USAID FROM THE AMERICAN PEOPLE Nawiri

Rural Entrepreneur Access Project (REAP) Secondary Data Analysis Report

September 2021

Rural Entrepreneur Access Project (REAP) Working Group: Secondary Data Analysis Report

Award Number: 72DFFP19CA00003

Award Period: October 1, 2019 – September 30, 2024

Prepared for USAID

United States Agency for International Development

Matthew Nims, Agreement Officer

ATTN: Kathleen Hartin
Agreement Officer's Representative
khartin@usaid.gov

Prepared by:

Mercy Corps Nawiri Consortium

This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents of this report are the responsibility of Mercy Corps and do not necessarily reflect the views of USAID or the United States Government.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ASALs	Arid and Semi-Arid Lands
BRAC	Building Resources Across Communities
CI	Confidence Interval
GOK	Government of Kenya
HFIAS	Household Food Insecurity Access Scale
HSNP	Hunger Safety Net Program
IQR	Interquartile Range
PCA	Principal Component Analysis
REAP	Rural Entrepreneur Access Project
SD	Standard Deviation
SEM	Structural Equation Modeling

ACKNOWLEDGEMENTS

This report was written by Valerie Flax (RTI) and Erin Lewis (BOMA). The statistical analysis was performed by Moses Ngari and Julie Jemutai (consultants), and Moses Ngari created the structural equation model diagrams and draft versions of results tables. Paul Bolo (BOMA) played a key role in compiling, cleaning, and labeling the data. Paul Bolo and Guyo Wako (BOMA) contributed to the recommendations. Susan Edwards (RTI) developed the analysis plan. Erica Browne, Jennifer Ryan, and Maitri Punjabi (RTI) assisted with data cleaning and preparation.

EXECUTIVE SUMMARY

This report describes the results of a secondary analysis of existing baseline-endline survey data from participants in the BOMA Project's Rural Entrepreneur Access Project (REAP). The purpose of the analysis was to gain insights into how REAP has contributed to nutrition of households and how the program can be modified to be more supportive of improved nutrition outcomes as part of Nawiri. The analysis was guided by a draft theory of change showing the pathways through which REAP might affect nutrition. The analysis was designed to understand the strength of the associations between constructs along the pathways in the theory of change, demographic attributes associated with the theory of change constructs, and the influence of season on theory of change constructs.

A total of 10 cohorts with data from 2013 to 2018 were included in different parts of the analysis. The constructs used as outcome variables were increased household food security, improved dietary intake, and decreased disease. The explanatory constructs included in the analysis were diversification of income sources, psychosocial benefits, access to local savings and credit, increased knowledge of health behaviors, increased income, increased women's household decision-making power, improved access to health services, increased girls' school enrollment, and increased women's involvement in community decision-making and activities.

We used principal component analysis to develop a composite value for constructs in the REAP theory of change that were composed of several variables. A comparison of mean baseline and endline values for the constructs showed that there were statistically significant increases in all constructs.

We used structural equation models to assess the relationships between constructs. For the model with improved dietary intake as the outcome, only one cohort was included because no other cohorts had food group consumption data. We found that increased women's household decision-making and improved household food security were directly associated with improved dietary intake, while increased income was not directly associated with improved dietary intake but worked indirectly through associations with improved household food security and increased women's household decision-making. In addition, access to savings and credit and income source diversification were associated with increased household food security in this model. For the model with decreased disease as the outcome, only one cohort was included because no other cohorts had morbidity data. We found that increased women's household decision-making was directly associated with decreased disease. Increased income was not directly associated with decreased disease but worked indirectly through increased women's household decision-making. The model with increased household food security as the outcome included seven cohorts. We found that increased income source diversification, increased women's household decision-making, and increased income were associated with increased household food security, while access to savings and credit was not associated. In addition, increased income also worked indirectly to influence household food security through increased women's household decision-making.

The analysis of demographic factors used multilevel regression models to test the association of REAP participants' age and marital status with theory of change constructs and included data from all 10 cohorts. While we found statistically significant associations of age and marital status with several of the constructs, the size of the coefficients was very small, indicative of a weak relationship, for most constructs. The one exception was the relationship between marital status and increased women's household decision-making power, where the coefficients were large and showed that compared to married women, unmarried (e.g., divorced, single, and widowed) women had greater decision-making power.

The analysis of season used t-tests to compare mean baseline-endline changes during the dry and rainy seasons, based on timing of data collection, and used data from all 10 cohorts. We found no statistically significant differences by season for any theory of change construct.

The importance of women's household decision-making in relation to diverse dietary intake, disease, and household food security through both direct and indirect pathways indicates that REAP pilots should include a male engagement strategy that involves men and women in activities that challenge and seek to improve social norms, beliefs, and practices related to gender equity. The need for a male engagement strategy was further reinforced by the demographic analysis showing that unmarried women have greater household decision-making power than married women.

The findings that the mean increase in baseline-endline income is small and that income is not directly associated with dietary intake have several implications. The small increase in incomes indicates that REAP pilots need to enhance income by making REAP businesses more profitable. The lack of association between income and diet may show that REAP participants lack knowledge about diverse foods, diverse foods are not available, or they are not affordable. The Nawiri cost of diet study showed that the cost of nutritious foods is a major barrier for the poor and extreme poor in the target counties and the availability of nutritious foods is inconsistent. REAP can address some of these gaps by incorporating nutrition trainings into pilots and encouraging REAP businesses to become last-mile sellers of nutritious foods. However, other Nawiri interventions or complementary Feed the Future or other programs should work on improving supply chains for nutritious foods that REAP businesses can sell.

The lack of differences in theory of change constructs by season suggests that the timing of initiation of REAP cohorts may not be important.

As part of this analysis, we also identified several data gaps that should be addressed in the surveys for the Nawiri REAP pilots. These have been outlined in more detail in a separate document. Briefly, we suggest that the surveys include the household food insecurity access scale, household dietary diversity score and/or minimum dietary diversity for children for children 6–23 months, mid-upper arm circumference for children 6–59 months, and types of foods being sold by food-related REAP businesses. We also recommend that indicators for access to health care, knowledge of health behaviors, and morbidity should be incorporated into the surveys.

1. BACKGROUND

"Poverty graduation" is a sequenced, layered set of holistic interventions targeting "ultra-poor" households. It is designed to help recipients build new livelihoods while building skills and confidence, along with an asset base to diversify income, protect themselves from shocks, and sustain well-being. The poverty graduation approach was originally developed and applied in Bangladesh by Building Resources Across Communities (BRAC) and includes consumption support, productive asset transfer, training, coaching, access to savings, and health education or access to basic health services. Across the graduation community of practice, there is significant iteration and adaptation to graduation programming in response to the diverse needs of the ultra-poor across different geographies and population segments. The BOMA Project's Rural Entrepreneur Access Project (REAP) is an adaptation of the poverty graduation model that has been tailored specifically to the unique needs of the ultra-poor in the drylands of Kenya, where it has been implemented and rigorously tested since 2009. **Table 1** illustrates the ways in which REAP retains the original building block components of graduation as pioneered by BRAC along with the adaptations fit for Kenyan arid and semi-arid lands (ASALs).

TABLE 1. REAP GRADUATION COMPONENTS AND ADAPTATIONS

Graduation Component	Part of REAP?	Explanation of REAP Adaptation
Consumption Support: Basic food or cash support to stabilize households and reduce the need to sell the new asset in an emergency.	Consumption stipend is not standard in REAP, but its inclusion is determined on a context-by-context basis.	In many second-generation graduation programs, government safety net transfers serve as a de facto source of consumption assistance. As approximately 90% of REAP enrollees are also Hunger Safety Net Program (HSNP) cash transfer recipients in HSNP counties, these and other Government of Kenya (GOK) safety net cash transfers serve as consumption support to the majority of participants. In geographic areas without such government safety net cash transfer support, BOMA has worked with donors to provide time-limited consumption stipends to participants, as in the case in the PROFIT program in Samburu County. 95% of REAP businesses earn income in the first 2 months of the program, making an additional consumption stipend unnecessary.
Productive asset transfer: An asset to spur income generation, such as livestock or goods, to start an informal store.	Yes	REAP generally does not distribute physical assets (e.g., livestock) to participants because it would be resource-intensive and logistically challenging in the drylands. Participants are given conditional cash transfers to invest in starting a microenterprise of their choice with training, market information, and support from their local mentor.

TABLE 1. REAP GRADUATION COMPONENTS AND ADAPTATIONS

Graduation Component	Part of REAP?	Explanation of REAP Adaptation
Training: Training on how to manage the asset.	Yes	BOMA's approach to training recognizes the need to equip participants with the right skills to run a business before providing them with asset transfers. However, given the literacy limitations among the target population, BOMA adopts a phased approach with a heavy emphasis on learning-by-doing and mentor accompaniment for practical application of lessons and reinforcement. Training begins prior to the first asset transfer with delivery of basic business and financial skills training (marketing, costing and pricing, recordkeeping, saving and credits, conflict management) as groups choose their business activity and work with their mentor to develop a basic business plan and budget. In the last 2 years, BOMA has introduced a market assessment study to better tailor the business skills training with relevant local market information to support their business choice, planning and budgeting, and other dimensions. Given the need to continue deepening and practicing these skills as business ventures evolve, mentors continue to reinforce and deepen training through mentorship at business level and through delivery of a microtraining curriculum to savings groups covering life skills and ongoing financial literacy topics. BOMA links women with other livelihood-specific training opportunities in coordination with government and nongovernmental organizations and private sector partners.
Coaching: Frequent (usually weekly) coaching visits to reinforce skills, build confidence, and help participants handle any challenges	Yes, at business group level	Community-based BOMA mentors visit each REAP business group (composed of three women) on a monthly basis (at minimum) to provide in-person support, monitor progress and support participants to solve any issues that arise. Monthly, group-level delivery of coaching is adapted to be cost and operationally effective given the geographically dispersed nature of the communities.
Access to Savings: A mechanism to help people put away money to invest or	Yes	The cash transfers given through REAP are used to immediately launch income-generating activities, which is unique as most graduation models start with savings. BOMA has flipped this sequencing, as ultra-poor women in ASAL counties often begin with few or no resources to save but are able to quickly generate income through

TABLE 1. REAP GRADUATION COMPONENTS AND ADAPTATIONS

Graduation Component	Part of REAP?	Explanation of REAP Adaptation
use in a future emergency		engagement in commercial activities. Generally, BOMA introduces savings group activities from month 6 of the intervention. BOMA determined that this adaptation was particularly important for ensuring that the pressure to save without money to save did not expose women to new risks or lead to high attrition given the mobility of participants in the pastoralist context.
Health Education or basic health services: Health education or access to health care to stay healthy and able to work.	Yes	BOMA provides REAP savings groups with training on water, sanitation and hygiene, dietary diversity, and/or family planning. These modules are adapted and reinforced based on the wider social behavior change strategy of projects within which REAP is operating and, where possible, delivered in collaboration with community health volunteers. In its most recent cohorts in Samburu County, BOMA ensured enrollment of REAP savings groups with National Hospital Insurance Fund (although there remain significant financial barriers to sustainability of health insurance coverage for ultra-poor populations in Kenya). Given the context in Kenyan ASAL counties, BOMA also puts a strong emphasis on girl child education, integrating messaging on this theme in communications throughout the graduation intervention.

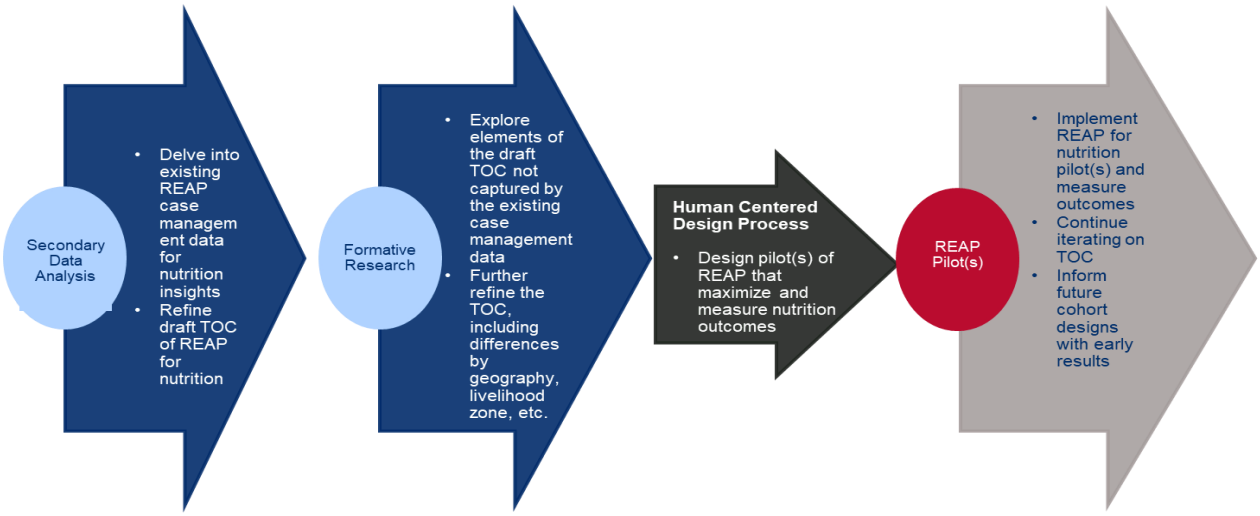
REAP has shown positive and significant impacts on income, savings, and asset accumulation.[1] Despite the cyclical risks faced by households in ASAL communities, evidence suggests that the results of REAP are sustained beyond the life of the intervention. A 2018 follow-up study of participants 3 to 5 years after their exit from REAP showed that business income continued growing after graduation, 81% of women continued to have at least one source of income, 79% felt they were fully able to provide food for their families, and 60% felt very confident that they could repay a loan if they had to take one.[2] School and medical expenditures also increased after graduation.

Despite these promising outcomes in terms of helping the ultra-poor climb out of extreme poverty, very little research on poverty graduation generally or on REAP specifically has provided evidence that the approach can reduce malnutrition or contribute to nutrition outcomes at scale. To date, only one study, a 2018 randomized controlled trial in Bangladesh, showed that poverty graduation can have large, positive long-term health and nutrition effects and lead to positive externalities in communities.[3] While this evidence is important, it is limited because any pathways to nutrition outcomes through poverty graduation are complex and context

dependent, suggesting a need for deeper research. Given REAP's primary emphasis on poverty reduction, measurement and analysis in REAP programming has not historically taken the next step to link promising income, food security, and women's decision-making outcomes to changes in nutrition for enrolled women, their household members, or those in their communities.

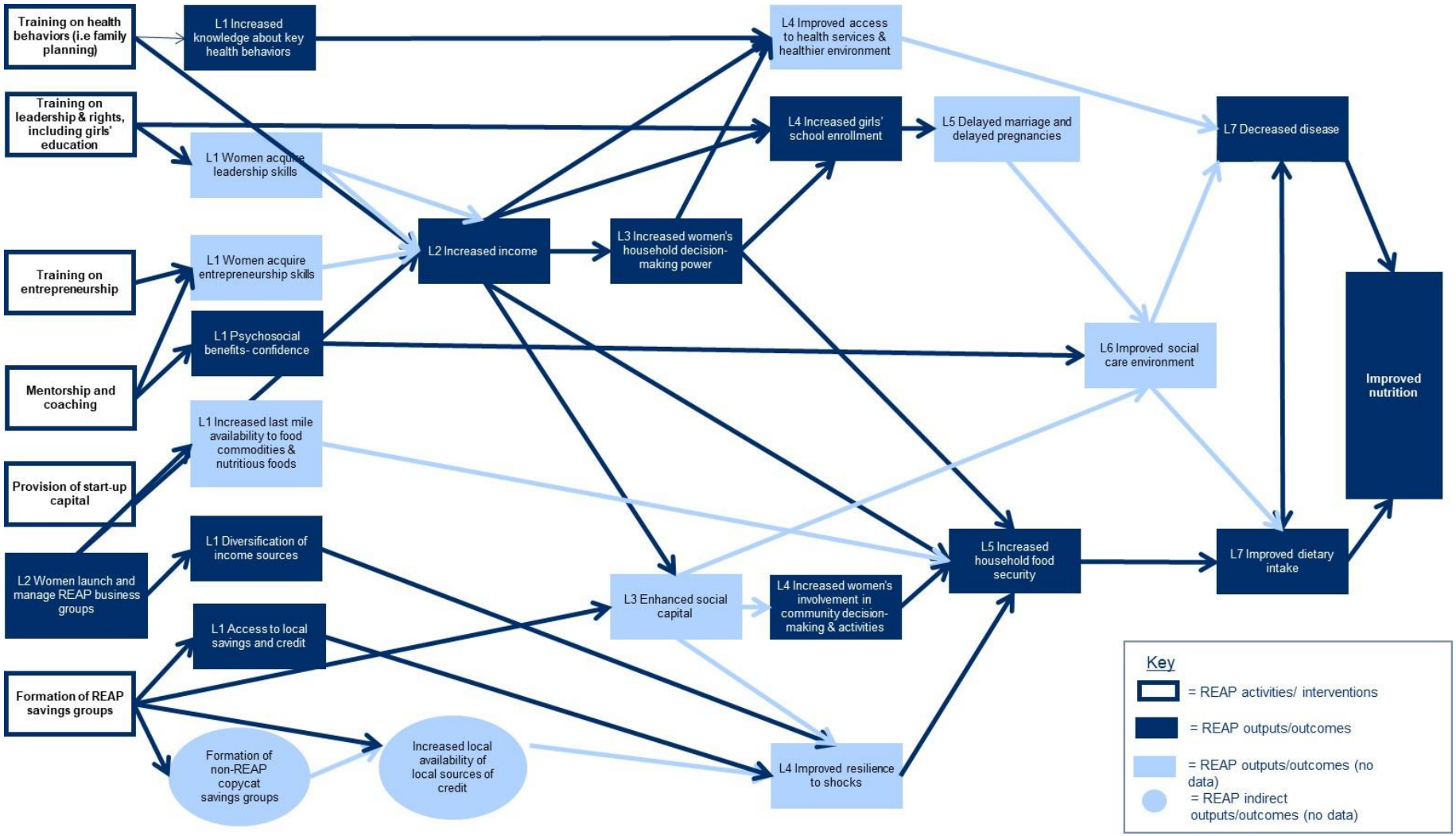
The immediate, underlying, and systemic drivers of acute malnutrition go beyond the poverty reduction and livelihood angles of standard graduation programming and include the interplay of behavior, disease, health and sanitation access, age, and gender, among other elements. Recognizing this complexity, Nawiri consortium partners aim to undertake a multistep research and learning process to inform the design of graduation pilot(s) that are adapted to contribute to a reduction of persistent acute malnutrition. The overall process is mapped in **Figure 1**.

FIGURE 1. RESEARCH AND LEARNING PROCESS FOR DESIGNING REAP PILOTS



This report focuses on one step of the research and learning process—a secondary analysis of existing REAP survey—which aims to provide insights into pathways to nutrition to inform pilot design. The secondary analysis is guided by a working draft theory of change that shows the hypothesized pathways through which REAP may affect nutrition outcomes (**Figure 2**). The main objective of this secondary analysis of REAP data is to generate evidence-based information about the pathways in the theory of change and other aspects of REAP programming that should be strengthened or modified to improve nutrition of young children and women and tested in REAP for Nutrition pilots.

FIGURE 2. DRAFT REAP FOR NUTRITION THEORY OF CHANGE



2. METHODS

2.1 RESEARCH QUESTIONS

The secondary analysis of REAP data seeks to address the following research questions:

1. What is the relative importance or strength of, and what are the interactions between, elements of the potential pathways by which REAP, as presently designed and implemented, plausibly impacts nutrition and nutrition drivers?
2. Which demographic attributes of REAP participants are associated with food security (as a proxy for nutrition outcomes) and drivers on the pathways to nutrition outcomes?
3. How does season affect graduation outcomes, including food security, livelihoods, and other drivers on the pathways to nutrition outcomes?

2.2 DATASETS AND CONSTRUCTS

The datasets used in this analysis were collected by BOMA as baseline and endline survey data from REAP cohorts in several ASAL counties in Kenya, including Marsabit, Samburu, Turkana, Isiolo, and Wajir, during the period from 2013 to 2018. A total of 10 cohorts are included with a total sample size of 6,366 REAP participants. However, not all cohorts were used for all analyses because some cohorts lacked relevant variables, as shown in **Table 2**. In addition, the theory of change included some theoretical pathways; therefore, no data were available for some constructs as indicated by the light blue construct boxes in Figure 2.

TABLE 2. THEORY OF CHANGE CONSTRUCTS AND DATA AVAILABLE BY COHORT

Construct	2013 May	2014 Sep	2015 Sep	2016 Apr Gates	2016 Nov Turkana	2016 Nov Wajir	2017 Apr Profit	2017 Jan	2017 May	2018 June Isiolo
L1. Diversification of income sources	1,238	220	620	1,326	202	216	1,080	330	222	912
L1. Psychosocial benefits-confidence	0	0	0	0	0	0	1,080	0	0	0
L1. Access to local savings and credit	0	0	620	1,321	202	216	1,079	326	174	912
L1. Increased knowledge about key health behaviors	0	0	0	0	202	216	1,080	330	222	912
L2. Increased income	1,238	220	620	1,326	202	216	1,080	330	222	912
L3. Increased women's household decision-making	0	0	620	1,326	202	216	1,080	330	222	912

TABLE 2. THEORY OF CHANGE CONSTRUCTS AND DATA AVAILABLE BY COHORT

Construct	2013 May	2014 Sep	2015 Sep	2016 Apr Gates	2016 Nov Turkana	2016 Nov Wajir	2017 Apr Profit	2017 Jan	2017 May	2018 June Isiolo
L4. Improved access to health services & healthier environment	0	0	619	0	0	0	1,079	330	222	0
L4. Increased girls' school enrollment	1,238	220	620	1,326	202	216	1,080	330	222	912
L4. Increased women's involvement in community decision-making & activities	0	0	0	0	202	216	1,080	330	222	912
L5. Increased household food security	0	0	0	1,326	202	216	1,080	330	222	912
L7. Improved dietary intake	0	0	0	0	0	0	0	0	0	912
L7. Decreased disease	0	0	0	1,045	0	0	0	0	0	0
Total	1,238	220	620	1,326	202	216	1,080	330	222	912

2.3 DATA ANALYSIS

2.3.1 Creation of the Theory of Change Constructs

The theory of change constructs are defined in **Table 3** and the variables used to create the constructs are shown in Annex 1. We applied principal component analysis (PCA) to develop a composite value for constructs in the REAP theory of change that were composed of several variables. We obtained composite values for 9 of the 12 constructs. We selected the first principal component because it accounts for the largest variance and provides the most information. We normalized the principal component scores, so they were rescaled from to 0 and 1 to allow for comparisons and further analysis.

The diversification of income and increase in income constructs had only one measure each; therefore, we did not run PCA. The access to health services and healthier environment construct had many missing values in three of the four measures, which made it impossible to obtain principal components.

We carried out a descriptive analysis reporting means, standard deviations (SD), medians, and interquartile range (IQR) for the constructs in the theory of change, both those that were created by PCA and those where a single variable from the cohort data was used to represent the

construct. We then applied Student's t-tests on the normalized scores from PCA and nonnormalized values for individual variables where PCA was not necessary to compare the two time points (baseline and endline). For all analyses, a difference was considered statistically significant at $P<0.05$.

TABLE 3. DEFINITIONS OF THEORY OF CHANGE CONSTRUCTS

Construct	Definition
L1. Diversification of income sources	Number of income sources the participant has access to
L1. Psychosocial benefits-confidence	Participant's confidence that they can take part in social activities, participate in income-generating activities, and can cope with shocks and stresses
L1. Access to local savings and credit	Participant's access to local savings and credit and amount of credit from REAP and non-REAP sources
L1. Increased knowledge about key health behaviors	Participant's knowledge, use of, and sources of information about family planning (which were the only health knowledge questions asked across several cohorts)
L2. Increased income	Amount of participant's household income (in Kenya shillings)
L3. Increased women's household decision-making	Participant's participation in household decision-making related to buying livestock, owning livestock, selling own livestock, buying food, children's medical needs, children's schooling, paying for school fees, and purchasing household items
L4. Increased girls' school enrollment	Number of primary-school-aged female children the participant has and how many of them are in school
L4. Improved access to health services & healthier environment	Participant's access to health insurance and whether the participant's family members have been vaccinated and received treatment when ill
L4. Increased women's involvement in community decision-making & activities	Number of community committees a participant is involved in and her leadership activities
L5. Increased household food security	Number of times per day members of participant's household ate in the last week, number of times per day the participant's children ate in the last week, whether children have gone to bed without an evening meal in the last week
L7. Improved dietary intake	Household consumption of food groups (cereals, white roots and tubers, dark green leafy vegetables, fish, flesh meat, organ meat, poultry and eggs, vitamin A rich fruits, other fruits, vitamin A rich vegetables and tubers, other vegetables, legumes and nuts, milk products, oil/fats)
L7. Decreased disease	Household members experienced cough, eye problems, injuries, malaria, or stomach illness in the last 6 months

2.3.2 Analysis for Research Question 1

For research question 1, we used structural equation modeling (SEM) to generate a more comprehensive understanding of the relationships between theory of change constructs and their direct and indirect effects. We built multilevel SEM models based on the relationships between constructs shown in the theory of change, with a random intercept for time of the cohort. We utilized the generalized SEM model with multilevel mixed effects, linear outcome (the PCA scores were continuous latent variables). and both ordinal and continuous exposure variables. The SEM models were adjusted for age and marital status, which were the only sociodemographic variables available across all cohorts. In reporting, we distinguish direct pathways (from a construct to an outcome) and indirect pathways (from a construct to an outcome via another construct). We built three separate SEM models based on different outcomes.

1. Model 1 used L7. Improved dietary intake as the outcome. This model only used data from the 2018 June Isiolo cohort. Data on dietary intake were only available for this cohort.
2. Model 2 used L7. Decreased disease as the outcome. This model only used data from the 2016 April Gates cohort. Morbidity data were only available for this cohort.
3. Model 3 used L5. Increased household food security as the outcome. This model used data from seven cohorts that included this outcome variable: 2016 April Gates, 2016 November Turkana, 2016 November Wajir, 2017 April PROFIT, 2017 January, 2017 May, and 2018 June Isiolo. For Model 3, inverse weights were created based on the size of the cohorts and included in the model to account for variability in the size of the cohorts, as shown in **Table 4**.

TABLE 4. INVERSE WEIGHTS FOR SEM MODEL 3 BASED ON THE COHORT SIZES

	2016 Apr Gates	2016 Nov Turkana	2016 Nov Wajir	2017 Apr PROFIT	2017 Jan	2017 May	2018 June Isiolo	Total
N	1,326	202	216	1,080	330	222	912	4,288
Proportion of each cohort of the total N	0.309	0.047	0.05	0.25	0.077	0.052	0.212	
Inverse weight of the proportion above	3.24	21.3	20	4	13.0	19.2	4.72	
Standardized inverse weights[a]	0.15	1.0	0.94	0.19	0.61	0.90	0.22	

[a]Each inverse weight divided by the largest inverse weight.

2.3.3 Analysis for Research Question 2

For research question 2, we used two-level mixed effect linear regression models [level 1: cohort (time of each cohort) and level 2: visit (either baseline/endline)] to estimate the association of demographic variables with food security and drivers on the pathways to nutrition outcomes. All 10 cohorts were used for this analysis.

2.3.4 Analysis for Research Question 3

For research question 3, we assessed the effect of season (rainy/dry) on graduation outcomes, including food security and other drivers on the pathways to nutrition outcomes. All 10 cohorts were used for this analysis. They were classified as being conducted in the dry or rainy season according to Kenya rain patterns. These cohorts had data collected during the rainy season: 2016 April Gates, 2016 November Turkana, 2016 November Wajir, and 2017 April PROFIT. These cohorts had data collected during the dry season: 2013 May, 2014 September, 2015 September, 2017 September, 2017 May, and 2018 June Isiolo. Independent t-tests were used to compare the mean differences between dry and rainy seasons.

3. RESULTS

3.1 BASELINE-ENDLINE COMPARISON OF THEORY OF CHANGE CONSTRUCTS

The absolute median and mean values for L1. Diversification of income sources and L2. Increased income, and the normalized median and mean values for all other constructs, are shown in **Table 5**. We found statistically significant differences in the mean baseline and endline values. The distribution of each theory of change construct at baseline and endline is shown in **Annex 2**.

TABLE 5. SUMMARY STATISTICS OF NORMALIZED SCORES FOR REAP THEORY OF CHANGE CONSTRUCTS AND COMPARISON OF MEAN VALUES

Constructs		Baseline		Endline		P-value[b]
	N	Mean (SD)	Median [IQR]	Mean (SD)	Median [IQR]	
L1. Diversification income sources[a]	6,366	1.46 (1.44)	1 [0, 2]	2.81 (1.41)	3 [2, 4]	<0.001
L1. Psychosocial benefits - confidence	1,059	0.58 (0.23)	0.59 [0.44, 0.77]	0.75 (0.21)	0.79 [0.64, 0.92]	<0.001
L1. Access to local savings and credit	4,852	0.02 (0.04)	0 [0, 0.05]	0.15 (0.10)	0.14 [0.08, 0.20]	<0.001

L1. Increased knowledge about key health behaviors	3,396	0.21 (0.14)	0.18 [0.11, 0.28]	0.29 (0.15)	0.26 [0.18, 0.38]	<0.001
L2. Increased income	6,365	4202 (5453)	3,000 [1100, 5100]	4,866 (6,580)	3,000 [500, 6500]	<0.001
L3. Increased women's household decision-making	3,058	0.58 (0.24)	0.54 [0.42, 0.74]	0.59 (0.17)	0.57 [0.50, 0.66]	<0.001
L4. Increased girls' school enrollment	6,366	0.10 (0.14)	0 [0, 0.17]	0.14 (0.15)	0.17 [0, 0.17]	<0.001
L4. Improved access to health services & healthier environment	1,124	0.78 (0.23)	0.89 [0.54, 1.00]	0.61 (0.3)	0.54 [0.46, 0.99]	<0.001
L4. Increased women's involvement in community decision-making & activities	3,760	0.05 (0.15)	0	0.07 (0.18)	0	0.004
L5. Increased household food security	4,427	0.24 (0.14)	0.23 [0.11, 0.33]	0.38 (0.12)	0.33 [0.33, 0.43]	<0.001
L7. Improved dietary intake	912	0.19 (0.15)	0.16 [0.11, 0.21]	0.25 (0.14)	0.21 [0.16, 0.32]	<0.001
L7. Decreased disease	1,045	0.39 (0.21)	0.37 [0.19, 0.59]	0.45 (0.19)	0.41 [0.37, 0.59]	<0.001

SD = standard deviation; IQR = interquartile range.

[a]These are summary statistics for the individual measure within these constructs, as they only had one measure.

[b]P-values from t-tests comparing mean values.

3.2 RESEARCH QUESTION 1 RESULTS

Research question 1 focused on the pathways in the theory of change and the strength of the relationships. SEM analyses were performed twice for the L7. Improved dietary intake and L7. Decreased disease outcomes. The first round of SEM models for these outcomes used the

original pathways specified in the theory of change framework (**Figure 2**). Those results are shown in Annex 3. Because there were no data for some of the theoretical constructs in the theory of change (i.e., L5. Delayed marriage and delayed pregnancies; L6. Improved social care environment). The initial models had L4. Increase in girls' school enrollment leading directly to L7. Improved dietary intake and L7. Decreased disease. After seeing the results and discussing them as a team, we felt there was no basis for a direct relationship between girls' school enrollment and the disease status or dietary intake of their household, but rather that girls' school enrollment would be expected to influence the disease status and dietary intake of their own future children. Therefore, we removed L4. Increase in girls' school enrollment from the subsequent SEM models. Instead, we tested the direct pathways from L3. Increased women's decision-making power in household and L2. Increased income to L7. Improved dietary intake and L7. Decreased disease. The revised version of the theory of change is shown in **Figure 3**. The dotted arrows in Figure 3 indicate either that no data were available or the pathway was not included in the final SEM analysis. The dark blue arrows in **Figure 3** on the following page show the additional pathways that were included in the final SEM models. There was no change in the L5. Increased household food security pathways, so only one SEM model was performed for that outcome.

3.2.1 Improved Dietary Intake Pathways (Model 1)

Model I examined pathways to improved dietary intake (**Figure 4**). In **Figure 4** and other SEM diagrams in subsequent sections, statistically significant associations are indicated by solid arrows, with thicker arrows showing a larger effect size (e.g., a stronger relationship). Dashed arrows indicate that there is not a statistically significant relationship between constructs and the thickness of the dashed arrows is not relevant. The numbers along the arrows show the coefficients and the level of statistical significance (P-value) for each association.

Increased women's household decision-making had a positive direct effect on improved dietary intake [regression coefficient of 0.16 (95%CI 0.11 to 0.21), P<0.001]. Sufficient household food security had a positive direct effect on improved dietary intake [regression coefficient of 0.08 (95%CI 0.007 to 0.15), P=0.03]. However, increased income had no significant direct effect on improved dietary intake [regression coefficient of 0.08 (95%CI –0.06 to 0.21), P=0.28]. Increased income had an indirect effect on improved dietary intake mediated through increased women's household decision-making [regression coefficient 0.14 (95%CI 0.03 to 0.24), P=0.01]. Increased income, increased diversification of income sources, and access to savings and credit had indirect positive effects mediated through increased household food security.

FIGURE 3. REVISED REAP THEORY OF CHANGE FOR IMPACTS ON NUTRITION

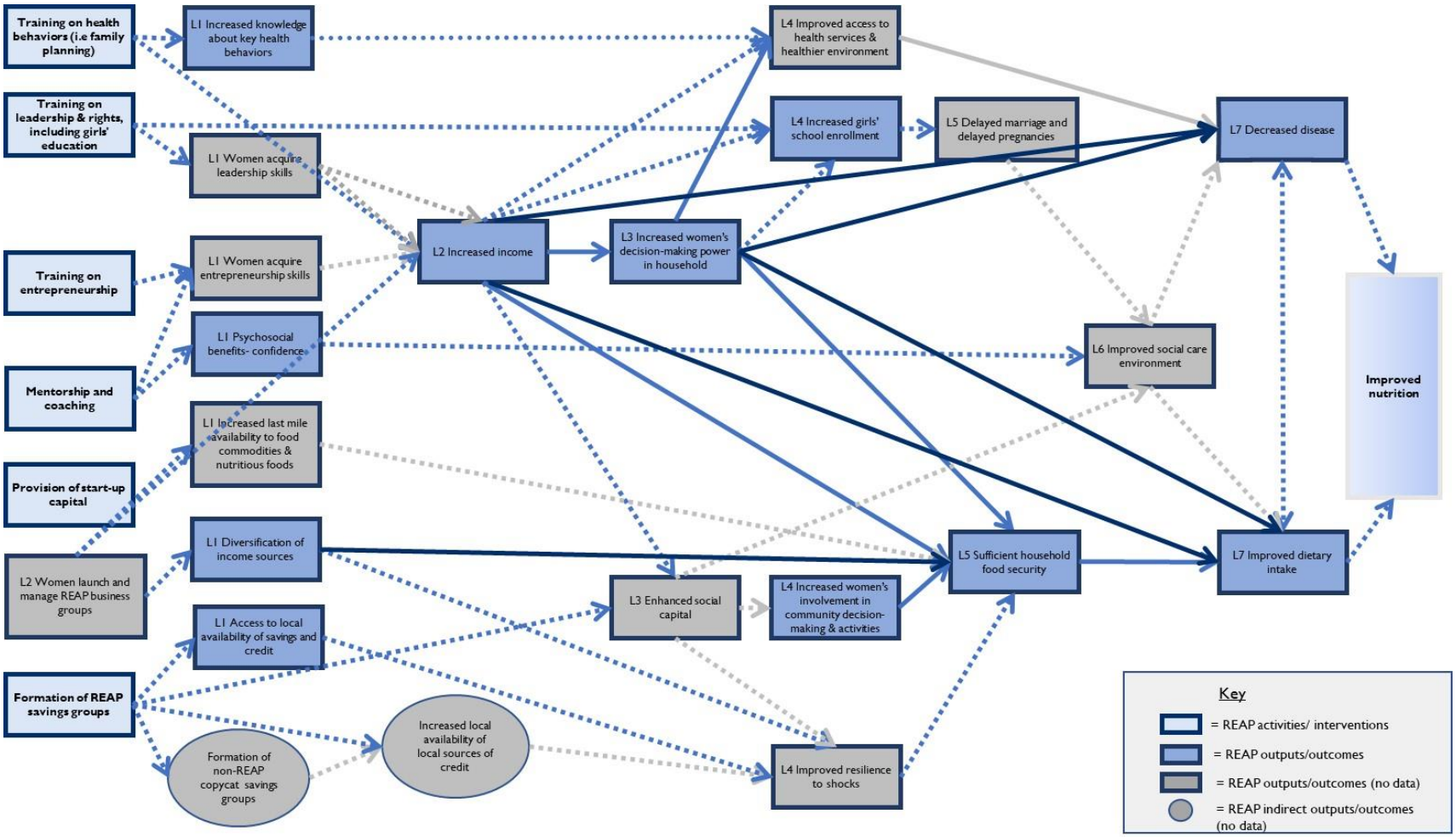
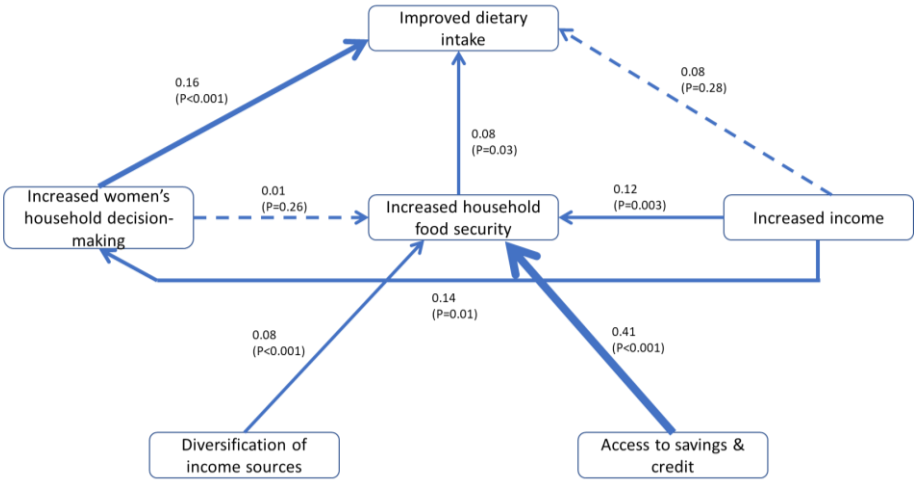


FIGURE 4. STRUCTURAL EQUATION MODEL OF RELATIONSHIPS BETWEEN THEORY OF CHANGE CONSTRUCTS AND IMPROVED DIETARY INTAKE

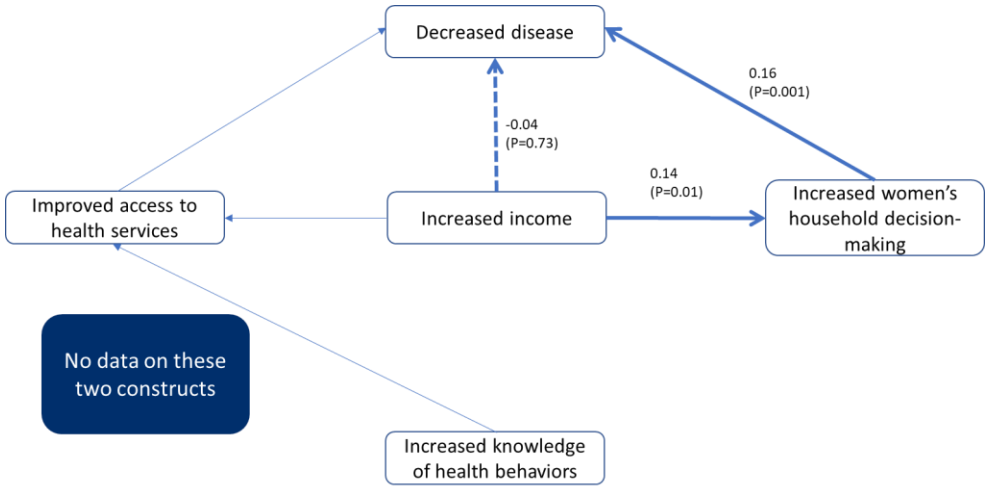


Statistically significant associations are indicated by solid arrows and statistically nonsignificant associations by dashed arrows. For the significant associations, the arrow thickness corresponds to the effect size. Each outcome was adjusted for age and marital status and was modeled with a random intercept at the visit level (baseline/endline).

3.2.2 Decreased Disease Pathways (Model 2)

Model 2 examined pathways to decreased disease (**Figure 5**). Increased women's household decision-making had a positive direct effect on decreased disease [regression coefficient of 0.16 (95%CI 0.06 to 0.26), P=0.001]. Increased income had no significant direct effect on decreased disease [regression coefficient of –0.04 (95%CI –0.28 to 0.20), P=0.73]. Increased income had an indirect effect on decreased disease mediated through increased women's household decision-making [regression coefficient 0.14 (95%CI 0.03 to 0.24), P=0.01].

FIGURE 5. STRUCTURAL EQUATION MODEL OF RELATIONSHIPS BETWEEN THEORY OF CHANGE CONSTRUCTS AND DECREASED DISEASE

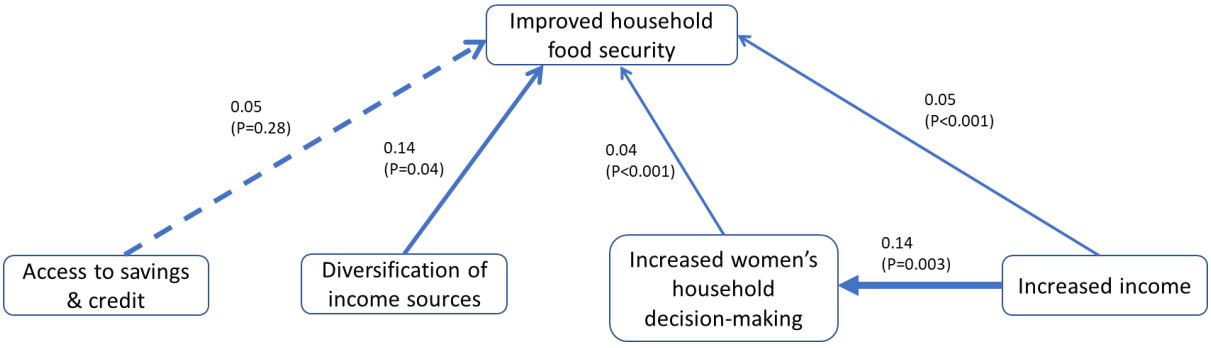


Statistically significant associations are indicated by solid arrows and statistically nonsignificant associations by dashed arrows. For the significant associations, the arrow thickness corresponds to the effect size. Each outcome was adjusted for age and marital status and was modeled with a random intercept at the visit level (baseline/endline).

3.2.3 Increased Household Food Security Pathways (Model 3)

Model 3 examined pathways to increased household food security (**Figure 6**). Increased women's household decision-making had a positive direct effect on household food security [regression coefficient of 0.04 (95%CI 0.03 to 0.05), P<0.001]. Increased income had a positive direct effect on household food security [regression coefficient of 0.05 (95%CI 0.04 to 0.06), P<0.001]. Diversification of income sources had a positive direct effect on household food security [regression coefficient of 0.14 (95%CI 0.007 to 0.28), P=0.04]. Increased income had an indirect effect on household food security mediated through increased women's household decision-making [regression coefficient 0.14 (95%CI 0.01 to 0.27), P=0.003].

FIGURE 6. STRUCTURAL EQUATION MODEL OF RELATIONSHIPS BETWEEN THEORY OF CHANGE CONSTRUCTS AND INCREASED HOUSEHOLD FOOD SECURITY



Statistically significant associations are indicated by solid arrows and statistically nonsignificant associations by dashed arrows. For the significant associations, the arrow thickness corresponds to the effect size. Each outcome was adjusted for age and marital status and was modeled with a random intercept at the visit level (baseline/endline).

3.3 RESEARCH QUESTION 2 RESULTS

Research question 2 focused on the relationship between REAP participants' demographic characteristics and theory of change constructs. The two demographic attributes that were available across all REAP cohorts were age and marital status of REAP participants.

3.3.1 Demographic Attributes of REAP Participants

Overall, the median (IQR) age of all the REAP participants was 34 (range 27 to 45) years. Median (IQR) ages across the ten cohorts are shown in **Table 6**. There was evidence of age heterogeneity across the cohorts (P<0.001).

TABLE 6. AGE OF STUDY PARTICIPANTS IN YEARS BY COHORT AND OVERALL

Cohort	N	Median (IQR)	P-value[a]
2013 May	1,238	32 (27 to 43)	<0.001
2014 September	220	33 (27 to 45)	
2015 September	620	34 (28 to 44)	
2016 April Gates	1,326	33 (28 to 46)	
2016 November Turkana	202	33 (27 to 41)	
2016 November Wajir	216	39 (30 to 49)	
2017 April PROFIT	1,080	32 (25 to 44)	
2017 January	330	40 (30 to 50)	
2017 May	222	37 (29 to 46)	
2018 June Isiolo	912	34 (30 to 47)	
Total	6,366	34 (27 to 45)	

IQR = interquartile range.
[a]P-value from Kruskal–Wallis equality-of-populations rank test.

Among REAP participants overall, 76% were married, 6.5% were divorced/separated, 3.2% were single, and 15% were widowed. Marital status varied across the 10 cohorts (P<0.001), as shown in **Table 7**.

TABLE 7. SUMMARY DISTRIBUTION OF MARITAL STATUS STRATIFIED BY COHORT

Cohort	Marital Status				P-value[a]
	Married N (%)	Divorced/ Separated N (%)	Single N (%)	Widowed N (%)	
2013 May	1059 (86)	32 (2.6)	52 (4.2)	95 (7.7)	<0.001
2014 September	169 (77)	11 (5.0)	4 (1.8)	36 (16)	
2015 September	485 (78)	35 (5.7)	18 (2.9)	82 (13)	
2016 April Gates	963 (73)	92 (6.9)	13 (1.0)	258 (19)	
2016 November Turkana	181 (90)	9 (4.5)	0	12 (5.9)	
2016 November Wajir	176 (81)	23 (11)	0	17 (7.9)	

TABLE 7. SUMMARY DISTRIBUTION OF MARITAL STATUS STRATIFIED BY COHORT

Cohort	Marital Status				P-value[a]
	Married N (%)	Divorced/ Separated N (%)	Single N (%)	Widowed N (%)	
2017 April PROFIT	751 (70)	70 (6.5)	66 (6.1)	193 (18)	
2017 January	233 (71)	26 (7.9)	3 (0.9)	68 (21)	
2017 May	164 (74)	13 (5.9)	3 (1.4)	42 (19)	
2018 June Isiolo	633 (69)	101 (11)	42 (4.6)	136 (15)	
Total	4,814 (76)	412 (6.5)	201 (3.2)	939 (15)	

[a]P-value from chi-square test of association.

3.3.2 Association of Participants' Demographic Attributes with Theory of Change Constructs

Table 8 shows the association of participants' age and marital status with each of the constructs in the theory of change, using data from all cohorts. Age in years was positively associated with increased income, increased women's household decision-making, increased girls' school enrollment, increased women's involvement in community decision-making & activities, and decreased disease (all positive regression coefficients and $P<0.05$). There was evidence of a negative association of age with increased knowledge about key health behaviors, increased household food security, and improved dietary intake (all negative regression coefficients and $P<0.05$). Marital status was associated with diversification of income sources, increased knowledge about key health behaviors, increased income, increased women's household decision-making, increased girls' school enrollment, and improved dietary intake (all $P<0.05$). Negative coefficients indicate a negative association with respect to the reference category. For example, REAP participants who are not married (divorced, single, or widowed) are less likely to have diversified income sources compared to participants who are married. Conversely, REAP participants who are not married are more likely than those who are married to have increased household decision-making power.

TABLE 8. ASSOCIATION OF REAP PARTICIPANTS' DEMOGRAPHIC ATTRIBUTES WITH THEORY OF CHANGE CONSTRUCTS

Construct	Regression Coefficient (95% CI)	P-value
Diversification of income sources		
Age in years (/log age)	0.01 (–0.001 to 0.02)	0.05

TABLE 8. ASSOCIATION OF REAP PARTICIPANTS' DEMOGRAPHIC ATTRIBUTES WITH THEORY OF CHANGE CONSTRUCTS

Construct	Regression Coefficient (95% CI)	P-value
Marital status		
Married	Reference	
Divorced/separated	–0.02 (–0.03 to –0.004)	0.01
Single	–0.03 (–0.05 to –0.006)	0.01
Widowed	–0.02 (–0.03 to –0.01)	<0.001
Psychosocial benefits - confidence		
Age in years (/log age)	–0.04 (–0.08 to 0.006)	0.09
Marital status		
Married	Reference	
Divorced/separated	0.007 (–0.05 to 0.06)	0.81
Single	–0.007 (–0.06 to 0.05)	0.80
Widowed	–0.03 (–0.06 to 0.01)	0.16
Access to local savings and credit		
Age in years (/log age)	–0.003 (–0.01 to 0.004)	0.40
Marital status		
Married	Reference	
Divorced/separated	0.002 (–0.006 to 0.01)	0.62
Single	–0.0002 (–0.01 to 0.01)	0.97
Widowed	–0.001 (–0.008 to 0.005)	0.72
Increased knowledge about key health behaviors		
Age in years (/log age)	–0.08 (–0.09 to –0.06)	<0.001
Marital status		
Married	Reference	
Divorced/separated	0.01 (–0.005 to 0.03)	0.17
Single	0.05 (0.03 to 0.07)	<0.001
Widowed	–0.02 (–0.03 to –0.005)	0.008

TABLE 8. ASSOCIATION OF REAP PARTICIPANTS' DEMOGRAPHIC ATTRIBUTES WITH THEORY OF CHANGE CONSTRUCTS

Construct	Regression Coefficient (95% CI)	P-value
Increased income		
Age in years (/log age)	0.007 (0.001 to 0.01)	0.01
Marital status		
Married	Reference	
Divorced/separated	–0.01 (–0.02 to –0.006)	<0.001
Single	–0.01 (–0.02 to –0.002)	0.02
Widowed	–0.01 (–0.02 to –0.007)	<0.001
Increased women's household decision-making		
Age in years (/log age)	0.06 (0.04 to 0.09)	<0.001
Marital status		
Married	Reference	
Divorced/separated	0.46 (0.41 to 0.52)	<0.001
Single	0.37 (0.24 to 0.50)	<0.001
Widowed	0.48 (0.45 to 0.52)	<0.001
Increased girls' school enrollment		
Age in years (/log age)	0.06 (0.04 to 0.07)	<0.001
Marital status		
Married	Reference	
Divorced/separated	–0.002 (–0.02 to 0.01)	0.79
Single	–0.07 (–0.10 to –0.05)	<0.001
Widowed	–0.05 (–0.06 to –0.03)	<0.001
Improved access to health services & healthier environment		
Age in years (/log age)	–0.04 (–0.07 to 0.002)	0.06
Marital status		
Married	Reference	
Divorced/separated	0.005 (–0.04 to 0.05)	0.82

TABLE 8. ASSOCIATION OF REAP PARTICIPANTS' DEMOGRAPHIC ATTRIBUTES WITH THEORY OF CHANGE CONSTRUCTS

Construct	Regression Coefficient (95% CI)	P-value
Single	0.014 (–0.04 to 0.07)	0.63
Widowed	0.006 (–0.03 to 0.04)	0.71
Increased women's involvement in community decision-making & activities		
Age in years (/log age)	0.03 (0.01 to 0.05)	0.002
Marital status		
Married	Reference	
Divorced/separated	–0.005 (–0.03 to 0.02)	0.63
Single	0.0001 (–0.03 to 0.03)	0.99
Widowed	–0.01 (–0.03 to 0.006)	0.21
Increased household food security		
Age in years (/log age)	–0.02 (–0.04 to –0.01)	<0.001
Marital status		
Married	Reference	
Divorced/separated	–0.01 (–0.03 to 0.002)	0.11
Single	–0.02 (–0.05 to –0.002)	0.05
Widowed	–0.003 (–0.01 to 0.008)	0.61
Improved dietary intake		
Age in years (/log age)	–0.03 (–0.06 to –0.001)	0.04
Marital status		
Married	Reference	
Divorced/separated	0.03 (–0.002 to 0.06)	0.07
Single	0.05 (0.001 to 0.09)	0.04
Widowed	0.04 (0.01 to 0.07)	0.005
Decreased disease		
Age in years (/log age)	0.09 (0.05 to 0.13)	<0.001
Marital status		

TABLE 8. ASSOCIATION OF REAP PARTICIPANTS' DEMOGRAPHIC ATTRIBUTES WITH THEORY OF CHANGE CONSTRUCTS

Construct	Regression Coefficient (95% CI)	P-value
Married	Reference	
Divorced/separated	0.007 (–0.04 to 0.05)	0.77
Single	0.04 (–0.08 to 0.16)	0.51
Widowed	–0.02 (–0.05 to 0.02)	0.28

3.4 RESEARCH QUESTION 3 RESULTS

Research question 3 focused on the relationship between season and theory of change constructs. There were marginal changes between baseline and endline during the dry and rainy seasons for all theory of change constructs, as shown by the very small mean values in **Table 9**. There was no statistically significant difference in mean values for any of the constructs during the dry compared with the rainy season (all P>0.05).

TABLE 9. EFFECT OF SEASON ON THEORY OF CHANGE CONSTRUCTS

Construct	Season Mean (SD)			
	N	Dry	Rainy	P-value
Diversification of income sources	3,184	0.001 (0.22)	–0.005 (0.21)	0.45
Access to local savings and credit	2,398	–0.003 (0.14)	–0.008 (0.18)	0.50
Increased knowledge about key health behaviors	1,230	0.014 (0.16)	0.002 (0.23)	0.27
Increased income	3,183	–0.004 (0.08)	0.004 (0.09)	0.17
Increased women's household decision-making power	1,151	0.018 (0.26)	–0.003 (0.20)	0.13
Increased girls' school enrollment	3,184	0.004 (0.16)	0.005 (0.14)	0.43
Improved access to health services & healthier environment	1,123	–0.003 (0.35)	0.035 (0.64)	0.22
Increased women's involvement in community decision-making & activities	1,477	0.005 (0.15)	–0.006 (0.23)	0.29
Increased household food security	1,991	–0.002 (0.25)	–0.009 (0.21)	0.56
Improved dietary intake	456	–0.002 (0.21)	–	
Decreased disease	383	–	0.024 (0.27)	

SD = standard deviation.

4. DISCUSSION

The comparison of mean baseline and endline values for the theory of change constructs suggests that the REAP program is improving many of these indicators. This aligns with results from individual REAP cohorts [4, 5] and extends those results by showing the changes over many cohorts. There is no comparison group in this analysis, so the findings do not prove that REAP has an impact compared to a control group, but they are suggestive of an effect. The size of the effect varies by theory of change construct, with the largest coefficient measured for psychosocial benefits (confidence) and women's household decision-making power.

The structural equation models show that increased women's household decision-making is associated with improved diet, decreased disease, and improved household food security, and that increased income does not have a direct association with nutrition outcomes, but works indirectly through women's decision-making. The relationship between women's decision-making aligns with research in low- and middle-income countries showing that women's decision-making power and empowerment are associated with child and household nutrition outcomes [6, 7] and that programs can successfully change gender norms and increase women's empowerment [8]. Several of the same theory of change constructs were used as explanatory variables across the structural equation models and, in some cases, the statistical significance and strength of the associations differs across the models. For example, increased income is significantly associated with household food security in the model with food security as the outcome, but not in the models with improved diet or decreased disease as the outcomes. However, in all models, we found an association between increased income and increased women's household decision-making. Similarly, access to savings and credit was strongly associated with household food security in the model with improved diet as the outcome, but was not associated in the model with household food security as the outcome. These differences can be explained by the different cohorts that were used in the three models. The models for improved diet and decreased disease each included one cohort, whereas the model for household food security included seven cohorts.

The analysis of the relationship between demographic variables and theory of change constructs was limited by the number of demographic characteristics of REAP participants that were collected in the same way across cohorts. The largest coefficients were for the relationship between marital status and women's decision-making, and indicate that women who are not married have more household decision-making power than those who are married. Greater decision-making power among nonmarried women may explain the positive relationship between improved diet in the households of nonmarried compared to married women. The very small coefficients for the other models show that demographics have little influence on most of the theory of change constructs, even though some of them have statistically significant associations with the constructs.

The lack of differences by season in baseline to endline changes in the theory of change constructs indicates that starting the cohorts during the rainy versus dry season does not seem to influence the constructs. Further, the small coefficients show the weak effect of season on the

constructs. For cohorts starting from 2016, the survey reports recorded whether it was rainy or dry during data collection, but for cohorts from 2013–2015 this information was not available, and those cohorts were divided by season based on general knowledge about the timing of rainy and dry seasons in the counties. Therefore, the season analysis should be considered in light of this limitation.

5. RECOMMENDATIONS

- The lack of direct effect of income on household food group consumption (e.g., dietary intake) suggests that although REAP participants' incomes are increasing, they are not using the income for increased food variety and/or their incomes are not increasing enough. This gap could be related to lack of knowledge, lack of availability, and/or high cost of diverse foods. Participants in the REAP formative study conducted by Nawiri confirmed that REAP businesses help improve food access but that food variety in many communities is still low. Because REAP has not been providing information/training on nutritious foods, Nawiri has an opportunity to integrate nutrition training into REAP to increase women's knowledge about nutritious foods. However, Nawiri's cost of diet study suggests that the cost of nutritious foods is a major barrier for the poor and extreme poor in the target counties. In addition, availability of nutritious foods across all seasons and markets is inconsistent. Therefore, nutrition training alone is unlikely to lead to improvements in dietary intake without significant increases in income among the poor and extremely poor, and supply-side interventions are needed that ensure adequate availability and decreased cost of promoted foods. Within REAP, pilots should concentrate on nutrition training to improve knowledge of dietary diversity and enhancing increased income by making REAP businesses more profitable, while encouraging REAP businesses to become last-mile sellers of nutritious foods. These REAP activities will need to be complemented by other Nawiri interventions that work to improve supply chains for nutritious foods that REAP businesses can sell.
- The importance of women's household decision-making in affecting diets, disease, and household food security through both direct and indirect pathways indicates that REAP should continue or enhance activities related to women's empowerment and household dynamics. The pilot design may consider a formal male engagement strategy that involves men and women in a process of challenging social norms, beliefs, and practices related to gender.
- The small coefficients in the analysis of demographics show that age and marital status generally do not need to be considered in targeting REAP participants. However, the results related to marital status show that unmarried women have more decision-making power than married women. This again indicates that engaging men will be key to improving women's household decision-making power and subsequently improving household nutrition.
- The lack of differences in theory of change constructs by season suggests that the timing of initiation of cohorts does not matter.

- In terms of variables for inclusion in REAP for Nutrition pilots, a separate document was drafted with suggestions for nutrition indicators, including household food insecurity access scale (HFIAS), household dietary diversity score and/or minimum dietary diversity for children for children 6–23 months, mid-upper arm circumference for children 6–59 months, and types of foods being sold by food-related REAP businesses. Based on the secondary analysis, we also recommend that indicators for access to health care, knowledge of health behaviors, and morbidity should be included in the surveys. In addition, the team should consider whether to focus the cohort data collection for REAP for Nutrition on household- or child-level dietary diversity and morbidity.

REFERENCES

i. A longitudinal assessment of REAP: A follow-up on program participants 3-5 years after graduation,(June 2018) (https://bomaproject.org/wp-content/uploads/2018/10/Longevity-Study-Exec-Summary.pdf)

ii. De Montesquiou, A., Sheldon, T. (2018). *From extreme poverty to sustainable livelihoods: A technical guide to the graduation approach, Second edition*. Partnership for Economic Inclusion. https://www.findevgateway.org/sites/default/files/publications/files/pei_graduation_technichal_guide_2018_edition_0.pdf

iii. Galie A et.al (2019) Women's empowerment, food security and nutriton of pastoral communities in Tanzania. *(*Global Food Security, 23:125-134).

iv. Gobin VJ, Santos P, Toth R: No longer trapped? Promoting entrepreneurship through cash transfers to ultra-poor women in northern Keny**a**. Amer J Agr Econ 2017, **99**:1362-1383.

v. Gobin VJ, Santos P (2015.): All together now: the impact of a multifaceted approach to poverty alleviation.

vi. Ickes SB et.al (2017 Aug): Associations between social support, psychological well-being, decision making, empowerment, infant and young child feeding, and nutritional status in Ugandan chidlren ages 0 to 24 months. Matern Chi Nutr 2018, **14**:doi: 10.1111/mcn.12483. Epub 1 12487.

vii. Raza W, Van de Pool E, Ourti V(2018): Impact and spill-over effects of an asset transfer program on child undernutrition: Evidence from a randomized control trial in Bangladesh. (J Health Econ, 62:105-120).

viii. Sanders C, Kimani F(2019): PROFIT financial graduation endline report. In. Nairobi, Kenya: The BOMA Project and CARE International.

ix. Van den Bold M et.al (2015): Can integrated agriculture-nutrition programmes change gender norms on land and asset ownership? Evidence from Burkina Faso (J Dev Stud, **51**:115-1174).

ANNEX 1: VARIABLES USED IN THE ANALYSIS

This annex outlines variables to be used in analysis and the amount of data available. Where data were not available for specific participants within cohorts, they were not included in the analysis because they do not have responses for all variables included in an indicator or construct.

TABLE 1-1. L1. DIVERSIFICATION OF INCOME SOURCES

	Cohort										
Measure	**2013 May**	**2014 Sept**	**2015 Sept**	**2016 Apr Gates**	**2016 Nov Turkana**	**2016 Nov WJR**	**2017 Apr PROFIT**	**2017 Jan**	**2017 May**	**2018 June Isiolo**	**Total**
l1_hh_no_income_sources	1,238	220	620	1,326	202	216	1,080	330	222	912	6,366

TABLE 1-2. L1. PSYCHOSOCIAL BENEFITS - CONFIDENCE

	Cohort										
Measure	**2013 May**	**2014 Sept**	**2015 Sept**	**2016 Apr Gates**	**2016 Nov Turkana**	**2016 Nov WJR**	**2017 Apr PROFIT**	**2017 Jan**	**2017 May**	**2018 June Isiolo**	**Total**
l1_conf_childschool	0	0	0	0	0	0	1,073	0	0	0	1,073
l1_conf_committee	0	0	0	0	0	0	1,076	0	0	0	1,076
l1_conf_emergencies	0	0	0	0	0	0	1,076	0	0	0	1,076
l1_conf_foodaid	0	0	0	0	0	0	1,076	0	0	0	1,076
l1_conf_loan	0	0	0	0	0	0	1,076	0	0	0	1,076
l1_conf_savingsgroup	0	0	0	0	0	0	1,065	0	0	0	1,065
l1_conf_sick_affordtreat	0	0	0	0	0	0	1,073	0	0	0	1,073

TABLE 1-3. L1. WOMEN ACQUIRE ENTREPRENEURSHIP SKILLS

No variables suggested for this indicator. Assume BOMA intervention provided entrepreneurship skills.

TABLE 1-4. L1. ACCESS TO LOCAL SAVINGS AND CREDIT

Measure	Cohort										
	2013 May	2014 Sept	2015 Sept	2016 Apr Gates	2016 Nov Turkana	2016 Nov WJR	2017 Apr PROFIT	2017 Jan	2017 May	2018 June Isiolo	Total
l1_save_no_sources	614	0	620	1,321	202	216	1,079	330	174	912	5,468
l1_save_total_calc	1,238	220	620	1,326	202	216	1,080	330	222	912	6,366
l1_credit_amt_total_fromboma	2	0	310	663	101	108	540	163	111	456	2,454
l1_credit_amt_taken_fromboma	2	0	310	663	101	108	540	163	111	456	2,454

TABLE L-5. L1. INCREASED KNOWLEDGE ABOUT KEY HEALTH BEHAVIORS

Measure	Cohort										
	2013 May	2014 Sept	2015 Sept	2016 Apr Gates	2016 Nov Turkana	2016 Nov WJR	2017 Apr PROFIT	2017 Jan	2017 May	2018 June Isiolo	Total
l1_fp_methods_duse	1,238	220	620	1,326	202	216	1,080	330	222	912	6,366
l1_fp_n_methods	0	0	310	383	202	216	1,034	289	222	912	3,568
l1_fp_methods_1	0	0	310	383	202	216	1,034	289	222	912	3,568
l1_fp_methods_2	0	0	310	383	202	216	1,034	289	222	912	3,568
l1_fp_methods_3	0	0	310	383	202	216	1,034	289	222	912	3,568
l1_fp_methods_4	0	0	310	383	202	216	1,034	289	222	912	3,568
l1_fp_methods_5	0	0	310	383	202	216	1,034	289	222	912	3,568
l1_fp_methods_6	0	0	310	383	202	216	1,034	289	222	912	3,568
l1_fp_methods_7	0	0	310	383	202	216	1,034	289	222	912	3,568
l1_fp_methods_8	0	0	310	383	202	216	1,034	289	222	912	3,568
l1_fp_methods_9	0	0	310	383	202	216	1,034	289	222	912	3,568
l1_fp_methods_10	0	0	310	383	202	216	1,034	289	222	912	3,568
l1_fp_methods_11	0	0	310	383	202	216	1,034	289	222	912	3,568
l1_fp_methodinuse	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_n_methodsuse	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_methods_in_use_1	0	0	620	1,326	202	216	1,080	330	222	912	4,908

TABLE L-5. L1. INCREASED KNOWLEDGE ABOUT KEY HEALTH BEHAVIORS

	Cohort										
Measure	**2013 May**	**2014 Sept**	**2015 Sept**	**2016 Apr Gates**	**2016 Nov Turkana**	**2016 Nov WJR**	**2017 Apr PROFIT**	**2017 Jan**	**2017 May**	**2018 June Isiolo**	**Total**
l1_fp_methods_in_use_2	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_methods_in_use_3	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_methods_in_use_4	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_methods_in_use_5	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_methods_in_use_6	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_methods_in_use_7	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_methods_in_use_8	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_methods_in_use_9	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_methods_in_use_10	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_methods_in_use_11	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_methods_in_use_12	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_fp_methods_in_use_13	0	0	620	1,326	202	216	1,080	330	222	912	4,908
l1_n_fp_sources_of_info	0	0	310	383	202	216	971	330	222	817	3,451
l1_fp_sources_of_info_1	0	0	310	383	202	216	971	330	222	817	3,451
l1_fp_sources_of_info_2	0	0	310	383	202	216	971	330	222	817	3,451
l1_fp_sources_of_info_3	0	0	310	383	202	216	971	330	222	817	3,451
l1_fp_sources_of_info_4	0	0	310	383	202	216	971	330	222	817	3,451
l1_fp_sources_of_info_5	0	0	310	383	202	216	971	330	222	817	3,451
l1_fp_sources_of_info_6	0	0	310	383	202	216	971	330	222	817	3,451
l1_fp_sources_of_info_7	0	0	310	383	202	216	971	330	222	817	3,451
l1_fp_sources_of_info_8	0	0	310	383	202	216	971	330	222	817	3,451
l1_fp_sources_of_info_9	0	0	310	383	202	216	971	330	222	817	3,451

TABLE 1-6. L2. INCREASED INCOME

Measure	Cohort										
	2013 May	2014 Sept	2015 Sept	2016 Apr Gates	2016 Nov Turkana	2016 Nov WJR	2017 Apr PROFIT	2017 Jan	2017 May	2018 June Isiolo	Total
l2_total_income_calc	1,238	220	620	1,326	202	216	1,080	330	222	912	6,366

TABLE 1-7. L3. INCREASED WOMEN'S HOUSEHOLD DECISION-MAKING

Measure	Cohort										
	2013 May	2014 Sept	2015 Sept	2016 Apr Gates	2016 Nov Turkana	2016 Nov WJR	2017 Apr PROFIT	2017 Jan	2017 May	2018 June Isiolo	Total
l3_hd_buy_livestock_hh	0	0	620	796	187	177	729	221	158	633	3,521
l3_hd_buy_own_livestock	0	0	620	949	187	191	730	185	157	633	3,652
l3_hd_buying_food	0	0	620	1,134	187	192	736	233	163	633	3,898
l3_hd_children_med	0	0	616	1,102	187	189	712	219	161	581	3,767
l3_hd_children_school_who	0	0	616	1,077	187	188	708	216	152	581	3,725
l3_hd_householditems	0	0	620	1,127	187	195	736	233	163	633	3,894
l3_hd_paying_school_fees	0	0	616	1,029	187	182	699	205	135	581	3,634
l3_hd_sell_own_livestock	0	0	620	771	187	193	726	191	159	633	3,480

TABLE 1-8. L4. INCREASE IN GIRLS' SCHOOL ENROLLMENT

Measure	Cohort										
	2013 May	2014 Sept	2015 Sept	2016 Apr Gates	2016 Nov Turkana	2016 Nov WJR	2017 Apr PROFIT	2017 Jan	2017 May	2018 June Isiolo	Total
l4_fem_child_pri_age	1,238	220	620	1,326	202	216	1,080	330	222	912	6,366
l4_fem_child_in_pri	1,238	220	620	1,326	202	216	1,080	330	222	912	6,366

TABLE 1-9. L4. IMPROVED ACCESS TO HEALTH SERVICES & HEALTHIER ENVIRONMENT

	Cohort										
Measure	**2013 May**	**2014 Sept**	**2015 Sept**	**2016 Apr Gates**	**2016 Nov Turkana**	**2016 Nov WJR**	**2017 Apr PROFIT**	**2017 Jan**	**2017 May**	**2018 June Isiolo**	**Total**
l4_basic_hhealth_insurance	1,238	220	620	1,326	202	216	1,080	330	222	912	6,366
l4_health_vaccinated	0	0	0	1,045	0	0	0	0	0	0	1,045
l4_rcvdtrt_ill	0	0	0	1,045	0	0	0	0	0	0	1,045
l4_exp_dmedicated_year	0	0	619	0	0	0	1,079	330	222	0	2,250

TABLE 1-10. L4. INCREASED WOMEN'S INVOLVEMENT IN COMMUNITY DECISION-MAKING & ACTIVITIES

	Cohort										
Measure	**2013 May**	**2014 Sept**	**2015 Sept**	**2016 Apr Gates**	**2016 Nov Turkana**	**2016 Nov WJR**	**2017 Apr PROFIT**	**2017 Jan**	**2017 May**	**2018 June Isiolo**	**Total**
l4_numcommittees	1,238	220	620	1,326	202	216	1,080	330	222	912	6,366
l4_basic_dleadership	0	109	310	383	202	216	1,076	330	222	912	3,760

TABLE 1-11. L5. INCREASED HOUSEHOLD FOOD SECURITY

	Cohort										
Measure	**2013 May**	**2014 Sept**	**2015 Sept**	**2016 Apr Gates**	**2016 Nov Turkana**	**2016 Nov WJR**	**2017 Apr PROFIT**	**2017 Jan**	**2017 May**	**2018 June Isiolo**	**Total**
l5_food_nmeals_week	1,229	217	620	1,321	202	216	1,076	330	222	912	6,345
l5_food_child_nmeals_week	0	0	614	1,321	202	216	1,039	305	215	823	4,735
l5_food_dchild_hungry_week	0	219	306	1,321	202	216	1,039	305	215	823	4,646

TABLE 1-12. L7. IMPROVED DIETARY INTAKE

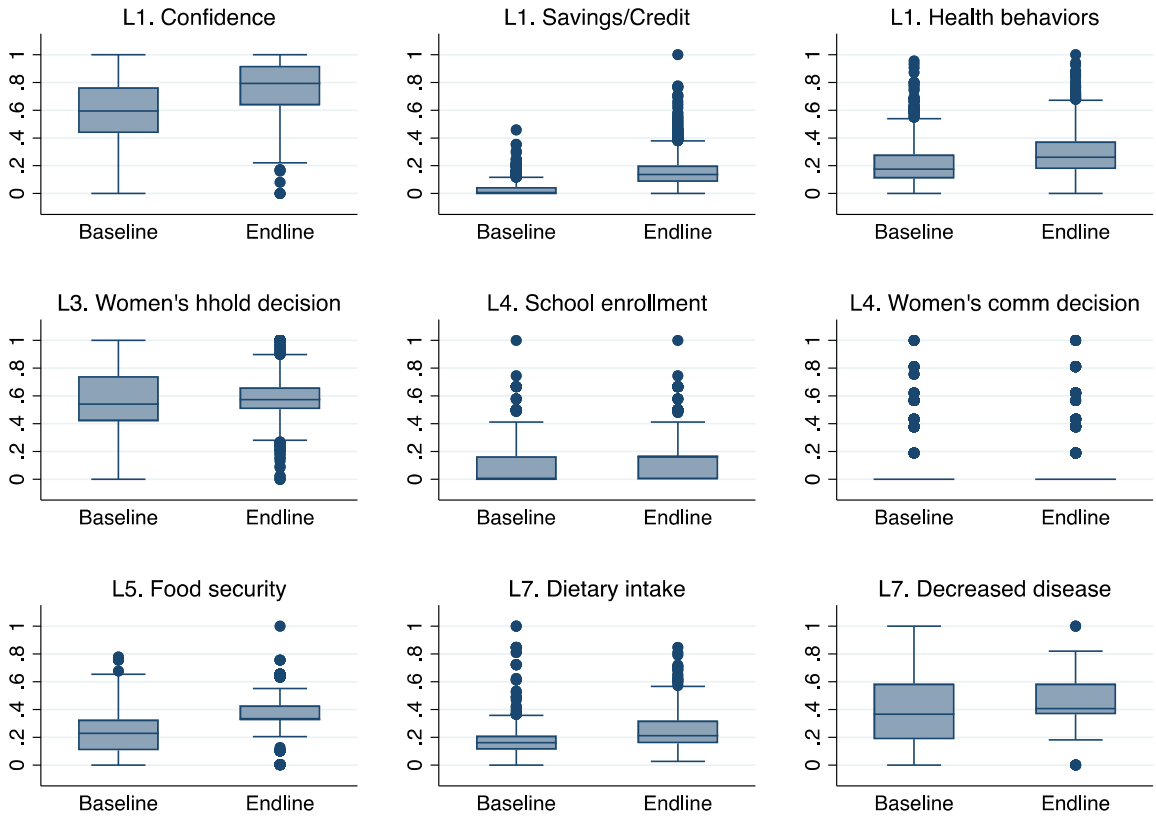
Measure	Cohort										
	2013 May	2014 Sept	2015 Sept	2016 Apr Gates	2016 Nov Turkana	2016 Nov WJR	2017 Apr PROFIT	2017 Jan	2017 May	2018 June Isiolo	Total
l7_nutrition_dcereal	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_ddarkgreen_lvegs	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_dfish	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_dfleshmeat	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_dfruits_other	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_dfruits_vita	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_dleg_nuts	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_dmilk_products	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_doil_fats	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_dorganmeat	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_dpoultryegg	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_dveg_other	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_dveg_tubers	0	0	0	0	0	0	0	0	0	912	912
l7_nutrition_dwhitetubers_roots	0	0	0	0	0	0	0	0	0	912	912

TABLE 1-13. L7. DECREASED DISEASE

Measure	Cohort										
	2013 May	2014 Sept	2015 Sept	2016 Apr Gates	2016 Nov Turkana	2016 Nov WJR	2017 Apr PROFIT	2017 Jan	2017 May	2018 June Isiolo	Total
l7_health_coughing	0	0	0	1,045	0	0	0	0	0	0	1,045
l7_health_eye	0	0	0	1,045	0	0	0	0	0	0	1,045
l7_health_getinjury	0	0	0	1,045	0	0	0	0	0	0	1,045
l7_health_getmalaria	0	0	0	1,045	0	0	0	0	0	0	1,045
l7_health_getstomachilness	0	0	0	1,045	0	0	0	0	0	0	1,045

ANNEX 2: DISTRIBUTION OF THEORY OF CHANGE CONSTRUCTS AT BASELINE AND ENDLINE USING NORMALIZED PCA SCORES

FIGURE 2-1. DISTRIBUTION OF THEORY OF CHANGE CONSTRUCTS

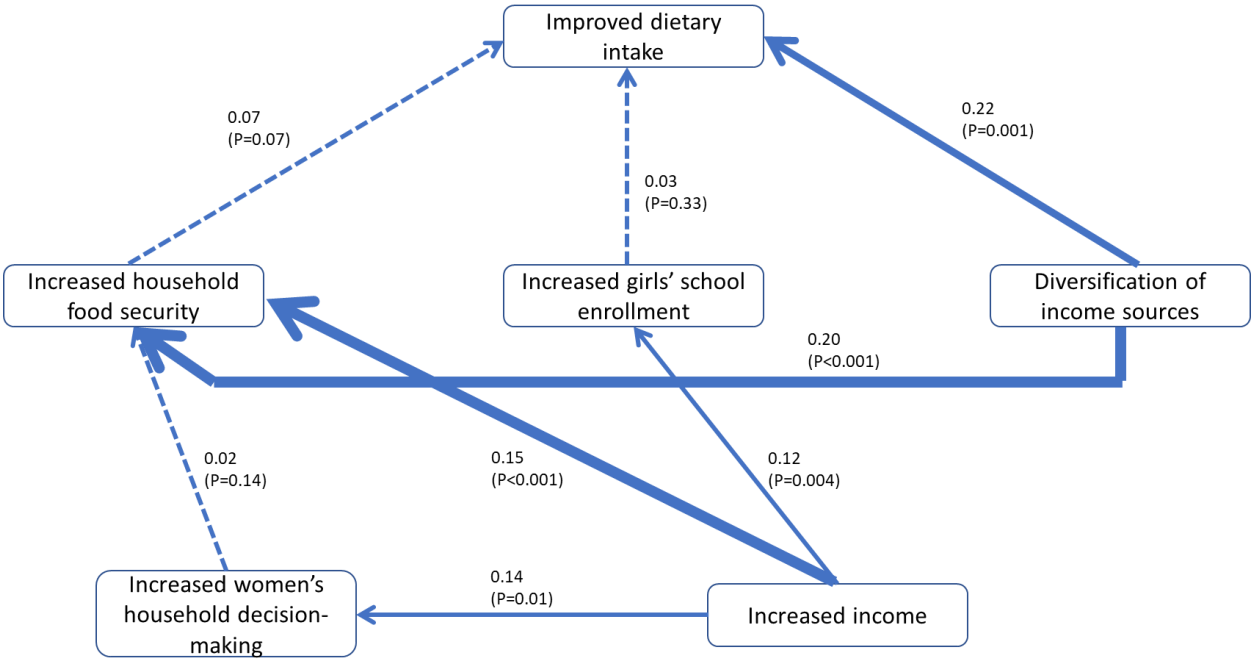


ANNEX 3: INITIAL SEM RESULTS USING PATHWAYS IN THE ORIGINAL THEORY OF CHANGE

Model 1

Model 1 had *improved dietary intake* as the outcome and used data from one cohort only (2018 June Isiolo cohort). Diversification of income sources had a positive direct effect on improved dietary intake [regression coefficient of 0.22 (95%CI 0.09 to 0.35), P=0.001]. Household food security [regression coefficient of 0.07 (95%CI –0.005 to 0.15), P=0.07] and increase in girls' school enrolment [regression coefficient of 0.03 (–0.03 to 0.10), P=0.33] had no direct effect on improved dietary intake. Diversification of income sources also had a positive direct effect on household food security [regression coefficient of 0.20 (95%CI 0.16 to 0.23), P<0.001], although household food security was not directly associated with improved dietary intake. Increased women's household decision-making had no significant direct effect on household food security. Increased income had a direct positive effect on increased women's decision-making, household food security, and increased girls' school enrolment.

FIGURE 3-1. STRUCTURAL EQUATION MODEL OF RELATIONSHIPS BETWEEN CONSTRUCTS AND IMPROVED DIETARY INTAKE USING ORIGINAL THEORY OF CHANGE PATHWAYS

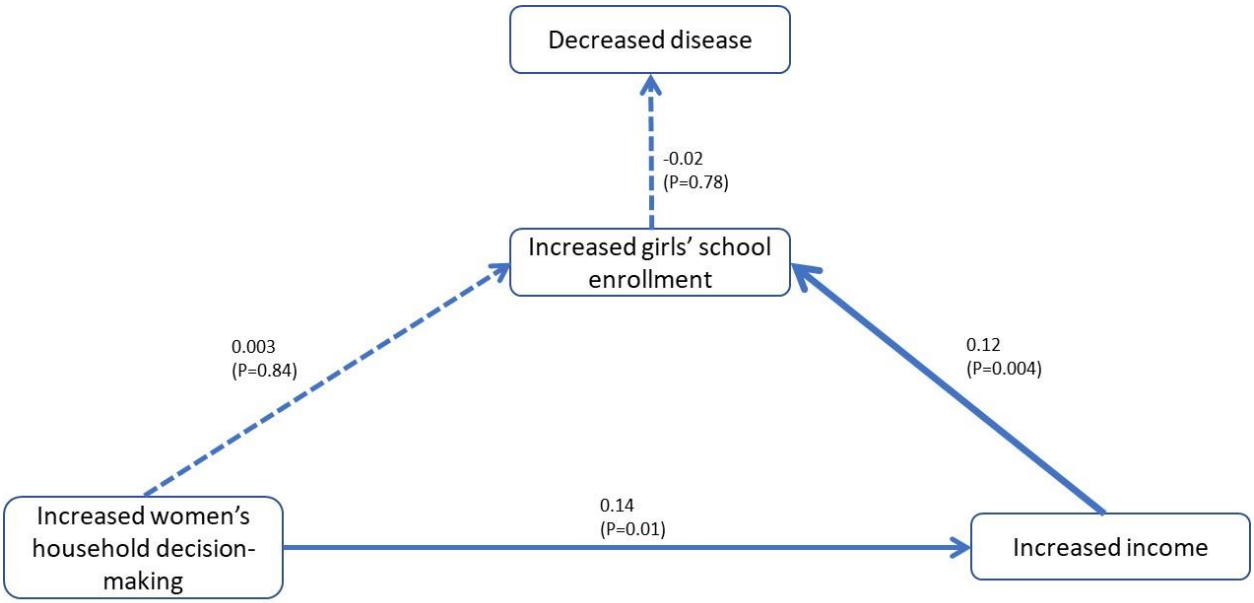


Statistically significant associations are indicated by the solid arrows and statistically nonsignificant associations by the dashed arrows. For the significant associations, the arrow thickness corresponds to the effect size. Each outcome was adjusted for age and marital status and was modeled with a random intercept at the visit level (baseline/endline).

Model 2

Model 2 had *decreased disease* as the outcome and used data from one cohort only (2016 April Gates cohort). Increase in girls' school enrollment had no significant direct effect on decreased disease [regression coefficient of –0.02 (95%CI –0.14 to 0.10), P=0.78]. Increased women's household decision-making had no significant direct effect on increase in girls' school enrollment [regression coefficient of 0.003 (95%CI –0.02 to 0.03), P=0.84]. However, increased income had a positive direct effect on increased women's household decision-making [regression coefficient of 0.14 (95%CI 0.03 to 0.24), P=0.01]. Increased income also had a positive direct effect on increase in girls' school enrollment [regression coefficient of 0.12 (95%CI 0.04 to 0.20), P=0.004].

FIGURE 3-2. STRUCTURAL EQUATION MODEL OF RELATIONSHIPS BETWEEN CONSTRUCTS AND DECREASED DISEASE USING ORIGINAL PATHWAYS



Statistically significant associations are indicated by the solid arrows and statistically nonsignificant associations by the dashed arrows. For the significant associations, the arrow thickness corresponds to the effect size. Each outcome was adjusted for age and marital status and was modeled with a random intercept at the visit level (baseline/endline).

CONTACT

DARIUS RADCLIFFE

Chief of Party (CoP), USAID Nawiri
MERCY CORPS
tel +254 701 442 396 | skype mdariusradcliffe
The Almont Park
Church Rd. | Westlands – Nairobi, Kenya

This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents of this report are the responsibility of Mercy Corps and do not necessarily reflect the views of USAID or the United States Government.

Nawiri is a consortium of: