately 1–1.5 hours and will involve an introduction about the Maintains programme and the purpose of the research, and a semi-structured conversation about topics related to health system shock responsiveness. A particular focus

will be on what happened during extreme dry periods and flood events over the past few years.

With your permission, the conversation will be digitally recorded, but anything you say will be anonymised and data will be referred to by generic organisational categories (e.g., scientist, non-governmental organisation representative), meaning you will not be personally identified and data will not be directly attributed to you.

What are the possible benefits of taking part?

By taking part in the interview you will contribute practical insights that will inform:

- policy reports for donors, government staff, and other key stakeholders to help them improve their strategies and support for the health system; and
- discussions at 'learning workshops' on the issues identified by the research and on potential solutions to make Kenya's health system more shock responsive.

All findings and tools produced during the project will be made freely available to your organisation to use and adapt.

What are the possible disadvantages and risks of taking part?

We do not believe that taking part in this interview poses any foreseeable risks to participants. The interview may discuss current inadequacies with existing approaches used in the sector, but these will not be attributed to individual participants or organisations, and will be sensitively dealt with in any publications. If there are any questions that you find too sensitive, you are welcome to not answer them or to stop the discussion.

What will happen if I don't want to carry on with the study?

You can stop taking part in the interview at any time without having to give a reason. You can also ask to withdraw any information you provided from any analysis by speaking to the researchers. From the point at which you withdraw, your data will not be included in any future analysis or publications. It will not be possible to remove anonymised data from analysis or publications that have been produced before you withdraw your data.

How will my information be kept confidential?

CHC processes personal data for the purposes of carrying out research in the public interest. CHC will endeavour to be transparent about its processing of your personal data and this information sheet should provide a clear explanation of this. If you do have any queries about the processing of your personal data that cannot be resolved by the research team, you can contact the director of CHC by emailing Nancy Balfour, nancy.balfour@whatworks.co.ke

Research data from the interview will be transcribed or converted into soft copy, and copies will be retained by the research team. All data will be kept on password-protected computers.

Personal data of interview participants (e.g. email contacts) will be retained on password-protected computers for the purposes of sharing research outputs and coordinating future activities.

Both research data and personal data will be destroyed five years after the completion of the Maintains programme. You can request for research and/or personal data to be deleted before that time.

Will I receive any payment for taking part?

There are no per diems or financial incentives offered under the Maintains programme funding for this interview.

What will happen to the results of this study?

The results of this study will be disseminated in a technical report and in academic publications and conferences. They will also be discussed in Maintains programme meetings, and may be used for other activities, such as research-led teaching.

Access to all of the project's outputs will be made available through the CHC website: <https://whatworks.co.ke/>

Who is organising and funding this study?

This interview is being organised by Emily Ebelenga, in collaboration with Peter Hailey and Matt Fortnam. The interview is part of the Maintains programme, funded by UK aid (Department for International Development, DFID).

Who has reviewed this study?

This study has been reviewed by [Pwani University ethics board, add ethics approval reference] and approved by [NACOSTI approval reference].

Further information and contact details

Please contact the CHC research team for any further information:

Ms Emily Ebelenga, emily.mbelenga@whatworks.co.ke, (+254) 722 421 323

Mr Peter Hailey: peter.hailey@whatworks.co.ke

Dr Matt Fortnam: matt.fortnam@whatworks.co.ke

Annex I Consent form

Maintaining Essential Services after Natural Disasters (Maintains) programme

CONSENT FORM

Please note that if you have any unanswered questions about this study then you should NOT complete this form.

PLEASE PUT YOUR INITIAL IN ALL THE BOXES

1	I confirm that I have read and understood the information sheet provided for the above study dated and have had the opportunity to discuss the study with the researcher. I do not have any further questions about this study.	
2	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.	
3	I understand that the data collected during this study will remain strictly confidential and accessible only to appropriate members of the research team for a period of five years after the completion of the Maintains Programme.	
4	I understand that data from this interview/focus group will be used in reports, academic publications, conferences, and teaching materials.	
5	I understand that parts of the interview/focus group will be audio-recorded and I have the right to ask not to be recorded.	
6	I agree that my contact details can be kept securely and used by researchers from the Kenya Maintains programme team to contact me about its findings. I understand that these details will be deleted five years after the completion of Maintains.	

Name of participant: _____

Date: _____ Signature: _____

Copied – one for participant; one for researcher