

Effectiveness of Social Marketing Interventions in Improving Knowledge,
Attitudes and Practices towards Consumption of Vitamin A-Fortified Oil in Rural
Tanzania: A Quantitative and Spatial Analysis

by

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Authors Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Background. Vitamin A deficiency (VAD) is a public health problem affecting many pregnant women and young children in Africa and South-East Asia. In children, VAD is associated with an increased risk of measles, malaria and other infectious diseases, and in pregnant women, it increases the risk of infant mortality and maternal morbidity and mortality. In 2010, 33 percent of children under 5 years and 37 percent of reproductive-aged women in Tanzania were vitamin A deficient. Hence, the Masava project was implemented to address VAD in rural Tanzania by enabling small and medium-sized sunflower oil processors to fortify unrefined sunflower oil with vitamin A and distribute it in the regions of Manyara and Shinyanga. To promote the fortified oil, a subsidy was provided via an e-voucher system. A social marketing campaign was also implemented to increase knowledge of vitamin A and promote consumption of the fortified oil.

Purpose. To evaluate the effectiveness of the social marketing campaign in improving knowledge, attitudes and practices (KAP) regarding consumption of vitamin A-fortified sunflower oil.

Methods. The study employed a quasi-experimental non-equivalent control group study design. In the intervention group, community mobilization events were conducted which included road shows, cooking shows, clinic shows, cultural shows, bicycle races and football matches, and print materials were distributed at health clinics and during events. The campaign delivered messages on health benefits of vitamin A and availability of vitamin A-fortified oil at a subsidized price. A radio campaign was also implemented towards the end of the intervention period. The control group did not receive any of the interventions until the endline survey was completed. To assess the impact of the campaign, two sets of surveys were undertaken to collect information on knowledge, attitudes and practices regarding consumption of the fortified oil: the

household survey conducted by the Sokoine University of Agriculture and the survey conducted by the Tanzania Communication and Development Center (TCDC survey). Both surveys were carried out before and after the campaign. For the household survey, lactating women with children under 5 years were recruited before the interventions and were followed up after nine months of the 13-month campaign. For the TCDC survey, random samples of women and men were recruited for the baseline, midline and endline surveys. In the household survey, oil samples were also collected from each household and analyzed to determine the retinol content. The retinol content in the oil samples served as an indicator of fortified oil consumption in the household.

Results. After nine months of intervention, consumption of inadequately fortified oil decreased significantly ($p < 0.05$) and consumption of adequately fortified and over-fortified oil increased significantly in both the intervention and control districts. However, the change was smaller in the control districts than in the intervention districts. Knowledge of the health benefits of vitamin A improved significantly in both the intervention and control districts after the intervention, based on the household survey. Health clinics, radio and cultural shows were the most-frequently listed source of information on vitamin A for women, whereas for men, health clinics, radio and IEC materials were important. No significant association was found between distance of households to the nearest clinic show location and consumption of fortified oil at the household level, however there were effects on sales. Compared to retailers that had a clinic show held within 0.5 km from its location, the volume of fortified oil redeemed was significantly lower at those retailers that did not have a clinic show held within 3 km. Among the different kinds of events that were conducted, clinic shows and cooking shows were positively associated with the

volume of fortified oil redeemed, whereas no association was found between either bicycle races or football matches, which were particularly designed and implemented to target men.

Conclusions. The social marketing campaign was effective in improving KAP towards consumption of vitamin A-fortified oil. Clinic shows and cooking shows that target women were more effective in promoting KAP towards household consumption of fortified oil than interventions that target men.

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List of Abbreviations

BCC	Behaviour Change Communication
BCW	Behaviour Change Wheel
CHWs	Community Health Workers
CBOs	Community-based Organizations
DBS	Dried Blood Spot
ELISA	Enzyme-linked immunosorbent assay
HPLC	High performance Liquid Chromatography
IEC	Information, education and communication
IYCF	Infant and Young Child Feeding
KAP	Knowledge, attitudes and practices
LMICs	Low- and middle-income countries
MEDA	Mennonite Economic Development Associates
OR	Odds Ratio
SMEs	Small- and Medium-Sized Enterprises
SUA	Sokoine University of Agriculture
TBS	Tanzania Bureau of Standards
TCDC	Tanzania Communication and Development Center
TDF	Theoretical Domains Framework
TFDA	Tanzania Food and Drugs Authority
TFNC	Tanzania Food and Nutrition Centre
TTM	Transtheoretical Model
UNICEF	United Nations Children's Fund

UTM	Universal Transverse Mercator
UW	University of Waterloo
VAD	Vitamin A deficiency
WHO	World Health Organisation

Chapter 1: Background

1.1 The Problem

Vitamin A deficiency (VAD) is the leading preventable cause of blindness in children.⁽¹⁾ VAD increases the risk of morbidity and mortality due to night blindness, measles, diarrhea, impaired cognitive functions, acute respiratory infections, malaria and other infectious diseases.^(1,2) In pregnant women, VAD is associated with fetal loss, low birth weight, preterm death, and increases the risk of all-cause infant mortality, maternal morbidity and mortality.⁽²⁾ Pregnant and lactating women and children are particularly susceptible to VAD due to their higher requirements for nutrition. In addition to the direct effect on human health, VAD also has severe impacts on economic development through loss of productivity due to morbidity and premature mortality, and increased healthcare costs.⁽³⁾

In 2010, 33 percent of children between 6-59 months and 37 percent of women between 15 and 49 years in Tanzania were vitamin A deficient.⁽⁴⁾ Most VAD is due to insufficient dietary intake. The majority of the complementary foods given to children are made from grains, which lack vitamin A.⁽⁵⁾ Intake of animal products, which are rich in retinol, a form of vitamin A that can be readily absorbed by the body, is low among women and children, particularly in rural areas.⁽⁵⁾ In order to improve vitamin A intake, increasing dietary diversity, supplementation and food fortification could be adopted. In 1987, vitamin A supplementation was introduced into the Essential Drugs Program implemented by the Ministry of Health of Tanzania with support from the Danish Government, WHO and UNICEF, for mothers immediately postpartum and children at nine months. In 1997, the WHO Expanded Programme on Immunization services for children between 6-59 months provided supplementation.^(6,7) Although coverage for vitamin A

supplementation for children under 5 years and postpartum women has significantly improved in the country since 2005,⁽⁵⁾ increasing coverage to reach all children and postpartum women is expensive.⁽⁸⁾ Moreover, high doses of vitamin A increases the risk of teratogenesis (birth defects) during the first trimester of pregnancy when women may not know that they are pregnant. Food fortification, which is “the addition of one or more essential nutrients to a food, whether or not it is contained in the food, for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups”,^{(9)(p10)} is usually less costly compared to supplementation, as it utilizes the existing food product market.⁽¹⁰⁾ Fortified foods are safe for consumption by pregnant women due to the much lower dose of vitamin A. The fortification process is also simple to implement and could have a quick and significant impact without involving substantial change in consumer behaviour that is needed for dietary diversification.⁽¹⁰⁾

1.2 The Masava project: Overview and Rationale

In an effort to fight VAD, in 2012, the government of Tanzania mandated the addition of iron, vitamin A and/or zinc to all locally-produced wheat flour, maize flour and vegetable oil. Such legislation is however, usually only met by large-scale producers that focus mainly on urban markets. The legislation is difficult to implement in remote areas which are predominantly served by local small and medium-sized enterprises (SMEs) that often do not have sufficient knowledge or necessary resources that are required for fortification. Hence, in 2014, the Masava project was implemented by the Mennonite Economic Development Associates (MEDA), a non-governmental organization based in Waterloo, ON, in partnership with the University of Waterloo (UW), and the Sokoine University of Agriculture (SUA) in Tanzania. The project aims to reduce VAD prevalence in rural Tanzania by supporting small and medium-sized sunflower

oil producers to fortify unrefined sunflower cooking oil with vitamin A and distribute it in the regions of Manyara and Shinyanga, where the prevalence of VAD are some of the highest in the country.⁽⁴⁾ In order to promote consumption of the fortified oil, the oil was initially made available with a subsidy which offset the higher fortification and packaging costs required, through a mobile phone-based electronic Voucher (e-Voucher) system.⁽¹¹⁾ As part of the Masava project, a behaviour change communication (BCC) campaign was also implemented by the Tanzania Communication and Development Center (TCDC), using a social marketing approach to promote consumption of the vitamin A-fortified sunflower oil by increasing knowledge of the health benefits of vitamin A and the availability of the oil at a subsidized price.

Chapter 2: Intervention Approach: Theory and Literature Review

2.1 Social Marketing as an Intervention Framework for Influencing Behaviour Change

Success of fortification programs and the acceptability of fortified foods depend on both a context of accessibility and affordability, and the knowledge, attitude and practices (KAP) of consumers towards the fortified food. Hence, fortification programs benefit from being implemented alongside communication interventions that are targeted towards behaviour change, at the population, community and individual levels consistently and simultaneously.⁽¹²⁾ Social marketing provides a framework for designing interventions that aim to promote specific behaviour or tackle a specific social issue for the benefit of the individual and the society as a whole by using the principles of commercial marketing. A wide range of definitions of social marketing exists in the literature, but the key elements in the various definitions of social marketing can be summarized as: a systematic process that utilizes commercial marketing principles and techniques in the “analysis, planning, execution, and evaluation of programs that are designed to influence”^{(13)(p7)} the specific behaviours of target audiences in order to improve their personal welfare and that of the society, “by offering benefits that they want, reducing barriers that they are concerned about and using persuasion”^{(14)(p24)} to create motivation to participate in the program. In order to influence behaviour change, social marketing also seeks to understand why people act as they do by employing theories, models, research approaches and forms of analysis from a wide range of disciplines.⁽¹⁵⁾ The principles of social marketing are described under the following eight benchmark criteria:⁽¹⁵⁾

1. Customer orientation- Social marketing should be customer-focussed. To achieve the desired behaviour change, social marketing interventions should be planned and implemented from

the perspective of the consumers. This requires understanding the consumers, including but not limited to, the social context of the consumers, the challenges that they face, their needs, what is important to them, what attracts them, their ability to perform the new behaviour, and what moves and motivates them, through consumer research. An effective social marketing approach develops interventions that are informed by what we know about the audience and what will motivate them to adopt the new behaviour, rather than persuading the audience to change by making them understand the long term benefits of the behaviour change.

2. Behavioural focus- The intervention must focus on specific behaviours. The behavioural goals must be clear, specific, measurable, realistic and timely given the length of the intervention.
3. Theory-informed- The approach used for designing the intervention must be informed by a behavioural theory or theories in order to understand why people act as they do and develop an intervention, based on this understanding, to effectively promote behaviour change.
4. Developing insight- Consumer research conducted for the purpose of understanding the perspective of the target consumers also provides a deeper understanding of why people act as they do, what they value, their beliefs, attitudes towards the new behaviour, and barriers to change. These insights inform what strategy is likely or not likely to work within the population.
5. Understanding the exchange- An effective social marketing campaign uses the perspective of the audience and the insights gained from consumer research, to understand the barriers of change and the benefits that the audience value. The campaign, then, analyzes the perceived and actual costs, and the perceived and actual benefits, to maximize the perceived benefits and minimize the perceived costs to create an attractive offer for the consumer.

6. Competition- A key principle in social marketing is to understand what competes with the behaviour that the campaign is promoting. The competing alternatives could be external, such as the promotion of counter-behaviour by other people and organizations, difficulty in switching to the new behaviour due to environmental factors and social norms, or internal, such as longer travel time required to obtain the product, unavailability of the product in stores where the consumer regularly shops and people's feelings about adopting the new behaviour. An effective social marketing campaign identifies the competing factors and develops strategies to minimize the impact of these factors.
7. Segmentation- Another important principle in social marketing is that it identifies audiences that have similar characteristics, such as beliefs, values or stages of adoption of innovations from Rogers' Diffusion of Innovations Theory,⁽¹⁶⁾ through consumer research and tailors the interventions to specific audience segments. According to Rogers' Diffusion of Innovations Theory, members of a society can be categorized into five groups based on how quickly the individual adopts new ideas and innovations: 1) innovators, 2) early adopters, 3) early majority, 4) late majority and 5) laggards.⁽¹⁶⁾ Segmenting the target population based on the stage of adoption of new ideas and developing interventions to target a specific segment is an important strategy for achieving behaviour change.
8. Mix of methods- Finally, a social marketing approach uses a mix of interventions to achieve behaviour change. Successful social marketing campaigns develop, based on insights from consumer research, the right combination of interventions in the domains of design, inform, control, educate and support, which constitutes the DICES acronym and intervention domains. Successful social marketing campaigns also employ the 4Ps of traditional marketing (Product, Price, Place and Promotion) to encourage behaviour change. The five intervention domains of

DICES and the 4Ps of social marketing are briefly described in Table 2.1 and Table 2.2 respectively.

Table 2.1 The DICES intervention domains, adapted from French, Blair-Stevens, McVey and Merritt, 2010.⁽¹⁷⁾

Domain	Description
Design	Creates the environment and procedures that support self and community development, and safety.
Inform	Informs and communicates facts and attitudes, and may seek to persuade and suggest behaviours.
Control	Using the power of the law and regulation as a body of rules and having binding force to incentivise and penalize the behaviour of individuals, organizations and markets for social good.
Educate	Informs and empowers critical reasoning, creates awareness about benefits and develops skills for change and personal development.
Support	State and other collectively funded products and services are provided to support mutually agreed social priorities.

Table 2.2 The 4Ps of social marketing, reprinted from French, Blair-Stevens, McVey and Merritt, 2010.⁽¹⁷⁾

Elements of the 4Ps	Description
Product	The promoted behaviour, associated benefits of performing the desired behaviour and any tangible objects or services that support or facilitate the desired behaviour. It also includes the characteristics of the product or service, such as features, product design, quality and branding.
Price	The cost and barriers the target audience faces when changing to the promoted behaviour. It also includes non-monetary cost, such as physical, emotional, time, and/or psychological costs. The benefits of changing to the promoted behaviour must be greater than the costs.
Place	Where the target audience will perform the desired behaviour, or where the product or service is made available to the target audience. It is important to consider where the target audience should receive the product or service and to make this as convenient and pleasant as possible.
Promotion	How the product or service is made known to the target audience. It includes advertising, personal selling, sales promotion, atmospheres, identifying the type of media the target audience attends to, where and when they will attend to your message, and the style of communication.

2.2 Overview of Use of Social Marketing in Nutrition Promotion in LMICs

Evidence suggests that BCC and social marketing interventions could be effective in improving nutrition in low- and middle-income countries (LMICs). Studies examining the impact of BCC and social marketing campaigns on improving nutrition are broad and abundant. The majority of the interventions were targeted towards women and child nutrition, but few studies have examined the impact on improving micronutrient intake.

Between 1999 to 2017, five systematic reviews have been conducted that examined the impact of BCC interventions on maternal knowledge and practices towards infant and young child feeding (IYCF) in LMICs.⁽¹⁸⁻²²⁾ These reviews found substantial evidence that BCC interventions improved knowledge, and some evidence that they improved practices. In Mexico, the Theory of Planned Behaviour was used to inform the message content of a behaviour change intervention that aimed to promote IYCF practices through nurses and radio broadcasts.⁽²³⁾ After three weeks of intervention, beliefs, attitudes, intentions and behaviours of IYCF improved significantly, but not social norms.⁽²³⁾ One of the limitations is that the study did not examine the association between beliefs, attitudes, intention, social norms and behaviour change, which could help identify if any of these factors are predictors of behaviour change.

Social marketing has been used to promote timely initiation of breastfeeding. In Jordan, after two and half months of intensive radio and television program interventions stressing the benefits of early initiation of breastfeeding for the mother and the child, and a two-day seminar on lactation management for health professionals, early initiation of breastfeeding improved significantly among mothers who gave birth in public hospitals and at home, but not those who gave birth at private hospitals, even though there was a significant improvement in knowledge in all three groups.⁽²⁴⁾ According to the authors of the study, private hospitals in Jordan were less

likely to support timely initiation of breastfeeding, but it is unclear whether the mothers were discouraged from doing so by the hospital or whether it was the mothers' decision that was influenced by other factors.⁽²⁴⁾ This study shows that communication and social marketing programs must not only target those individuals whose behaviour we intend to change, but also the people around them who may have to change their attitudes to support behaviour change among the target individuals.

In China, social marketing was used to promote multiple micronutrient powder (Ying Yang Bao) and optimal child feeding practices.⁽²⁵⁾ The campaign activities included distribution of information, education and communication (IEC) materials to caregivers, health workers and during clinic visits, television spots, providing incentives to village doctors to sell Ying Yang Bao, and promotions in grocery stores.⁽²⁵⁾ After running the campaign for eight months, early initiation of breastfeeding improved from 8.6 percent to 16.8 percent, prevalence of meeting minimal dietary diversity improved from 58 percent to 74 percent and 59.6 percent of caregivers knew about Ying Yang Bao.⁽²⁵⁾ However, among those who knew about Ying Yang Bao, only 22.6 percent purchased it at least once.⁽²⁵⁾ The authors did not report the level of knowledge and consumption of Ying Yang Bao before the campaign. Since the product was developed and marketed the same year, it may be reasonable to assume that knowledge and consumption of the product was minimal before the campaign. The main reasons for the low intake of Ying Yang Bao were that the product was relatively new to the people, people had not consumed it previously and were concerned about potential adverse effects of the product.⁽²⁵⁾ This study shows that one of the major challenges of social marketing of products that are newly introduced to the market, particularly edible goods, is overcoming people's apprehension towards the new product.

From this review of the literature on the use of social marketing interventions in promoting improved nutrition, we found that many of these interventions were reported to be effective in improving knowledge, attitude and/or practices, but very few mentioned using theories to inform their intervention design and evaluation, or specified constructs that the intervention was designed to target. Such limited systematic methodology in the design and evaluation makes it difficult to replicate the results for other behaviours and in other contexts.

2.3 Evaluation of Social Marketing in LMICs

Depending on the purpose, evaluation of social marketing programs may take on four different forms, namely, formative, summative, process and impact evaluation.⁽²⁶⁾ Impact or outcome evaluations are carried out at the end of the program to examine and review the short-term, mid-term and long-term outcomes of the program.⁽²⁶⁾ Short-term outcomes are changes in variables that mediate the behaviour change, such as awareness of the program; mid-term outcomes are changes in behaviour and determinants of behaviour change; and long-term outcomes are the impacts on health, social, environmental and other outcomes.⁽²⁶⁾ When long-term outcomes cannot be measured due to time and financial constraints, evaluations must be conducted based on a behaviour change model.⁽²⁷⁾

In outcome evaluations, programs are evaluated based on the goals and objectives of the program.⁽²⁶⁻²⁸⁾ Hence, the program goals and objectives must be made clear and measurable in the design phase. The outcomes to be measured should be selected based on the purpose, duration and power of the intervention.⁽²⁶⁾ For instance, when the duration of the intervention is short, effectiveness may be measured by short-term outcomes such as recall of messages and level of exposure to components of the campaign like clinic shows, road shows or food demonstrations. Although factors such as knowledge, attitude and subjective opinions of the

audiences are important in determining behaviour change, the primary focus of social marketing is the effect on behaviour change.^(27,28)

Evidence suggests that programs are more likely to succeed when they are informed by appropriate theory and evidence.⁽²⁹⁻³¹⁾ This is, in part, because theories inform us, based on empirical evidence, of how determinants of behaviour change interact with each other to influence behaviour change. In order to examine the use of BCC and social marketing interventions in promoting improved nutrition practices in LMICs, a scoping review of the literature was conducted in June 2017. The search was conducted on the PubMed electronic database and was limited to peer-reviewed journal articles published in English language. We reviewed studies that reported impact of community-based interventions that aimed at improving knowledge, attitude or practices related to improved nutritional status in non-diseased population in an LMIC setting, as classified under the World Bank 2017 country classification.⁽³²⁾ Bibliographies of review articles were also searched. A summary of the studies reviewed is given in Appendix A. From this review, we found a large number of studies which reported that BCC and social marketing interventions are effective in promoting improved nutrition behaviour. In many of these studies, interventions are designed and evaluated based on educational strategies and outcomes that are intuitive. Out of 35 studies on BCC and social marketing interventions that we reviewed,^(23,25,33-65) only six studies,^(23,38,39,49,50,60) representing 17 percent of the studies, mentioned that the intervention design and/or evaluation were informed by behaviour change theories; and out of the six studies, only two studies mentioned the behaviour change constructs that were addressed in the design of the intervention or which informed the intervention evaluation.^(38,39) Such low proportions of theory-based health interventions were also reported in other systematic reviews and meta-analyses.⁽⁶⁶⁻⁶⁹⁾ As some factors are more important than

others in mediating behaviour change for a given group or a given behaviour, interventions must be designed based on specific theories that are targeted towards specific behaviour in order to make the most effective use of the available resources. Further, interventions also need to be evaluated based on a behaviour change theory or set of theories in order to identify challenges in implementing the intervention and limitations in the intervention design.

2.4 Relevant Theoretical Frameworks

Behaviour is guided by a wide range of factors that are personal as well as environmental. Many theories have been proposed across multiple disciplines, including but not limited to psychology, anthropology, sociology and economics that have attempted to explain the process of behaviour change. Many of these behaviour change theories have overlapping constructs or mediators of behaviour change, but are named differently.⁽⁷⁰⁾ There is also little guidance on which theory to use in which context.⁽⁷¹⁾ The Behaviour Change Wheel (BCW) is a framework, developed by Michie and others in 2011, that is synthesized from 19 pre-existing theoretical frameworks of behaviour change to provide program and policy developers with a comprehensive toolkit for designing interventions.⁽⁷¹⁾ The BCW framework is based on the COM-B model of behaviour change, which suggests that capability, opportunity and motivation interact to influence human behaviour, which in turn influences each of the three components (Figure 2.1).⁽⁷¹⁾ As policy can only influence behaviour through interventions, the framework is represented by a wheel, in which the outer layer comprising of seven policy categories influences the next layer inwards that is composed of nine intervention functions.⁽⁷¹⁾ These intervention functions, in turn, influence behaviour through capability, motivation and opportunity, which forms the centre of the BCW. (Figure 2.2).⁽⁷¹⁾ However, each component of the BCW addresses some intervention functions and/or sources of behaviour better than others. For example, legislation creates

motivation to perform the behaviour through coercion, but it does not enable individuals to have the physical capability to perform the behaviour.

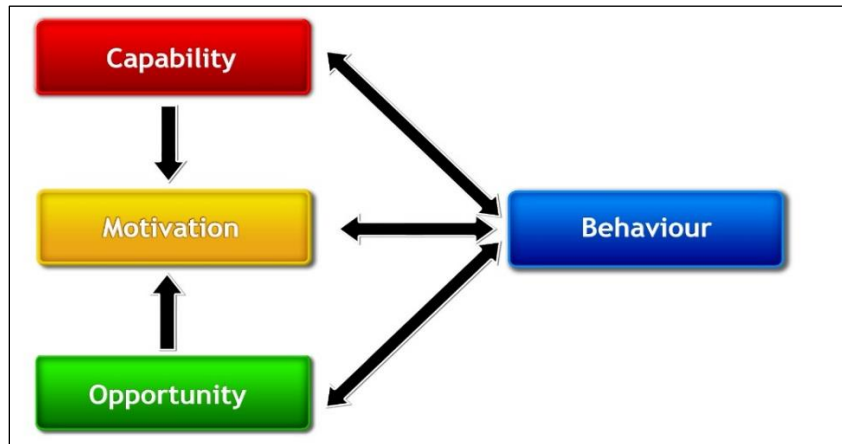


Figure 2.1 The COM-B Model of Behaviour Change, adapted from Michie, van Stralen and West, 2012.⁽⁷¹⁾

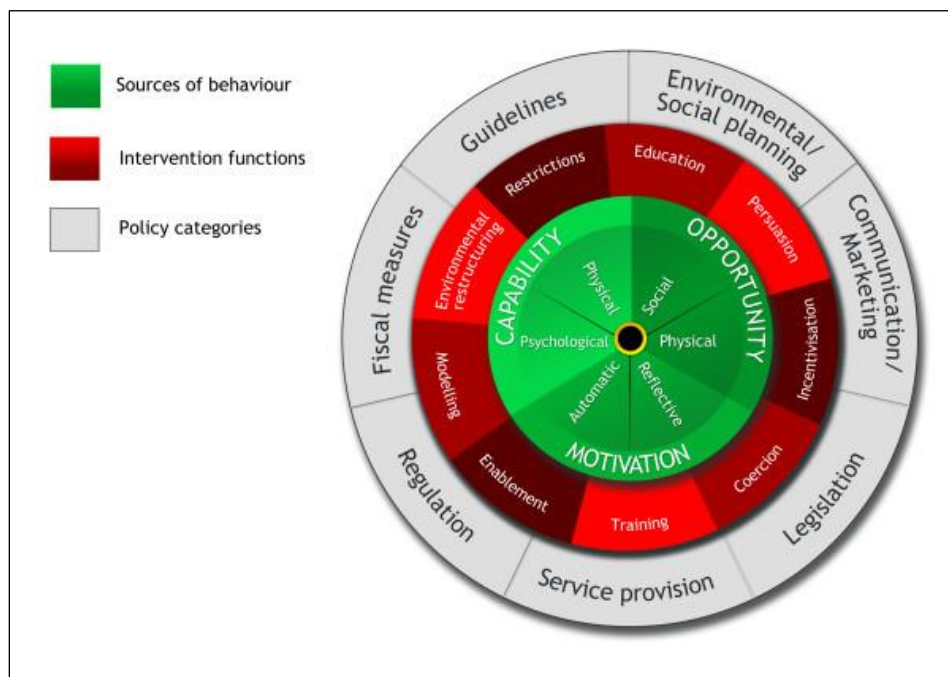


Figure 2.2 The Behaviour Change Wheel, excerpted from Michie, van Stralen and West, 2012.⁽⁷¹⁾

The three components of the COM-B model, which forms the core of the BCW, are also reflected in the MOA model of consumer behaviour used in marketing which suggests that

motivation, opportunity and ability are the key predictors of behaviour change.⁽⁷²⁾ The three components of the COM-B model are defined as follows:⁽⁷¹⁾

Capability- The psychological and physical capacity of the individual to perform the behaviour.

Opportunity- All environmental factors that make the behaviour possible or prompt it.

Motivation- The brain processes that drive behaviour. Motivation includes reflective motivation such as making plans to perform the behaviour, and automatic motivation that involves emotion and impulse.

Communication for behaviour change can take on multiple approaches, such as education, marketing and legislation.⁽⁷³⁾ The choice of which approach or combination of approaches to use to promote behaviour change depends on the program targets.⁽¹⁰⁾

Disseminating messages on the needs and benefits of behaviour change through education informs individuals of their needs and motivates them to act voluntarily in a particular manner, without providing direct or immediate reward or punishment.⁽⁷³⁾ The “education” and “training” approach of behaviour change provides target audiences with the knowledge and practice necessary to have the physical and psychological capability, while reflective motivation focuses on the long term benefits of the behaviour change, which stimulates performance of the action.⁽⁷¹⁾ However, education alone does not provide opportunities for individuals to perform the action. Since individuals must perform the behaviour voluntarily, the ‘education’ and ‘training’ intervention function of the BCW is most effective when the benefits of the change are obvious and immediate, and the cost associated with the change is low.⁽¹⁰⁾

Under legislation, behaviour change could be achieved in a non-voluntary manner through “restriction” by imposing costs or punishments if one does not comply with the

legislation. Using the 'coercion' intervention function of the BCW to achieve behaviour change could create persuasion and indirect motivation to perform the desired behaviour.⁽⁷³⁾ The use of force, however, is appropriate only when the rights of the audience are irrelevant or when the cost of the behaviour change cannot be overcome by the benefits associated with the behaviour change.⁽⁷³⁾

On the other hand, behaviour change through social marketing is completely voluntary.⁽⁷⁴⁾ Social marketing utilizes marketing techniques to influence behaviour change for the benefits of the individual and for the society as a whole.⁽¹⁰⁾ Like the educational approach, under the social marketing approach, messages of the benefits of behaviour change are communicated to the target audience and adoption of behaviour change is completely voluntary. However, in addition to trying to achieve behaviour change by changing people's understanding through education, social marketing attempts to address the structural determinants of behaviour. These structural determinants of behaviour are policies or institutional practices that makes it easier for the target audience to adopt the new behaviour ("enablement"). They include improving access to the product promoted by making sure that it is available to people in places where people typically shops, making it available in sufficiently large quantities in these shops, ensuring a constant supply and lowering the monetary cost of the product. Social marketing also identifies enablers and barriers of the target behaviour change in the target population to create an environment where the target audience are offered incentives or benefits that they value ("incentivisation"), where they could adopt the behaviour change with reduced barriers ("enablement") and where they are persuaded by communication or imagery that induces a positive feeling towards the new behaviour ("persuasion"), or by a role model whom the audience aspires to become like ("modelling").⁽¹⁴⁾ By creating an enabling environment that addresses the structural determinants

of behaviour, providing direct and immediate benefits and/or reducing costs, social marketing creates opportunity and motivation to adopt behaviour change without the use of coercion that is involved in some forms of legislation (although, other forms of legislation that is not coercive such as the government subsidizing fortified oil to make it cheaper than unfortified oil could be very effective in improving fortified oil uptake). Therefore, social marketing is likely to be more effective than education in promoting behaviours that have distant benefits to audiences who often neither recognize the problem nor take action to adopt the new behaviour.⁽⁷⁴⁾ By encouraging people to associate the new behaviour with a positive self-perceived image, social marketing could enable the new behaviour to become a new social norm (“environmental restructuring”). Thus, social marketing addresses all three determinants of behaviour change of the COM-B model, and incorporates more intervention functions of the BCW than education and legislation.

The COM-B model of behaviour change is further elaborated in the Theoretical Domains Framework (TDF), developed by Michie and others in 2005, with the purpose of identifying determinants of behaviour and designing and evaluating behaviour change interventions.⁽⁷⁰⁾ The TDF framework is comprised of 14 domains generated and synthesized from 128 constructs from 33 psychological theories.⁽⁷⁰⁾ The 14 domains of the TDF framework, along with a brief description of each domain and the constructs included in each domain are given in Table 2.3.⁽⁷⁵⁾

Table 2.3 Domains of the Theoretical Domains Framework, reprinted from Cane, O’Connor and Michie, 2012.⁽⁷⁵⁾

Domain	Brief Description	Constructs
1. Knowledge	An awareness of the existence of something.	Knowledge (including knowledge of condition/scientific rationale), procedural knowledge, knowledge of task environment.
2. Skills	An ability or proficiency	Skills, skills development,

	acquired through practice.	competence, ability, interpersonal skills, practice, skill assessment.
3. Social/Professional Role and Identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting.	Professional identity, social identity, identity, professional boundaries, professional confidence, group identity, leadership, organizational commitment.
4. Beliefs about Capabilities	Acceptance of the truth, reality, or validity about an ability, talent or facility that a person can put to constructive use.	Self-confidence, perceived competence, self-efficacy, perceived behavioural control, beliefs, self-esteem, empowerment, professional confidence.
5. Optimism	The confidence that things will happen for the best or that desired goals will be attained.	Optimism, pessimism, unrealistic optimism, identity.
6. Beliefs about Consequences	Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation.	Beliefs, outcome expectancies, characteristics of outcome expectancies, anticipated regret, consequents.
7. Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus.	Rewards, incentives, punishment, consequents, reinforcement, contingencies, sanctions.
8. Intentions	A conscious decision to perform a behaviour or a resolve to act in a certain way.	Stability of intentions, Stages of change model, Transtheoretical model and stages of change.
9. Goals	Mental representations of outcomes or end states that an individual wants to achieve.	Goals (distal/proximal), goal priority, goal/target setting, goals (autonomous/controlled), action planning, implementation intention.
10. Memory, Attention and Decision Processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternative.	Memory, attention, attention control, decision making, cognitive overload/tiredness.
11. Environmental Context and Resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social	Environmental stressors, resources/material resources, organizational culture/climate, salient events/critical incidents, person and environment

	competence and adaptive behaviour.	interaction, barriers and facilitators.
12. Social Influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours.	Social pressure, social norms, group conformity, social comparisons, group norms, social support, power, intergroup conflict, alienation, group identity, modelling.
13. Emotion	A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event.	Fear, anxiety, affect, stress, depression, positive/negative affect, burn-out.
14. Behavioural Regulation	Anything aimed at managing or changing objectively observed or measured actions.	Self-monitoring, breaking habit, action planning.

The Transtheoretical Model of Behaviour Change (TTM) attempts to explain behaviour change by examining why certain people succeed, while others fail in the process of achieving behaviour change. According to the transtheoretical model, individuals move through six stages in the behaviour change process: precontemplation, contemplation, preparation, action, maintenance and termination.⁽⁷⁶⁾ In the precontemplation stage, people tend to be defensive and avoid changing their thinking and behaviour because they are unaware or under-aware of the consequences of their behaviour.⁽⁷⁶⁻⁷⁸⁾ When people become aware of the consequences of their current behaviour and have enough motivation to contemplate the costs and the benefits of the behaviour change, they enter into the contemplation stage.⁽⁷⁶⁻⁷⁸⁾ Contemplation between the costs and the benefits of behaviour change may profoundly delay the adoption of the new behaviour.^(76,78) If individuals continue to progress, they move into the preparation stage where they are intending to take action in the immediate future, usually measured in the next month such that they already have a plan of action.⁽⁷⁶⁾ In the action phase, people have already made

overt behavioural changes in the past six months.⁽⁷⁶⁾ In the maintenance stage, people are taking action to prevent relapse; and finally, in the termination stage, people have no temptation and have 100 percent self-efficacy such that no matter how they feel, they will not return to their old habits.⁽⁷⁶⁾ Evidence suggests that approaches that do not consider the stage of change of the target audience, develop a resistance against the behaviour change.⁽⁷⁹⁾ Many behaviour change programs fail because these programs are often action-oriented and the majority of the target individuals who need to make the behaviour change are not in the action phase and require programs that prepare them for the change.⁽⁸⁰⁾ Hence, identifying the stage of change of the target audience is important for the design of effective behaviour change interventions.

2.5 Informing Intervention Design: Formative Research for Developing the Current Intervention

To inform the design and implementation of the social marketing intervention of the Masava project, a formative research was conducted by the TCDC in November-December 2014. The formative research sought to examine the perspective of the target audience, their current knowledge, attitudes and beliefs on vitamin A and fortified foods, their behaviour and factors that influence their behaviour. The methodology used for participant recruitment and data collection is described in detail in Chapter 4. The information obtained from the research was used to inform the development of strategic behaviour change communication and social marketing strategies that would be most effective in reaching the target audience and enabling behaviour change.

The formative research found that 82.5 percent of the respondents had never heard about fortified foods, but most of them showed interest and were willing to buy vitamin A-fortified oil when they were informed about the benefits of consuming the oil and if the oil was available at an affordable price.⁽⁸¹⁾ Based on these findings, education alone would not be sufficient to

promote the consumption of vitamin A-fortified oil. Findings from the formative research also suggest that the stage of change of the population in Manyara and Shinyanga is best described as the contemplation stage of the TTM of behaviour change, where individuals are still considering the pros and cons of the behaviour change before adopting the new behaviour. Hence, social marketing is the most appropriate strategy to be used to assist individuals to move from the contemplation stage to the action stage.

Chapter 3: Study Objectives and Hypotheses

Studies on the effectiveness of BCC and social marketing interventions in changing nutrition-related behaviour in “hard-to-reach” populations in LMICs are broad and abundant in the literature. The majority are focussed on maternal and child nutrition practices. Few studies have been conducted on the impact of BCC or social marketing on uptake of fortified foods. In addition, evidence from BCC interventions targeting improvements in maternal and child nutrition suggests that interventions are more effective in modifying behaviours when they use multiple BCC approaches and channels, and target secondary audiences or influencers as well as the primary audience.⁽⁸²⁾ Very few studies have examined the effectiveness of different BCC approaches and channels in reaching men as compared to women.

This study contributes to the gaps in the literature by examining the effectiveness of a BCC campaign, planned and implemented using a social marketing approach, on improving KAP towards consumption of vitamin A-fortified unrefined sunflower oil, particularly among lactating women and children under five in rural Tanzania.

Specifically, this study aims to evaluate the effectiveness of the social marketing campaign by examining:

1. The change in self-reported and actual consumption of vitamin A-fortified sunflower oil before and after the campaign, as well as knowledge of and attitudes towards vitamin A and vitamin A-fortified sunflower oil. Particular attention will be paid to differences between men and women in the major sources of information. As this study is based on findings from two sets of surveys: the household survey and the TCDC survey, the methodologies employed and samples obtained for the two surveys would be contrasted to validate the findings.

2. The association between distance of household from social marketing events and consumption of fortified sunflower oil in the household,
3. The association between distance of social marketing events from stores selling the fortified sunflower oil and volume of fortified sunflower oil redeemed through the mobile phone-based e-Voucher in each store, and
4. The association between the number and type of social marketing events conducted in a ward, and volume of fortified sunflower oil redeemed in the ward.

Based on the above study objectives, we generated the following hypotheses:

H1a: Self-reported and actual consumption of vitamin A-fortified sunflower oil should improve significantly after the campaign,

H1b: Knowledge of and attitudes towards vitamin A and vitamin A-fortified sunflower oil should improve significantly after the campaign,

H2: Distance between social marketing events and households is negatively associated with fortified sunflower oil consumption,

H3: Distance between social marketing events and stores that sell fortified sunflower oil is negatively associated with the volume of fortified oil redeemed in these stores, and

H4: The number of each type of social marketing events conducted in a ward is positively associated with the volume of fortified sunflower oil redeemed in the ward.

Chapter 4: Methodology

4.1 Study Setting

The study was conducted in eight districts with four each in Manyara and Shinyanga regions in Tanzania (Figure 4.1a). In Manyara, the intervention districts were Babati Rural, Babati Urban and Hanang; and the intervention districts in Shinyanga were Shinyanga Rural, Shinyanga Urban and Kahama Urban. The control districts were Mbulu in Manyara and Kishapu in Shinyanga (Figure 4.1b and 4.1c).

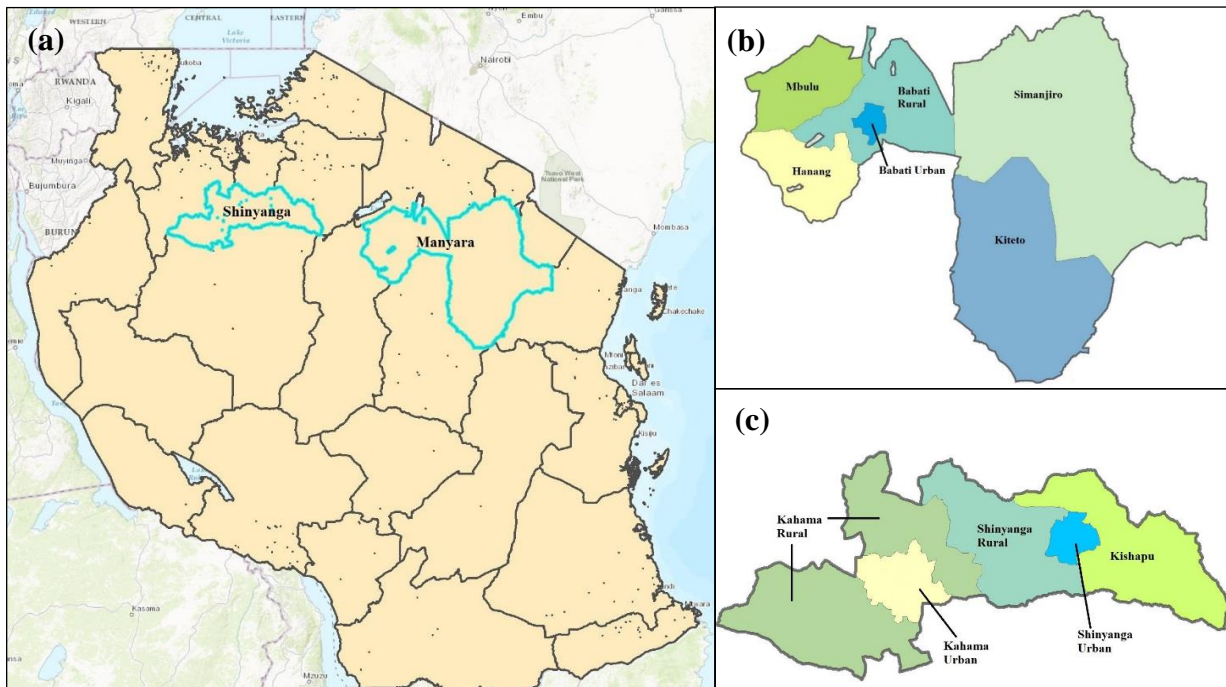


Figure 4.1 (a) Locations of study regions in Tanzania, (b) Location of study districts in Manyara, (c) Locations of study districts in Shinyanga. *Source: National Bureau of Statistics, Tanzania, 2017.*⁽⁸³⁾

4.2 Study Design

A quasi-experimental non-equivalent control group study design was used for the purpose of the study. Eight districts (four districts each in Manyara and Shinyanga) were assigned non-randomly to the intervention and control groups. Intervention groups were selected based on two criteria: 1) the availability of good cellphone network connectivity that was required for redemption of e-Vouchers, and 2) retailers who were more likely to carry oil from the Masava SMEs which was fortified with vitamin A. This resulted in six districts (three each in Manyara and Shinyanga) being assigned to the intervention group and two districts (one each in Manyara and Shinyanga) to the control group (Figure 4.2).

Quasi-experimental study designs are often subjected to concerns of internal validity, because without random assignment, it is difficult to ensure that the intervention and the control groups have similar baseline characteristics.⁽⁸⁴⁾ Selection bias may also be a concern, as individuals who choose or are chosen to participate may be systematically different from those who do not choose or are not chosen to participate.⁽⁸⁴⁾ Hence, the observed difference in the results could, in part or in full, be due to the difference in the participant characteristics rather than the impact of the intervention.⁽⁸⁴⁾

4.3 The Intervention

The goal of the social marketing intervention was to increase knowledge, attitudes and practices of household consumption of vitamin A-fortified sunflower oil in Manyara and Shinyanga. The most important intended outcome was a change in behaviour from using unfortified oil to fortified sunflower oil for household cooking. The target population was

lactating women with children between 6 months and 5 years, who are most vulnerable to the consequences of VAD and who were in the contemplation stage of change of the TTM model.

In order to promote the use of fortified oil, reducing the monetary cost associated with the behaviour change was one of the major considerations that was taken into account in the campaign. The fortified oil was made available to consumers for a period of 19 months, from November 2015 to May 2017, at a subsidized price through a mobile phone-based e-Voucher system, where the subsidy essentially offset the cost of fortification and packaging required for the fortified oil. In addition, retailers were also allowed to set their own price for sales.

Community events, community mobilization activities and use of mass media were implemented from February 2016 to March 2017 in the intervention districts to convey messages of the health benefits of vitamin A, the availability of vitamin A-fortified sunflower oil at a discounted price and to enable the community to identify the fortified sunflower oil by the use of logo depicting fortification. Local community-based organizations (CBOs) were recruited to implement community events which included clinic shows, cooking shows, cultural shows and road shows. Clinic shows were particularly chosen to promote fortified oil use, as holding events in clinics encourages people to associate cooking with fortified oil with healthier families and a better mother. Cooking shows were designed to address the “skills” and “beliefs about capabilities” domains of the TDF framework by demonstrating that no additional skills were required in cooking with fortified oil compared to traditional unfortified oil. After the cooking show, the audience were allowed to taste the food cooked. This was done to demonstrate that food does not taste different when cooked with fortified sunflower oil. All events were designed to be both educative and entertaining in order to appeal to the audience and maintain their attention. The fortified oil was displayed and sold at the event venues.

Community mobilization activities that were carried out included education provided by trained community health workers (CHWs) through home visits and education in groups at the village or ward level. Community resource kits, comprised of two modules of lessons about the fortified oil taught in the form of discussions and games, were developed to aid CHWs to make group-learning sessions fun and interactive. In addition to providing information on the health benefits of vitamin A and recommending intake of vitamin A through balanced diet and consumption of fortified foods, the messages also addressed existing misconceptions about fortified foods. The campaign also involved CHWs, community leaders and religious leaders in implementing community events, as they were identified as important channels of information in the community. Labels on the vitamin A-fortified unrefined sunflower oil were changed to depict the TFDA-approved logo of fortified food to demonstrate good quality and to indicate that vitamin A was added to the sunflower oil. IEC materials, such as fliers and brochures, were distributed at clinics and campaign events. Banners and posters were designed to show good food and healthy and happy families to encourage people to associate cooking with fortified sunflower oil with good food and healthy and happy families. Attractive packaging and messages on product labels and IEC materials were designed based on suggestions provided by the regional and district authorities in Manyara and Shinyanga, CBOs and women in the community. The product packaging was also designed such that the messages could be understood even by those who were unable to read. The new product labels and some of IEC materials used during the campaign are given in Appendix B. Some of the messages also targeted men, as formative research conducted prior to the implementation of the social marketing campaign suggested that men dominated household spending on food in Shinyanga.⁽⁸¹⁾ In Shinyanga, to target men to support the behaviour change, bicycle races were also conducted. At the bicycle race venues,

banners showing the fortified sunflower oil and the fortification logo were displayed. Participants of the race were also allowed to ask questions and express concerns regarding the fortified oil. During the rainy season from January to March 2017, the bicycle race was replaced by promotion at football matches held in the evening after the men have ended their farm activities. All messages and designs on the product labels and IEC materials were approved by MEDA and the Tanzania Food and Drug Authority (TFDA).

The mass media component of the campaign was a live radio talk show which ran for six weeks from February to March 2017, after the endline household survey was completed. The radio component was introduced only after the endline household survey had been completed in order to prevent contamination between the intervention and control districts. However, the endline TCDC survey was conducted in April 2017 after the radio campaign. During the radio talk show, audiences could interact with and ask questions to the show attendees, which included district nutrition officers, MEDA field workers, Masava oil distributors and retailers, CBO personnel and CHWs concerning the fortified oil. Table 4.1 shows the domains of the TDF framework and components of the social marketing campaign that addressed some of the domains. The social marketing events were planned and implemented by the TCDC on the basis of a three-month timeframe or “quarter”. At the end of each quarter, the number of each type of events conducted, their locations and number of people reached were reported in a quarterly report by the TCDC to MEDA.

Table 4.1 Domains of the Theoretical Domains Framework addressed in the design and implementation of the social marketing campaign.

Domains of TDF Framework	Components of the social marketing campaign addressing the domain
Knowledge	Education provided by CHWs in community and through home visits, messages conveyed at community events and through IEC materials.
Skills	Cooking shows showing no new skill required.
Social/Professional Role and Identity	Messages and pictures from events and IEC materials that associate cooking with fortified oil with a good and caring mother.
Beliefs about Capabilities	Cooking shows demonstrating that no new skill required.
Optimism	Messages and pictures from events and IEC materials designed to associate cooking with fortified oil with good food and happy and healthy families.
Beliefs about Consequences	Education through CHWs and messages conveyed at community events and through IEC materials.
Reinforcement	Subsidized price using e-Voucher.
Intentions	Overall intervention
Goals	-
Memory, Attention and Decision Processes	Entertaining and educative clinic shows, cooking shows, cultural shows and road shows.
Environmental Context and Resources	Making the fortified oil available during the community events and in stores; live radio talk shows that enabled individuals to raise questions or concerns about the fortified oil.
Social Influences	Involvement of community and religious leaders as role models in implementing the community events.
Emotion	Entertaining clinic shows, cooking shows, cultural shows and road shows.
Behavioural Regulation	-

4.4 Evaluation: KAP Surveys

Information on KAP towards vitamin A-fortified oil consumption was collected from two different sets of surveys that were developed and administered independently by researchers from SUA (hereafter called “household survey”), and the TCDC and an independent consultant hired by the TCDC for the purpose of carrying out the survey (hereafter called “TCDC survey”). Overall, two household surveys were conducted: baseline and endline; and three TCDC surveys were undertaken: baseline, midline and endline (Figure 4.2). The household surveys were designed by researchers from UW and SUA, drawing on previously validated instruments,⁽⁸⁵⁾ while the TCDC baseline, midline and endline surveys were designed by the TCDC and the hired consultant, with the endline survey revised by researchers from UW. Since the social marketing campaign was implemented by the TCDC, results from the household survey conducted by SUA could confirm the sampling method and validity of the results reported of the TCDC survey, which could be subjected to investigator bias.

	Pre-test	Intervention	Post-test
Intervention (6 districts)	O ₁	X	O ₂

Control (2 districts)	O ₁	-	O ₂

Figure 4.2 Quasi-experimental non-equivalent control group pre-test post-test study design. O₁: Observation 1; O₂: Observation 2; X: Intervention.

4.5 Participation Criteria

Household survey. For the household survey, all lactating mothers with children under five years were deemed eligible to participate in the survey. The oldest child of the mother who was above six months but under five years of age, referred to as the index child, at the time of the baseline survey in June-July 2015, was also included. The mothers and children were then followed up after about nine months of social marketing intervention in November 2016-January 2017. Mothers who did not provide consent to participate in the study were excluded. In total, 568 mothers and children participated in the baseline survey and out of these, 494 of them were followed up at endline. This study focuses on the change in KAP of mothers. Impact of the fortification program on index child is being studied elsewhere.⁽⁸⁶⁾

TCDC survey. In the baseline survey conducted by the TCDC, only households with women and children under five years at the time of the survey in April 2014 were included, since the survey was carried out to inform the design and implementation of social marketing events to particularly target lactating women. For the midline and endline surveys, all adult individuals were deemed eligible to participate in the survey. Inclusion of men in the survey was essential in order to provide information on household support for women towards the behaviour change. Participants were excluded from the study if no consent was provided to participate in the study. In total, 308 individuals at baseline, 443 at midline and 442 at endline participated in the TCDC surveys.

4.6 Sample Recruitment

Household survey. The household survey was conducted in all eight intervention and control districts in June-July 2015 before the social marketing intervention, and followed up after

about nine months of social marketing and 11 months of sale of fortified oil in November 2016-January 2017. Lactating mothers in each district were identified based on the lists of lactating mothers in each district provided by personnel from health centres. To select participants for the survey, the mothers in the lists were first stratified into age groups of below 20 years, 20-35 years, and over 35 years, geographic areas, and income levels. Then, from each group, mothers were randomly selected to obtain a representative sample (Figure 4.3). Mothers and children were excluded if no consent was obtained from the mothers to participate in the study.

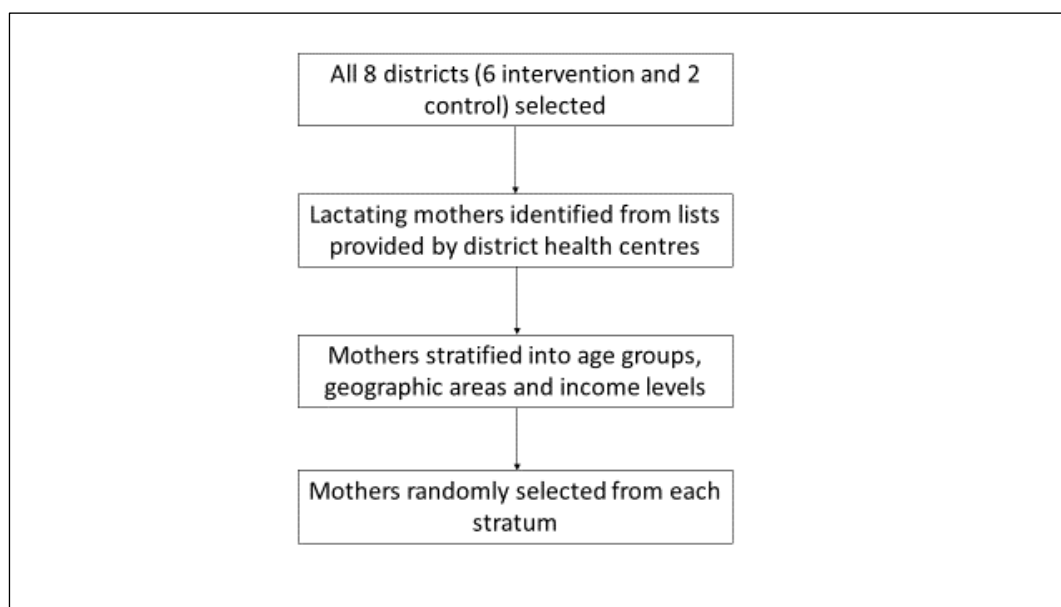


Figure 4.3 Sampling methodology used for selecting participants for household survey.

TCDC survey. Three surveys on KAP were carried out. The formative research survey, which is treated as the baseline survey for the study, was conducted in April-May 2014 before the social marketing interventions were implemented, in two of the three intervention districts in each region (the districts of Babati Urban and Hanang in Manyara region, and Kahama Urban and Shinyanga Rural in Shinyanga region). The midline survey was conducted in April 2016 covering five out of the six intervention districts (Babati Rural and Hanang in Manyara, and

Kahama Urban, Shinyanga Urban and Shinyanga Rural in Shinyanga); and the endline survey was conducted in April 2017 in the same five districts. There was no assessment in the control districts. Different sampling methodologies were used for the baseline as compared to the midline and endline surveys, because different consultants were involved in developing and implementing the formative research (baseline), and the midline and endline surveys. A multistage sampling technique was used to select participants for the baseline survey (Figure 4.4). First, two districts each in Manyara and Shinyanga, where the campaign would be implemented, were selected. Next, from each district, two wards, one urban and one rural, were selected randomly; and from each ward, two villages were randomly selected. In each village, depending on the size of the village and availability of participants, about 20 households were randomly selected. Multistage sampling was also employed to obtain samples for the midline and the endline surveys (Figure 4.5). For the midline and the endline surveys, first, a random sample of five districts out of the six intervention districts were selected. Then, five random wards were selected from within each district, and from each ward, one village was selected systematically. Finally, in each village, at least 27 adult individuals were randomly selected, although in some cases, fewer individuals were selected if the village is small.

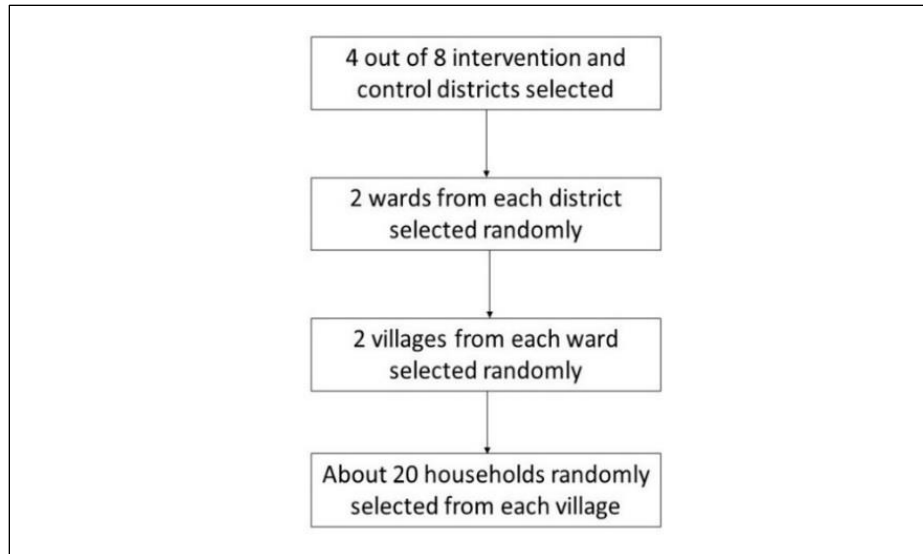


Figure 4.4 Multistage sampling technique for selecting participants for TCDC formative research (baseline) survey.

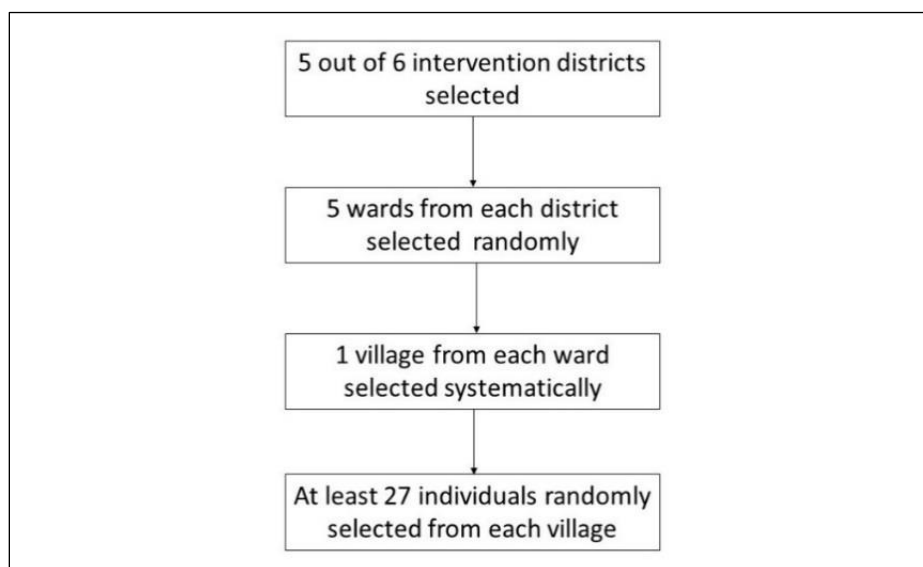


Figure 4.5 Multistage sampling technique for selecting participants for TCDC midline and endline surveys.

4.7 Sample Size

To calculate the minimum sample size for participants of the household survey and the TCDC survey, the following formula was used:

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where:

n= Minimum sample size

Z= Z statistic (=1.96 for 95% confidence interval (CI))

p= Expected proportion (proportion that picked a choice)

1-p= Probability of failure (proportion that did not pick the choice)

d= margin of error (=5% for 95% CI)

Using Z=1.96, p=0.50 (assuming maximum variability in the population), 1-p= 0.50 and d= 0.05, the minimum sample size was found to be 385. To account for non-response rate, the required sample size was increased by 5 percent, resulting in a minimum sample size of 404 study participants. Effect of cluster was not accounted for in calculating the minimum required sample size, as village-level information was not collected in the survey to determine the between-cluster and within cluster variances.

4.8 Data Collection and Processing

Household survey. The KAP questionnaires in the household survey were based on Hellen Keller International's survey on knowledge, attitudes and practices on the use of fortified foods in West Africa.⁽⁸⁵⁾ Information collected in the household survey included location variable: region, district and ward; demographic variables: age and years of education; vitamin A knowledge variables: heard of vitamin A, health benefits of vitamin A and measures to improve vitamin A intake; and major sources of information on vitamin A. Four additional questions were added into the endline survey that specifically tested knowledge of fortification, ability to identify the fortified sunflower oil and the intended behavioural outcome: use of the fortified oil

in the household. Other data collected included anthropometric information on the index child and information on patterns of oil purchases. The KAP questionnaire used for the baseline and endline surveys is given in Appendix C. The questionnaire was translated from English into Swahili by the researchers from SUA and was pre-tested in the target population. All selected mothers were interviewed in Swahili through household visits by CHWs and the research team from SUA who were trained for conducting the survey. Paper questionnaires were used for the baseline, and tablets were used for the endline. Oil samples were collected from the households to test for retinol content. The retinol content in the oil samples served as an indicator of actual oil consumption behaviour in the household. All oil samples were treated with anti-oxidants and transported under cold conditions to the laboratories of TFDA and analyzed for retinol content using high performance liquid chromatography (HPLC).⁽¹¹⁾ Blood samples were also collected from the mother and index child by finger prick to determine the level of serum retinol binding protein (RBP), a measure of the level of retinol in blood serum.⁽⁸⁷⁾ Blood sample from each participant was collected on a piece of filter paper and allowed to dry before storing them in a refrigerator and transported to the Tanzania Food and Nutrition Centre (TFNC) laboratory for analysis. In the TFNC laboratory, RBP level was measured by the enzyme-linked immunosorbent assay (ELISA) method using HPLC.⁽⁸⁶⁾ Data on retinol content in the household oil samples was used in this study, and data on RBP level in the dried blood spot (DBS) samples is being studied elsewhere.⁽⁸⁶⁾

The survey data were entered into Microsoft Excel spreadsheets by researchers from the SUA. Names of all respondents were de-identified and each respondent was assigned a unique identification number. The survey data was then sent to researchers from UW for analysis. In the analysis stage, index child were excluded if they were twins or triplets. Among 568 households

that were interviewed, 12 of them had twins and 2 of them had triplets as the index children, and were excluded.

From the household survey, knowledge of and attitudes towards vitamin A was assessed based on yes/no answers to the question testing knowledge of vitamin A. Knowledge of health benefits of vitamin A was defined as knowing at least one correct health benefits of vitamin A. Knowledge of using fortified foods to improve vitamin A intake was defined as a “yes” if the respondent mentioned “using fortified foods” as one of the methods one can use to avoid a diet poor in vitamin A. Knowledge of fortification was interpreted as a “yes” if “additional nutrients in food” was mentioned. Ability to identify the vitamin A-fortified sunflower oil was defined as the ability to identify the oil based on the fortification logo. To measure consumption of fortified oil the retinol content in the oil samples, determined using HPLC, was divided into three categories: inadequately fortified, adequately fortified, and over-fortified, based on the standard for fortification with retinyl palmitate of 20.0-40.0 mg/kg recommended by the Tanzania Bureau of Standards (TBS),⁽¹¹⁾ which converts to 36.6-73.3 mg/kg of retinol. Actual fortified oil consumption was assessed based on the fortification level category of the oil consumed by the household.

TCDC survey. In the TCDC survey, data on demographic variables, knowledge of vitamin A, major sources of information on vitamin A, attitudes and practices of consumption of vitamin A-fortified oil were collected during the baseline, midline and endline surveys using the questionnaires given in Appendix D and Appendix E respectively. The demographic variables collected in the midline and endline surveys were respondent’s age, sex, education level and major sources of income; knowledge variables included exposure to messages on vitamin A and vitamin A-fortified oil, knowledge of the health benefits of vitamin A and ability to identify

shops that sell the fortified sunflower oil; attitude variables included perceived susceptibility to VAD and confidence in the effectiveness of the fortified oil in preventing VAD; and practice variable was the intended outcome: household consumption of vitamin A-fortified oil. The questionnaires were translated from English to Swahili by an independent public health consultant hired by the TCDC for the purpose of conducting the survey. All surveys were conducted in Swahili through face-to-face interviews in public areas, shops and through household visits by CHWs and the consultant. The survey data were entered into Microsoft Excel spreadsheets by the independent consultant and sent to researchers from UW for analysis.

From the TCDC survey, knowledge related to fortified oil was assessed based on yes/no answers to questions testing knowledge of vitamin A and fortified foods and awareness that fortified sunflower oil is available at a discounted price for a limited time. Knowledge of the health benefits of vitamin A was defined as knowing at least one correct health benefit of vitamin A. Ability to identify shops that sell the fortified oil was defined as being able to identify the Masava retailers from the poster of the fortified oil or the fortification logo. Consumption was assessed based on self-reported practices.

E-Voucher redemption. Number of e-Vouchers redeemed was used as a measure of sales for fortified oil. Data on the number of e-Vouchers redeemed in each month for each package size was downloaded as Microsoft Excel spreadsheets from the online e-Voucher system. The e-Voucher system provides real time data on the number of e-Vouchers redeemed for fortified oil of 1 L, 5 L, 10 L or 20 L package size by each store that carries the oil. The workflow of the e-Voucher technology is given in Appendix F.

Spatial data. GPS coordinates of households that participated in the endline household survey and retailers who carried the fortified oil (hereafter called “Masava retailers”) were

recorded using Garmin® eTrex® Handheld GPS device. Due to poor GPS signal in rural areas, GPS coordinates could not be recorded for some households and Masava retailers. These resulted in 58 out of the total of 494 households and 94 out of the total of 554 retailers not being mapped. Locations of the social marketing events were obtained from the quarterly reports prepared by the TCDC. In the quarterly reports, the landmark or ward was recorded as the event location. If the given landmark was a health facility or if only the name of the ward was given as the location of clinic shows, the GPS coordinates of the health facility were obtained from the online Tanzania Health Facility Registry (HFR portal) database (for each of the ward that was recorded as a clinic show location, only one public health facility was identified in the HFR database).⁽⁸⁸⁾ For other types of events where no GPS coordinates or precise location was given, the most central point in the ward was used as a crude estimate to map the event location. The GPS coordinates of the ward was obtained from Google Maps or from the geographic search engine, Geody, if the ward was not found in Google Maps.

Information as to the wards in which the participant households were located were collected in the baseline household survey, and the wards of the Masava retailers was obtained from the e-Voucher database. Since the CBOs did not provide the wards for all social marketing events that were conducted, the wards were identified from the HFR portal or otherwise based on spatial overlap between their approximate location and the area administered by the wards.^(88,89)

Figure 4.6 shows the project timeline outlining the period of implementation of the BCC events and the different phases of data collection for the household and the TCDC surveys.

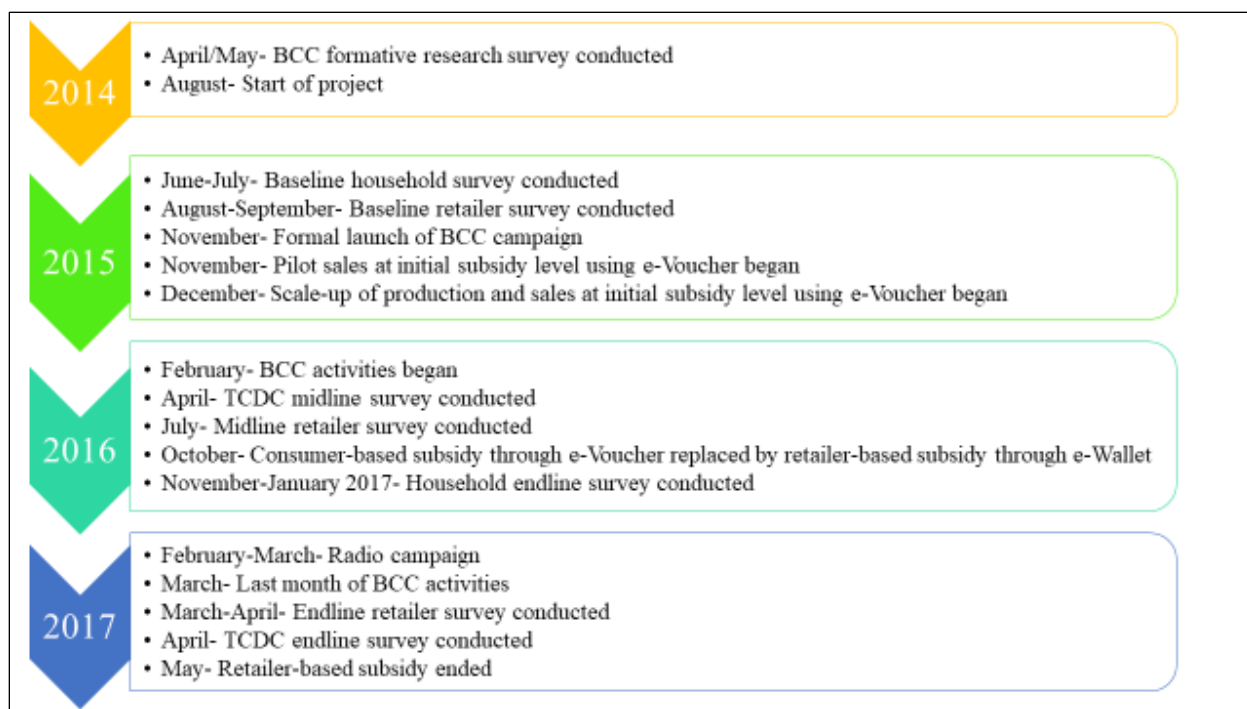


Figure 4.6 Project timeline.

4.9 Data Analysis

Spatial analysis. Locations of the Masava retailers, households that participated in the endline household survey and social marketing events with available GPS coordinates were mapped and visualized in ArcGIS 10.5.1. Euclidean distances or straight-line distance, in meters, from each household to the nearest clinic where clinic shows were held, and from each Masava retailer to the nearest clinic where clinic shows were held, were calculated using the “point distance” tool in ArcGIS and exported into Microsoft Excel for further analysis. The distance between household and clinics were then divided into five categories: 0-0.5 km, 0.5-1.0 km, 1.01-2.0 km, 2.01-3.0 km and greater than 3.0 km. Small increments were used as individuals in rural areas are less likely to travel far to purchase cooking oil, since poor households often purchase oil on a daily basis. The geographical data were geo-rectified to the Universal Transverse Mercator (UTM) zone 37S projection, 1984 datum.

Statistical analysis. From the results of the household survey, Pearson's chi-squared (χ^2) test was used to compare the sociodemographic characteristics and knowledge related to vitamin A and the fortified oil between participants from the intervention and control groups. Pearson's χ^2 test was used as the test allows us to determine how likely the observed difference in categorical variables from two independent groups is purely due to chance.⁽⁹⁰⁾ To test hypothesis H1, six measures were compared in the intervention and in the control group before and after nine months of intervention using the McNemar's test. The six variables were knowledge of vitamin A, health benefits of vitamin A, using vitamin A-fortified foods to improve vitamin A intake, self-reported consumption of fortified oil, ability to identify the fortified oil among other oils and actual household fortified consumption, indicated by the retinol content in the oil samples. The McNemar's test was used as it is suited to test for a statistically significant change in proportion of categorical variables at two time-points in the same population.⁽⁹¹⁾ From results of TCDC survey, Pearson's χ^2 test was used to compare the sociodemographic characteristics of participants of the baseline, midline and endline surveys. Pearson's χ^2 test was also used to test the difference in knowledge related to fortified oil and consumption of fortified oil after 3 months and 13 months of the social marketing campaign. The results from the TCDC surveys were then compared with the results from the household surveys using χ^2 test in order to test for bias. Major sources of information on vitamin A were compared between men and women using the TCDC survey to identify differences between the two sexes in the major sources of health information.

To determine the association between distance from household to the nearest social marketing event location and retinol level in the oil consumed (Hypothesis H2), proportional odds logistic regression was used. In the analysis, retinol level was treated as an ordinal variable

with three ordered levels: inadequately fortified, adequately fortified and over-fortified. Distance was also treated as ordinal data with five levels: 0-0.50 km, 0.51-1.0 km, 1.01-2.0 km, 2.01-3.0 km and more 3.0 km. The regression model was adjusted for region, mother's age, education level, wealth, knowledge of vitamin A and fortification, number of Masava retailers within 2 km from the household and number of events held in the ward.

To examine the association between distance of Masava retailer to the nearest social marketing event location and volume of fortified oil redeemed from each Masava retailer after the event (Hypothesis H3), multilinear regression was used. Since the supply of sunflower seeds varies during the year, the regression model was adjusted for seasonal variation in the oil supply using three-month intervals, or quarters. In the analysis, distance to nearest clinic was treated as ordinal data with five levels, using the same cut-offs as that that used for the distance between households and event locations, while quarter was treated as nominal data.

Lastly, multilinear regression model was used to examine the relationship between number and type of social marketing events held in each quarter, and volume of fortified oil redeemed in the ward following the events (Hypothesis H4). In testing hypotheses H3 and H4, the volume of redemptions used in the analyses was the total volume of fortified oil redeemed, in litres, from the day of the first event in the quarter to 30 days after the day of the last event in the quarter. A period of 30 days was used to account for spill-over effects from events held in the last quarter.

4.10 Ethics Approval

Household survey. Ethics approval for the collection and use of survey data from humans was obtained from the UW Office of Research Ethics and the National Institute for Medical Research of Tanzania (Promoting Use of Locally Fortified Sunflower Oil Using E-

Vouchers (NIMR/HQ/R.8a/VOLIX/1299). All personnel involved in conducting the study and data analysis at UW were approved by the UW Office of Research Ethics. A copy of the UW Research Ethics approval form and ethics clearance from the National Institute for Medical Research of Tanzania can be found in Appendix G and H respectively.

TCDC survey. The TCDC survey was conducted as an administrative survey of the TCDC. Use of the survey data for this study was approved by TCDC and MEDA.

Chapter 5: Results

5.1 Sample Size

The sample size in both the baseline and the endline household surveys met the minimum sample size of 404. In the household survey, 568 households participated at baseline and of these, 494 were followed up at the endline survey, giving an attrition rate of 13 percent. The sample size in the TCDC baseline survey (n=308), however, did not meet the minimum sample size. In the TCDC midline and endline surveys, the sample sizes were increased to 443 and 442 respectively.

5.2 Social and Demographic Characteristics

In the household survey, the majority of the mothers were from rural areas and were under 26 years with primary education as the highest level of education attained (Table 5.1). Among the 568 participants, the median age was 29 years in both the intervention and the control group. Besides the setting, there was no significant difference between the intervention and control districts at baseline. There would be no difference in participant characteristics, except age, between the baseline and endline household surveys, since the mothers from the baseline survey were followed up for the endline survey. Attrition rates were low enough not to cause concerns about bias in the endline survey. Reasons for attrition included migration and unavailability of the mothers at the time of the endline survey. The only difference that was significant between households that attrited the sample and those who were followed up was that mothers from households that attrited the sample were younger (by 2 years) than those who were followed up.⁽⁹²⁾

In the TCDC survey, the majority of the participants of the baseline and midline surveys were women between 26 and 33 years with primary education as the highest level of education attained. Age information was not collected at the endline survey. The baseline survey interviewed more participants from urban settings compared to the midline and the endline surveys. Compared to the participants of the household survey, participants of the TCDC surveys were older and a significantly higher proportion were from urban settings at the baseline point, when compared to intervention districts only. Also, the participants of the midline and endline TCDC survey were more educated compared to those of the household survey.

Table 5.1 Social and demographic characteristics of survey participants.

Variable	Household survey		TCDC survey		
	Intervention n (%) (N=366)	Control n (%) (N=202)	Baseline n (%) (N=308)	Midline n (%) (N=443)	Endline n (%) (N=442)
Age (median, years)	29	29	31	N/A	N/A
Age group					
<26 years	132 (36.1)	72 (35.6)	44 (14.3) ^{\$}	86 (19.4) ^{*, \$}	Data not collected
26-33 years	113 (30.8)	66 (32.7)	155 (50.3) ^{\$}	145 (32.7) ^{*, \$}	
34-42 years	104 (28.4)	61 (30.2)	90 (29.2) ^{\$}	113 (25.5) ^{*, \$}	
>42 years	17 (4.6)	3 (1.5)	19 (6.2) ^{\$}	99 (22.3) ^{*, \$}	
Setting					
Rural	214 (58.5)	163 (80.7) ⁺	136 (44.2) ^{\$}	275 (62.1) [*]	257 (58.1)
Urban	152 (41.5)	39 (19.3) ⁺	172 (55.8) ^{\$}	168 (37.9) [*]	185 (41.9)
Sex					
Male	0 (0.0)	0 (0.0)	56 (18.2) ^{\$}	208 (47.0) ^{*, \$}	165 (37.3) ^{*, \$}
Female	366 (100.0)	202 (100.0)	252 (81.8) ^{\$}	235 (53.0) ^{*, \$}	277 (62.7) ^{*, \$}
Education level					
No education	22 (6.0)	13 (6.4)	35 (11.3)	48 (10.8) ^{*, \$}	21 (4.8) ^{*, \$}
Primary education	300 (82.0)	168 (83.2)	237 (76.9)	312 (70.4) ^{*, \$}	298 (67.4) ^{*, \$}
Secondary and above	44 (12.0)	21 (10.4)	36 (11.7)	83 (18.7) ^{*, \$}	123 (27.8) ^{*, \$}
Major source of income					
Farmer	Data not collected		141 (45.8)	215 (48.5) [*]	383 (86.7) [*]
Food vendor			10 (3.2)	0 (0) [*]	0 (0) [*]
Employee			N/A	63 (14.2) [*]	53 (12.0) [*]

Livestock/poultry/ pet trader	18 (5.8)	149 (33.6)*	419 (94.8)*
Fishing	N/A	0 (0.0)*	82 (18.6)*
Small business	69 (22.4)	16 (3.6)*	0*
Others	70 (22.7)	0 (0)*	0*

N/A- Option not given in questionnaire.

[†]Significantly different from intervention group at 95% CI.

^{*}Significantly different from TCDC baseline survey participants at 95% CI.

[§]Significantly different from household survey participants in intervention and control districts.

5.3 Change in KAP

From the results of the household survey, there was no baseline difference in knowledge of vitamin A, health benefits of vitamin A and of using vitamin A-fortified foods to improve vitamin A intake between the intervention and the control group (Table 5.2). After nine months of intervention, there was no statistically significant change in knowledge of vitamin A and of using vitamin A-fortified foods to improve vitamin A intake in either the intervention or the control group. However, knowledge of the health benefits of vitamin A improved significantly in both groups. Based on the endline survey, knowledge of fortification was significantly higher in the intervention group than in the control group. At the endline survey, five mothers from the intervention districts reported consuming the fortified sunflower oil, while in the control districts, one mother reported consuming the fortified oil. The household survey did not collect information that explains the low rate of consumption of the fortified sunflower oil. The mothers from the intervention districts knew that the oil they were using was fortified because either they recognized the fortification logo or they were told by the retailer that the oil was fortified. In the control districts, the mother reported that she knew that the oil was fortified because “no chemicals was added to it”.

Actual fortified oil consumption was assessed based on the retinol content in the oil samples collected from the households. Out of the 494 households that participated in the endline household survey, no oil sample was available for 13 households (2.6 percent). Based on the retinol content in the oil samples, at baseline, consumption of inadequately fortified oil was significantly higher and consumption of adequately fortified oil was significantly lower in the control districts compared to the intervention districts. This result was still observed after nine months of intervention. However, the proportion of households consuming inadequately fortified oil in the intervention districts significantly decreased from 78 percent to 35 percent while the proportion of households consuming adequately fortified and over-fortified oil increased significantly from about 22 percent to 26 percent and from 0.3 percent to 39 percent respectively. Significant decrease in consumption of inadequately fortified oil and increase in consumption of adequately fortified and over-fortified oil was also observed in the control districts. However, the change was smaller in the control districts as compared to the intervention districts (1.8 percent versus 4.3 percent).

Table 5.2 Change in KAP towards consumption of vitamin A-fortified oil based on results of household survey.

Variable	Baseline n (%)			Endline n (%)		
	Overall n (%) (N=568)	Intervention n (%) (N=366)	Control n (%) (N=202)	Overall n (%) (N=494)	Intervention n (%) (N=309)	Control n (%) (N=185)
Knowledge of vitamin A	425 (74.8)	270 (73.8)	155 (76.7)	392 (79.4)	242 (78.3)	150 (81.1)
Knowledge of health benefits of vitamin A	187 (32.9)	121 (33.1)	66 (32.7)	222 (45.0)	138 (44.7)*	84 (45.4)*
Knowledge of using vitamin A-fortified foods to improve vitamin	10 (1.8)	8 (2.2)	2 (1.0)	6 (1.2)	6 (1.9)	0 (0.0)

A intake						
Knowledge of fortification	N/A	N/A	N/A	63 (12.8)	50 (16.2)	13 (7.0) ⁺
Self-reported use of vitamin A-fortified oil	N/A	N/A	N/A	6 (1.3)	5 (1.0)	1 (0.5)
Ability to identify the vitamin A-fortified oil	N/A	N/A	N/A	4 (0.8)	4 (1.3)	0 (0.0)
Retinol level in oil consumed						
Inadequately fortified	425 (81.1)	266 (78.0)	159 (86.9) ⁺	235 (48.9)	105 (35.0)*	130 (71.8) ⁺⁺
Adequately fortified	97 (18.5)	74 (21.7)	23 (12.6) ⁺	104 (21.6)	78 (26.0)*	26 (14.4) ⁺⁺
Over-fortified	2 (0.4)	1 (0.3)	1 (0.5) ⁺	142 (29.5)	117 (39.0)*	25 (13.8) ⁺⁺

N/A- Question not in questionnaire.

⁺Significantly different from intervention group at 95% CI.

^{*}Significantly different from baseline at 95% CI.

From the TCDC survey, we found that knowledge of fortified foods and vitamin A-fortified oil improved significantly by 56 percent and 60 percent after 3 months and 13 months of intervention respectively (Table 5.3). Awareness of the availability of vitamin A-fortified sunflower oil at a discounted price and knowledge of the health benefits of vitamin A increased significantly by 10 percent and 12 percent respectively from 3 months to 13 months of intervention. At the endline survey, 68 percent of the endline survey participants knew that they could purchase the fortified oil from stores that display the poster of Masava oil or the fortification logo. Change in attitude towards fortified oil pre- and post-intervention could not be assessed as the attitude variables were not collected at the baseline and midline surveys. The endline survey found that 35 percent of the participants consider themselves susceptible to VAD, 56 percent of the participants believe that cooking with vitamin A-fortified oil can highly prevent

VAD and 19 percent believe that cooking with vitamin A-fortified oil can somewhat prevent VAD. The TCDC survey also found changes in self-reported consumption of fortified sunflower oil from 3 months to 13 months of intervention. Households that reported never consuming fortified sunflower oil decreased significantly by 27 percent and those consuming the oil more than two times a week increased significantly by 32 percent. The primary reasons reported for not using the fortified oil was that the oil was not sold in shops where the households usually purchase their cooking oil (reported by 146 or 33.0 percent of all respondents) and shops selling it were far from their homes (reported by 149 or 33.7 percent of all respondents). Six respondents mentioned that they did not use the fortified oil because they were satisfied with the traditional oil that they have been using. Other reasons for not consuming the oil include high price, lack of family support and uncertainty of the advantages of consuming fortified oil.

Table 5.3 Change in KAP towards consumption of vitamin A-fortified oil based on results of TCDC survey.

Variable	Baseline n (%) (N=308)	Midline n (%) (N=443)	Endline n (%) (N=442)
Heard of fortified foods and vitamin A-fortified sunflower oil	54 (17.5)	324 (73.1) ⁺	344 (77.8) ⁺
Aware that vitamin A-fortified oil is available at a discounted price for a limited time	N/A	275 (62.1)	322 (72.6)*
Knowledge of health benefits of vitamin A	N/A	277 (62.5)	329 (74.4)*
Ability to identify shops that sell vitamin A-fortified sunflower oil	N/A	N/A	301 (68.1)
Perceived susceptibility to VAD	N/A	N/A	156 (35.3)
Confidence in the effectiveness of vitamin A-fortified oil in preventing VAD			
Very much			249 (56.3)
Somewhat	N/A	N/A	85 (19.2)
Not at all			108 (24.4)
Fortified oil use			
Never		239 (53.9)	119 (26.9)*
Once a week	N/A	17 (3.8)	28 (6.3)*

More than 2 times a week	28 (6.3)	173 (39.1)*
At least once a day	159 (35.9)	122 (27.6)*

N/A- Question not in questionnaire.

[†]Significantly different from baseline at 95% CI.

^{*}Significantly different from midline at 95% CI.

5.4 Sources of Information

In both the household survey and the TCDC survey, respondents were asked about the sources of information on vitamin A and the fortified oil. In the household survey, the mothers mentioned health centre, CHWs, radio, school, neighbours, television, IEC materials, family members, church, Masava team/MEDA and public announcements as sources of information. A health centre was the most frequently listed source of information, reported by 81 percent of the mothers who had heard of vitamin A, followed by CHWs and radio, reported by about 19 percent and 8 percent of the mothers respectively (Figure 5.1).

In the TCDC survey, the respondents reported clinic shows, radio, cultural shows, bicycle races, IEC materials, road shows, CHWs, health service providers, friends, relatives and television as sources of information on fortified oil. Clinic shows were the most frequently listed source of information for women, reported by 82 percent of the women who had heard of fortified oil, followed by radio and cultural shows, reported by 64 percent and 60 percent of the women respectively (Figure 5.2). For men, radio was the major source of information, followed by clinic shows and IEC materials.

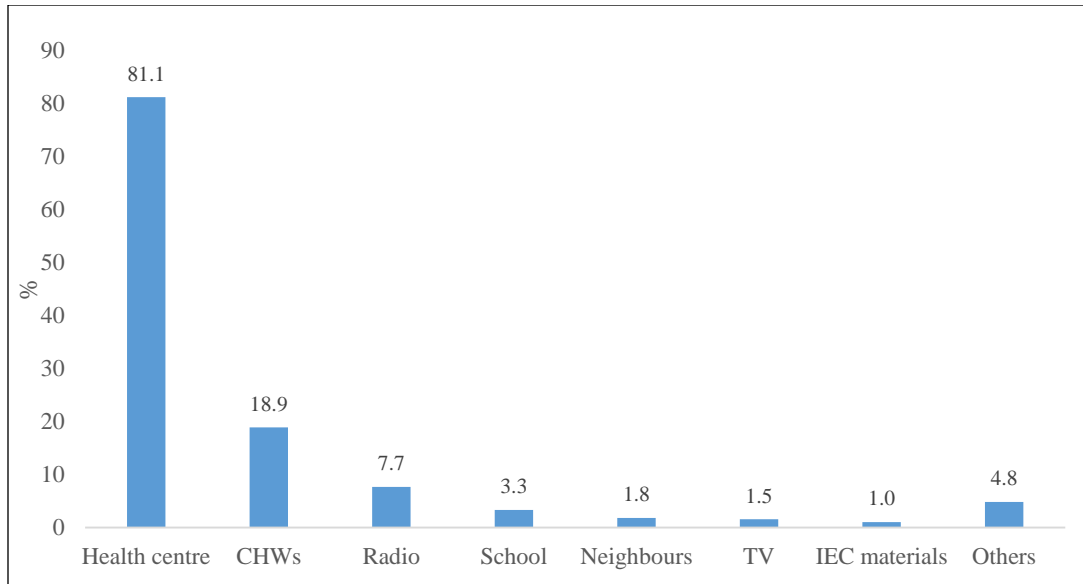


Figure 5.1 Sources of information for women based on results of household survey.

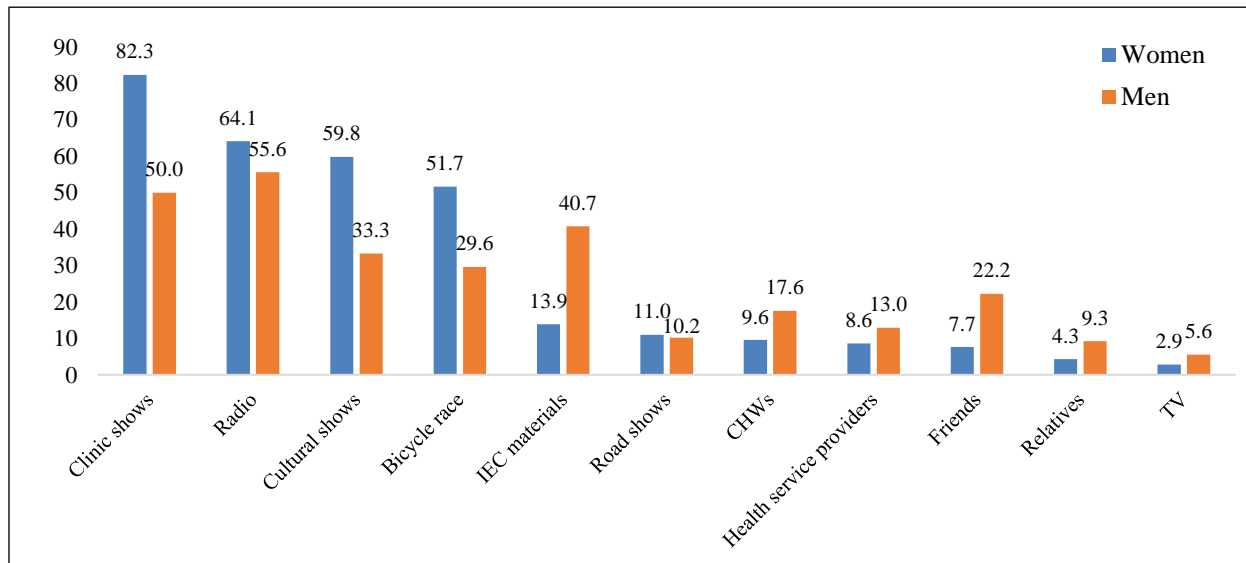


Figure 5.2 Sources of information for men and women based on results of TCDC survey.

5.5 Spatial distribution of households, Masava retailers and events

Among the 494 households that participated in the endline household survey, about two-third of the households were from Manyara. Out of the 554 Masava retailers, 46 percent of them were from Manyara. Table 5.4 shows the number of households interviewed and the number of

Masava retailers in each district in Manyara and Shinyanga. In Manyara, 43 percent of the participant households were from the control district, whereas in Shinyanga, 27 percent of the households were from the control district. The number of Masava retailers were about the same in all the three intervention districts in Manyara, whereas in Shinyanga, there were more retailers in the urban districts compared to the rural district.

The spatial distribution of households from the intervention and control districts that participated at the endline household survey together with the locations of the Masava retailers and social marketing events in Manyara and Shinyanga are shown in Figure 5.3 and Figure 5.4 respectively. Out of the 494 households interviewed at the endline survey, GPS coordinates could not be recorded for 58 households (46 in the control district of Mbulu and 12 in Babati Urban). And out of the 554 Masava retailers, GPS coordinates could not be obtained for 96 retailers. From the total of 291 events that were conducted during the 13 month period, wards where they were conducted could not be identified for 27 events. 77 of the 291 events conducted were clinic shows (26 percent), out of which, GPS coordinates could not be obtained for 7. Households, retailers and clinic shows whose GPS coordinates could not be obtained and events whose wards could not be identified are not shown in the figures.

Table 5.4 Distribution of household survey participants and Masava retailers in each district in Manyara and Shinyanga regions.

Region	District	Number of households interviewed (%)	Number of Masava retailers (%)
Manyara	Babati Rural	68 (21.0)	80 (31.0)
	Hanang	65 (20.1)	93 (36.0)
	Babati Urban	52 (16.0)	85 (32.9)
	Mbulu (control)	139 (42.9)	0 (0.0)
Shinyanga	Shinyanga Rural	44 (25.9)	67 (22.8)
	Shinyanga Urban	42 (24.7)	102 (34.7)
	Kahama Urban	38 (22.4)	125 (42.5)
	Kishapu (control)	46 (27.0)	0 (0.0)

The second objective of the study was to determine the association between distance of social marketing events from the household and household consumption of fortified oil. It was not possible to obtain the precise locations of most types of events by TCDC and the CBOs that conducted the events, or even if the precise locations were recorded, their GPS coordinates could not be obtained from the internet. Precise GPS coordinates could be obtained only for clinic shows from the Tanzania HFR database. Hence, we only studied the association between distance of clinic shows from household and consumption of fortified oil. This is a disadvantage, as our results may be confounded by occurrence of other events. However, as we will show in section 5.9 below, the time-series data on oil sales and events suggest that only the clinic shows and cooking shows had a significant effect on sales. Clinic shows and cooking shows comprised of 26.5 percent (n=77) and 37.8 percent (n=110) respectively of all the events conducted.

Among the participant households from the intervention districts in Manyara whose GPS could be recorded, about 15 percent of them were located within 0.5 km from the nearest clinic show location, 16 percent were between 0.5-1 km, 22 percent were between 1-2 km, 4 percent were between 2-3 km and 43 percent were more than 3 km from the nearest clinic show location (Table 5.5). In Babati Urban, as compared to households, retailers were located closer to event locations (Figure 5.3). The majority of the households were located 0.5-2 km or more than 3 km from the nearest clinic show location (Table 5.5). In Hanang, most retailers were within 2 km from event locations, while most households were located 1-2 km or more than 3km from the nearest clinic show location. On the other hand, in Babati Rural, unlike the trend observed in Babati Urban and Hanang, most retailers were more than 3 km away from event locations and

most households were within 1 km from nearest clinic show location. In Mbulu, there were no retailers or events since Mbulu was the control district in Manyara.

In Shinyanga, among the participant households in the intervention districts whose GPS could be obtained, 16 percent of the households were located within 0.5 km from nearest clinic show location, 11 percent were located between 0.5-1 km, 15 percent were between 1-2 km, 4 percent were between 2-3 km and more than 50 percent were more than 3 km from the nearest clinic show location (Table 5.5). In Kahama Urban and Shinyanga Urban, most retailers were clustered at the town centre and some were scattered elsewhere in the district (Figure 5.4). In Kahama Urban, about one-fourth of the households were located 1-2 km and two-thirds of the households were located more than 3 km away from the nearest clinic show location (Table 5.5). Unlike the observation in Kahama Urban, in Shinyanga Urban, most households were located within 1 km (45 percent) and 43 percent were located more than 3 km away from the nearest clinic show location. In Shinyanga Rural, most retailers were located more than 3 km from event locations and households were fairly evenly distributed from <0.5 km to 2 km from the nearest clinic show location. Like Kahama Urban and Shinyanga Urban, most households in Shinyanga Rural were located more than 3 km from the nearest clinic show location. In Kishapu, no households or retailers are located within 3 km from the two locations where events were conducted. Kishapu was the control district in Shinyanga.

Overall, in terms of distance to the nearest clinic show location in the intervention areas, no distinct trend was observed for urban or rural districts or districts in Manyara or Shinyanga.

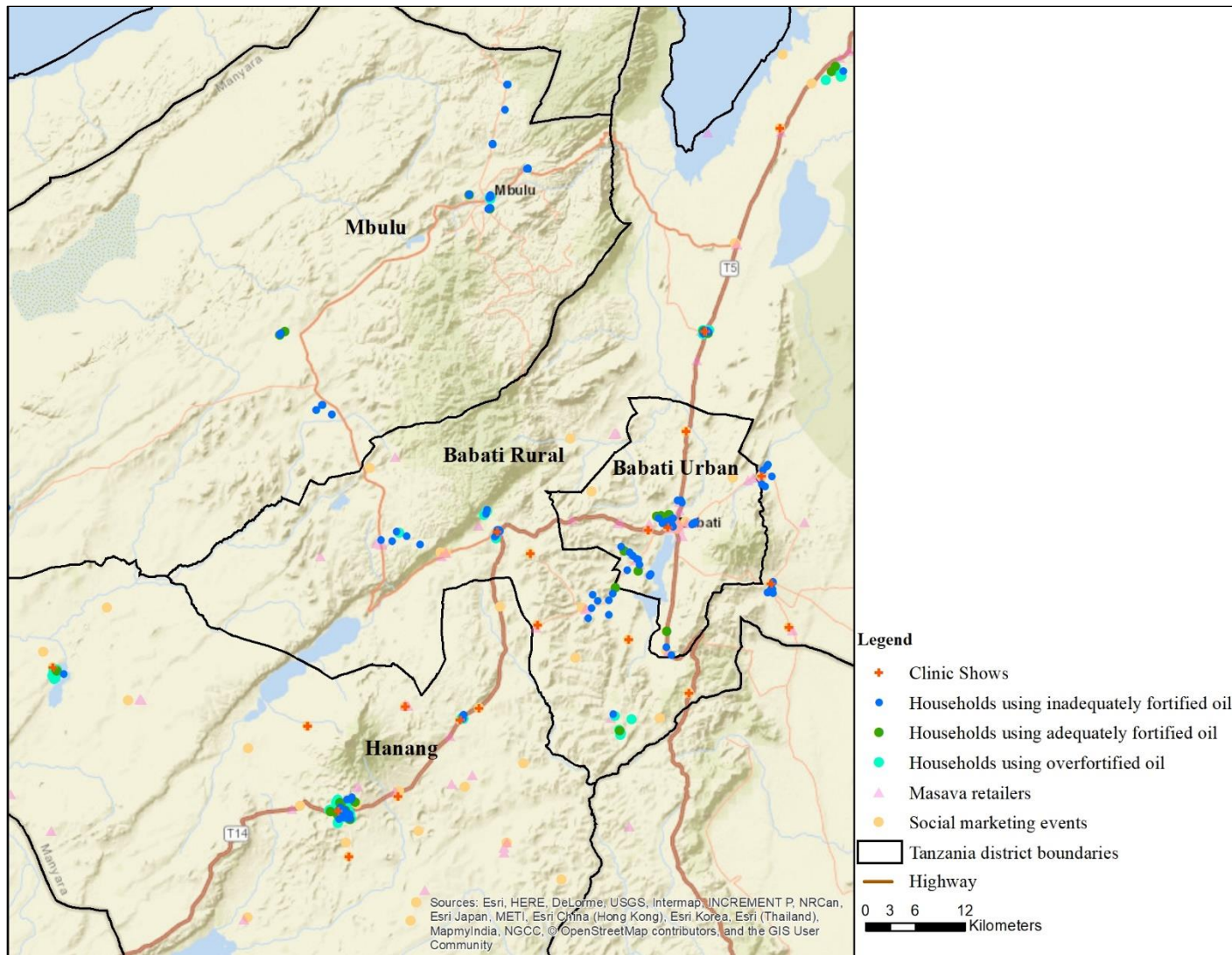


Figure 5.3 Spatial distribution of social marketing events, Masava retailers and participant households in Manyara. District boundary basemap source: National Bureau of Statistics, Tanzania, 2017.⁽⁸³⁾ Road basemap source: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia. © OpenStreetMap contributors, and the GIS User Community, 2018.⁽⁹³⁾

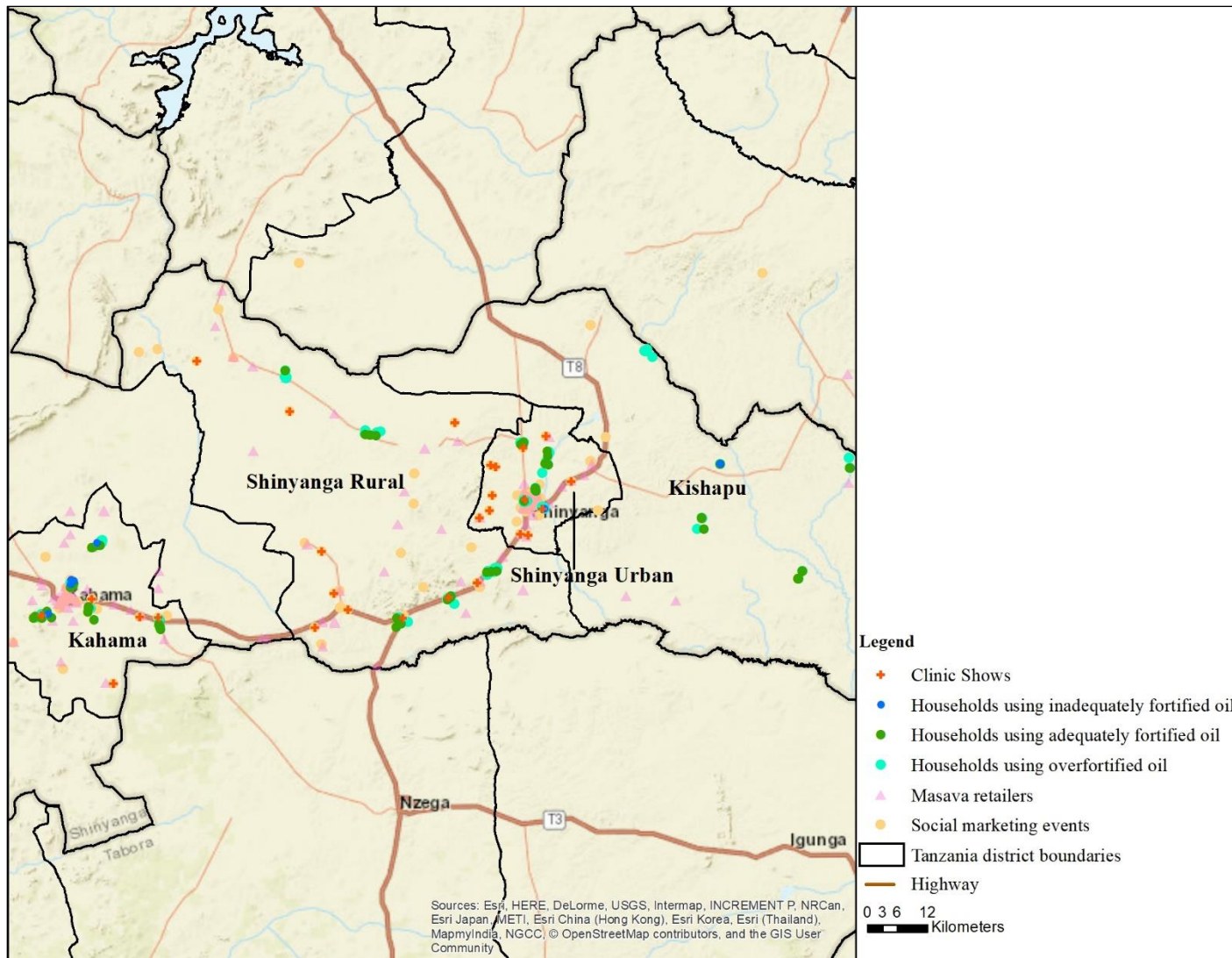


Figure 5.4 Spatial distribution of social marketing events, Masava retailers and participant households in Shinyanga.

District boundary basemap source: National Bureau of Statistics, Tanzania, 2017.(83) Road basemap source: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community, 2018.(93)

Table 5.5 Distribution of participant households by distance to nearest clinic where clinic shows were held in Manyara and Shinyanga.

Region	District	Number of households (%)				
		≤ 0.5 km	0.5-1 km	1-2 km	2-3 km	>3 km
Manyara	Babati Urban	2 (5.0)	9 (22.5)	8 (20.0)	3 (7.5)	18 (45.0)
	Hanang	5 (7.7)	8 (12.3)	26 (40.0)	0 (0.0)	26 (40.0)
	Babati Rural	19 (27.9)	10 (14.7)	5 (7.4)	4 (5.9)	30 (44.1)
Manyara (overall)		26 (15.0)	27 (15.6)	39 (22.5)	7 (4.0)	74 (42.8)
Shinyanga	Kahama Urban	1 (2.6)	2 (5.3)	9 (23.7)	3 (7.9)	23 (60.5)
	Shinyanga Urban	12 (28.6)	7 (16.7)	5 (11.9)	0 (0.0)	18 (42.9)
	Shinyanga Rural	7 (15.9)	5 (11.4)	5 (11.4)	2 (4.5)	25 (56.8)
Shinyanga (overall)		20 (16.1)	14 (11.3)	19 (15.3)	5 (4.0)	66 (53.2)

5.6 Association between household characteristics and distance to nearest clinic show location, and fortified oil consumption

The relationship between household characteristics and distance to the nearest clinic show location, and household fortified oil consumption, defined as the level of retinol— inadequately fortified, adequately fortified or over-fortified— in the oil samples obtained from the households, was studied using proportional odds logistic regression analysis. The analysis was restricted to 288 out of the 309 participant households in the intervention districts whose GPS coordinates could be recorded and from which oil samples could be collected.

Table 5.6 shows the odds ratios (OR) and the associated 95% CI from the model predicting the probability of consuming oil with the next higher retinol level category. At 95% CI, after adjusting for region, mother’s age and education level, household wealth, knowledge of vitamin A, health benefits of vitamin A and fortification, number of clinic shows and other types of social marketing events held in the ward, and number of Masava retailers within 2 km from the household, there was no significant association between distance of nearest clinic show location and fortified oil consumption. When controlled for other factors, compared to mothers who are

under 26 years old, mothers who are older than 33 years are significantly more likely to use oil that is fortified to the next higher retinol level category (adjusted OR_{34-42 years vs <26 years} = 1.93, p-value = 0.031, OR_{>42 years vs <26 years} = 3.82, p-value = 0.043). Compared to mothers with more than 12 years of education, mothers with 7-12 years and less than 7 years of education are significantly less likely to consume oil with higher retinol content, after adjusting for other factors (adjusted OR_{7-12 years vs >12 years education} = 1.77×10^{-7} , p-value ≈ 0.00 , OR_{<7 years vs >12 years education} = 1.74×10^{-7} , p-value ≈ 0.00). Households in Shinyanga were significantly more likely to consume oil with higher retinol content compared to households in Manyara. Wealthier households were also significantly more likely to consume oil with higher retinol content than poorer households. On the other hand, no significant association was found between any of the predictors of behaviour change— knowledge of vitamin A, health benefits of vitamin A or fortification, number of clinic shows or other types of social marketing events conducted in the ward— and retinol level in the oil consumed.

Table 5.6 Proportional odds logistic regression results of the association between retinol level category and distance of household from nearest clinic show location.

Variables	Adjusted Odds Ratio	95% CI	p-value
Age group			
<26 years (reference)	1.00	—	—
26-33 years	0.93	0.52 to 1.68	0.816
34-42 years	1.93	1.06 to 3.49	0.031*
>42 years	3.82	1.04 to 14.01	0.043*
Region			
Manyara (reference)	1.00	—	—
Shinyanga	7.11	4.13 to 12.25	1.553×10^{-12} *
Education level			
High (>12 years) (reference)	1.00	—	—
Medium (7-12 years)	1.77×10^{-7}	1.04×10^{-7} to 3.43×10^{-7}	0.000*
Low (<7 years)	1.74×10^{-7}	8.82×10^{-8} to 3.43×10^{-7}	0.000*
Wealth index	1.33	1.11 to 1.59	2.010×10^{-3} *

Knowledge of vitamin A			
No (reference)	1.00	—	—
Yes	1.34	0.71 to 2.53	0.362
Knowledge of health benefits of vitamin A			
No (reference)	1.00	—	—
Yes	0.65	0.37 to 1.12	0.122
Knowledge of fortification			
No (reference)	1.00	—	—
Yes	0.99	0.51 to 1.91	0.980
Clinic shows held in ward	0.85	0.60 to 1.20	0.364
Other types of social marketing events held in ward	1.06	0.93 to 1.21	0.372
Number of Masava retailers within 2 km from household	1.02	0.99 to 1.06	0.218
Distance of household from nearest clinic show location			
<0.5 km (reference)	1.00	—	—
0.5-1 km	0.57	0.23 to 1.42	0.229
1-2 km	1.06	0.45 to 2.52	0.897
2-3 km	0.68	0.18 to 2.59	0.573
More than 3 km	0.80	0.30 to 2.08	0.642

Fortification level (mg/kg): inadequately fortified: <36.6, adequately fortified: 36.6-73.3, over-fortified: >73.3

*Significant association at 95% CI (p<0.05).

Residual deviance = 550.570

5.7 Time-series analysis of volume of fortified oil redeemed

The fortified oil could be purchased at a subsidized price through the consumer-based e-Voucher system from November 2015 to May 2017. During the period from November 2015 to May 2016, the oil was sold only in 1 L bottles. Findings from the baseline household survey suggested that less than 20 percent of the households buy cooking oil in packages of 1 L or more, but a majority of them, particularly the poorer households in Shinyanga, buy oil in scoops (approximately 30-60 ml or approximately enough to cook one meal). It is a common practice for retailers to purchase oil in larger containers from the factory (e.g. in 10 L or 20 L containers)

and repackage it into smaller containers or sell it in scoops provided from the large containers. In order to reach the poorer households, fortified oil began to be produced in 5 L containers from June 2016 and 20 L containers from July 2016, following permission being granted from the TFDA.

Through the e-Voucher technology, data on the volumes of e-Vouchers redeemed for each of 1 L, 5 L, 10 L and 20 L containers from November 2015 to May 2017 in Manyara and Shinyanga was obtained (Figure 5.5, Figure 5.6). During the 19-month period, a total of 42,481 L of fortified oil was redeemed in Manyara. Of these, 2,367 L (5.6 percent) were redeemed from November 2015 to January 2016 before the social marketing campaign was initiated and 5,666 L (13.3 percent) were redeemed during the first 3 months of the campaign from February to April 2016 (Figure 5.10). Although the redemptions did not increase linearly over time with the implementation of the social marketing campaign, in Manyara, redemptions increased by more than 3 times from an average of 789 L before the campaign (November 2015-January 2016) to 2,532 L after 2-3 months of campaign (March-May 2016). After one year of campaign, in February-April 2017, the average redemption increased to more than 5 times that from before the campaign to 4,235 L. In Shinyanga, a total of 11,247 L of fortified oil was redeemed from November 2015 to May 2017. Of these, 955 L (8.5 percent) were redeemed between November 2015 and January 2016 before the campaign was initiated (Figure 5.7). The redemptions increased gradually from an average of 318 L before the campaign to 790 L after about 5 months of campaign in June-August 2016. Although there was a general increasing trend in the volume of fortified oil redeemed in both Manyara and Shinyanga, the volume of oil redeemed was substantially higher in Manyara than in Shinyanga. This finding contradicts the result of our earlier analysis shown in Table 5.6 that the retinol content in oil samples from Shinyanga were

significantly higher than those from Manyara. This could be explained by the fact that palm oil, which is the main oil consumed in Shinyanga, is often over-fortified by the large scale manufacturers who produce the oil in Dar es Salaam. Sunflower oil, on the other hand, itself has low levels of vitamin A and is the preferred oil in Manyara.

A common trend observed in the volume of redemptions in both Manyara and Shinyanga is the increasing volume of redemptions from June 2016 to around September 2016 and the period of low redemption in December 2016 and January 2017. The trend was particularly prominent in Manyara. The increase in redemptions from June 2016 could, in part, be explained by the fact that in June and July 2016, the fortified oil began to be produced into 5 L and 20 L containers respectively. With the availability of larger containers of oil, retailers could repackage them into smaller packages or sell them in scoops to the poorer households. Another reason for the high redemption between July and September 2016 is that June is the harvest season for sunflower seeds and sunflower oil was produced within 3-4 months after the harvest season. The small enterprises that produce the sunflower oil did not have the financial resources to buy seeds during the harvest season and stock them for production during off-seasons. To encourage production during the low season, MEDA had a scheme to provide working capital to the SMEs which ran from February to November 2016. After the scheme was withdrawn, low supply of sunflower seeds may in part explain the low redemption in December 2016-January 2017. Another reason that could have been responsible, at least in part, for the low redemption in December-January, is that few social marketing events were held during this period, as this period was the holiday season in Tanzania.

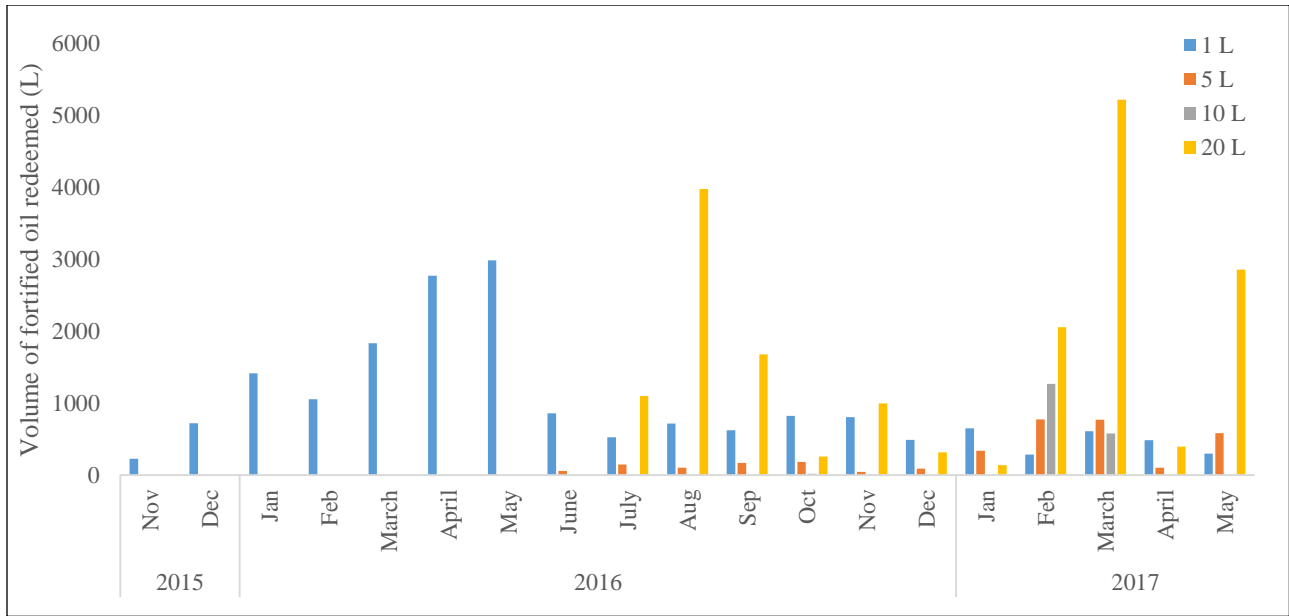


Figure 5.5 Volume of fortified oil redeemed in Manyara, by package size.

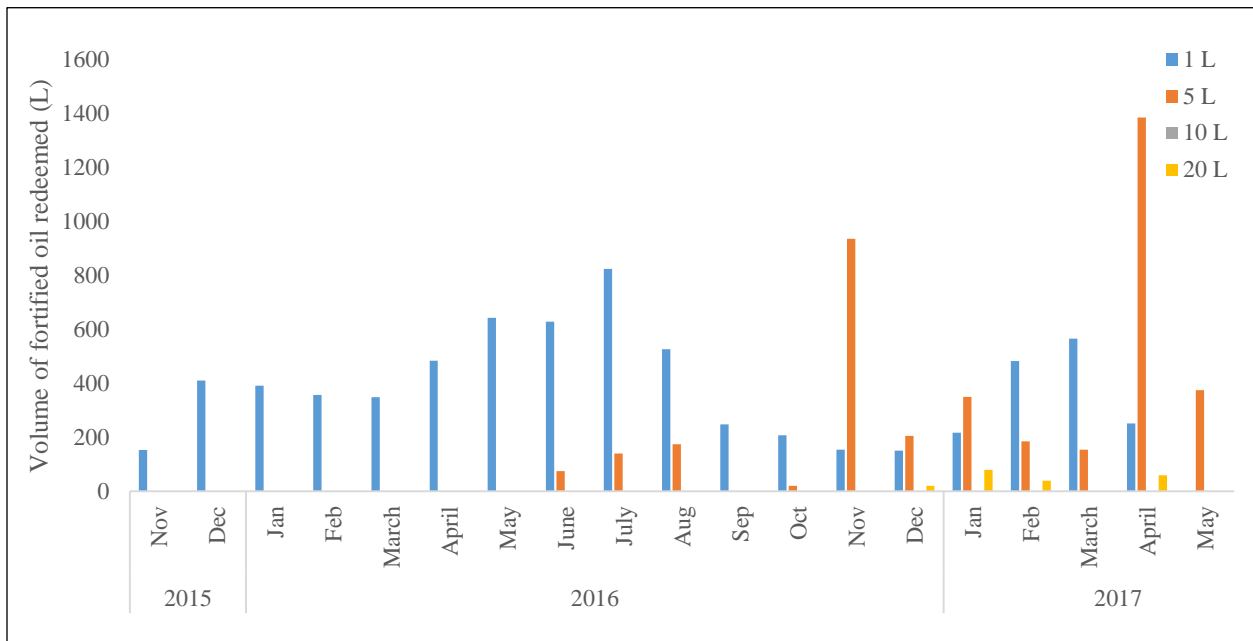


Figure 5.6 Volume of fortified oil redeemed in Shinyanga, by package size.

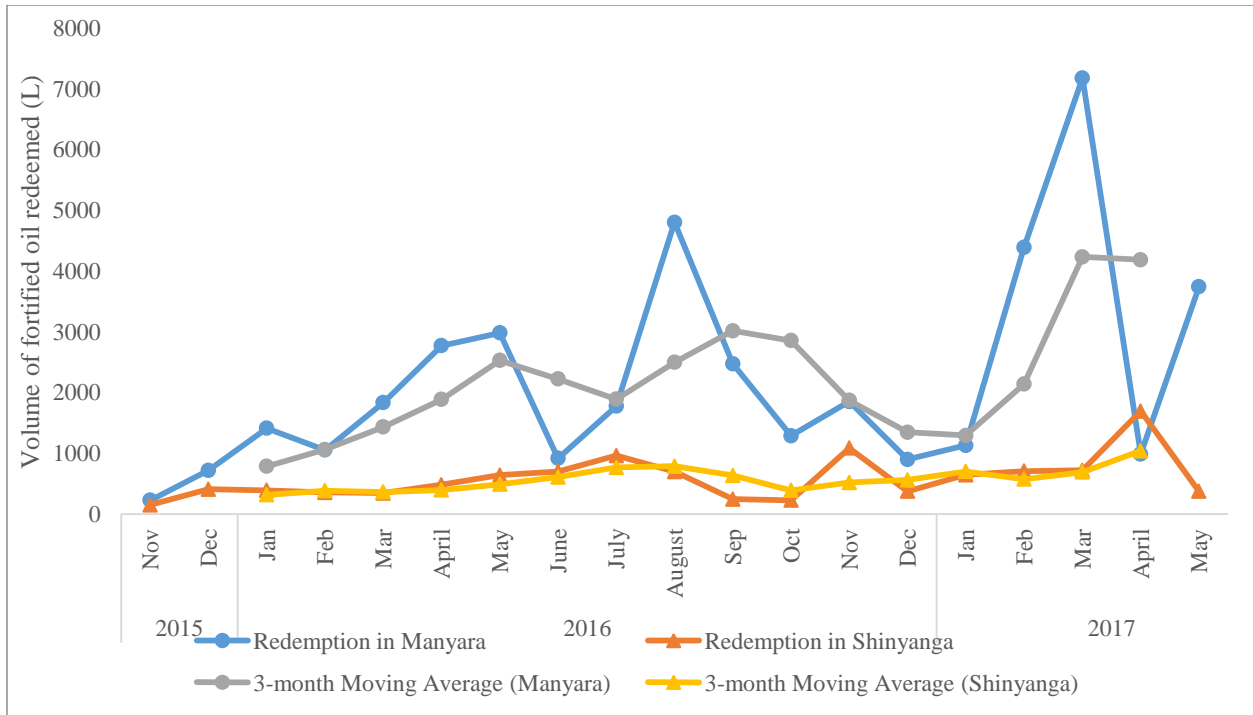


Figure 5.7 Volume of fortified oil redeemed in Manyara and Shinyanga.

5.8 Distance of Masava retailers from nearest clinic show location and volume of fortified oil redeemed

To examine the association between distance of Masava retailers to the nearest clinic show location and the volume of fortified oil redeemed, multilinear regression was used. The analysis was restricted to 458 out of the total of 554 retailers and 70 out of the total of 77 clinic shows, whose GPS coordinates could be obtained.

Table 5.7 shows the results of the multilinear regression analysis of the association between distance of Masava retailers from the nearest clinic show location and volume of fortified oil redeemed 30 days from the day of the clinic show. After adjusting for seasonal variation in oil supply and the number of Masava retailers in the ward who were active during the quarter, compared to retailers that had clinic shows held within 0.5 km, the volume of

fortified oil redeemed from retailers that had no clinic shows within 3 km was significantly lower (adjusted β -coefficient $>3 \text{ km vs } <0.5 \text{ km} = -53.38$, 95% CI = -95.63 to -11.13, $p=0.013$). In terms of seasonal variation, there was no significant difference in the volume of oil redeemed during any of the other quarters compared to Quarter 1. There was also no significant association between the number of Masava retailers in the ward and the volume of fortified oil redeemed.

Table 5.7 Multilinear regression results of the association between distance of nearest clinic show location from Masava retailers and volume of fortified oil redeemed.

Variables	Adjusted β -coefficient	95% CI	p-value
Distance of nearest clinic show location from Masava retailer			
<0.5 km (reference)	1.00	—	—
0.5-1 km	-54.37	-119.76 to 11.05	0.103
1-2 km	-43.44	-113.50 to 26.63	0.225
2-3 km	-70.09	-201.90 to 61.72	0.297
More than 3km	-53.38	-95.63 to -11.13	0.013*
Number of Masava retailers	0.02	-1.06 to 1.11	0.966
Quarter			
Q1 (Nov 2015 – Jan 2016) (reference)	1.00	—	—
Q2 (Feb – April 2016)	7.42	-21.19 to 36.02	0.611
Q3 (May – July 2016)	11.89	-16.55 to 40.22	0.412
Q4 (Aug – Oct 2016)	20.72	-8.75 to 50.19	0.168
Q5 (Nov – Dec 2016)	1.19	-28.93 to 31.31	0.938
Q6 (Jan – March 2017)	15.86	-10.70 to 42.42	0.242

*Significant association at 95% CI ($p<0.05$).

Adjusted R-squared: 0.00023

5.9 Number and type of social marketing events and volume of fortified oil redeemed

Table 5.8 shows the results of the multilinear regression analysis of the association between number and type of social marketing events held in each ward in each quarter, and volume of fortified oil redeemed 30 days from the day of the event. The analysis included redemptions from all of the 554 Masava retailers and excluded one clinic show where the ward in which the event was conducted could not be identified. After accounting for seasonal variation

in oil supply and the number of Masava retailers who were active in the ward during the quarter, we found that the number of clinic shows and cooking shows conducted were positively associated with the volume of fortified oil redeemed (adjusted β -coefficient_{clinic shows} = 94.41, p-value = 0.012; adjusted β -coefficient_{cooking shows} = 210.71, p-value = 0.008) and the number of cultural shows conducted was negatively associated with the volume of redemptions (adjusted β -coefficient_{cultural shows} = 178.74, p-value = 0.021). Neither bicycle races nor football matches, which were implemented to target men, was significantly associated with the volume of redemptions. After adjusting for the number and type of social marketing events conducted and the time of the year, we found that the number of Masava retailers that were active in the ward was significantly associated with the volume of oil redeemed. In terms of seasonal variation in oil supply, after accounting for all other factors, there was no significant change in the volume of redemptions in any other quarter compared to Quarter 1.

Table 5.8 Multilinear regression results of the association between number and type of social marketing events and volume of fortified oil redeemed.

Variables	Adjusted β-coefficient	95% CI	p-value
Type of social marketing events			
Road show	35.48	-35.05 to 106.00	0.325
Cultural show	-178.74	-328.86 to -28.61	0.021*
Clinic show	94.41	18.18 to 170.65	0.016*
Cooking show	210.71	57.69 to 363.73	0.008*
Bicycle race	-16.55	-124.55 to 91.46	0.764
Football match	23.78	-183.83 to 231.39	0.823
Number of Masava retailers in ward	9.57	3.82 to 15.32	0.001*
Quarter			
Q1 (Nov 2015 – Jan 2016) (reference)	1.00	—	—
Q2 (Feb – April 2016)	75.06	-62.10 to 212.23	0.285
Q3 (May – July 2016)	118.56	-18.50 to 255.62	0.092
Q4 (August – October 2016)	67.11	-81.34 to 255.62	0.377
Q5 (November – December 2016)	41.89	-88.81 to 172.59	0.531
Q6 (January – March 2017)	32.72	-115.94 to 181.37	0.667

*Significant association at 95% CI (p<0.05).

Adjusted R-squared = 0.1092

Chapter 6: Discussion and Conclusions

6.1 Key findings and Contribution to literature

This study was conducted to examine the impact of the social marketing campaign of the Masava project on improving KAP towards consumption of vitamin A-fortified sunflower oil in rural Tanzania, using data obtained from two sets of surveys that were developed and implemented by the TCDC and SUA independently. The study used a mix of statistical and spatial approaches to examine the impact of the campaign by studying (i) the change in KAP towards consumption of vitamin A-fortified sunflower oil, (ii) the association between distance of households from social marketing events and household consumption of fortified oil, (iii) the association between distance of Masava retailers from social marketing events and volume of fortified sunflower oil redeemed, and (iv) the association between number and type of social marketing events conducted in a ward and volume of fortified sunflower oil redeemed in the ward.

Using the results of the household survey, we found significant improvement in actual consumption of adequately fortified oil in the intervention districts after nine months of intervention (although the increase was also observed in the control districts but by a smaller percentage). This result falls in line with the result of the TCDC survey where self-reported consumption of vitamin A-fortified sunflower oil also increased significantly from 3 to 13 months of intervention. Thus, our results support the hypothesis that actual and self-reported consumption of vitamin A-fortified oil improved after the campaign (Hypothesis H1a).

Using the results of the household and the TCDC survey, we found significant improvement in knowledge of the health benefits of vitamin A after the intervention. However,

knowledge of the health benefits of vitamin A also improved significantly in the control districts, according to the household survey. The midline and endline TCDC surveys were not conducted in the control districts. The household survey found no significant change in knowledge of vitamin A after nine months of intervention but knowledge of fortification at endline was significantly higher in the intervention districts compared to the control districts. The improvement in knowledge of fortification, found in the household survey, agree with the results of the TCDC survey, which found significant improvement in knowledge of fortified foods and vitamin A-fortified oil. The TCDC survey also found significant increase in awareness of the availability of fortified sunflower oil at a discounted price in the intervention districts after 3 and 13 months of intervention. Based on these findings, in regard to hypothesis H1b, it may be concluded that the social marketing campaign was effective in improving knowledge of the health benefits of vitamin A and fortification. The impact on attitudes is inconclusive.

The significant increase in knowledge and awareness of the product found in our study is consistent with the findings from several studies that used social marketing or BCC interventions to improve micronutrient intake.^(25,94,95) The significant increase in consumption after nine months of the campaign agrees with the finding by Wang et al.⁽⁹⁴⁾ on promotion of iron-fortified soy sauce in China through social mobilization and social marketing that employed similar product promotion strategies as the Masava project.

Previous studies on sources of health information in rural Africa reported that health facilities, CHWs, radio, television and IEC materials were important sources of health information for women.⁽⁹⁶⁻⁹⁸⁾ No study was found in the literature that reported on major sources of health information based on the sex of the target audience separately. Our study found consistent results from the household survey and the TCDC survey that health centre was the

major source of health information for women. Similar results were reported by Silali et al.⁽⁹⁶⁾ on accessibility to health information among rural women in Kenya, a neighbouring country of Tanzania. Based on the TCDC survey, radio, cultural shows and CHWs were other important sources of information for women, whereas for men, radio, health centre and IEC materials were important. Radio was reported only by 7.7 percent of the mothers in the endline household survey as this survey was conducted before the radio campaign, while the TCDC endline survey was conducted after the radio campaign.

The second objective of the study was to determine the association between distance of social marketing events from household and household consumption of fortified oil. But due to unavailability of precise data, only the association between distance of clinic shows from household and consumption of fortified oil was studied. Using proportional odds logistic regression, we found no significant association between distance of nearest clinic show location from household and household consumption of fortified oil. It should be noted that the distance between households and clinic show locations was computed as Euclidean distance, not road network distance. Since the study area was predominantly rural where most roads are unpaved, there is no road network data for the area in ArcGIS. Despite the limitations of Euclidean distance in the fact that it does not account for transportation network and geographic barriers,⁽⁹⁹⁾ Euclidean distance is considered a valid, albeit crude, measure of accessibility in both rural and urban settings.⁽¹⁰⁰⁾ Euclidean distance, however, does not serve as a good proxy for attendance at a social marketing event, as would be discussed later in Section 6.3.

Using logistic regression analysis, we found no significant association between each of knowledge of vitamin A, knowledge of health benefits of vitamin A and number of social marketing events held in the ward, and consumption of fortified oil. From the analysis, we also

found that households located in Shinyanga are significantly more likely to consume oil with higher retinol content compared to those in Manyara. This finding contradicts our finding in the time-series analysis of the volume of fortified sunflower oil redeemed that the volume of the fortified sunflower oil redeemed in Manyara was substantially higher than in Shinyanga. This may have been, in part, because sunflower oil was the popular cooking oil in Manyara and palm oil was preferred in Shinyanga.⁽⁴⁾ Under the Masava project, sunflower oil is fortified by two SMEs, Singida Sunshine and Sweetdrop, to the standard of 20.0-40.0 mg/kg retinyl palmitate (or 36.6-73.3 mg/kg retinol) recommended by the TBS, whereas palm oil is often over-fortified by the large scale manufacturers. This explains the finding that households in Shinyanga consume oil with higher retinol level than those in Manyara. We also found that households with higher wealth index, with mothers older than 33 years and more than 7 years of education are significantly more likely to consume oil with higher retinol content. The reason for this could be because richer households, older mothers and mothers with higher education level have better skills and resources to evaluate the information they receive, are more conscious of the health and well-being of their family, and receive more support from their family to adopt the behaviour change.

Compared to stores that had a clinic show conducted within 0.5 km, the volume of fortified oil redeemed was significantly lower in stores that did not have a clinic show conducted within 3 km. However, there was no significant difference in the volume of redemptions in stores where a clinic show was conducted between 0.5-1 km, 1-2 km or 2-3 km when compared to those that a clinic show conducted within 0.5 km. We found no significant association between the number of active Masava retailers in the ward and volume of redemptions. There was also no significant difference in the volume of redemptions in any of the other quarter compared to Quarter 1.

Among the different types of social marketing events that were conducted, clinic shows and cooking shows conducted were found to be positively associated with the volume of fortified sunflower oil redeemed, while cultural shows was found to be negatively associated with the volume of fortified sunflower oil redeemed. None of the events implemented to particularly target men, namely bicycle races and football matches, were significantly associated with the volume of redemptions. We also found that the number of active Masava retailers in the ward was significantly associated with the volume of fortified oil redeemed. This finding highlights the importance of access to the fortified oil in adopting the use of the fortified oil. There was also no significant difference in the volume of redemptions in any of the other quarter compared to Quarter 1.

Based on the findings that (i) self-reported and actual consumption of fortified sunflower oil as well as knowledge of the health benefits of vitamin A, knowledge of fortification, knowledge and awareness of the fortified sunflower oil improved significantly after the social marketing campaign, (ii) distance of clinic shows from Masava retailers was significantly associated with the volume of fortified oil redeemed, and (iii) number of cooking shows and clinic shows conducted was significantly (positively) related to the volume of fortified oil redeemed, it may be concluded that the social marketing campaign has been effective in improving KAP towards fortified oil consumption. This study is novel in the fact that, to date, to the best of our knowledge, no study has employed geospatial tools to examine the impact of social marketing interventions in the field of public health. The use of geospatial tools in public health has been mostly confined to studies on healthcare utilization and planning and delivery of health services in rural settings in LMICs. The results of our study are important, because, to date, few studies have been conducted to examine the impact of social marketing or BCC

interventions on KAP towards fortified foods intake in LMICs. This study shows the effectiveness of social marketing interventions and provides guidance for the choice of interventions in promoting KAP towards consumption of fortified foods in LMICs, particularly in Africa.

6.2 Evaluation of the campaign from a social marketing perspective

From the social marketing standpoint, the effectiveness of the campaign could be attributed to a number of factors. First, the campaign addressed 12 of the 14 domains of the TDF which was discussed in detail earlier in Section 4.3. Second, through formative research, the campaign was able to identify the stage of change of the target population and tailor the intervention to reach and influence the behaviour of these individuals. Third, from an evaluation standpoint, the campaign addressed the 4Ps of marketing: (1) the *product* being promoted, i.e. the act of using fortified sunflower oil, was specific; (2) the *price* was reduced through subsidy provided through e-Vouchers such that the price of the fortified sunflower oil is almost equivalent to that of traditional cooking oil, if not slightly cheaper (this was likely the biggest factor inducing the consumption of the fortified sunflower oil); (3) the *place* where the messages were conveyed were clinics and public areas within the community and where the fortified oil could be purchased was ordinary retailers that sell cooking oil in the community; and (4) the *promotion* activities were tailored to the community. Finally, the campaign conducted educative events like clinic shows and cooking shows to promote the product. Clinic shows are often perceived as reliable sources of information and are associated with good health, while cooking shows demonstrated that no additional skills are required to cook with fortified oil compared to unfortified oil and that food does not taste different when cooked in fortified oil. In summary, the success of the campaign could be attributed to the fact that it addressed many key constructs of

behaviour change from the BCW, the COM-B model of behaviour change, the TDF, the TTM and the 4Ps of marketing. More importantly, through formative research, it was able to identify the beliefs and socio-cultural norms of the community and tailor the intervention to assist the target audience in switching to the new behaviour.

Our study found that consumption of adequately fortified oil increased significantly from 21.7 percent before the campaign to 26.0 percent after nine months of campaign. Although the increase was statistically significant, it was not particularly substantial. To better promote behaviour change, in addition to emphasizing on the monetary cost through discounts provided by the e-Voucher, the campaign could have addressed the non-monetary cost of behaviour change. From the perspective of the target audience, behaviour change is also associated with non-monetary costs, such as inconvenience and longer travel time to stores that sell fortified oil as not all stores in the community carried the fortified oil, or going against family's decision/preference to use traditional unfortified oil. Little attention was given to these non-monetary costs of behaviour change in the campaign. The campaign could have also addressed competitors of the behaviour change, such as advertisement from unfortified oil brands and availability of unfortified oil throughout the year as opposed to the fortified sunflower oil which tends to run low before the sunflower harvest season. In addition to advertising the fortified oil through community events, education and distribution of IEC materials, the social marketing campaign could have better addressed the structural determinants of behaviour. The campaign could have made the fortified oil available beside the other oils on the shelves in all stores that carry cooking oil so that consumers can conveniently choose the fortified sunflower oil over unfortified oil when making their purchase in shops that they frequent, and ensured a constant supply of the fortified sunflower oil. This could have produced better results, as it is supported

by our finding that the number of Masava retailers was significantly associated with the volume of fortified sunflower oil redeemed. Finally, in order to introduce new behaviour into a community and create a social norm of the new behaviour, in addition to identifying the stage of change of the target individuals using the TTM, it is useful to identify and target “early adopters” as described in Rogers’ Diffusion of Innovations Theory. Unlike the innovators who are usually high-risk takers and are always very eager to try new ideas, early adopters check before adopting the new idea.⁽¹⁶⁾ Early adopters are usually individuals from whom potential adopters seek advice and information about new ideas.⁽¹⁶⁾ Once the early adopters adopt the innovation, the innovation diffuses rapidly in the society. Hence, to increase the chance of achieving behaviour change, besides addressing the behaviour change constructs of the BCW, the COM-B model, the TDF, the 4Ps of marketing, and TTM, behaviour change social marketing interventions should consider identifying the early adopters, designing interventions to target these early adopters and finally, using these individuals and other trusted sources of information such as CHWs as change agents to conduct educative community activities, door-to-door education and counselling to achieve behaviour change in a community.

One of the major barriers to replacing traditional oil with fortified sunflower oil in cooking at the time of the study, from the perspective of the community, was that the fortified oil was not available in all stores that carry cooking oil. It must be noted that the purpose of the Masava project was to test the feasibility of SMEs in fortifying unrefined sunflower oil for local consumption and to test if using e-Vouchers can succeed in promoting consumption of the fortified oil. Under the Masava project, fortified sunflower oil was produced by only two SMEs. Hence, the total supply volume is insufficient to meet the needs of the entire population of Manyara and Shinyanga. Also, majority of the Masava retailers were located far from

households interviewed in the household and the TCDC surveys. Since households in rural areas are less likely to travel far as they often purchase oil on a daily basis, unavailability of the oil in nearby stores is another key barrier to adopting the use of the fortified oil. A third barrier to the behaviour change was the lack of constant supply of the oil all year round. The supply was particularly low between November and January, months after the sunflower seed harvest season in June, when there is no seed available. Although MEDA provided working capital for a limited time to the SMEs to buy seeds for production during the off-seasons, the SMEs typically do not have sufficient storage to continue production during the off-season. Therefore, an increased and more constant supply of the product could have led to better results.

6.3 Limitations of current study

This study was based on findings from two sets of surveys that were implemented by two organizations, SUA and TCDC, at two different time-points separately and independently. The two organizations adopted different methodologies in selecting the sample and also used different sets of questionnaires to assess the change in KAP towards vitamin A and vitamin A-fortified sunflower oil before and after the intervention. The household survey selected only lactating women with children under five years, whereas both women and men were selected for the TCDC survey. The different methodologies of the two surveys, however, allowed triangulation of the findings from two sources and also provided information on KAP towards the fortified oil among different populations. There was also a significant difference in age between participants of the household survey and that of the TCDC survey. The majority of the participants of the household survey were under 26 years of age, whereas in the TCDC survey, majority of participants were between 26-33 years. The impact of the campaign on younger mothers could have been less significant than on older mothers, as suggested in the regression

analysis in Section 5.6. This could be because older mothers are likely to be more mature and more receptive to messages that cater to the well-being of their children and family. There is also a possibility that older individuals reported that they have heard the messages, even when they have not, in order to be perceived as a good and caring mother. Thus, the difference in the demographic characteristics of the participants of the household survey and the TCDC survey may have, at least in part, been responsible for the difference in the results of the two surveys.

The month of the surveys could have also affected the survey results. The endline household survey was conducted from November 2016 to January 2017 when the consumption of fortified oil, indicated by the number of e-Vouchers redeemed, was low due to a low supply in both Manyara and Shinyanga. On the other hand, the endline TCDC survey was conducted in April 2017 when the number of e-Vouchers redeemed in Shinyanga was 63 percent higher than in November 2016. This variation in oil supply between the two survey time-points could have affected the households' opinion on the fortified oil, particularly on the reliability of using fortified oil to improve vitamin A intake.

There were also several limitations in the implementation of the TCDC survey. First, the TCDC survey questionnaire was translated from English to Swahili and was not translated back into English and compared to the original English questionnaire to identify possible discrepancies in the terminology used. Second, the TCDC surveyors did not undergo training for conducting the survey, and the survey was not pre-tested in the target population. These technicalities in the implementation of the survey are necessary to ensure that the questions were asked and interpreted in the correct manner in order to obtain the most accurate and relevant information. It is also very likely that the TCDC survey was subjected to selection bias as random sampling was not used; surveyors could have selected participants who knew or were

more likely to know about vitamin A and the fortified oil. The age difference between samples suggest an effect of this non-random selection process for the TCDC. Based on the above three explanations and also that the same individuals were interviewed in the household survey at baseline and endline, the results from the household survey are likely to be more reliable. However, the TCDC endline survey occurred later than the household endline survey and also after radio broadcasts were used; this may also explain the differences.

Another limitation in the study is the low supply of the fortified sunflower oil during the period of the endline household survey. During the period of low supply, it is possible that some households, who otherwise would be consuming the fortified oil, would have to use the traditional unfortified cooking oil. Thus, the oil samples collected at the endline household survey may not be a good representation of the oil that was commonly consumed. Also, since the fortified sunflower oil was produced by only two small- and medium-sized businesses, the total supply volume may have been insufficient to meet the demand of the population of the two regions.

Our study found no significant association between distance of nearest clinic show location from household and household consumption of fortified sunflower oil. In this study, retinol content was used as an indicator of consumption of vitamin A-fortified sunflower oil. As mentioned earlier in the discussion, under the Masava project, the fortified sunflower oil is fortified to the TBS standard, while palm oil, which is the preferred cooking oil in Shinyanga, is often over-fortified. Hence, retinol content may not be the most appropriate indicator of consumption of the fortified sunflower oil that was promoted by the social marketing campaign. To account for the regional difference in the type of oil consumed, a sensitivity analysis was performed for Manyara and Shinyanga separately. Results of the sensitivity analysis, however,

showed no significant association between distance of clinic show location from household and fortified oil consumption. It must also be noted that using distance of nearest clinic show location from household as a proxy for participation in the event assumes that the members of households located close to the event location will attend the event. This assumption may not hold true. Thus, distance of nearest clinic show location from household was not a good proxy for household participation in the event. Data on whether or not the household participated in clinic shows was not collected in the household survey. Another issue is that by focussing only on clinic shows, which comprised only about one-fourth of all the social marketing events conducted, the impact of the campaign could be obscured by other types of events; particularly cooking shows were not included.

For this study, we also evaluated the effectiveness of the campaign in improving consumption of the fortified sunflower oil by examining the association between distance of nearest clinic show location from a Masava retailer and number of e-Vouchers redeemed in that store. Using this association to evaluate the effectiveness of the campaign involved making the assumption that all oil that was purchased was consumed. This may not hold true for all households. Due to limited availability of precise location or GPS data on the locations of social marketing events besides clinic shows, associations between distance of all social marketing events from households and Masava retailers, and consumption of fortified oil could not be studied. Availability of GPS data of all the social marketing events would provide more accurate and informative results of the effectiveness of the campaign.

While interpreting the results of the study, it is important to recognize that the change in practice towards consumption of fortified oil seen from the results of the household and the TCDC surveys and the e-Voucher system, was during the period when the oil was available at

the subsidized price. Thus, the consumption of fortified oil found in the study does not represent the consumption after the project has ended when there would be no subsidy and when the oil would become more expensive than unfortified oil.

6.4 Future work

The results of the study suggest that social marketing interventions that address the 12 of the 14 domains of the TDF could be effective in promoting consumption of fortified foods in LMICs. Additional studies are required to establish the effectiveness of social marketing interventions in promoting fortified food intake.

To date, the TDF framework has never been used for designing and evaluating social marketing interventions. Further studies are required to assess social marketing interventions across different settings and cultures based on the TDF, in order to test the validity of TDF as a framework for designing effective social marketing interventions. For instance, a systematic review could be conducted to study the association between the number of TDF domains addressed in the intervention and the intervention success.

Further research could also be conducted to identify specific components of the social marketing intervention, such as education or subsidy provided through e-Vouchers, that led to the desired behaviour change. Finally as some information sources are considered more reliable than others, future research could also explore the relationship between source of information and practise of the desired behaviour. Knowing the information sources that are associated with the desired behaviour could help to identify important channels for promoting behaviour change.

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Appendix A- Summary of studies on the use of BCC and social marketing interventions in promoting improved nutrition practices in LMICs reviewed in June 2017.

Lead author (Year)	Study country	Target population	Period of intervention	Condition addressed	Intervention description	BCC theory/model used	Key findings
<i>Lin et al. (2017)</i> ⁽⁴⁶⁾	China	Women of childbearing age and planning a pregnancy	1 year	Folic acid supplementation	Nutrition education and counselling by doctors at village clinics; text messages that provide information on the benefits of folic acid, where and when to obtain free folic acid supplements and rules for folic acid supplementation; and family planning staff providing information of free folic acid supplements available at village health posts.	-	Folic acid knowledge score in the intervention group increased from 3.07 to 3.65 compared to the increase from 3.11 to 3.35 in the control group where doctors provided usual service. Self-reported compliance with folic acid supplement use increased from 17.0-29.2% at baseline to 41.7-59.2% after 1 year of intervention.
<i>Brasington et al. (2016)</i> ⁽⁴⁵⁾	Egypt	Pregnant women and mothers of children under 2 years	16 months	Maternal and newborn child health	Training for CHW to disseminate information and encourage healthy behaviours, community events such as cooking classes, family solidarity sessions with husbands and mother-	-	Knowledge of danger signs related to pregnancy, delivery and newborn illness, antenatal care visits and consumption of iron-folate tablets

					in-laws, and disseminating messages by local leaders, pharmacy staff and healthcare providers.		were increased significantly in the intervention group compared to the control group.
<i>Menon et al. (2016)</i> ⁽⁴⁴⁾	Bangladesh	Pregnant women and mothers of children under 2 years	4 years	Infant feeding	Intensified interpersonal counselling (IPC) through multiple age-targeting IYCF practices-focused counselling visits to households, coaching mothers as they tried out practices, engaging other family members to support the behaviours, TV spots and community mobilization through sensitization of community leaders to IYCF and community theater shows versus standard nutrition counselling through home-visits, less intensive TV spots and community mobilization.	-	Improvement in complementary feeding practices were significantly higher in the intensive group than in the non-intensive group (difference-in-difference impact estimates: 16.3, 14.7, 22.0 and 24.6 percentage points for minimum dietary diversity, minimum meal frequency, minimum acceptable diet and consumption of iron-rich foods).
<i>Menon et al. (2016)</i> ⁽⁴¹⁾	Bangladesh and Vietnam	Pregnant women and mothers of	6 years	Breastfeeding	Intensive group: Interpersonal counselling at health	-	In Bangladesh, women who reported practising

		children under 2 years			facilities; TV programs targeting mothers, family members, health workers and local doctors; home visits and community mobilization; community theatre shows; policy advocacy, engagement of journalists to broaden reporting on IYCF in the media, creation of IYCF alliance and other such activities. Non-intensive group: Standard nutrition counselling and less intensive mass media, community mobilization and policy advocacy.		exclusive breastfeeding to children under 6 months and initiation of breastfeeding within 1 hour after birth were 36.2% and 16.7% higher respectively in the intensive group than in the non-intensive group. In Vietnam, the increase in exclusive breastfeeding and early initiation of breastfeeding in the intensive group was 36.86% and 16.54% higher respectively than in the non-intensive group.
<i>Mulualem et al. (2016)</i> ⁽³⁸⁾	Ethiopia	Caregivers of healthy children between 6-18 months	6 months	Infant feeding	Nutrition education involving education sessions at participants' homes, discussions and recipe demonstrations versus usual education.	Health Belief Model	Knowledge score on pulse-incorporated complementary feeding increased from 1.09 out of 10 to 9.46 in the intervention group endline compared to the increase from

							1.48 to 1.68 in the control group. The attitude score in the intervention group increased from 2.09 out of 10 to 9.41, compared to the increase from 1.91 to 1.99 in the control group; and the practice mean score increased from 1.31 out of 10 to 7.60 in the intervention group, compared to the increase from 1.15 to 1.23 in the control group.
<i>Undlien et al. (2016)</i> ⁽³⁶⁾	Kenya	Pregnant and mothers with children under 6 months of age	12 months	Malnutrition	Mother support group providing information about the importance of breastfeeding and nutrition through health education, demonstrations and group discussions at local health clinic.	-	There was a significantly higher number of children with severe acute malnutrition in the control group compared to those in the intervention group.
<i>White et al. (2016)</i> ⁽³⁹⁾	Indonesia	Pregnant women and mothers of children under 2	3 months	Infant feeding	TV commercials, community activations and home visits.	Behaviour Centered Design	Dietary diversity increased by 0.8 points among those who were exposed to TV

		years					advertisements and a further of 0.2 points among those who were exposed to TV advertisements and community activations.
<i>Bhiri et al. (2015)</i> ⁽⁵³⁾	Tunisia	Adults aged 18 years and older	3 years	NCDs—poor nutrition, physical activity and tobacco use	Educative sessions, educative films, workshops about healthy diet and tobacco cessation, open sensitization days focusing on healthy diet, increasing physical activity and tobacco cessation, free physical activity sessions, providing physical activity facilities at workplaces, free smoking consultations and banning smoking at the workplaces and distribution of leaflets.	-	There was a significant improvement towards dietary and physical activity behaviours but not for tobacco use.
<i>Olney et al. (2015)</i> ⁽⁴²⁾	Burkina Faso	Women with children 3-12.9 months	2 years	Anaemia	Integrated agriculture and nutrition and health BCC program involving distribution of seeds, saplings, chicks and small gardening tools, and agriculture training	-	The impact was higher among children 3-12.9 months of age living in villages served by a health committee member

					provided by female village farm leaders at demonstration farms. BCC component includes home visits by old woman leaders or health committee member providing lessons on optimal nutrition practices.		than those served by an old women leader.
<i>Zammit et al. (2015)</i> ⁽⁵¹⁾	Tunisia	Individuals aged 18 years and older	3 years	Non-communicable diseases (NCDs)—poor nutrition, physical activity and tobacco use	Sensitization sessions, distribution of leaflets, broadcasts and short radio messages about tobacco cessation, healthy diet and physical activity; similar interventions in school and workplaces, training of primary care physicians about NCDs management and prevention.	-	Tobacco use decreased by 7.3% among men in the intervention group, versus an increase of 3.5% in the control group. Physical activity and fruits and vegetable intake increased by 25% and 19% respectively in the intervention group.
<i>Nagesh et al. (2014)</i> ⁽³⁵⁾	Ethiopia	Caregivers of children between 6-23 months	6 months	Undernutrition	Nutrition education session, cooking demonstrations and posters that encouraged caregivers to properly prepare complementary foods.	-	Knowledge of complementary feeding increased from 5.8 out of 8 at baseline to 7.1 at endline in the intervention group, while the score remained

							unchanged at 6.3 at both time points. There was a significant improvement in feeding practices in the intervention group compared to the control group.
<i>Waswa et al. (2014)</i> ⁽³⁷⁾	Kenya	Caregivers of children between 6-23 months	4 months	Malnutrition	Nutrition education sessions consisting of group trainings, cooking demonstrations, use of IEC materials and home visits.	-	Mean nutrition knowledge score was significantly higher among caregivers in the intervention group compared to those in the control group. The children's dietary diversity score in the intervention group was 27% higher compared to that in the control group.
<i>Davis et al. (2013)</i> ⁽⁴⁰⁾	Mozambique	Pregnant women and mothers of children under 2 years	2 years	Undernutrition	Nutrition education through one-on-one home visits or in small groups.	-	Percentage of children with undernutrition decreased by 8.1% after 52 months of intervention in Area A, and decreased by 11.5% after 16 months of

							intervention in Area B
<i>Monterrosa et al. (2013)</i> ⁽²³⁾	Mexico	Women with children 6-24 months	3 weeks	Infant feeding	Nutrition communication using radio and nurses.	-	Beliefs, attitudes and intention, but not social norms improved significantly in the intervention group compared to control. Breastfeeding frequency, consumption of vegetables and beef and thicker consistency of chicken and vegetable broths improved significantly in the intervention group.
<i>Zhang et al. (2013)</i> ⁽⁶⁴⁾	China	Parents and grandmothers of children between 2-4 months	18 months	Infant feeding	Group training at clinics providing information on enhanced food-prepared recipes and food preparation and hygiene to family members followed up by individual counselling; home visits every 3 months to identify possible feeding	-	The intervention group had better knowledge and practices related to complementary feeding, and significantly higher infant and child feeding index scores at 6, 9, 12, 15 and 18 months. Children in the

					problems and provide individual counselling; dissemination of booklets on child feeding, and demonstration of preparing enhanced recipes during group training and home visits.		intervention group achieved higher z-scores for weight-for-age and weight-for-height than the control at 18 months of age, and were less likely to have stunted growth.
<i>Hotz et al. (2012)</i> ⁽⁴³⁾	Mozambique	Women and children 6 months to 5.5 years	1 year and 3 years	VAD	Distribution of vines to support planting of orange sweet potato and providing training for improved production practices. BCC component comprised of education on maternal and child health and nutrition targeting to women, a campaign to raise awareness of the benefits of orange sweet potato through community dramas, field day events and radio and TV programmes. Marketing and program development component comprised of training for traders,	-	After 1 year of intervention, the mean intakes of orange sweet potato among children 6-35 months at baseline, children 6-35 months at follow-up and women increased by 48.3, 46.1 and 97.4 g/day compared to control. After 3 years of intervention which did not provide agricultural training and health and nutrition education door-to-door after the first year, the mean sweet potato

					urban and rural market development for the sale of orange sweet potato and establishment of distinct market stalls selling and providing information on orange sweet potato.		intakes among children 6-35 months at baseline, children 6-35 months at follow-up and women increased by 41.4, 32.3 and 119.4 g/day compared to control.
<i>Inayati et al. (2012)</i> ⁽⁶³⁾	Indonesia	Mildly wasted children 6-60 months	1 year	Wasting	Intensive educational intervention (INE) that provides culturally adapted interactive lessons on the importance of healthy family meals, food safety, feeding infants and young children, feeding sick children and prevention/treatment of malnutrition; INE+MNP: INE plus providing seven sachets of micronutrient powder (MNP) per week for daily consumption; Non-intensive educational programs (NNE) provided monthly; NNE+MNP: NNE plus	-	Children's weight gain, proportion of children who reached discharge criterion and shortest length of stay until recovery were highest in the INE+MNP group, followed by INE, NNE+MNP and NNE group.

					receiving seven sachets of MNP per week.		
<i>Pandey et al. (2013)</i> ⁽⁴⁷⁾	India	Women between 35-70 years	6 months	Cardiovascular disease (CVD)	Posters, handouts, street plays, public lectures, group lectures and focus group discussions.	-	Chronic disease knowledge increased significantly after the intervention in both rural and urban areas. However, there was no significant changes in the intake of low fat, high protein and high fibre diet, except for sieving the flour which significantly declined.
<i>Sadeghi et al. (2011)</i> ⁽⁵²⁾	Iran	Women	5 years	CVD	Training young women attending pre-marriage classes and middle-aged women attending literacy courses at health/treatment centers by health advisors; using radio and TV programs to educate women in community.	-	Overall physical activity of housewives and working women increased, but the percentage of passive smokers among housewives remained unchanged. There was no significant difference between the intervention and control group in BMI and waist-to-

							hip ratio.
<i>Sun et al. (2011)</i> ⁽²⁵⁾	China	Caregivers of children between 6-24 months	8 months	Anaemia	Handbooks about IYCF, booklets about multiple micronutrient powder (MMP) for health workers, TV programs, education about IYCF and distribution of brochures during clinic visit; product marketing through banner and brochures and promotions in grocery stores and encouraging village doctors to sell MNP in village clinics and providing commissions.	-	After 8 months of intervention, 59.6% of caregivers knew about MNP and 13.5% of them ever purchased it. Among those who were aware of the product, 22.6% purchased it. Among children whose caregivers purchased MNP, 55.6% consumed the product everyday, 40.7% consumed it every other day and 3.7% consumed it occasionally.
<i>Upadhyay et al. (2011)</i> ⁽³³⁾	India	Non-pregnant and non-lactating women	2 months	Anaemia	Nutrition education through calendar distribution versus through calendars, video films and group discussions versus a do-nothing strategy.	-	Knowledge of cause, prevention, symptoms and control of anaemia increased by a mean of 12.79%, 36.96% and decreased by 2.66% in the print media, multimedia and control groups respectively.
<i>le Roux et</i>	South Africa	Mothers of	1 year	Malnutriti	Home visits by mentor	-	After three months,

al. (2010) ⁽⁵⁵⁾		children under 5 years		on	mothers.		children in the intervention group were five times more likely to reach a healthy weight for their ages compared to those in the control group.
<i>Shi et al.</i> (2010) ⁽⁵⁷⁾	China	Family members of children between 2-4 months	8 months	Malnutrition	Educational messages on food selection, preparation and hygiene, childhood nutrition and growth, and responsive feeding style, demonstration of preparing enhanced weaning food receipts formulated through group trainings and home visits; distribution of booklets and involving important family members and community members and leaders in the intervention.	-	Food diversity, meal frequency and hygiene practices were improved in the intervention group. Infants in the interventions group gained 0.22 kg more weight and gained 0.66 cm more length than those in the control group.
<i>Guyon et al.</i> (2009) ⁽⁶¹⁾	Madagascar	Pregnant women and children under 2 years	5 years	Infant feeding	Educational activities during home visits and group discussions at community health centres, newsprint and child health booklets to promote age-specific	-	There was a significant improvement in the rate of early initiation of breastfeeding, rate of exclusive

					recommendations, use of radio, cassette tapes in buses and taxis, print and concerts to reinforce messages.		breastfeeding under 6 months of age, rate of continuation of breastfeeding at 20-23 months, rate of feeding children the minimum number of meals per day at 6 to 23 months, rate of iron-folic acid supplementation during pregnancy and rate of postpartum vitamin A supplementation.
<i>Aboud et al. (2008)</i> ⁽⁶⁰⁾	Bangladesh	Mohers with children between 12-24 months	8 months	Malnutrition	Weekly education session emphasizing child self-feeding and maternal responsiveness versus weekly education session on nutrition.	Social Cognitive Theory	Weight, weight gain and child self-feeding were significantly higher in the responsive feeding group.
<i>Bonvecchio et al. (2007)</i> ⁽⁴⁸⁾	Mexico	Households with children 6-23 months	5 months	Malnutrition	Home visits and demonstrations of the correct preparation of the nutritional supplement (Papilla) by local community volunteers, counselling by healthcare service providers to mothers, videos in clinic waiting	-	Prevalence of reported correct behaviours increased significantly in the intervention group compared to the control group for 3 of the 4 behaviours: a mean increase of

					room, posters in health centres, stores, community centres and churches, megaphones mounted on trucks and cars to broadcast messages.		42.5% for preparing papilla as pap, 64.4% for daily administration and 61.5% for giving papilla between breakfast and dinner.
<i>Li et al. (2007)</i> ⁽⁶⁵⁾	China	Mothers and caregivers of children under 18 months	2 years	Malnutrition	Maternal and child nutrition education with video compact disc and pamphlet developed based on local culture and language, face-to-face discussion and demonstration of preparing weaning food, encouraging peer education, recording the frequency of infant food intake once every month, growth monitoring of children between birth and 17 months of age, implementing integrated management of childhood diseases, supplying normal healthcare services to children and distribution of thiamine to women just before or	-	Prevalence of underweight improved from 20.5% before the intervention to 13.7% after the intervention among children aged 6-11 months, and from 39.0% to 26.4% among children aged 12-17 months. The status of child nutrition also improved significantly after the intervention.

					after delivery.		
<i>Roy et al. (2007)</i> ⁽⁵⁸⁾	Bangladesh	Mothers of children between 6-9 months	2 years	Malnutrition	Weekly group education using flip charts, demonstrations of preparation of energy- and protein-rich local complementary foods rich in micronutrients.	-	The intervention group had a higher weight gain than control after the intervention period and after 6 months of observation. The proportion of normal or mildly malnourished children was greater in the intervention group than in the intervention group after the end of the observation period.
<i>White et al. (2006)</i> ⁽⁴⁹⁾	Panama, and Trinidad and Tobago	Women aged 40-60 of low socioeconomic status	6 weeks	Chronic disease	Video presentation, focus group discussions	Gollwitzer's Theory of Implementation Intentions and Theory of Social Support	The increase in consumption of 5 servings of fruits and vegetables daily was not maintained after 6 months after the intervention period.
<i>Lucumi et al. (2006)</i> ⁽⁵⁰⁾	Colombia	Women 18-60 years who looks after children younger	1 year	Chronic disease	Group sessions, phone counselling, home visits to promote smoke-free homes, participation of family members or peers during group	Social Cognitive Theory	Regardless of whether there are additional activities, in households where the women received

		than 15 years			session, grocery store intervention where grocery store owners were visited by a nutritionist and invited to participate in a session where they receive information about their role in promoting healthy eating behaviours.		information and communication about healthy behaviors, the increase in the proportion of homes with an agreement that forbids in-home smoking increased from 27.9% at baseline to 44.1% after 7 months of intervention, and the proportion of women who reported consuming vegetables or salad daily increased from 44.1% to 64.7%.
<i>Hotz et al. (2005)</i> ⁽⁶²⁾	Malawi	Mothers of children between 6-23 months	5 months	Infant feeding	Nutrition education based on four locally adapted lessons for complementary feeding practices to increase total complementary food intake, energy and nutrition density of the complementary diet, and iron and zinc bioavailability of the complementary diet; dissemination of health	-	The amount of complementary foods and energy intake, animal protein, niacin, riboflavin, calcium, iron and zinc, but not vitamin A, were significantly greater in the intervention group compared to the control group, as were the energy,

					messages and growth monitoring, and follow-up home visits and home counselling.		iron, riboflavin density, and the estimated amount of bioavailable iron and zinc.
<i>Roy et al. (2005)</i> ⁽⁵⁶⁾	Bangladesh	Mothers of children aged 6-24 months	3 months	Malnutrition	Intensive nutrition education (INE) twice a week through posters, leaflets, pictures and cooking sessions, and INE + supplementary feeding (SF) for six days a week versus nutrition education fortnightly (control)	-	After 3 months of intervention, 37% of children in the INE group and 47% of those in the INE+SF group improved from moderate to mild or normal nutrition compared to 18% in the control group. After six months of observation, the nutritional status of children in the intervention groups improved further from moderate to mild or normal nutrition compared to the control group.
<i>Bhandari et al. (2004)</i> ⁽⁵⁴⁾	India	Mothers of children between 6-18 months	18 months	Infant feeding	Monthly home visits for new births until aged 12 months, counselling in immunization clinics by auxiliary nurses and midwives during clinical visits, message	-	There was a small but significant effect on length gain in the intervention group. There was no effect on weight gain.

					on complementary feeding discussed at monthly meetings conducted by auxiliary nurse and midwives with community representatives, neighbourhood meetings of community representatives with caretakers of children under 2 years.		Energy intakes from complementary foods were significantly higher in the intervention group at 9 months of age.
<i>Guldan et al. (2000)</i> ⁽⁵⁹⁾	China	Pregnant women and women with infants upto 1 year of age	1 year	Complementary feeding	Home visits by trained nutrition educators to all pregnant women and women with infants up to 1 year of age, dissemination of feeding guidebook and growth chart, providing breastfeeding and complementary feeding suggestions and advice and growth monitoring during home visits.	-	Mothers in the intervention group showed significantly higher nutrition knowledge and reported better infant feeding practices than those in the control group. The education group infants were significantly heavier and longer but only at 12 months, had higher breastfeeding rates overall and lower anemia rates than the control group infants.

Appendix B- New product labels and social marketing materials used to promote vitamin A-fortified oil consumption

TFDA-approved logo of fortified-foods.



New product labels for the three small- and medium-sized enterprises producing vitamin A-fortified sunflower oil showing “Sunflower oil with added vitamin A”.



Social marketing materials used to promote vitamin A-fortified oil consumption. (a) Poster showing “Sunflower oil with added vitamin A for delicious and good food”. (b) Posters outside shops selling Masava vitamin A-fortified oil that translates to “Sunflower oil with added vitamin A sold here”. (c) Banners used at social marketing events.

(a)



(b)



(c)



Appendix C- KAP survey questionnaire for baseline and endline household surveys

		Skips
va01	<p>Have you heard information about vitamin A?</p> <p>a. Yes</p> <p>b. No</p>	If No, skip to end
va02	<p>If yes, what are the main benefits?</p> <p><i>(can select more than one answer if appropriate: do not prompt)</i></p> <p>a. Helps with child growth</p> <p>b. Strengthens immunity to illness</p> <p>c. Improves vision</p> <p>d. Improves health/reduces illness</p> <p>e. Avoids night blindness</p> <p>f. Reduces mortality</p> <p>g. Other _____ (specify)</p>	
va03	<p>If yes, where did you hear about vitamin A?</p> <p>a. Health center</p> <p>b. Community health worker</p> <p>c. Neighbours</p> <p>d. Radio</p> <p>e. Television</p> <p>f. Other _____ (specify)</p>	
va04	<p>Could you list up to three foods rich in Vitamin A?</p> <p>_____</p> <p>_____</p> <p>_____</p>	
va05	<p>What methods can one use to avoid a diet poor in vitamin A?</p> <p>a. Balanced diet</p> <p>b. Foods rich in vitamin A</p> <p>c. Vitamin A supplement</p> <p>d. Foods fortified with vitamin A</p> <p>e. Don't know</p> <p>f. Other _____ (specify)</p>	
va06	<p>Do you know what fortification means?*</p>	Skip next question if No or Don't

	<ul style="list-style-type: none"> a. Yes b. No c. Don't know 	Know
va06b	<p>If yes in of6a... What is food fortification?*</p> <ul style="list-style-type: none"> a. Additional nutrients in food b. Food that makes you healthy c. High-energy food d. Low-fat food e. Don't know / Don't remember f. Other: _____ 	
va06c	<p>Can you tell me if the oil you use is fortified with vitamin A?*</p> <ul style="list-style-type: none"> a. Yes b. No c. Don't know 	Skip next question if No and Don't Know
va06d	<p>If yes, how do you know the oil you use is fortified?*</p> <ul style="list-style-type: none"> a. Logo/label indicating fortified b. Retailer indicated it was fortified c. Don't know / Don't remember d. Other: _____ 	

*denotes questions only asked at the endline survey

Appendix D- KAP survey questionnaire for TCDC formative research (baseline) survey

SECTION ONE: DEMOGRAPHICS

N ^o .	Questions	Responses	Skip
101	RECORD GENDER OF RESPONDENT	Male Female	
102	How old are you?	RECORD AGE IN COMPLETED YEARS <input type="text"/> <input type="text"/>	
103	What is your current marital status?	Single/never married Widowed/divorced/separated Married/cohabiting– monogamous Married /cohabiting – polygamous	
104	What is the highest level of education that you attained?	None Primary Secondary Post-secondary	
105	What is your occupation	House wife Farmer Teacher Food vender Pastoralist Poultry Small business Other (specify):	
106	What is your main source of income	Farming Teaching Food vending Pastoralism Poultry Small business Other (specify):	
107	In your household is there...? READ LIST OF OPTIONS AND CIRCLE ALL THAT APPLY	Electricity Piped water Mobile phone Working Radio Working Television Refrigerator Bicycle Motorcycle Car/Truck Watch Chair Table	

		Kerosene lamp/pressure lamp	
108	In the last 6 months, how often has your family experienced the following – READ EACH STATEMENT : Lacked enough food to eat Lacked Shelter/House to stay in Been unable to afford to send children to school Lacked money to buy medicines/medical treatment	Often Sometimes Rarely Never Often Sometimes Rarely Never Often Sometimes Rarely Never Often Sometimes Rarely Never	
109	On average, How much do you on average earn in a month?	Number of shillings: Don't know	
110	Where do you get information about foods that your child/children should eat? MULTIPLE RESPONSES POSSIBLE PROBE ONCE (Anywhere else?)	Radio TV Friends/Neighbors In laws Local retailer Health staff Newspapers Others (Specify):	
111	Of the sources you listed, which do you trust most when it comes to information about feeding your child/children? (Multiple answers not allowed)	Radio TV Friends/Neighbors In Laws Local retailer Health staff Other (Specify):	
112	How often do you listen to the radio in a week?	None Once a week 2-3 times a week 4-5 time a week More than 5 times a week	
113	How many times in a week do you watch television?	None Once a week 2-3 times a week 4-5 time a week More than 5 times a week	
114	How many times do you read a newspaper per week?	None Once a week 2-3 times a week 4-5 time a week More than 5 times a week	
115	What is the main source of information in this community		

116	How many people live in this household with you? (number of the persons)	
117	What foods do adults in this community eat every day?		
118	What foods do children in this community eat every day?		

SECTION TWO: HOUSEHOLD DECISION MAKING ON FOOD PURCHASE

N ^o .	Questions	Responses	Skip
201	Who in your household decides how much money should be spent on food?	Husband Wife Husband and wife Other (specify):	
202	Who in your household decides what foods to purchase?	Husband Wife Husband and wife Other (specify):	
203	Who usually buys the food for your household?	Husband Wife Husband and wife Other (specify):	
204	Do you/this person need to get permission from anyone else before buying the food?	Yes No	
205	Who is supposed to give the permission?	Husband Wife Husband and wife Other (specify):	
206	When you were deciding what food to purchase/cook, what did you consider? [MULTIPLE RESPONSES ALLOWED]	If the quantity will be enough for everybody The vitamins in the food Price Taste of the food Other (Specify):	
207	What food do you purchase everyday?	Wheat Flour Maize Flour Cooking Oil Other (Specify):	

SECTION THREE: KNOWLEDGE AND PERCEPTION ON FORTIFIED FOOD

N ^o .	Questions	Responses	Skip
301	Have you ever heard of fortified foods, or foods that have had vitamins, minerals added to them?	Yes No Don't know	→302 →303 →303
302	What does it mean when a food is fortified or have had vitamins, minerals added to them?	Vitamins and minerals have been added to the food Vitamins and minerals have been removed from the food Other (specify):	
303	Have you ever heard of fortified foods, or foods that have had vitamins, minerals added to them? Do you know of any food that is fortified?	Yes No Don't know	→303 →305 →305
304	What is that food?		
305	Would you consume them?	Yes No	
306	If available, would you consume them?		
307	If someone wants to communicate to you regarding fortified food, what channels should be used (Don't probe, multiple answers is allowed)	Radio TV Friends/Neighbors In laws Local retailer Health staff Newspapers Other (Specify):	
308	What channel do you believe most as your source of information? (Don't probe, tick whatever is mentioned)	Radio TV Friends/Neighbors In laws Local retailer Health staff Newspapers Other (Specify):	
309	What channels would you believe the least?	Radio	

N ^o .	Questions	Responses	Skip
		TV Friends/Neighbors In laws Local retailer Health staff Newspapers Other (Specify):	
310	Would you buy and cook for your family a fortified food?	Yes No Don't know	
311	Why would you cook this food?	Nutrition benefit Tastes good Would be cheap Other (Specify):	
312	What name would you give to a fortified food?		

Threat on eating fortified food (To provide information about fortified food)

I am going to read a series of statements to you and I would like you to tell me how much you agree with them. For each statement, please tell me if you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with it.

		Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
401	If your child does not eat fortified food s/he will not get important vitamins/minerals.	1	2	3	4
402	My family would be in danger if they do not eat fortified food.	1	2	3	4
403	A child should only eat fortified food when s/he is sick.	1	2	3	4
404	Fortified food should only be eaten during no harvest/ hunger seasons.	1	2	3	4
405	I don't worry my child not getting important vitamins, s/he will get them when s/he grows up.	1	2	3	4
406	Under nourished children should eat fortified food.	1	2	3	4
407	Not eating fortified food can harm a child's brain development.	1	2	3	4

Perceived effectiveness of fortified food

I am going to read a series of statements to you and I would like you to tell me how much you agree with them. For each statement, please tell me if you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with it.

		Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
408	Fortified food contains important nutrients for children growth and development	1	2	3	4
409	Children that eat food reach in vitamin A and minerals always do best in school	1	2	3	4
410	Eating fortified food is the only best way to ensure your children gets all important vitamins and minerals	1	2	3	4
411	Expensive fortified food are more effective than less expensive ones	1	2	3	4

Confidence in ability to use fortified food

I am going to ask you about a series of actions you could take, and I would like you to tell me how confident you are that you could actually do that action successfully. For each action, please tell me if you think you definitely could, probably could, probably could not or definitely could not do each action successfully.

		Definitely could	Probably could	Probably could not	Definitely could not
412	I can purchase a food product with added vitamins and minerals and cook for my family	1	2	3	4
413	I can differentiate a fortified product from the one that is not fortified if I know the features	1	2	3	4
414	I can recommend a fortified product to a friend	1	2	3	4
415	My children will be healthy if they eat a fortified food	1	2	3	4
416	My children will be smart in school if they eat a fortified food	1	2	3	4
417	If fortified food are available in our shops, my family will demand for them from the retailers	1	2	3	4
418	If essential micronutrients are added in cooking oil and wheat flour community will need to be informed on the additives	1	2	3	4

Social norms related to consumption of fortified food

N ^o .	QUESTIONS	RESPONSES
419	How often do you discuss with your spouse/friends about the type of food you eat	Very often Not very often Never Don't know
420	Generally how many households in your community do people know about fortified food?	All Most At least half Fewer than half None Don't know
421	Now, I would like you to think of the people outside of your household with whom you talk about personal matters. How many of these people do you think will accept to use a fortified food	All Most At least half Fewer than half None Don't know

Perceptions of fortified food

I am going to read a series of statements to you and I would like you to tell me how much you agree or disagree with them. For each statement, please tell me if you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with it.

		Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
422	The nutrients in the fortified food can be dangerous to the people who use them.	1	2	3	4
423	My young children would not like fortified food	1	2	3	4
424	Nutrients in the fortified food are safe	1	2	3	4
425	Many people will choose to feed their children fortified food	1	2	3	4
426	It can be dangerous for a pregnant woman to eat a fortified food	1	2	3	4
427	I am most at times hesitant on purchasing food that has some added staff until I am well informed about the additives	1	2	3	4

Do you have any other comments or thoughts that you would like to share with us?

Thank you for your attention and contribution.

Appendix E- KAP survey questionnaire for TCDC midline and endline surveys

A. MINI DEMOGRAPHIC INFORMATION

1. Gender of respondent

a. Male

b. Female

2. Respondent's formal education level

a. Never attended school

c. Secondary level (7-13 years)

b. Primary level (less than 7 years)

d. Tertiary level (more than 13 years)

3. What is your main source of income?

a. Farming

e. Fishing

b. Employee

f. Small business

c. Food vending

g. Other (please specify):

d. Pastorist/animal husbandry

B. KNOWLEDGE AND ATTITUDES ABOUT FOOD FORTIFICATION

Now I would like to ask you some questions about food fortification

1. In the past 4 weeks, have you seen or heard any messages about fortification of sunflower oil with Vitamin A?

a. Yes

b. No (*If no, please go to Question 5*)

2. Where did you hear or see the information about the Vitamin A-fortified sunflower oil?

(Do not prompt, check all that are mentioned)

a. TV

g. Cultural shows

b. Radio

h. Clinic shows

c. Printed materials

i. Bicycle races

d. Friends and peers

j. Village brand ambassadors (or community health workers)

e. Relatives

k. Healthcare works

f. Road shows

l. Other (please specify):

3. In the messages that you have seen or heard, did you see or hear about the benefits of the sunflower oil that is fortified with Vitamin A?*(Do not prompt, check all that are mentioned)*

a. Yes

c. Not sure

b. No (*Please go to Question 5*)

4. What are the main benefits of consuming sunflower oil that is fortified with Vitamin A?

(Do not read the options below, check all that are mentioned)

a. Helps with child growth

b. Strengthens immunity to illness

c. Improves vision

d. Improves health/reduces illness

e. Avoids night blindness

- f. Reduces mortality
- g. Other (please specify):

5. How likely do you think you and your family are to suffer from lack of Vitamin A in the body?*

- a. Likely
- b. Not sure
- c. Not likely. If not likely, can you tell me why you think it is not likely:

6. What methods can one use to avoid a diet poor in Vitamin A?* (Do not read the options below, check all that are mentioned)

- a. Balanced diet
- b. Foods rich in Vitamin A
- c. Vitamin A supplement
- d. Food fortified with Vitamin A
- e. Don't know
- f. Other (please specify):

7. Could you list up to three foods that are rich in Vitamin A?*

- a. _____
- b. _____
- c. _____

8. How much do you think cooking with Vitamin A-fortified oil can prevent Vitamin A deficiency?*

- a. Very much
- b. Somewhat
- c. Not at all

9. Are you aware that you can purchase sunflower oil fortified with Vitamin A at a discounted price for a limited time?

- a. Yes
- b. No

10. As a family member, how often do you use the Vitamin A-fortified sunflower oil?

- a. Never
- b. Once a week
- c. More than 2 times a week
- d. At least once a day

(If answer is "At least once a day", please go to Question 12)

11. What are the reasons for not using the Vitamin A-fortified sunflower oil? *(Do not prompt, check all that are mentioned)*

- a. Sold very far from here
- b. Not available at the store where I buy cooking oil
- c. Too expensive to afford
- d. Lack of family support
- e. I am not sure about the benefits that it provides
- f. We have been consuming the oil that is not fortified and there had been no problems
- g. Other (please specify):

12. How would you rate your knowledge of current information on fortified sunflower oil with Vitamin A?

- a. Excellent
- b. Good
- c. Fair
- d. Poor

13. Do you know where fortified sunflower oil is sold?

- a. Yes
- b. No (*If no, please go to Question 15*)

14. How can you recognize the shop that sells fortified sunflower oil?(**Probe** to know how household member can distinguish a shop with and without fortified sunflower oil A)

15. Are there any problem(s) that you face when you want to buy fortified sunflower oil? If yes, can you tell me what they are?

16. Do you have any other comments or thoughts that you would like to share with us?

17. In your opinion, was the campaign appealing and interesting?*

- a. Yes
- b. No

18. Did the campaign include valuable and effective information regarding the MASAVA oil?*

- a. Yes
- b. No

19. Was the content of the campaign relevant to your conditions?*

- a. Yes
- b. No

20. Have you recommended the information to your family member or other relatives?*

- a. Yes
- b. No

*denotes questions only asked at the endline survey

Appendix F- Workflow of the e-Voucher technology

The e-Voucher technology is a mobile-phone based technology that allows residents of Manyara or Shinyanga region to purchase vitamin A-fortified sunflower oil of the Masava project at a discounted price from retailers who are registered with MEDA as sites for issuing and redeeming e-Vouchers for the fortified oil. To receive the discount, the retailer would first send an SMS, requesting for a voucher ID, to a central server that is operated by MEDA. The voucher ID is then sent as a text message to the customer's mobile phone. The customer would present the voucher ID to the retailer who validates it by sending another SMS to the central MEDA-operated server, which acknowledges and authorizes the sale of the fortified oil at the discounted price. The subsidy is then paid to the retailer by MEDA based on the number of e-Vouchers redeemed. With the discount provided using e-Voucher, one litre of fortified unrefined sunflower oil could be purchased for Tsh 2,900, whereas one litre of unfortified cooking oil costs about Tsh 3,000.

Appendix G- University of Waterloo Ethics Clearance Forms

UNIVERSITY OF WATERLOO

<https://oreprod.private.uwaterloo.ca/ethics/form101/ad/reports/certific...>

UNIVERSITY OF WATERLOO OFFICE OF RESEARCH ETHICS

Notification of Ethics Clearance of Application to Conduct Research with Human Participants

Principal/Co-Investigator: Susan Horton **Department:** Economics
Principal/Co-Investigator: Thom Dixon **Department:** MEDA, Waterloo
Principal/Co-Investigator: Theobald Moshia **Department:** Sokoine University of Agriculture

ORE File #: 20501

Project Title: From Farm Gate to Dinner Plate (MASAVA)


This certificate provides confirmation the above project has been reviewed in accordance with the University of Waterloo's Guidelines for Research with Human Participants and the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans. This project has received ethics clearance through a University of Waterloo Research Ethics Committee.

Note 1: *This ethics clearance is valid for one year from the date shown on the certificate and is renewable annually. Renewal is through completion and ethics clearance of the Annual Progress Report for Continuing Research (ORE Form 105).*

Note 2: *This project must be conducted according to the application description and revised materials for which ethics clearance has been granted. All subsequent modifications to the project also must receive prior ethics clearance (i.e., Request for Ethics Clearance of a Modification, ORE Form 104) through a University of Waterloo Research Ethics Committee and must not begin until notification has been received by the investigators.*

Note 3: *Researchers must submit a Progress Report on Continuing Human Research Projects (ORE Form 105) annually for all ongoing research projects or on the completion of the project. The Office of Research Ethics sends the ORE Form 105 for a project to the Principal Investigator or Faculty Supervisor for completion. If ethics clearance of an ongoing project is not renewed and consequently expires, the Office of Research Ethics may be obliged to notify Research Finance for their action in accordance with university and funding agency regulations.*

Note 4: *Any unanticipated event involving a participant that adversely affected the participant(s) must be reported immediately (i.e., within 1 business day of becoming aware of the event) to the ORE using ORE Form 106. Any unanticipated or unintentional changes which may impact the research protocol must be reported within seven days of the deviation to the ORE using ORE form 107.*


Maureen Nummelin, PhD
Chief Ethics Officer

Date



OR
Julie Joza, MPH
Senior Manager, Research Ethics

OR

Sacha Geer, PhD
Manager, Research Ethics

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UNIVERSITY OF WATERLOO
OFFICE OF RESEARCH ETHICS

Request for Ethics Clearance of a Revision or Modification to an
Ongoing Application to Conduct Research with Human Participants

ORE #: 20501 Date of Full Ethics Clearance: 27-Jun-2017

Project Title: From Farm Gate to Dinner Plate: MASAVA

Principal Investigator: Susan Horton; Thom Dixon; Theobald Masha

Department: Economics/SPHHS; MEDA; Sokoine University of Agriculture

Faculty Supervisor 1: Susan Horton

Department: Economics/SPHHS

Faculty Supervisor 2: _____

Department: _____

Student Investigator 1: Daphne CN Wu, SPHHS

Student Investigator 2: Dylan Walters, IHME, University of Toronto

1. Previous Modifications Associated with this ORE 101 Application

Have you previously submitted a modification request (ORE 104) for this project? Yes No

If Yes, please provide the clearance dates for each previous modification under this ORE #.

1.	2.	3.
4.	5.	6.
7.	8.	9.

2. Information Letter and Consent Form

Do the proposed revised procedures require any change(s) to the Information Letter-Consent Form currently in use? Yes No

If Yes, briefly describe these changes below in section 3 and attach a copy of the revised version of the Information Letter-Consent Form.

3. Summary of the Nature, Description and Rationale for Proposed Modifications

Describe the nature of each modification for this current request and provide a rationale for each proposed change. Attach additional pages if needed

- a. New condition or group or revision to an existing procedure.
(Provide detailed explanation /rationale for change.)

ORE Form 104

h) For new researchers please provide name, Waterloo email, and department. (If the change is to the principal investigator (PI) or lead faculty supervisor (FS) roles, please also include a signed letter from the current PI or FS confirming the change.)

I am adding Daphne Wu, Master's student in SPHHS, such that she can write her Master's thesis using data from the MASAVA project.

i) Other changes?

I am also adding Dylan Walters, a PhD student at University of Toronto, of whom I am a co-supervisor, who is writing his PhD thesis using the data

4. Revised ORE 101 Pages

Attach all pages from the ORE Form 101 that have been revised due to the proposed modification

Name and Signature of
Principal & Co-Investigators

Investigator: Susan Horton, Thom Dixon, Theoba

Name and Signature of
Faculty Supervisor(s)

Supervisor: Susan Horton

Susan Horton

Julie 27 2017

Investigator: _____

Supervisor: _____

Name and Signature of Student Investigator(s)

Investigator: Daphne CN Wu, SPHHS

Date: 27/06/2017

Daphne Wu

Investigator: Dylan Walters, IHME, University of T

Date: _____

FOR OFFICE OF RESEARCH ETHICS USE ONLY

- The current modification request to an ongoing project involving human participants has been reviewed and received ethics clearance as submitted
- The current modification request to an ongoing project involving human participants has been reviewed and requires revisions as outlined in the attached email

Julie Joza, MPH, Acting Chief Ethics Officer

Karen Pieters, MPH, Research Ethics Advisor

Nick Caric, MDiv, Research Ethics Advisor

Psychology Delegated Ethics Review Committee (DERC)

Appendix H- National Institute for Medical Research of Tanzania Ethics Clearance Certificate



National Institute for Medical Research
P.O. Box 9653
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NIMR/HQ/R.8a/VOLIX/1299

Prof. Theobald Moshia
Department of Food Science and Technology
Sokoine University of Agriculture
P.O. Box 3006, MOROGORO

THE UNITED REPUBLIC OF
TANZANIA



Ministry of Health and Social Welfare
P.O. Box 9083
Dar es Salaam
Tel: 255 22 2120262-7
Fax: 255 22 2110986

29th December, 2014

CLEARANCE CERTIFICATE FOR CONDUCTING MEDICAL RESEARCH IN TANZANIA

This is to certify that the research entitled: Promoting Use of Locally Fortified Sunflower Oil using E-Vouchers (Moshia, Dixon and Horton) has been granted ethics clearance to be conducted in Tanzania.

The Principal Investigator of the study must ensure that the following conditions are fulfilled:

1. The methodology of the study should not be changed or modified.
2. Progress report is submitted to the Ministry of Health and the National Institute for Medical Research, regional and District Medical Officers at the end of the study.
3. Permission to publish the results is obtained from the National Institute for Medical Research.
4. Copies of final publications are made available to the Ministry of Health and Social Welfare and the National Institute for Medical Research
5. Any researcher, who contravenes or fails to comply with these conditions, shall be guilty of an offence and shall be liable to a fine. NIMR Act No. 23 of 1979, PART III Section 10(2).
6. Approval is for three years: 1st January 2015 to 31st December 2017.


Name: Dr Mwelecele N Malecela

Signature 

CHAIRPERSON
MEDICAL RESEARCH
COORDINATING COMMITTEE

CC: RMO
DMO

Name: Dr Donan Mmbando

Signature 

ACTING CHIEF MEDICAL OFFICER
MINISTRY OF HEALTH, SOCIAL
WELFARE