Dietary Transitions in African Cities: A Study of Nairobi, Kenya

Leveraging Evidence for Interventions and Policy to Prevent Diet-Related Non-Communicable Diseases (TACLED project)

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List of Abbreviations

AMREF	Africa Medical Research Foundation
APHRC	African Population and Health Research Centre
BMI	Body Mass Index
FBDGs	Food-Based Dietary Guidelines
GIS	Geographic Information System
GPS	Global Positioning System
HICs	High Income Countries
LMICs	Low Middle Income Countries
NCDs	Non-Communicable Diseases
WHO	World Health Organisation

Project Title

Dietary transitions in African cities: *Leveraging evidence for interventions and policy to prevent diet-related non-communicable diseases (NCDs)*

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ABSTRACT

Background: Africa is experiencing rapid urbanisation partly driven by increasing migration of individuals to cities. Dietary habits are also changing with increasing consumption of unhealthy foods. Such changes have resulted in increasing levels of obesity in cities, with rates higher among women. Policy responses have been limited in success so far, and are mostly influenced by experiences in higher income countries. There is also a lower understanding of the factors that drive food consumption in Kenya, particularly the role that people's social networks and the neighbourhoods that individuals live in play in driving these relationships.

Objective: This project aims to explore the factors associated with people's food consumption and their food environments (where, when and with whom they eat) in Nairobi, Kenya.

Methods: This is a cross-sectional descriptive study, employing a mixed methods approach to data collection and analyses, including a **survey and anthropometric measurements**, **24 hour dietary recall** to collect information on participants' food consumption, **photovoice and qualitative interviews** to explore the social, economic, and physical factors influencing participants' food consumption, and **spatial (GIS) data collection** on the features of the participants' neighbourhoods that may influence food choices. The findings will be shared with experts and policy makers for discussions on designing effective strategies to improve dietary patterns and practices to tackle obesity and related non communicable diseases.

Data Analysis: Anonymised quantitative data will be analysed using STATA, and will involve descriptive and correlational analyses. Qualitative data will be transcribed verbatim, and the word files coded in NVivo. Thematic analysis will then be used to identify emergent themes from the interview data . The GIS data will be analysed using open source software R- and QGIS- data.maps.

Study Duration and Budget: The study duration is two years, with a budget of $255,432, awarded by Medical Research Fund - Global Challenges Research Fund.

I. BACKGROUND AND INTRODUCTION

Africa is experiencing a nutritional transition with changing dietary patterns, related to rapid urbanization (1). The overconsumption of unhealthy (energy-dense and nutrient-poor) diets is implicated in the onset of diet-related NCDs (2,3). Unhealthy diets are also associated with lower micronutrient intake, which remains prevalent in Africa (4,5). As a consequence, obesity and diet-related non communicable diseases (NCDs) are rapidly increasing and becoming a critical public health problem (3). Kenya exemplifies this trend in the African region, as it is experiencing rapid urbanisation, accompanied by increasing levels of overweight/obesity and related NCDs (6,7), with higher levels among urban residents, and women in particular (8–10). NCDs in Kenya account for 27% of total morbidity and are now recognised as a pressing health concern, with the recent publication of national NCD prevention strategy including interventions to promote healthy diets (11). Evidence for developing interventions and policies in low and middle income countries (LMICs) including Kenya comes mainly from high income countries (HICs). Whilst useful, it is important to investigate the environments that people live in, so that policies and interventions are context and culturally specific.

Rapid urbanisation is implicated in changing diets, as it leads to changes in the social and physical environments that people inhabit, shifting food habits and practices (12,13). There is however a lack of evidence about how these environments drive these shifts in food consumption in a Kenyan context and especially in urban settings where overweight, obesity and related NCDs are a growing problem.

In order to address this gap, the government of Kenya has developed national guidelines for healthy diets and physical activity, soon to be launched. This will act as the foundation for the process of developing food-based dietary guidelines (FBDGs) in Kenya, with the goal for the project team being to contribute to the process of developing these guidelines. FBDGs are interventions that promote healthy diets; however, they are yet to be implemented in this setting, and partly due to lack of local evidence on food consumption practices, and the physical and social influencers of these practices.

By investigating the role of urban social and physical environments, emerging public policies and recommended interventions, this study will provide the much needed evidence to inform context-specific intervention including Kenyan based intervention as stipulated in the NCDs prevention and control policies including the FBDGs.

II. REVIEW OF LITERATURE

Urbanisation is defined as the increase in the population living in urban areas, mainly as a result of rural-to-urban migration (17). Africa is among the regions with the highest rates of urbanization, and it is projected that about two thirds of the population will be living in urban areas by 2050 (18). Kenya like other African countries is urbanizing rapidly, with about a third of its population residing in urban areas, and expected to rapidly increase in coming years (6). Rapid and unplanned urbanization in developing countries has been associated with various emerging environmental and health hazards (17), including an increased risk of NCDs such as hypertension, heart diseases, and diabetes (19). It is also associated with dietary transition owing to rapidly changing social and physical environments, food habits, and practices such as a proliferation of fast-foods, often high in trans fats, salt, and sugar (20,21). This, combined with reduced energy expenditure, which is increasingly common among urban labourers, particularly those working in desk-jobs, means that NCDs and their risk factors in developing countries are advancing more rapidly in cities (21,22).

Over consumption of unhealthy diets for long periods of time is related to the onset of overweight, obesity and other NCD risks (2). Poor dietary practices, including high cholesterol and alcohol intake, have been documented among urban dwellers and higher socioeconomic populations in Kenya (15). Other studies also show an increased prevalence of overweight and obesity in both children and adult populations, with higher proportions observed among urban compared to rural dwellers (8), and among women compared to their male counterparts (9,15). The prevalence of overweight and obesity among women increased by about 10 fold (25% to 33%) from 2008 to 2014 (7). Similarly, NCDs are on the rise in the country, accounting for about a third of all deaths and half of all hospital admissions (8). The national NCDs prevention and control strategy calls for improved policy formulation, legislation, and interventions to promote healthy diets. For successful development of such interventions and policies, it is important to investigate the prevailing food practices, the physical environment and social factors influencing these practices, and how habits related to food consumption are structured and organised, including when, where, and with whom unhealthy foods and beverages are consumed (16). The strategy further highlights a paucity of data to facilitate planning, policy formulation, regulations, and legislation, in empowering individuals to make informed decisions with regards to prevention and control of NCDs as a barrier in the prevention and management of NCDs. Community-based interventions that promote healthy lifestyles and behaviour are recommended as one approach in the management of NCDs and its prevention of

associated risk factors.

III. PROBLEM STATEMENT

There is lack of country specific evidence about how food environments (physical and social) drive the shifts in food consumption patterns and practices in Kenya. This project aims to fill this gap by gathering and synthesizing evidence on how urban social and physical environments influence food consumption, and emerging public policies and programs, to inform the design and implementation of such interventions that are context and culturally-relevant and that are cognisant of a need to reduce social and gender inequalities, making them more likely to positively impact on the fight against NCDs. This will include the development of dietary guidelines, as a practical development tool for policy makers, with evidence-based messages aimed at preventing diet-related NCDs and other forms of malnutrition (23). The focus will be on commonly consumed foods, using language and symbols that the public can understand with ease. In Africa, only six countries currently have national dietary guidelines, including Seychelles (first developed in 2006), Namibia (2000), Nigeria (2001), South Africa (2003), Benin (2015), and most recently Sierra Leone (2016) (24). Kenya has no national dietary guidelines; however, there is some progress towards their development. Of importance, will be to ensure that they are relevant to the local context. It is also important to consider that many dietary guidelines have several elements in common, for example, most promote increased consumption of a variety of plant-based foods, as well as reduced intake of trans fats, salt, and sugar. Dietary guidelines are therefore an essential step in supporting broader development of interventions and policies to promote healthy dietary habits.

III. RESEARCH OBJECTIVES

1. To assess the current food consumption patterns and practices and their evolution over time in Nairobi, Kenya;
2. To explore how social environments (family, friends, peers, social support, social norms), economic and physical environments (home, work, school, neighbourhoods, food outlets) influence food consumption in Nairobi, Kenya;
3. To investigate the relationship of diet with other health behaviours (physical activity, smoking status/tobacco use, and alcohol use) in Nairobi, Kenya;
4. To identify context-relevant interventions and policies to improve food consumption

practices (to prevent diet-related NCDs); and,

5. To facilitate knowledge translation pathways into intervention/policy to prevent diet related NCDs.

IV. CONCEPTUAL FRAMEWORK AND OPERATIONALIZATION

Our study uses a socio-ecological framework approach developed by Story et al 2008 (*Figure 1*) to examine the factors in the social and physical environments that drive food and beverage consumption. We chose this framework because it goes beyond focusing on individual-level drivers. Individual-level approaches have limited success when they do not account for wider contextual factors (26,27) that drive food choice in an individual's social, physical and macro- environments (25,28,29).

Figure 1: *Socio-ecological model of food choice*
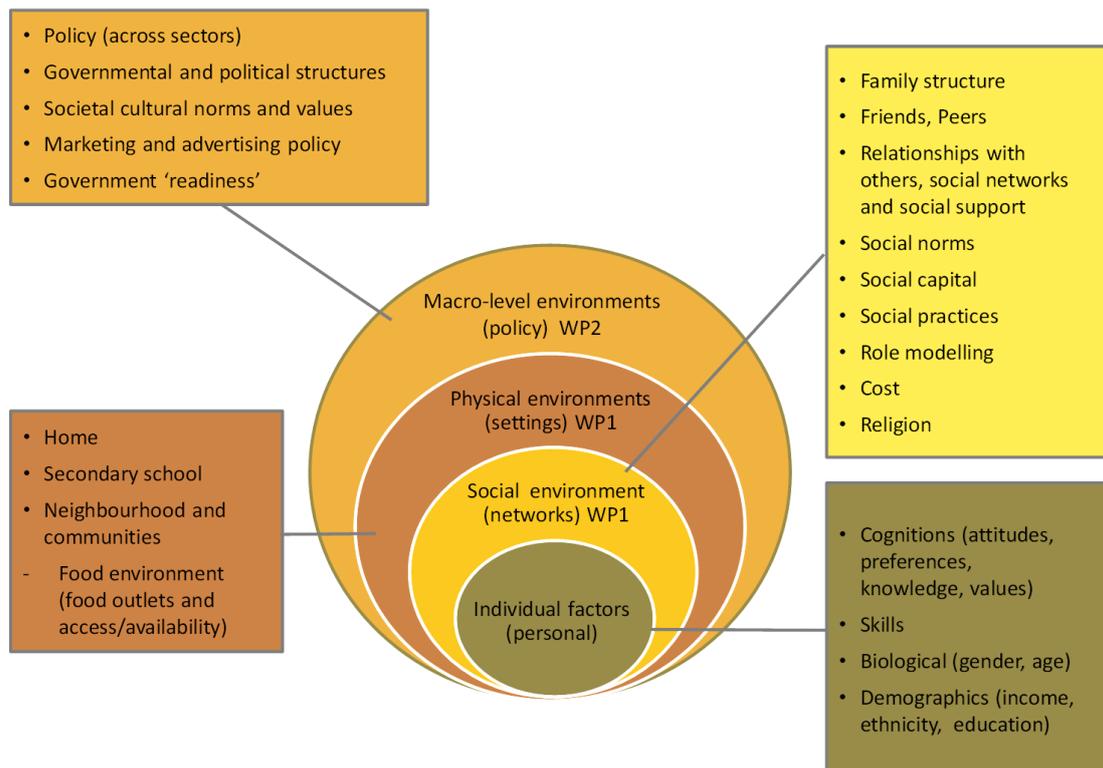
Adapted from Story et al., (2008) *Annu. Rev. Public Health*; 29:253-72

By focusing on the environments that drive food and beverage consumption, emerging interventions tackling these contextual factors will also benefit those who influence decisions about the family's diet, for example, husbands/grandmothers, thereby increasing impact. We will use this framework to guide the exploration of food consumption practices in an urban setting, the physical

and social environmental factorst associated with these practices, and the identification of context-relevant interventions and policies that can improve food consumption practices in order to prevent diet-related NCDs in the Kenyan urban context.

V. RESEARCH QUESTIONS ADDRESSED

1. What are the current food consumption practices in Nairobi, and how have they evolved over time?
2. What social, economic, and physical environments influence food consumption practices in Nairobi?
3. What context-relevant interventions and policies can improve food consumption practices in order to prevent diet-related NCDs?

VI. STUDY DESIGN AND SAMPLING STRATEGY

Study Design and Population

The study will employ a cross-sectional descriptive study design utilising a mixed-method approach, including a screening quantitative questionnaire and anthropometric measurements, 24-hour dietary recall, photovoice and qualitative interviews, and spatial data collection (GIS mapping), supported by systematic review and meta-analyses, to better understand dietary patterns and the macro, social, and physical environmental factors associated with dietary habits.

STEP 1 - Quantitative survey and anthropometric measurements: We used data from the Kenya National Bureau of Statistics (KNBS) to identify the deprivation level of locations (wards) in Nairobi, and randomly selected a location from within Makadara Constituency, in which we could feasibly work. This component of the work will involve recruitment of a sex-balanced sample of participants, half of low-income status, and half of low-to-middle-income status, who will be required to complete a screening questionnaire including questions on basic demographic information such as age, education, occupation, income, and health behaviours. Their height and weight will also be measured to allow derivation of their Body Mass Index (BMI). This component of the work will be a screening step (to assess whether they meet the inclusion criteria in the quota sampling plan) for the selection of 144 individuals for the subsequent step of data collection as detailed in *Table 1* and may require an oversampling of individuals in order to meet the minimum numbers in each strata.

Given the largely qualitative nature of this work, our focus will be on covering the relevant

domains that could potentially affect our primary variables of interest and to achieve saturation of ideas in these domains. We will begin by explicitly recruiting participants that account for age, BMI, occupation and economic status, to ensure breadth in the range of views and environments that participants are exposed to, ensuring that the FBDGs that are developed and potential policy/interventions identified are broad reaching. This overall sample size of 24 participants per age strata for males and females is deemed sufficient to attain saturation.

STEP 2 – 24 hour dietary recall: In this step, we will interview a sex-balanced sample of **144** selected socio-economically diverse participants, stratified by age, current working status, and BMI category, with 6 participants in each strata as illustrated in *Table 1*. Flexibility will be observed to allow additional recruitment of participants in other domains should ideas begin to emerge from one case that are different and not reinforced by other cases in that strata. This will avoid knowledge being dismissed from one case without further exploration. Quota sampling and random selection of participants will be employed to achieve saturation of ideas in each strata.

Table 1: Sample Selection for 24 Hour Dietary Recall (n=144)

Participants	Lowest SES				Low-to-middle SES			
	Not working or in school		Currently working or in school		Not working or in school		Currently working or in school	
	Healthy weight	Overweight/Obese	Healthy weight	Overweight/Obese	Healthy weight	Overweight/Obese	Healthy weight	Overweight/Obese
13 – 18 (adolescents)	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female
19 - 49 (adults)	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female
50+ (older adults)	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female	3 male 3 female

NOTE: Participants characteristics will be established in the quantitative survey (Step 1).

STEP 3 - Photovoice and qualitative interviews: This component of the work will require recruitment of a sex-balanced sample of **48 participants** stratified by age, current working status, socioeconomic status, and BMI category, with 2 participants from each strata as illustrated in *Table 2*. It is important that these participants have completed the 24 hour recall dietary recall. The participants will be trained on the type of photographs that are appropriate for this activity. They will also receive cameras from trained field staff members, and will be asked to spend the week taking photographs that depict their food environment. The photographs they capture will be reviewed by trained field staff members and up to 5 of the most meaningful photographs to the participant or the most diverse with respect to what they represent will be selected for discussion during audio-recorded qualitative in-depth interviews. The participants will then work with the field staff members to

develop brief captions or descriptions of what their photographs represent.

Table 2: *Sample Selection for Photovoice (n=48)*

Participants	Lowest SES				Low-to-middle SES			
	Not working or in school		Currently working or in school		Not working or in school		Currently working or in school	
	Healthy weight	Overweight/Obese	Healthy weight	Overweight/Obese	Healthy weight	Overweight/Obese	Healthy weight	Overweight/Obese
13 – 18 (adolescents)	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female
19 - 49 (adults)	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female
50+ (older adults)	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female	1 male 1 female

NOTE: Participants characteristics will be established in the quantitative survey (Step 1).

Inclusion Criteria

The study shall be conducted in Makadara Constituency, located in the Eastlands suburbs of Nairobi city. Residents in this area represent a majority of ethnic tribes in Kenya, and are mainly tenants, paying monthly for their occupancy. As detailed in tables 1 and 2, this study will focus on adolescents (13 to 18 years), adults (19 to 49 years) and older adults (50 years or older) residing in the study area. A sex-balanced sample of 144 participants representing different socioeconomic and employment or schooling status, will be recruited to participate in the study. Participants will be recruited if they are willing and consenting to participate in the study. For those 13 to 17 years, parental consent, and participant assent will be obtained prior to participation.

Exclusion Criteria

Physically or intellectually impaired individuals will be excluded, since this may hinder clear communication and accurate anthropometric measurements. No other exclusion criteria will be employed.

STEP 4 – Spatial (GIS) mapping: This component of the work will involve geocoding of food locations in the same socio-economically diverse community identified in Step 1 above that participants live in, using 1 Kilometre radii buffers of locations (10 minute walking time from their homes) to measure the local food environment. Data will be obtained through primary data collection by walking in the neighbourhood, and recording the location/type of food outlet, recording all instances of external marketing of unhealthy foods/beverages. Data collected will be geocoded using GPS coordinates and input into a GIS software to produce maps to understand how the food

environment varies spatially in the study location. The map will also be triangulated with the qualitative data collected in Step 3 above to understand how the 'objective' food environment relates to the 'subjective' food environment.

STEP 5 – Supportive background work

(**a**) *Synthesis and meta-analyses* of existing secondary data will be done to identify the extent of data availability on food consumption patterns and dietary practices in urban areas in Kenya. This will be part of an identical, integrated process led by Loughborough University in collaboration with partners in Ghana. We will engage with key stakeholders during the literature identification process and follow standard procedures outlined in the Cochrane Handbook for conducting reviews (25). Some of the datasets that will be used include the food consumption dietary patterns data in urban areas collected in the Kenya Stepwise Survey for NCD risk factors in 2014 (8), and data on anthropometry, diet, and diet-related NCDs among slum-dwelling adults 18-65 years collected by APHRC in 2012 -2014. Where possible, the analyses will include a breakdown by sex and socioeconomic status. In addition, a *systematic review* of the factors influencing food consumption patterns/practices in urban African cities will be conducted. This review will be led by University of Sheffield in collaboration with partners in Ghana. This review will allow for the mapping and categorisation of existing literature and identification of the gaps in research (30). Observational and intervention studies, using quantitative, qualitative or mixed methods will be included. All studies that identify an association between a factor (including correlates, predictors, moderators, determinants and mediators) and food consumption patterns and practices will be retained. A similar method was used in a systematic mapping review of the factors influencing dietary behaviour in ethnic minority groups living in Europe (31). The review protocols will be registered with PROSPERO and we will follow standard procedures as detailed in the Cochrane Handbook. Two independent reviewers will be used at appropriate stages of the review process, for example, during title/abstract review and selection, during full-text review and selection, or during quality grading using recognised quality assessment tools. We will also follow best practice reporting guidelines (e.g. PRISMA-P, PRISMA, MOOSE and RAMESES).

(b) Benchmarking food environments using the food environment policy index (Food-EPI) tool

Realising that comprehensive actions by governments and the food industry are needed to achieve global targets to halt the rise in obesity and diet-related NCDs, the International Network for Food and Obesity/Non-Communicable Diseases Research, Monitoring and Action Support (INFORMAS) was formed to monitor and benchmark food environments, relevant government policies, and private

sector actions, with the goal of increasing accountability and action by relevant stakeholders. INFORMAS developed a healthy food environment policy index (Food-EPI) tool (32) for use in assessing the extent of government policy and infrastructure implementation on food environments in comparison to international best practice in the creation of healthy food environments to reduce obesity, NCDs, and their related inequalities. The goal of the Food-EPI assessment is to identify and prioritise actions needed to address critical gaps in NCDs related nutrition policy and strategy implementation (32).

The Food-EPI tool includes various domains for which a monitoring framework has been designed and the indicators determined. There are *process domains,* which focus on monitoring the policies and actions of public and private sector organisations impacting on food environments and obesity or NCD prevention. There are *impact domains*, which focus on monitoring the key aspects of food environments, including the nutrient composition of foods, food labelling, exposure of children to food promotion, food provision, the availability and accessibility of food in communities, food prices and affordability of foods and aspects of food in trade and investment agreements. There are also *outcome domains*, which focus on monitoring population risk factors (including behavioural, physiological and metabolic risk factors), population diet quality, and health outcomes. There are a set of global good practice indicators for each domain, against which a national expert panel will be tasked with assessing the extent of implementation.

The following steps will be involved in the benchmarking food environment process, using the Food Epi Tool.

1. Collection of relevant policy documents and policy scan to gather evidence

2. Validation of evidence document with government officials

3. Collection of benchmarks for each of the policy and infrastructure support indicators

4. Pilot testing of the rating workshops (optional, dependent on budget)

5. Rating workshops to rate the extent of government policy implementation and propose concrete actions to move the domain actions ahead

6. Prioritization of proposed policy and infrastructure support actions by an Expert Panel

7. Generation of databases, data analysis, and indicators

8. Feedback of results

VII) DATA COLLECTION METHODS

a) Data collection

Quantitative survey data collection

Quantitative data will be collected through interviewer administered questionnaire, using electronic data capture gadgets (tablets). The data to be collected will mainly include:

1. Participant's sociodemographic, economic, and health behaviour characteristics; and,

2. Food consumption (type and quantity) from 24 hour recall.

Anthropometric data collection

Anthropometric measurements including height and weight measurements will be collected. Body weight and height, in light dress and without shoes, will be measured in kilograms (kg) using an electronic scale and a portable stadiometer (SECA 217). For accuracy and reliability in the measurements, two measurements will be taken and the average obtained. From these measures we will be able to determine BMI, and categorise individuals into underweight, healthy weight, overweight, and obese using the WHO cut-points (33).

24 hour dietary recall data collection

This will be accomplished by face-to-face interviews to explore the participants' food consumption patterns. Interviewers will record all food/drink consumed inside/outside the home by the participant in the previous 24hr period excluding weekends, also recording how long a food event lasts ('tempo'), time of day of the food event ('periodicity') and who participants eat with and where ('synchronization') in order to ascertain the place of unhealthy foods in their everyday lives. A score specifically focusing on unhealthy foods consumed will be developed and will guide analyses of the 24 hour recall interviews after categorisation of food items into an analysis framework. We will explore what drives unhealthy food and beverage consumption by analysing how 'tempo', 'periodicity' and 'synchronization' are associated with the overall diet quality. These findings will also be triangulated with some of the findings from the photovoice activity as described below.

Photovoice

Photovoice is a participatory visual qualitative methodology of research whereby participants are given a camera and asked to take photographs that represent their situation in relation to a particular topic or research question. Participants can then discuss what the photographs represent. Photovoice allows researchers to see 'through the eyes' of those who are often the most marginalised in the research process. It gives the participants an opportunity to capture the conditions around them,

reflect on these conditions or their experiences, and develop strategies to reach policy-makers. In this study, participants will use photography to identify characteristics in their social and physical environments that drive unhealthy food/beverage consumption. The process will start with training participants on using digital cameras and how photographs may be used to capture images that address the research topic. In addition, the participants will be taken through the research objectives in order to ensure that they understand the goals of the photo taking exercise. Participants will receive cameras from the research team and will be asked to spend the week taking photographs that depict the foods that they eat as well as their physical and social eating/food environments. Trained research team will conduct peroiodic checks as needed during the Photovoice exercise, and will work with the participants to select the most suitable photographs. They will discuss the photographs with participants, what the photographs represent, and captions will be developed to briefly explain the context of the photographs. These discussions will be recorded digitally and later transcribed verbatim.

GIS mapping of the physical food environment

GIS data will be collected by walking in the same neighbourhood that participants live in, as established through previous interviews, using 1km radius buffers of locations (10-minute walking time from their homes) to measure the local food environment. We will record the location and type of food outlet, recording all instances of external marketing of unhealthy foods/beverages. Data collected will be geocoded using GPS coordinates and software that will produce maps to help better understand how the food environment varies spatially in our study locations.

b) **Training of interviewers and piloting**

Data will be collected by qualified and carefully trained data collectors in line with APHRC's training requirement. Qualitative data collection will be undertaken by trained field interviewers with college or higher level of education (preferably in nutrition or health related field) and with previous experience in qualitative data collection in an urban setting. Quantitative data will be collected by carefully trained field workers with a grade of C+ or above in the Kenya Certificate of Secondary Examination (KCSE), and with experience in quantitative data collection. All field workers will be expected to be fluent in both English and Swahili, with a preference given to interviewers residing in or near the study area. After recruitment, research experts on the different methods of research as detailed above from within the team will conduct a week-long training of field interviewers on ethics for research with human participants, data collection procedures, ensuring good quality data, and

reporting. Consistent check-ins with the interviewers will be used as an approach to ensure high quality data is captured.

c) Management of data quality during field work

To ensure that high quality quantitative data is collected, validation rules, constraints or checks (skips) in the questionnaire will be embedded within the data collection electronic software during programming of the tool. This will allow the interviewers to quickly notice missing data and implausible or out of range values. The data collection program will also be tested severally prior to data collection. Regular spot checks by the project team with field interviewers, and an automated routine check on data completeness and discrepancies will also be implemented to enhance data quality. Interviewers will be responsible for following-up on any inconsistencies or errors in the data with their participants as/when needed.

To ensure that high quality qualitative interviews are conducted, the research team will sit-in on a select number of interviews, also regularly review the data collected for quality. Regular debriefing sessions with the interviewers will also ensure that emerging ideas are followed-up on in subsequent interviews. In addition, transcripts will undergo data verification by checking them to confirm accuracy against the original audio-recordings.

A GIS expert from the University of Liverpool will provide training to ensure that the spatial data collected during the study meets high standards and is adequate for analyses. For the meta-analyses and systematic review, highly qualified collaborators with vast experience in this area of work will guide this component, and ensure that best practise is adhered to during all steps of the process.

d) Ethical considerations

Primary data collection for this study will involve human subjects. As such, we will observe all the ethical principles of justice, beneficence, and respect. The co-principal investigators and the co-investigators have all received certified training on ethics in research involving human subjects. We will also seek ethical clearance from the Amref Health Africa - Ethical and Scientific Review Committee (Amref-ESRC- ESRC).

All data collection tools, guides, participant information sheets, and consent forms will be translated into Swahili, and will be shared with the Amref Health Africa – ESRC. This will allow for participants whose preference is Swahili to participate with ease. Interviewers will also be recruited based on their expertise in both English and Swahili for the same reason.

The study sample will comprise of adolescents and adult participants 13 years of age and

older. The inclusion of adolescents is important for the development of food based dietary guidelines, but has been restricted to those 13 years or older owing to the challenges of conducting accurate dietary recall data from younger adolescents (10 to 12.9 years). Further, for participants 13-17 years of age, we will seek to complete the quantitative survey including questions on sociodemographic and economic characteristics with their parent or legal guardian.

All participants will receive an information sheet and a clear verbal explanation of the different steps of the research process prior to signing consent or assent forms. Written informed consent will be obtained from all adult participants. Written informed consent will be obtained from adult legal guardians of those 13-17 years, and an assent from participants 13 to 17 years of age. Interviewers will inform participants from the very start that participation in the study is voluntary, and that they may choose to withdraw from the study or decline to respond to any question that they are not comfortable answering at any time and for whatever reasons without fear of repercussions. Any individual who does not want to participate will not be recruited. Participants will also be notified that their identifying information will be kept confidential. Confidentiality for respondents participating in the study will also be enhanced by conducting interviews in home-settings or other private settings where respondents are comfortable. Identifying information including names, addresses, and telephone numbers will be stored separately from their questionnaire data, and destroyed after 2 years, after which, only anonymised data will be available to researchers. The data provided by respondents will be used for research purposes only and will not be presented in any way that may allow the identification of the respondents or facilities.

The risks associated with participating in this study are minimal. In the case of photovoice, due to the visual component of the work, participants taking the photographs will be trained on the idea of a 'No Faces' protocol, such that participants are aware not to reveal people's identities, and when they do, ensure that those captured have given consent for their photographs to be taken. All visual data and interview data will be saved on a password protected server to which only the core members of the research team will have access.

There will be no direct compensation to respondents for participating in the screening survey and 24 hour recall component of the study; however, we will explain the importance of their participation in informing policy and interventions that would benefit their community and the general population. Participants will be reimbursed for transport costs if/when required to travel to a venue for research purposes. During longer meetings, meals/snacks will be provided. Participants in the photovoice activity will also be allowed to keep the cameras that they will be using once they have completed their photovoice exercise.

VIII) DATA PROCESSING AND ANALYSIS

All digital project data will be stored in encrypted computers or laptops that are password protected, with regular back-up procedures to the server put in place to ensure that the data is not lost. All survey data will be collected via password protected tablets and uploaded to a secure cloud-based data depository after completion of the survey. Data will then be deleted from the tablets. Non-anonymized data will be stored on a secure, password projected server made accessible only to the core research team. All data will be anonymized before being made available to other project staff, ensuring the confidentiality of data following collection. The University of Sheffield's Shared Network Storage system will be used as a secondary secure back-up folder, made available to core members of the research team there. This is a secure on-line repository for data sharing with regular backup of all University file storage for disaster recovery purposes. Clear labelling of versions and dates will also ensure data management integrity. Quantitative data will be analysed using STATA, SPSS and/or MLWin files. Prior to data sharing, it will be anonymised. The primary aim of the analyses conducted will be to answer the research questions outlined in the protocol. Quantitative data analysis will mainly be descriptive. Qualitative interviews will be audio-recorded on encrypted recorders, transcribed verbatim (and translated/transcribed as needed), anonymised and stored in digital format (MS Word compatible). A qualitative software package (NVivo) will be used to code the qualitative data and support analyses. Thematic analysis will be used to identify specific themes from the individual interviews using NVivo. Coding and interpretation will be undertaken by at least two members of the research team to ensure objectivity and consistency during coding. Matrix comparisons will be undertaken to compare themes between age, current working status, socioeconomic status, and BMI strata. An estimated 200 photographic images will be generated from digital cameras for storage in jpeg/png formats and for potential use in photo exhibitions.

The GIS data will be stored (and made available) in separate shape files and a text file of all analytical data combined. Analyses will use open source software R- and QGIS- data.maps. The GIS mapping exercise will also be triangulated with the 24 hour dietary recall data to improve our understanding of how 'objective' food environments relate to 'subjective' food environments.

1X) PLANS FOR COMMUNICATING THE FINDINGS

Engagement, communication and dissemination with academics and wider communities (e.g.

key informants, policy makers and media) will take place through knowledge translation and research uptake activities; open access publications; conference presentations; and via a project website and social media platforms.

1. **Research uptake by academic and wider audiences**

i. Photography exhibitions within and outside the country focusing on the drivers of dietary patterns and practices. The photographs, maps, and captions displayed during the exhibitions will stimulate awareness and discussions about the research among academic researchers, the media, and the wider audiences, extending our network across disciplines (e.g. photography, human geography, nutrition and health sciences, public health, clinical sciences, demography, anthropology). The web-based version of the exhibition will also promote findings of the study among wider audiences.

ii. Policy briefs and press releases with evidence to strengthen interventions that promote healthier diets. The team has established links with policy makers, which will facilitate dissemination of the findings to the relevant ministries and government departments. Press releases will also be an approach used to get information on the study findings out to media and journalists.

iii. A deliberative workshop with key stakeholders, including government ministry representatives (of health, education, food and agriculture, employment and social welfare, urban development); the UN Scaling-Up Nutrition (SUN) networks (a group of influential leaders such as state officials, donors, civil society, businesses, and academics) aiming to drive changes and progress in nutrition in Kenya; academics working in nutrition-related disciplines; and, key members of international organisations (WHO, FAO, IFPRI) will be invited to participate in our stakeholder meetings. The focus will be on garnering buy-in from the start, and disseminating and communicating our findings on prevention and management of unhealthy dietary patterns and practices and diet-related NCDs in Kenya.

iv. An international Africa-wide webinar, conducted in both English and French, to be used as a means to disseminate the study's findings to stakeholders in the whole of the African region, UN agencies and NGOs. These events will be promoted through the African Nutrition Society networks.

2. **Academic papers, conference presentations, and research seminars**

Resulting manuscripts will be published open access in journals such as Nutrition Reviews and Public Health Nutrition, and key findings presented at conferences such as the International Congress of Nutrition, the World Congress of Nutrition, and the African Nutrition Epidemiology Conference. Research seminars will be hosted by various research groups across Kenya, Africa, and the UK. Publications, presentations, and seminar discussions will be shared on the project website.

3. Social media and the project website

The project website will serve as a knowledge-sharing platform, and will be regularly updated with reports, publications, presentations, photographs, press releases, related research blogs, and webinars based on study findings. Twitter and other social media will be used to send alerts about upcoming events and provide updates to ensure a maintained interest in and appetite for the results of the study throughout its duration.

X) STUDY RISKS AND LIMITATIONS

Limitations of the study design include the short-term duration of the project, which will limit the extent of causal inferences made based on the data collected, and that the results only provide a situational (current) understanding of the relationships under investigation. Nonetheless, the multiple yet complementary methods of research that will be employed will adequately allow for the exploration of factors associated with food consumption patterns and practices in Nairobi, in the context of a growing incidence of NCDs in the country.

Overall, this project is expected to pose few risks to the participants, their families, and the community, and we anticipate that it will be favourably received by the community. We believe that the minimal chance of risk is acceptable in light of the benefits of the research project. Participant informed consent and confidentially will be adhered too strictly.

XI) MANAGEMENT AND ORGANISATION OF THE STUDY

a) Team members, their roles, and management procedures in the study

Applicants	Area of Expertise	Key Role in the Project
INVESTIGATORS		
School of Health and Related Research (ScHARR), University of Sheffield, UK		
Michelle Holdsworth	Public health nutrition	**Co-Principal Investigator in UK:** Project co-ordination, lead systematic mapping review and conceptual framework development.
African Population and Health Research Centre (APHRC)		
Elizabeth Kimani-Murage	Public health nutrition	**Co-Principal Investigator :** Contribute to technical aspects of fieldwork, benchmarking of food environments, FBDGs development, photography exhibition, and the stakeholder engagement.
Joseph Mogendi	Public health nutrition	**Project Manager in Kenya:** Lead research activities including fieldwork, benchmarking food environments,

		contribution to FBDGs development, photography exhibition, and stakeholder engagement.
Gershim Asiki	NCD risk research	**Co-Investigator**: Contribute to data analyses, benchmarking food environments, FBDGs development, photography exhibition, and stakeholder engagement.
Dickson Amugsi	Public health nutrition and urbanisation	**Co-Investigator**: Contribute to data analyses, benchmarking food environments, FBDGs development, photography exhibition, and stakeholder engagement.
Milka Njeri	Public health nutrition	**Research Officer:** Oversee the recruitment of research participants and facilitate training for data collectors. Coordinate implementation of the work plan and logistical assistance to field team.
Teresia Macharia	Public health nutrition	**Research Officer:** Assist with overseeing the recruitment of research participants and facilitating training for data collectors. Assist with coordinating implementation of the work plan and logistical assistance to field team.
COLLABORATORS and TECHNICAL ADVISORS		
School of Health and Related Research (ScHARR), University of Sheffield, UK		
Amy Barnes	Health policy processes in Africa, systems approaches to understanding policy	Benchmarking food environments and policy brief development
Andrew Booth	Evidence synthesis in Africa, evidence-based practice, knowledge translation	Realist review of interventions and methodological input to the meta-analysis and systematic mapping review
Centre for Global Health & Human Development, Loughborough University, UK		
Paula Griffiths	Social demography, social statistics, nutrition transition, neighbourhood health in Africa	Training on secondary data analysis and in using Photovoice and oversee its use.
Emily Rousham	Anthropology, transitions, obesity prevention in Africa, socio-economic inequalities	Systematic review and meta-analysis of dietary patterns and evidence of changes in over time.
Marco Bohr	Community Photography, Photovoice	Training in taking photographs, and lead the design of photography exhibition.
Department of Geography & Planning, University of Liverpool, UK		
Mark Green	Health geography, social and neighbourhood interactions in obesity	Training in GIS mapping of the food environment and oversee its use.
Department of Population, Family and Reproductive Health, University of Ghana, Ghana		
Amos Laar	Public health, knowledge translation, nutrition transition	Policy brief development
Richmond Aryeetey	Evidence-informed policy making; NCD prevention	FBDGs development in Kenya and stakeholder workshop

b) Schedule and timelines of the study

The project is expected to take a total of 24 months, starting in April 2017. The first 2 months will be spent on planning and preparation of the protocol and tools for ethical review and approval.

Data collection will be done between July 2017 and July 2018. Specific deliverables and timelines are indicated in the Gantt chart below.

Monthly periods	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Month	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
Ethical approval		▨	▨	▨																				
Larger project team meetings in Ghana-G/Kenya-K				K							G							K						G
Monthly planning teleconference with technical advisors	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
Training on photovoice and 24hr dietary recall				▨																				
Training on food-EPI tool for policy mapping						▨																		
Training on GIS mapping						▨																		
Meta-analysis of dietary practices and patterns			▨	▨	▨	▨	▨	▨	▨															
Systematic review of drivers of diet			▨	▨	▨	▨	▨																	
Qualitative 24hr recall and photovoice					▨	▨	▨	▨	▨	▨	▨													
GIS mapping of physical food environment												▨	▨											
Producing conceptual framework map														▨	▨	▨								
Food based dietary guidelines development					▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨				
Policy brief production																				▨	▨			
Develop and run photography exhibitions																		▨	▨	▨	▨			
Deliberative workshops with stakeholders																							K	
Africa-wide webinars																							▨	▨

c) Budget

Exchange rate 1USD = 98 Kshs	Year 1 ($)	Year 2 ($)	Total ($)
APHRC STAFF COSTS			
Research Scientist (APHRC)	9,789.01	10,278.46	20,067.46

Post-Doc	66,432.43	69,754.05	136,186.48
Communication Officer	1,609.30	1,689.76	3,299.06
Sub-Total	77,830.73	81,722.27	159,553.00
POLICY MAPPING			
Stakeholder and FBDGs meetings - 10 pax, 2 meetings, with transport re-imbursement	4,725.00		4,725.00
Training for 4; data collectors (venue, allowance, meals)	630.00		630.00
Wages for 4 fieldworkers working 120 days	11,314.29		11,314.29
Transport reimbursement for 144 people (includes digital cameras for field work)	8,316.00		8,316.00
Venue for the interviews	3,857.14		3,857.14
Security during fieldwork	1,542.86		1,542.86
Data Programmer	5,031.99		5,031.99
Sub-Total	30,692.28		30,692.28
EQUIPMENT			
Digital recorders	300.00		300.00
Headphones for transcription	80.00		80.00
Phones for electronic data capture	1,000.00		1,000.00
Laptop	1,800.00		1,800.00
Trips to the field	1,050.00		1,050.00
Sub-Total	4,230.00		4,230.00
OTHER DIRECT COSTS			
Office supplies and consumables, printing and stationery	262.50	551.25	813.75
Sub-Total	262.50	551.25	813.75
ETHICAL APPROVAL			
AMREF fees (including yearly renewal)	1,050.00		1,050.00
NACOSTI	210.00		210.00
Sub-Total	1,260.00		1,260.00
DISSEMINATION MEETING MATERIALS			
Deliberative workshop 50 pax, for 1 day in Nairobi		2,756.25	2,756.25
Photovoice exhibition including printing photographs		1,653.75	1,653.75
Transport reimbursements to dissemination meeting participants		2,756.25	2,756.25
Production of policy brief (100 copies)		551.25	551.25
Sub-Total		7,717.50	7,717.50
CONFERENCE MEETINGS			
Return flight ticket	3,150.00	1,653.75	4,803.75
Conference cost, accommodation, meals	3,675.00	1,929.38	5,604.38
Other costs (Visa, airport transfer etc.)	525.00	275.63	800.63
Sub-Total	7,350.00	3,858.75	11,208.75
Total Direct Costs	126,350.51	93,849.77	220,200.28
Overhead costs	20,216.08	15,015.96	35,232.05
Grand Total (USD)	146,566.60	108,865.73	255,432.33

Grand Total (£) Exchange rate of 1USD = 0.76 £			194,128.57

XII) REFERENCES AND APPENDICES

References

1. Vorster HH, Kruger A, Margetts BM. The nutrition transition in Africa: can it be steered into a more positive direction? Nutrients. 2011 Apr;3(4):429–41.

2. NIH National Institute of Diabetes and Digestive and Kidney Diseases. Overweight and Obesity Statistics. WIN Weight Inf Netw [Internet]. 2010;4(4158):6. Available from: http://win.niddk.nih.gov/publications/PDFs/stat904z.pdf

3. WHO. WHO | Obesity and overweight. World Heal Organ Media Cent Fact Sheet No 311 [Internet]. 2012; Available from: http://www.who.int/mediacentre/factsheets/fs311/en/#.U2gDIH5zIZ4.mendeley

4. Troesch B, Biesalski HK, Bos R, Buskens E, Calder PC, Saris WHM, et al. Increased Intake of Foods with High Nutrient Density Can Help to Break the Intergenerational Cycle of Malnutrition and Obesity. Nutrients. 2015 Jul;7(7):6016–37.

5. FAO. Population nutrient intake goals for preventing diet-related chronic diseases. 2017.

6. Cira, Dean A.; Kamunyori, Sheila W.; Babijes RM. Kenya urbanization review [Internet]. Washington, DC; 2016. Available from: http://documents.worldbank.org/curated/en/639231468043512906/Kenya-urbanization-review

7. Kenya National Bureau of Statistics (KNBS); ICF Macro. Kenya Demographic and Health Survey 2014. Heal (San Fr. 2014;1–314.

8. Kenya Bureau of Statistics. Kenya STEPwise Survey for Non Communicable Diseases Risk Factors 2015 Report. 2015.

9. Ettarh R, Van de Vijver S, Oti S, Kyobutungi C. Overweight, obesity, and perception of body image among slum residents in Nairobi, Kenya, 2008-2009. Prev Chronic Dis [Internet]. 2013;10(4):E212. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3869529&tool=pmcentrez&rendertype=abstract

10. Kimani-Murage EW, Muthuri SK, Oti SO, Mutua MK, Van De Vijver S, Kyobutungi C. Evidence of a double burden of malnutrition in urban poor settings in Nairobi, Kenya. PLoS One. 2015;10(6).

11. Ministry of Health. Kenya National Strategy for the prevention and control of Non-communicable Disease, 2015–2020 [Internet]. 2015. Available from: http://ianphi.org/documents/kenyastrategyforNCDs.pdf

12. Kearney J. Food consumption trends and drivers. 2010;2793–807.

13. Vasantha S, Vijaylakshmi S, Prabha K. Review on impact of changing lifestyles on dietary pattern. Int J Curr Res Acad Rev. 2015;3(6):135–47.

14. World Bank. Why do Kenyans want to live in cities? | AfricaCan End Poverty. 2011.

15. Mbochi RW, Kuria E, Kimiywe J, Ochola S, Steyn NP. Predictors of overweight and obesity in adult women in Nairobi Province, Kenya. BMC Public Health [Internet]. 2012;12(1):823. Available from: BMC Public Health

16. Shove E, Pantzar M, Watson M. The dynamics of social practice: Everyday life and how it changes. 2012;

17. World Health Organization. Climate Change and Health : Urbanisation and Health [Internet]. Geneva; 2017. Available from: http://www.who.int/globalchange/ecosystems/urbanization/en/

18. United Nations. World Urbanisation Prospects [Internet]. New York; 2014. Available from: https://esa.un.org/unpd/wup/publications/files/wup2014-highlights.Pdf

19. Godfrey R, Julien M. Urbanisation and health. Vol. 5, Clinical Medicine, Journal of the Royal College of Physicians of London. 2005. p. 137–41.

20. Vorley B, Lançon F. Food consumption , urbanisation and rural transformation The trade dimensions. 2016;(May).

21. Hawkes C. Globalization and Health Uneven dietary development : linking the policies and processes of globalization with the nutrition transition , obesity and diet-related chronic diseases. 2006;18:1–18.

22. Shetty PS. Nutrition transition in India. 2017;5:175–82.

23. FAO. Food-based dietary guidelines. 2016.

24. Levesque S, Delisle H, Agueh V. Contribution to the development of a food guide in Benin: linear programming for the optimization of local diets. Public Health Nutr. 2015;

25. Story M, Kaphingst KM, Robinson-O'Brien R, et al. Creating healthy food and eating environments: policy and environmental approaches. Annual Review of Public Health. 2008;29:253-272.

26. Doak C, Visscher T, Renders C, et al. The prevention of overweight and obesity in children and adolescents: a review of interventions and programmes. Obesity Reviews.

2006;7(1):111- 136.

27. Tanentsapf I, Heitmann BL, Adegboye AR. Systematic review of clinical trials on dietary interventions to prevent excessive weight gain during pregnancy among normal weight, overweight and obese women. BMC Pregnancy and Childbirth. 2011;11(1):1.

28. Mackenbach JD, Rutter H, Compernolle S, et al. Obesogenic environments: a systematic review of the association between the physical environment and adult weight status, the SPOTLIGHT project. BMC Public Health. 2014;14(1):1.

29. Allender S, Owen B, Kuhlberg J, et al. A Community Based Systems Diagram of Obesity Causes. PloS One. 2015;10(7):e0129683.Higgins J, Green S. Cochrane handbook for systematic reviews of interventions. 2011.

30. Grant M, Booth A. A typology of reviews: an analysis of 14 review types and associated methodologies. Heal Inf Libr J. 2009;

31. Osei-Kwasi H, Nicolaou M. Systematic mapping review of the factors influencing dietary behaviour in ethnic minority groups living in Europe: a DEDIPAC study. International. 2016;

32. Vandevijvere S, Dominick C, Devi A, Swinburn B. The healthy food environment policy index: findings of an expert panel in New Zealand. Bull World Health Organ [Internet]. 2015;93(5):294–302. Available from: http://www.who.int/entity/bulletin/volumes/93/5/14-145540.pdf

33. World Health Organisation. Nutrition : Body mass Index [Internet]. Geneva; 2017. Available from: http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi

Appendices

Appendix A: Quantitative and Anthropometric Tool

Appendix B: 24 Hour Dietary Recall Guide

Appendix C: Photovoice Guide

Appendix D: GIS Reading Tool

Appendix E: Consent Forms, Parental Consent Forms, and Assent Forms

Appendix F: Investigator CVs

Appendix G: Investigator Ethics Certificates