Pre-Analysis Plan
Feed the Future Nigeria Project Impact Evaluation

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Abstract

This document outlines the analysis plan for the Feed the Future Nigeria Livelihoods Project (FNLP) impact evaluation in northwest Nigeria. The Feed the Future approach is founded on an agriculture-led growth strategy that is expected to help vulnerable families diversify their income and grow assets while the community is strengthened by improving nutrition, water sanitation, and hygiene. The impact evaluation, consists of three randomized experiments: (E1) overall village-level impacts of the FNLP bundle of nutrition and agriculture interventions; (E2) household-level impacts of a livelihood mentoring program; and (E3) household-level impacts of unconditional cash transfers delivered to women in ultra-poor households. In collaboration with Catholic Relief Services (CRS) we experimentally varied the size, frequency and timing of unconditional cash transfers. Women were randomly assigned to receive the same total cash amount in 15 monthly installments or 5 quarterly installments. This document includes the outcome variables and econometric methods we will use to assess how the bundled-package of FNLP interventions, household-level livelihood mentoring intervention and monthly and quarterly cash transfers separately and synergistically affect household wellbeing. The effects of the cash transfers will be examined in three follow-up time periods (during cash transfer payment, immediately after all transfers were paid and the longer run effect of cash transfers, approximately one year after the cash transfers were completed).

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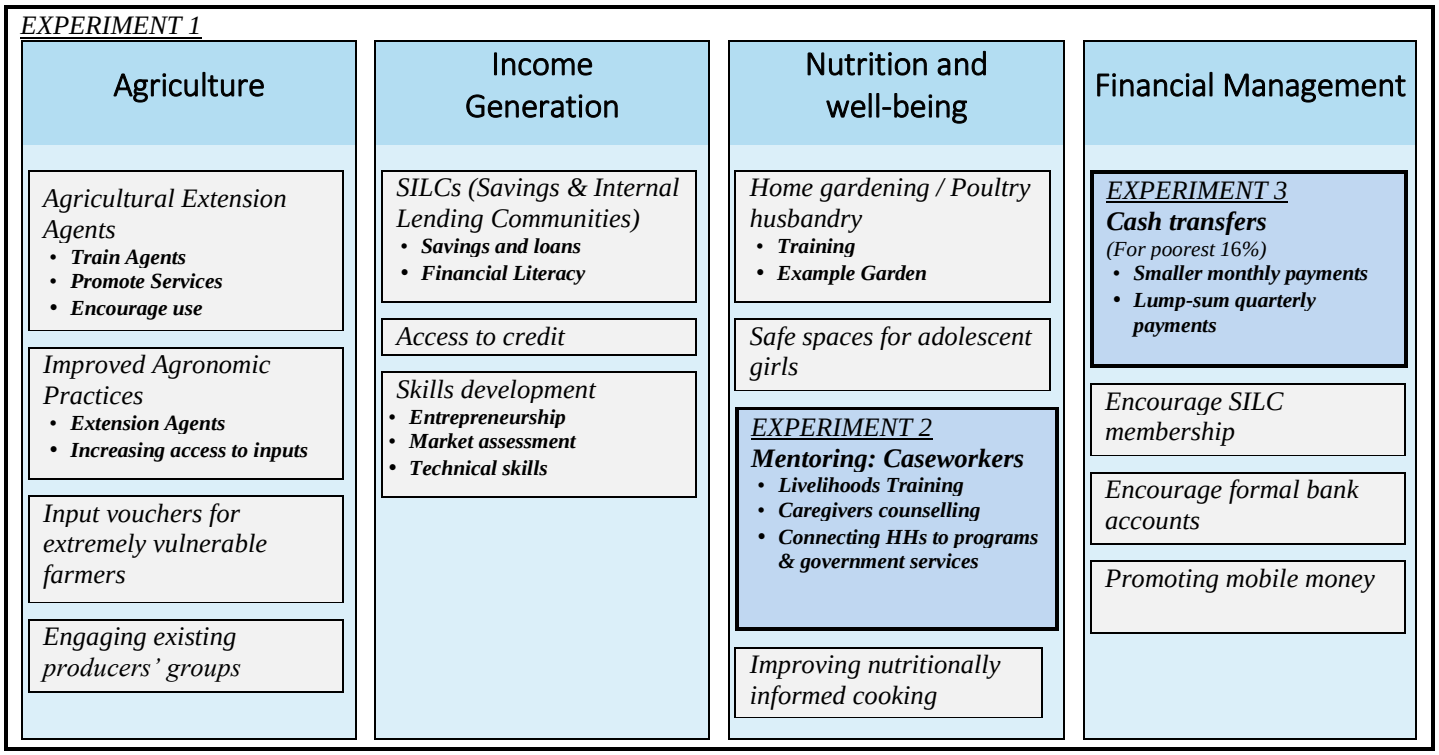
1 Introduction

This analysis plan is for the impact evaluation of the Feed the Future Nigeria Livelihoods Project (FNLP) conducted by the World Bank's Africa Gender Innovation Lab (GIL).

FNLP was a multi-component development project based on the ultra-poor graduation model designed and implemented by Catholic Relief Services (CRS). Between 2013 and 2018 the project targeted 42,000 poor rural households in Sokoto and Kebbi states, and the Federal Capital Territory (FCT). Both the intervention and the impact evaluation are funded by United States Agency for International Development (USAID).

FNLP's theory of change focused on helping vulnerable households diversify their income and grow assets while strengthening village-level nutrition, water sanitation, and hygiene. Figure 1 outlines the major components of this project.

Figure 1: Major components and subcomponents of the project



This impact evaluation, consists of **three experiments**: (E1) **Overall village-level impacts of the FNLP bundle** of nutrition, livelihood and agriculture interventions, (E2) Household-level impacts of a **livelihood mentoring program**, and (E3) Household-level impacts of **unconditional cash transfers** for the extremely vulnerable households in FNLP treatment and control villages.

The impact evaluation was conducted only in Kebbi state, in Northwest Nigeria, one of the poorest regions of the country. The impact evaluation sample was drawn from an overall program target population of 12,000 households in 104 villages in Birnin Kebbi and Danko Wasagu local government areas (LGAs).

A more detailed discussion of all the program components can be found in the impact evaluation baseline report (Papineni et al. 2016). Statistical power calculations are briefly discussed in Appendix 1.

2 Data Sources

The main source of data are individual surveys of the primary decision-making woman and man in beneficiary households. This is supplemented with administrative data from the program implementer's monitoring and evaluation activities which will be used as a robustness check for program participation.

Table 1. Timeline of Data Collection

			Years→	**2015**				**2016**				**2017**				**2018**			
			Quarters→	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*
Survey	**Sample**	***n***	**Timeline**																
Baseline	All	4,000	*Apr-Jun 2015*		■														
1st Follow-up	Cash Transfer Experiment Only	2,400	*Nov-Dec 2016*								■								
2nd Follow-up	All	4,000	*Apr-Jun 2017*										■						
3rd Follow-up	All	4,000	*May-Jul 2018*														■		

The baseline household questionnaire included a household listing, demographics, dwelling characteristics, household-level consumption, expenditures and assets, exposure to shocks, and participation in safety nets. Additionally, the primary decision-making woman and man were separately asked individual-level questions about food security, risk aversion, aspirations and time preferences were included. in the households.

The primary decision-making woman was also asked a version of the Women's Empowerment in Agriculture Index (A-WEAI) module (Alkire et al. 2012). All agricultural households were asked a module on crops, livestock, land holdings, agriculture production, sales and income, and participation in extension programs. The agriculture module was based on the relevant modules of the World Bank's Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) 2014 questionnaire.

The 1st follow-up survey was conducted during the cash transfer disbursement and were administered to both the decision-making woman and man in cash-transfer experiment households. The questionnaire covered questions about household consumption (including food), productive investments, savings, health, diet, food security, employment, housing and a measure of women's bargaining power. The 2nd follow-up used a similar questionnaire, but was conducted after the cash transfer disbursements and include the entire sample.

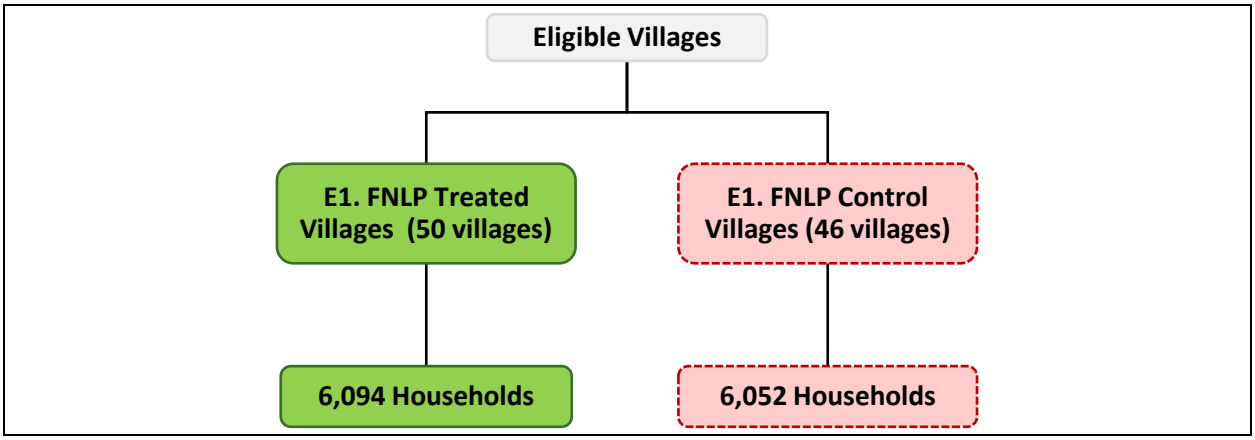
The 3rd follow-up survey will be conducted after all FNLP activities have ended, and will capture outcomes similar to the baseline and previous follow-ups. Additionally, questions on gender attitudes, intimate partner violence and anthropometric measurement of children aged 0-5 years and women respondents have also been included.

3 Study Design and Hypotheses

3.1 Experiment 1: Overall impacts of FNLP

This clustered RCT allows us to identify the overall effect of FNLP at the village-level. The implementers identified 96 eligible villages comprising 12,146 households.[2] Village randomization was stratified by ward and level of infrastructure development.[3] There are 50 treatment villages (with 6,094 households) and 46 control villages (with 6,052 households). The vulnerable households within the villages were identified through a community-based poverty assessment validated by a Progress Out of Poverty Index (PPI) household survey.

Figure 2: Experiment 1 Study Design



Hypotheses

The impact of the FNLP bundled package will be determined by comparing outcomes of households in treatment villages with households in control villages. (See Appendix 2 for full details of how the primary (P) and secondary (S) outcomes will be measured).

Hypothesis 1a: Households in FNLP villages are expected to present a higher level of assets (P1) and consumption (P2).

Hypothesis 1b: Households in FNLP villages are expected to have better nutrition outcomes and improved food security (P3) especially for children (P3.3, S5.2 and S5.3).

Hypothesis 1c: Women in FNLP villages are expected to experience more or less intimate partner violence (IPV) depending on the dominant mechanism through which IPV is influenced (P4). See section 5.4 for a further discussion on the IPV mechanisms.

Hypothesis 1d: Households in FNLP villages are expected to be more resilient in the face of shocks (S2).

[2] Initially 104 eligible villages were chosen however some were very close to each other. To reduce spillover risk, villages within a ½ mile (.802 km) radius of one another or within a ½ mile of each other by road, were grouped together. 14 villages were affected by these criteria and were assembled into 6 village groups. 90 villages were unaffected by these criteria, leaving 96 "villages".

[3] Development was measured using an infrastructure index created by counting the number of infrastructure items in each village.

Hypothesis 1e: Women in FNLP villages are expected to have a higher BMI, and children in FNLP villages are expected to have a lower incidence of stunting, wasting and malnutrition (S5).

Hypothesis 1f: Households in FNLP villages are expected to have achieve higher agricultural productivity across seven key crops targeted by the program (P6).

Hypothesis 1g: Women in FNLP villages are expected to have higher labor force participation (P6 and P7).

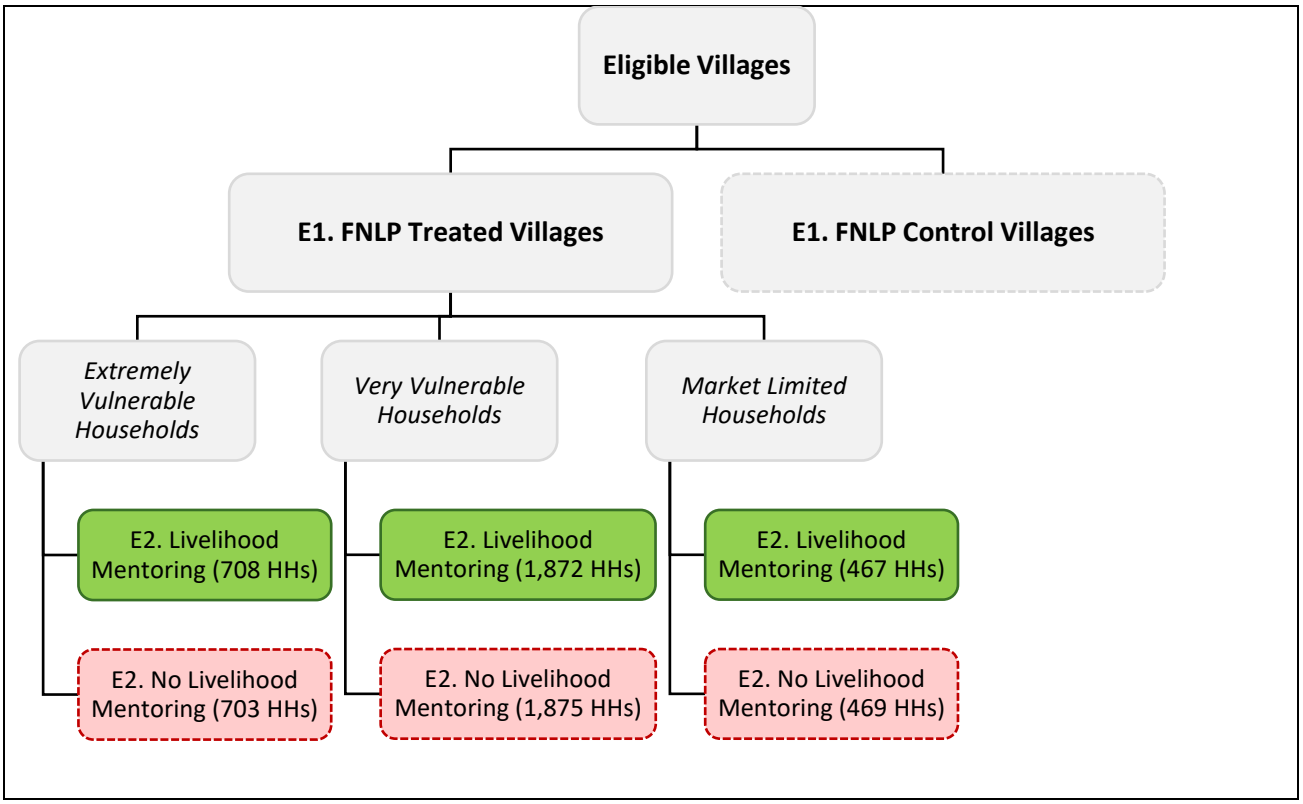
Hypothesis 1h: Men in FNLP villages are expected to record larger differences in outcomes related to agriculture than women (e.g. crop yields and expenditures on farming assets) (P6).

3.2 Experiment 2: Livelihood Mentoring

This experiment allows us to identify the incremental effect of livelihood mentoring on households in FNLP villages. Livelihood mentoring was an in-home intervention meant to help households make better choices with their limited resources to graduate out of poverty. Local women volunteers called liaisons delivered in-home mentoring and facilitated women's caregiver groups, focused hygiene and family planning.

All vulnerable households in FNLP treatment villages were eligible to participate in the livelihood mentoring. Of the 6,094 vulnerable households in the 50 FNLP treatment villages, half (3,047) were randomly selected to receive the livelihood mentoring stratified by vulnerability category. The other half were controls, but were eligible for other village-level FNLP services. Figure 3 shows the study design and sample size allocation for the different cells.

Figure 3: Experiment 2 Study Design



Hypotheses

The livelihood mentor is expected to match FNLP households to FNLP program services based on household need and therefore may accentuate the impact of the FNLP program services.

Hypothesis 2a: The livelihood mentor leads to higher take up of FNLP project services (self-reported).

Hypothesis 2b: Experiment 1 outcomes (nutrition and consumption) are higher among the households receiving a livelihood mentor.

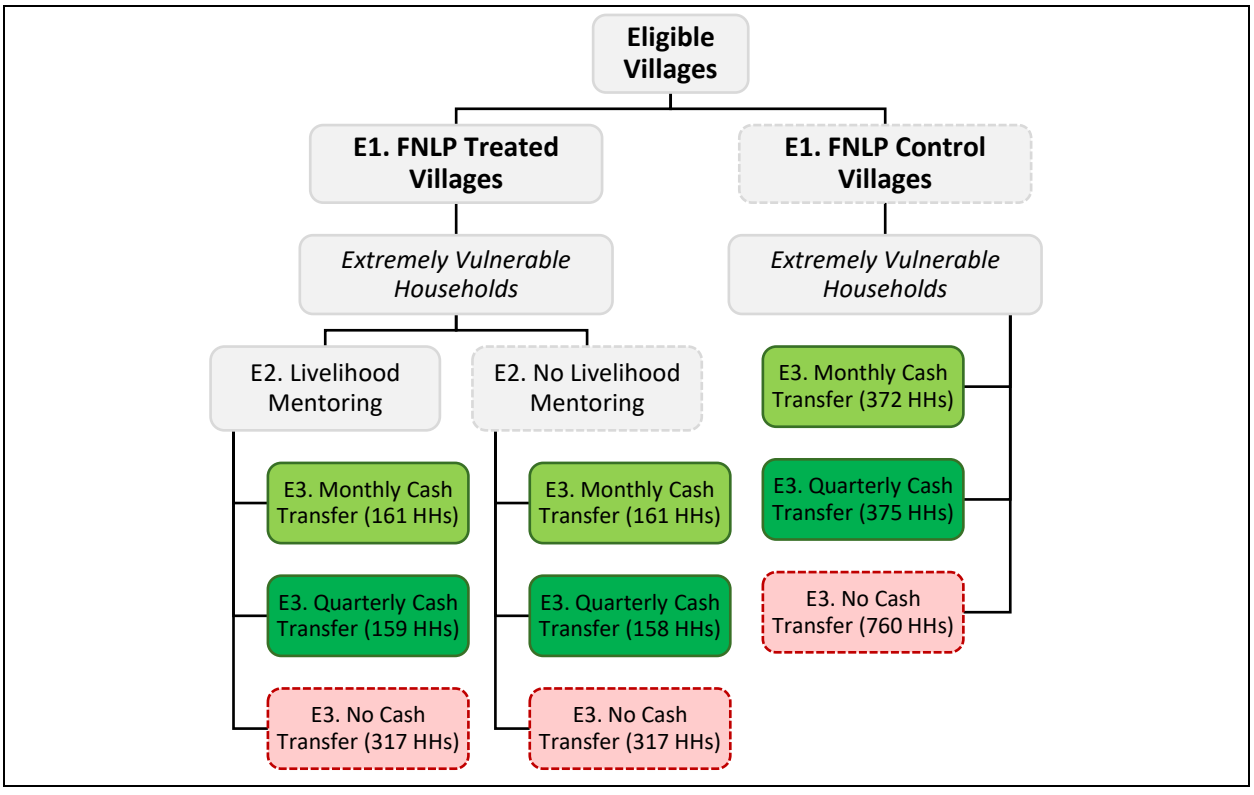
The characteristics of the livelihood mentor will be collected during the final follow-up survey to assess whether specific attributes of the mentor made a difference on the household level FNLP impacts. For example, perhaps the literacy level or age of the liaison made a difference in the take-up of program services of FNLP.

3.3 Experiment 3: Cash Transfers

Unconditional cash transfers were given to women in extremely vulnerable (EV) households in both the FNLP treatment and control villages. In public lottery ceremonies, about a quarter of the EV households were randomly assigned to receive 5,000 Naira cash 15 monthly installments, another quarter were assigned to receive 15,000 Naira cash in 5 installments over 15 months[4]. The remaining half received no cash transfers. In FNLP villages treatment assignment was stratified by Livelihood Mentoring treatment status. Figure 4 shows the study design and sample size allocation for the different cells.

Cash disbursements began in Sep-2015 and by Mar-2017 all treated households had received 71,500 Naira.

Figure 4: Experiment 3 Study Design



[4] Roughly USD 693 PPP terms and USD 250 based at the April 2017 market exchange rate. 3,500 Naira was taken from the first few payments of the transfer to pay for a mobile phone that was to be used for electronic payments.

Research Questions Experiment 3. Cash Transfers

The structure of the cash transfer (monthly versus quarterly cash transfers) and timing of payments in the different farming seasons guides us to the following research questions.

- Are cash transfers an efficient tool to improve the welfare of the most vulnerable households? How are they spent/saved? Who makes spending decisions, and what influences those decisions? Can this be changed?
- How does the structure of payments (small monthly vs larger quarterly lump-sums) affect consumption and investment decisions? Is there a difference in terms of long-term resilience?
- How does the timing of the payments (paid in planting, harvest and the hungry season) affect consumption and investment decisions? Is there a difference in terms of long-term resilience?
- Do vulnerable households need cash transfers in addition to services provided by a program like FNLP, to make the most of those interventions? Looked at in the other direction, is the use of those cash transfers influenced by the recommendations provided by FNLP? In other words, do both programs interact and are there synergies?
- Is there an interaction between the decisions linked to the cash transfers and the presence of a livelihood mentor?
- Who in the household makes the decision about the use of the transfers (which are given to the woman), and how are these decisions made? Does the decision-making process affect the eventual outcome, i.e. the efficiency of the cash transfers in helping the household out of vulnerability? Does the distribution methodology (i.e. directly to the woman) affect the gender dynamic in household decision-making?
- Do larger lump sums attract more male influence / interference? Does the visibility of payments have a differential effect on bargaining and empowerment depending on the amount of control that a woman can exercise over the payment? When other household members (particularly the husband) are better informed about the funds that the spouse has been given, how does that affect the weight that their preferences get in HH decisions / composition of HH consumption? In FNLP, making the woman's cash payment more salient could decrease their bargaining power.
- Does the size or timing of the payments in the different farming seasons have an impact on the visibility of the payments to other members of the household? Does this impact the decision about the use of the transfers and its impact on household welfare outcomes?
- Assuming that people are hyperbolic discounted and have low self-control, limiting their discipline for savings, how does the frequency of payments impact the way they allocate the funds between consumption and investment decisions?
- Are women beneficiaries more likely to be forced into making suboptimal decisions by other household members when payments are received in the hungry season versus harvest or planting season? Could visibility of the payment change depending on what season the payment is given?
- Does the recipient of the cash matter if the husband and wife are considered a cooperative team? Cooperative model of family – are women able to redistribute the money efficiently within the household? Is there a correlation between the amount that gets shared / hidden by the female based on how she feels about her marital relationship? Does the female's own sense of self and emotional strength determine the impact of the cash transfer on household welfare.
- Does the cash transfer have an impact on women's experience of intimate partner violence (IPV), and is this mediated by exposure to the FNLP program, or timing of the cash transfer? If it does have an impact on IPV, how does the impact of the intervention vary depending on gender norms in the village, female work, women's bargaining power, and relationship quality with her partner?

Hypotheses

Livelihood choices, intra-household decision-making, women's empowerment, consumption smoothing, investments, savings and intimate partner violence were among the primary economic outcomes of interest for experiment 3. (See Appendix 2, 3 and 4 for detailed descriptions of how outcomes and explanatory variables will be measured).

Hypothesis 3a. Both monthly and quarterly cash transfers may have positive average impacts on the consumption of treated households. To measure this impact, we are going to use the P2 variables described in Appendix 2.

Hypothesis 3b. Both monthly and quarterly cash transfers may have positive average impacts on dietary diversity and food security (P3).

Hypothesis 3c. Both monthly and quarterly cash transfers may have positive average impacts on female's knowledge, empowerment and decision-making power (P5, S4 and S7).

Hypothesis 3d. Both monthly and quarterly cash transfers may have impacts on social outcomes such as whether individuals head their own household and community participation (P5 and S4).

Hypothesis 3e. Both monthly and quarterly cash transfers may have positive average impacts on life satisfaction for the beneficiaries. (S3).

Hypothesis 3f: Compared to monthly cash transfers, quarterly cash transfers may have a stronger impact on the accumulation of assets (farming, business, livestock and household assets). (P1)

Hypothesis 3g: Women in FNLP villages are expected to experience more or less intimate partner violence (IPV) depending on the dominant mechanism through which IPV could be influenced (variables P4). See section 5.4 for a further discussion on the IPV mechanisms. (P4)

Hypothesis 3h: We expect there to be an ambiguous impact of the cash transfer on IPV for those women who are more socially disadvantaged at baseline i.e. those who have faced social structures that make life more difficult (for example, beliefs on gender or social norms, laws and matrilocal versus patrilocal societies).

Hypothesis 3i: We expect there to be a stronger impact of the cash transfer for those women who exhibit a stronger sense of self i.e. those who score higher on psychological outcomes.

Hypothesis 3j: Women who receive a larger quarterly payment are expected to share more of the cash transfer with other members of the family than monthly cash transfer recipients.

4 Empirical strategy

4.1 Econometric Specifications:

Our analysis will use an analysis of covariance (ANCOVA) estimator in assessing all outcomes for which we have both baseline and endline data.

The main regression specification to capture the impact of the FNLP bundled impact, monthly vs quarterly cash transfers and livelihood mentoring will be:

$$Y_{1ig} = \beta_0 + \beta_1 MCash_i + \beta_2 QCash_i + \beta_3 Y_{0ig} + \beta_4 FNLP_g + \beta_5 LM_{ig} + \lambda_s + \beta_6 X'_{0ig} + \varepsilon_{igt} \quad (1)$$

Where Y_{1ig} is the outcome variable for the female respondent in household i in village g measured during the follow-up survey rounds $MCash_i$ and $QCash_i$are the treatment dummy variables taking the value of one if the household was a recipient of a monthly cash transfer or a quarterly cash transfer, respectively. β1 and β2 will measure the intent-to-treat (ITT) effect of being assigned to the monthly or quarterly cash transfer groups compared to the control group that received no cash transfers. Y_{0ig} is the baseline value of the outcome variable All regressions control for strata ward-infrastructure tercile fixed effects (λs) and a vector of baseline covariates X_{0ig} (for example, baseline head of household's characteristics, household demographic composition and size). For the cash transfer analysis, we would control for whether the household was assigned to a village that was randomly assigned to access the Feed the Future package of services (FNLPg) and if the household was randomly assigned to a livelihood mentoring treatment (LMig). In all regressions standard errors are clustered at the village level and we report the p-values for the test of equality of the regression coefficients that tests whether the monthly and quarterly transfers have significantly different treatment effects. When household data are available for all follow-up rounds we pool the data and include a linear time trend i.e. we pool the outcome variable across the follow-up surveys for these outcomes. Where there is interest in the longer-term impacts of the cash transfer on a specific outcome of interest we will present the impacts separately for the different follow-up rounds to highlight immediate and longer-term impacts. All variables denominated in Nigerian Naira are winsorized at the 99th percentile to deal with the possibility of sensitivity of the results to outliers.

In addition, to assess the incremental impact of receiving a cash transfer and/or a livelihood mentoring when a household already receives the bundled package of FNLP services we will interact the different treatment variables (FNLP, LM, MCash and QCash) in the regression. Since all treatments were randomly assigned the coefficients will provide us with the average treatment effect estimates and we will be able to assess the complementarity and synergies across the treatments.

For outcomes variables with only endline data (for example, violence and anthropometric measurement) we will rely on random assignment and use ordinary least squares estimation to compare outcomes for treatment and control groups.

4.2 Accounting for multiple inference

As cash transfers and the FNLP project are likely to impact many economic behaviors and dimensions of welfare, and since our survey instrument included several questions related to a single behavior or dimension, we need to account for the multiple inference hypothesis. For this:

1. We need to adjust the statistical test for each hypothesis. One of the ways to do this is to follow the approach proposed by Benjamini and Hochberg (1995) who proposed a method for controlling the false discovery rate (FDR). The B-H Q-values are the name given to the adjusted p-values found using an optimized FDR approach.

2. We can aggregate the primary outcome variable into an index or composite variable. We use outcome variable indices for several of our groups. These indexes combine multiple measures to reduce the total number of tests conducted. In general, if variables have comparable scales, we can take a simple average. Alternatively, we can compute the average standardized effects where we divide each variable by its standard deviation and takes the average of these normalized variables (Kling, Liebman, and Katz 2007) or else, normalize the values and do a principal component analysis with them to construct the index (Anderson 2008).

4.3 Comparison of short and long-run impacts

Since we have outcome data measured in the short run (during the cash transfer payment; and one month after the final payment of cash transfers) and in the longer-run (more than 1 year after the completion of transfers), we will test equality between the short and long-run effects.

5 Outcomes

This study will examine how the bundled-package of FNLP interventions, household-level livelihood mentoring intervention and monthly and quarterly cash transfers separately and synergistically affect household wellbeing; measuring primary impacts on consumption, diet, food security, nutrition, productive and household asset accumulation, labor force participation, IPV and agricultural productivity.

We look at a variety of primary and secondary outcomes of interest as detailed in appendix 2 and 3 respectively. Since the primary male decision maker and primary female decision maker may be responsible for different expenditures – we ask the same questionnaire to both female and male respondents and will run a separate analysis for both females and males.

5.1 Primary Outcomes

There are five categories of primary outcomes that we are interested in: (P1) Assets, (P2) Consumption, (P3) Nutrition and Food Security including Dietary Diversity, (P4) Intimate Partner Violence and (P5) Intrahousehold Bargaining. A more detailed description of the outcomes of interest can be found in Appendix 2.

P1. Assets: We are interested in four types of assets: Moveable Assets, Savings, Housing and Land. Amongst Moveable Assets we will examine the total number and current value of Livestock, Farming, Household and Business Assets. We will examine the type of formal and informal savings mechanisms used by households, as well as the current value of money held in different savings mechanisms. We are especially interested in the Savings and Internal Lending Cooperatives setup by the FNLP project. We will also examine the ownership and quality of housing stock (e.g. building materials of walls, roof and floor) as well as the availability of electricity and toilet facilities.

P2. Consumption: We will examine impacts on food consumption as well as food and non-food expenditures. Specifically, food consumption measured as self-reported market value of self-produced food, as well as food purchased from the market in the 7 days before the survey data are collected. Non-food expenditures include transport, leisure, communication, personal care goods, school fees, household expenses (e.g. clothing and utensils), social expenditures (e.g. weddings, donations and festivals) as well as temptation goods. We will also compute and analyze total expenditures as a sum of data different expenditure categories.

P3. Nutrition and Food Security: Here we will analyze the self-reported number of meals consumed by adults and children in the household as well as the number of times in the 7 days before the survey data were collected that anyone has gone to bed hungry or without any food. We will also look at the incidence of non-availability of any food in the household, the necessity to borrow food from friends and relatives and the need to reduce the number of meals eaten in a day, all in the same time frame. A dietary diversity score computed based on WHO guidance about 7 major food groups will also be calculated and analyzed.

P4. Intimate partner violence (IPV): We will examine women's self-reported incidence of physical, sexual and emotional violence over the 12-month period preceding the survey asking questions based on the modified Conflict Tactics Scale used in Demographic and Health Surveys. We will collect data on IPV

using both direct questions (e.g. "*During the last twelve months, how often did your husband* say or do something to humiliate you in front of others") as well as a list experiment (e.g. “Of the following 4 things, HOW MANY of them have happened to you in the past 12 months? You do NOT need to tell me which things have happened: 1. You purchased a fan; 2. You went to Abuja with a family relative; 3. You participated in a marriage celebration in a neighborhood household; 4. Your husband said or did something to humiliate you in front of others”). We will use IPV data from the list experiment as our primary measure of IPV given its lower risk of social desirability bias and classical measurement error, but given the limited statistical power and ability to conduct heterogeneity analysis with list experiment data, we will also complement the IPV analysis using the direct question data on IPV. We will also analyze women's attitudes towards the justifiability of violence by intimate partners. These data are not collected from men.

P5. Women’s Empowerment and Decision-Making Power: Here we are interested understanding intra-household decision-making. For decision-making we will look at who has the final say on the purchase of assets and land. There are multiple decisions throughout the survey that will be assessed.

P6. Agricultural outcomes: We are interested in five types of agricultural outcomes. We are going to examine: farming activity in the past 30 days, total spend on hired labor in the last agricultural season, total production per hectare of the seven key crops targeted by FNLP agricultural extension program, total expenditures on inputs and seeds and the number of crops cultivated.

P7. Enterprise variables: We will examine variables related to self-employment. In the first instance we want to explore if the respondent is a non-agricultural business owner. If he/she is, we then examine the total value of investment in raw materials of a non-agricultural business and the average monthly profit of the business.

5.2 Secondary Outcomes

In this section we give a brief overview of secondary outcomes that we will consider. A more detailed description of the outcomes of interest can be found in Appendix 3.

S1. Financial variables: Here we are interested in understanding financial variables in two categories: loan and hypothetical money sharing. For loans we are including access to loan, value outstanding of loan and inability of individual within the household to pay the loan. For hypothetical money sharing we include a few questions that measure hypothetically how the female respondent would divide the money and if this differs when the money comes from a relative of from an NGO.

S2. Coping with shocks: We will examine if the household experiences at least one type of shock in the last 12 months and which type of shocks. Within the possible shocks we study we include: crop failure (weather), crop failure (nonweather), family illness or death, asset theft, loss or damage and job loss.

S3. Behavioral Characteristics of female & wellbeing: Within this section we are interested in studying cover the following categories: happiness, economic satisfaction, worries, self-efficacy, optimism, self-esteem and locus of control. In general, for this we include several questions that try to measure for example the happiness of the female and then create and index using the self-reported questions. More information can be find in Appendix 3.

S4. Women's Empowerment Agriculture Index (A-WEAI): Based on the new format of the WEAI we will examine the following characteristics: leadership, group membership and time use.

S5. Anthropometric measurement and health: In this section we analyze the health of the individuals in the household. For this we examine the BMI of female respondent, the middle and upper arm circumference (malnourishment indicator), the height and weight of children aged 0-5 years (stunting, underweight) and the number of weeks that household members were absent from usual activity due to illness.

S6. Children's schooling: Here we will analyze the education of children 5 years and above. For this, we measure the school attendance of any/all children in current school year and the time spend in the school in the past week.

S8. Knowledge: In this section we will examine the extension practices and the health and nutrition knowledge of the adults of the household. For extension practices, we measure if any individual in the household receives any advice on distinct categories of extension topics as fertilizer use, irrigation, marketing, crop sales, etc. For the health and nutrition category we create an index that measures the share of correct questions answered about feeding practices for infants and children (out of the total questions answered).

5.3 Heterogeneous Effects

For the heterogeneity analysis we will look at the distribution of effects for different subgroups. We will test whether the impact of the FNLP program, livelihood mentoring treatment and cash transfers vary with various household and individual (female or male) characteristics.

Heterogeneous effects will be considered along the following dimensions:

a. Respondent gender
b. Respondent age
c. Household type (single vs. joint control vs polygamous)
d. Wealth Quantile
e. Attitudes towards violence
f. Female Decision making and bargaining power
g. Risk, worries and impatience
h. Psychological welfare: Self-esteem, Conformism, Trust and Self-efficacy
i. Marital cooperation and power relations
j. Family history and intergenerational norms
k. Community norms about female work
l. Vulnerability category (EV, VV and ML)
m. Sharing of money with other household members (hypothetical)
n. Local Government Authority (LGA) Birnin Kebbi versus Danko Wasagu.

We will examine if some households respond differently to the treatments than other households, and the mechanisms through which the program produces those impacts. Specifically, we want to understand why the cash transfers did or did not improve well-being outcomes by assessing the impacts on a range of potential explanatory factors as described in Appendix 4 below. We will also analyze whether the cash transfers or FNLP worked better for certain types of females based on their characteristics and the norms

and attitudes they hold or are exposed to in the community. In addition, we will assess whether any of the characteristics impact the female's capacity to retain more of the cash transfer.

Heterogeneous treatment effects will be estimated by interacting treatment status with the variable of interest. To test interaction effects, we will use multiple variable regression analyses and include the product of centered variables as interaction term (Aiken & West, 1991). We will predominantly include use baseline variables as moderators. If baseline variables are not available to test moderating effects of interest, we will need to argue theoretically and show statistically that the moderator is stable over time. For example, some psychological characteristics of the female and relationship quality that were measured during the final follow-up survey are expected not to change due to the treatment status.

To test some of the heterogenous effects, we will first create an index calculated by summing each question encapsulating a theme in the endline survey, we will score 1 for a correct/yes answer and 0 for an incorrect/no answer. 'Doesn't know' and 'refusal' will be coded as incorrect. We will then take the average for all of the questions or if the coding for the questions are from strongly disagree to strongly agree we will divide the total scores by the maximum score possible. In case of reflective scales, sufficient scale reliability is a precondition for the analysis and will be assessed using Cronbach's alpha. Where we have used a widely used, validated psychological scale, we will create a measure using the standard approach (e.g. self-efficacy scale). In some cases where there is a diverse set and type of questions that are relevant to one theme (e.g. a mimx of likert scale questions, and binary and continuous variable questions that are all relevant to measuring 'relationship quality'), we will create indices using the approach outlined by Kling, Liebman and Katz (2007) and Anderson (2008) as discussed earlier (see Appendix 4 for the mediators that will be analyzed based on an index).

5.4 Intimate Partner Violence (IPV) Analysis

One of the primary outcomes from the cash transfer analysis will be to assess impacts on intimate partner violence (IPV). There is increasing evidence that cash transfer programs decrease intimate partner violence (IPV); however, little is known about how cash transfers achieve this impact (see mixed method review by Buller et al. 2018). We utilize both direct and list methods of data collection to identify the incidence of physical, emotional and sexual violence and will assess a range of possible pathways and channels through which the receipt of the cash transfer might impact IPV.

Measurement of IPV: List randomization and face-to-face method

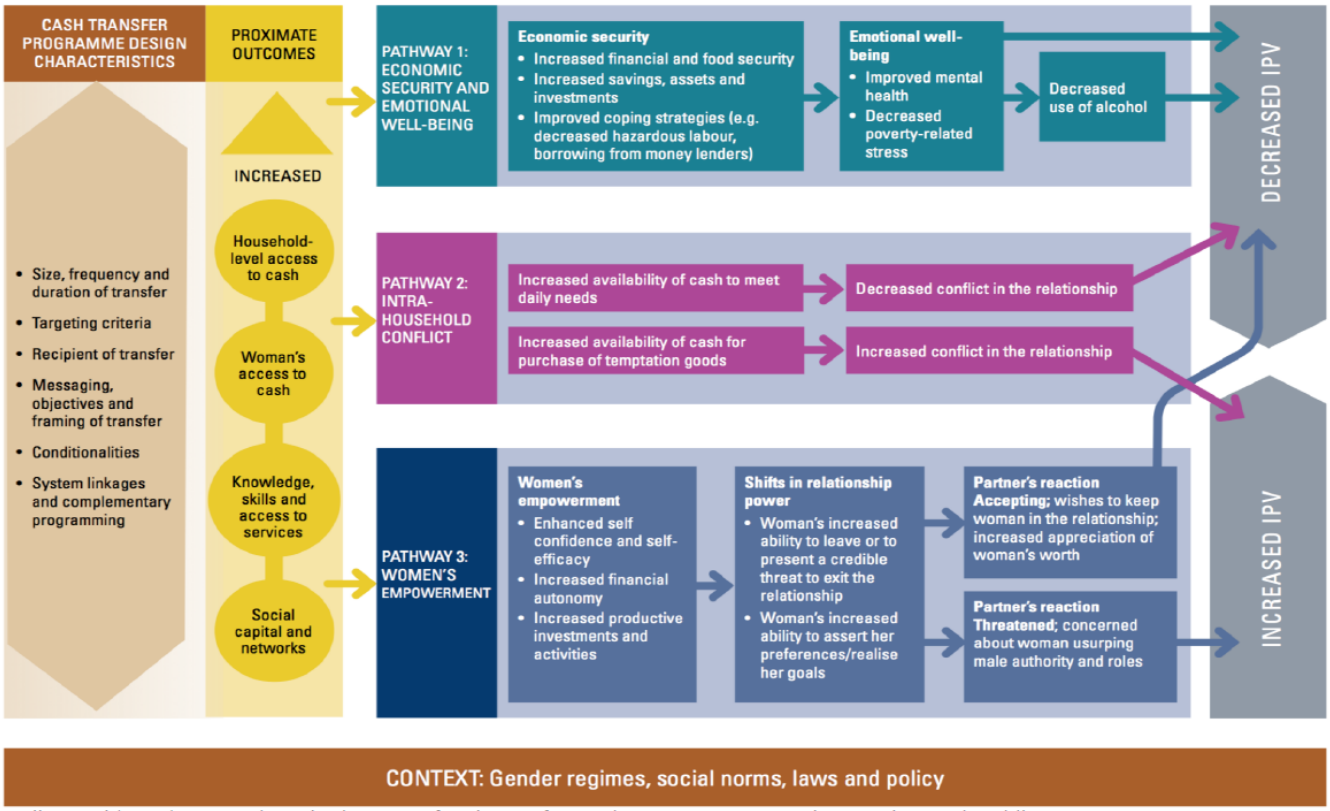
We will ask married women about their experience of IPV in the previous 12 months using a set of 8 questions based on the modified conflict tactics scale questions that are also used in Demographic Health Surveys. Three IPV questions were asked using the list experiment (see Blair and Imai, 2012, for an outline of the approach), including one emotional, one physical and one sexual violence question. An additional 5 questions were asked directly of all married women, using the same approach as is used in the DHS. We ask using both of these methods because there is some evidence that for sensitive topics such as IPV, the list experiment may provide less biased estimates of prevalence, and may also provide less biased treatment effect estimates (Rosenfeld et al., 2015; Bulte & Lensink, 2017). However, the list method has greater variance than asking the question directly, and also is only able to identify prevalence at the whole-of-sample level rather than individual level, and thus can be underpowered and difficult to study heterogeneous treatment effects. For this reason, we will use the list experiment IPV data for our primary outcome measure and to examine mechanisms and heterogeneous treatment effects. However given we are likely to be underpowered to study the pathways of observed impacts on IPV using sample-level list method IPV data,

we will also compare main and heterogeneous treatment effects using the direct IPV questions. The direct questions will also allow us to analyze the frequency of IPV episodes by individuals' characteristics.

Pathways through which the cash transfer might impact IPV

Based on the framework outlined in Buller et al. (2018) we will assess a range of possible pathways and channels through which the receipt of the cash transfer might impact IPV.

Figure 5. Pathways through which a cash transfer to women might impact Intimate Partner Violence (IPV) (Buller et al., 2018)



Buller et al (2018). A mixed-method review of cash transfers and intimate partner violence in low and middle-income countries

In the context of northwest Nigeria, norms and faith-based reasoning are expected to have a strong influence on the female's capacity to make use of a cash transfer (for example, how much of the cash she keeps and whether she works). Since the cash transfer in FNLP is given to the primary female in the household the impact on IPV is ambiguous and any negative consequences may depend largely on the relationship dynamics and the extent to which the male reacts if he believes his role in the family as the provider is potentially threatened.

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Appendix 1: Statistical Power Analysis & Randomization

For the Impact Evaluation baseline survey, a sample of 2,400 EV households and 1,100 households equally divided between the VV and ML households was necessary based on power calculations. We sampled 2,074 of the 'Class B' households in FNLP treatment villages and 2,254 from FNLP control villages and sent this sample of 4,328 households to the survey firm to conduct a baseline survey. The number of household interviews completed was 3,976 for a household response rate of 92 percent.

For the **village-level FNLP experiment (Experiment 1),** mirroring the stratified sample of 1,750 from the FNLP treatment villages in the FNLP control villages gives us a total sample size of 3,500 households for the village-level experiment. The random assignment is clustered at the village-group level into 96 clusters. The sample is composed of 69% EV (2,400 households), and 550 households each in the VV and ML groups. Given this sample, we are powered to detect 18-24% changes on income, 5-6% changes in the number of hours worked and 23-28% changes in household nutrition.

For the **cash transfers experiment (Experiment 3),** budgetary constraints limited the sample size to approximately 600 beneficiary households in treatment villages and another 600 beneficiaries in the control villages. All extremely vulnerable (EV) households were eligible for cash transfers. Adding an equal number of non-cash transfer households raised the sample size to 1,200 in each arm of the village level experiment. These households are spread over 104 villages; however, the sample is stratified by 96 village groups. Some smaller or geographically indistinct villages were grouped with larger neighbors by the implementer for logistical efficiency.

Since the sample size is programmatically fixed for the cash transfer experiment, we conducted a sensitivity analysis to find the minimum detectable effect sizes at 80% power. With a sample of 1,200 households we are powered to detect: 32-36% changes in income, 8-9% changes in hours worked, and 40-45% changes in nutrition. With a sample of 2,400, i.e. including the FNLP control village sample, we are powered to detect slightly smaller effects: 26-30% changes in income, 7-8% changes in hours worked and 32-38% changes in household nutrition.

The **livelihood mentoring experiment (Experiment 2)** includes the very vulnerable (VV) and market limited (ML) groups in addition to the extremely vulnerable (EV). All households in FNLP villages within each of these groups were randomized in this experiment. In determining the sample size required for data collection, first, we included the cash transfer sample of 1,200 households for whom we are already collecting data. The cash transfer sample is, in fact, the entire population of EV households within the FNLP villages. Power calculations indicated that roughly 550 additional households needed to be sampled, equally distributed over the VV and ML groups, with half receiving the livelihood mentoring treatment. With a combined sample size of 1,750, stratified by 48 village groups, the study is powered to detect effects in the range of 24-27% changes in income, 6-7% changes in hours worked, and 30-34% changes in household nutrition for the livelihood mentoring intervention.

Appendix C of the Concept Note provides a detailed technical discussion about these power calculations.

Appendix 2: Description of Primary Outcomes

Category		Outcome	Description
P1: Assets			
Moveable assets	1	Livestock	Total number and current value
	2	Farming Assets	Total number and current value
	3	Household Assets	Total number and current value
	4	Other productive assets	Total number and current value
Savings	5	Savings	Types of formal and informal savings used by households and current value by type. Use of a SILC.
Land	6	Land owned	Do you own the dwelling
Housing	7	House has non-mud walls	Binary Variable (Yes or No)
	8	House has non-thatch roof	Binary Variable (Yes or No)
	9	House has non-mud floor	Binary Variable (Yes or No)
	10	House has electricity	Binary Variable (Yes or No)
	11	House has toilet or pit latrine	Binary Variable (Yes or No)
	12	Repairs or construction expenditure	Expense value for repairs made to house in past year.
P2. Consumption			
Food Consumption	1	Food own production	Total value consumed by household in last 7 days
	2	Food purchased	Total value on food expenditures during past 7 days.
Non-food Expenditures	3	Total amount spent in categories of frequent expenditures in last 7 days	Regular expenditures: Transport, leisure.
	4	Total amount spent in categories of infrequent expenditures in last month and six-month timeframe.	Communication, personal care goods, services, other
	5	Education expenditure	School fees in past 6 months
	6	Health expenditures	Medical expenses in past 6months
	7	Household Expenditures	Children clothing, adult's clothing, household utensils, etc.
	8	Social Expenditures	Ceremonies/festivals (weddings, funerals etc.). House decorations. Donations to church, mosque, other religious groups.
	9	Other Expenditures	Temptation goods – expenditures on tobacco and alcohol in past 7days
Index of total expenditures	10	Daily per capita expenditures and daily adult equivalence expenditures.	Total of food and non-food consumption scaled by household size and converted to a daily amount.
P3. Nutrition and food security			
Nutrition and food security	1	Household did not have enough food to feed the household in past 12months.	Binary variable if faced a situation where not enough food to eat.
	2	Number of meals (adults)	Total number
	3	Number of meals (children)	Total number
	4	Go a whole day and night without eating anything?	In the past seven days has anyone from your household
	5	Go to sleep at night hungry because there is not enough food	In the past seven days has anyone from your household

	6	Have no food or any kind in your household	In the past seven days has anyone from your household
	7	Borrow food, or rely on help from a friend or relative	In the past seven days has anyone from your household
	8	Reduce number of meals eaten in a day	In the past seven days has anyone from your household
	9	Restrict consumption by adults in order for small children to eat	In the past seven days has anyone from your household
	10	Index of food security measures – anxiety, quality	In the past seven days has anyone from your household
Dietary diversity	11	Number of food groups consumed	WHO guidance
P4. Intimate Partner Violence			
Experience of violence from husband or partner	1	Physical violence, last 12 months	Self-reported using a direct question and using a list experiment. Incidence (list and direct methods) and frequency (direct method only).
	2	Sexual violence, last 12 months	Self-reported using a direct question and using a list experiment. Incidence (list and direct methods) and frequency (direct method only).
	3	Emotional violence, last 12 months	Self-reported using a direct question and using a list experiment. Incidence (list and direct methods) and frequency (direct method only).
	4	Violence index	Weighted standardized average of variables.
	5	Any violence, last 12 months	Binary variable equals 1 if respondent says they have experienced at least 1 type of violence in past 12 months (direct only)
	6	Physical and/or sexual violence, last 12 months	Binary variable equals 1 if respondent says they have experienced at least 1 type of physical or sexual violence in past 12 months (direct only)
P5. Women Empowerment and Decision-Making Power			
Decision making	1	Male has final say on purchase of assets	By category and proportion. Assets: faming, animal and household assets.
	2	Male makes most of decision on plots	Who in the household makes most decisions on this plot?
	3	Female has sole decision-making power on any decision	Purchase of assets, plot or crop decisions to be examined.
A-WEAI	4	Empowerment based on WEAI indicators	Replicate A-WEAI from proxy indicators.
P6. Agricultural outcomes			
	1	Farming activity in the past 30days	Binary variable that indicates if the individual within the household practice any faming activity in the past 30 days?
	2	Total hired labor on plots in last agricultural season	How many days did your household hire men, women and children for activities such as land preparation, planting, ridging, weeding and fertilizing?
	3	Crop Productivity	Total production per hectare of seven key crops targeted by the FNLP agricultural extension program.
	4	Inputs expenditures	Total expenses on inputs (fertilizer) and seeds
	5	Crop variety	Number of crops. Shift to any cash crops.

P7. Enterprise variables			
	1	Non-farm business owner	Binary variable indicates the individual is owner of a non-farm business.
	2	Value of investment in non-agricultural business	Expenditures on Raw materials in past 30days
	3	Average monthly profit	Business profits in past 30days

Appendix 3: Description of Secondary Outcomes

Category		Outcome	Description
S1. Financial variables			
Loans	1	Access to loans	Binary variable indicate access to loans at some point in past 3years.
	2	Value of outstanding loans	Total Amount of loans (self-reported)
	3	Unable to pay loans	Binary variable indicates the individual was unable to pay loans.
S2. Household Shocks			
	1	Household experienced at least one type of shock in the past 12months	The shocks include the following types: Crop failure (weather), crop failure (nonweather), family illness or death, asset theft, loss or damage and job loss.
S3. Wellbeing			
	1	Happiness	World Value Survey indicator. We compute an index using the answers for all the questions in this section. Each question has four possible answers that very from not very happy to very happy. We use the answers for the four questions, if answered, in this section and compute an index.
	2	Life Satisfaction	World Value Survey indicator.
	3	Risk and Worries index	We compute an index using the answers for all the questions in this section. Each question has four possible answers that vary from been not worried at all to very worried. We use the total number of points accumulate, average by number of questions answered. The higher the index the most worry the individual is
	4	Health	Proportion of household sick or injured. How much spent on health-related expenditures by the household in the past 12months? Household member consulted a health practitioner in past 12monts.
S4. Women's Empowerment Agriculture Index (A-WEAI)			
Leadership	1	Speaking up in public	Binary Variable (Yes or No)
Group membership	2	Member of a group in the community	Binary Variable (Yes or No)
Time Use	3	Share of time spent on household activities versus economic activities.	Calculate total time spend on household activities and we calculate total time spend on economic activities. Then we use these two variables to calculate a share.
S5. Anthropometric measurement and health			
BMI of female respondent	1	Height and weight of female respondent	BMI = kg/m2

Middle and Upper Arm Circumference (MUAC)	2	MUAC collected for all children aged 0-5 years in the household	Malnourishment indicator.
Height and weight of children aged 0-5 years	3	Height and weight of all children aged 0-5 years in the household	Stunting, Underweight and Wasting indicators to be measured.
Health	4	Number of weeks household members absent from usual activity due to illness	Household roster – did you suffer from illness or injury.
S6. Children's schooling			
Education of children 5 years and above	1	School attendance of any/all children in current school year	Binary variable indicating the child attended school last week.
	2	How many hours has {child} spent in school in the past week?	Total number of hours spent in school during last week
S7. Knowledge			
Extension practices	1	In the past 3 years, did you or anyone in your household receive any advice on [TOPIC]?	Binary variable indicating an individual within the household received advice on extension topics.
Health and Nutrition	2	Index of correct answers about feeding practices for infants and children	Total correct answers out of total of feeding practices answered.

Appendix 4: Description of Mediators

Category	*Variable*		*Description*
M1. Gender Attitudes and perceptions			
Gender attitudes	1	Gender attitudes index – among primary male and female	Gender Attitudes index standardized on number of questions of this category answered.
Gender Role	2	Gender Equitable Norms Index	Index standardized on number of questions.
	3	Eliciting norms in the community about female work	We compute an index using the answers for all the questions in this section.
Aspirations	4	Desired future occupation of daughter is not to work outside home	Binary variable coded from a list of desired occupations.
	5	Desired future occupation of son is not to work outside home	Binary variable coded from a list of desired occupations.
Household Chores Share	6	Number of household chores performed by husband versus wife	Count on household chores perceived to be male-dominated versus female-dominated.
M2. Women's behavioral characteristics			
	1	Conformism	Index of conformism
	2	Trust	Most people can be trusted? Binary variable Yes or No
	3	Self-esteem	Index of self-esteem
	4	Locus of control	Freedom of choice scale
	5	Decision maker	Purchase of animals or physical assets / Ability to choose husband etc.
	6	Risk averse	Risky choice versus certain choice
	7	Impatient	Time preference indicators
	8	Self-efficacy	Index of self-efficacy
M3. Cooperative relationship with partner			
	1	Satisfaction with married life	Index of satisfaction with married life scale
	2	Trust within marriage	Index of trust scale
	3	Empathic relationship with husband	Index of relationship quality
	4	Matching in the marriage	Assets brought into the marriage. Difference in level of education and age
	5	Alcohol	Wife reports husband drinking alcohol (binary and frequency)
	6	Poverty and economic hardship	Weighted index of household income, assets and consumption
	7	Stress faced by husband	Index of risk and worries reported by the man
M4. Family History and the intergenerational transmission of norms			
	1	Parents occupation and education	Family role models when women or men in the previous generations have exhibited more empowered choices.
	2	Age at marriage	
	3	Quality of relationship with own parents	Index of husband and wife's experience of violence and trauma when they were children, and parents' and grandparents' education and employment.

M5. Norms in the community			
	1	Norms in the community about female work	Index of perceptions about community norms on female work and gender dynamics.
Attitudes towards violence	2	Justified violence scale	Index of woman's views of justification of violence questions
	3	Attitude towards violence index	Weighted standardized average of variables.
Mean village gender attitudes and norms in the sample	4	Index of village gender norms in sample	Mean of the gender attitudes index and gender equitable norms index for respondents by village.
	5	Religion	Respondent religion
M6. Intrahousehold Bargaining and relationships			
Decision making	1	Male has final say on purchase of assets	By category and proportion. Assets: faming, animal and household assets.
	2	Male makes most of decisions on plots	Who in the household makes most decisions on this plot?
Family support and bargaining power	3	Village ties	Was respondent born in the village, and number of relatives living in the village.
	4	Education	Wife's years of education
	5	Employment	Wife reports being engaged in formal employment in the past week
Intrahousehold relationships	6	Satisfaction with married life scale Index	Total standardized by number of questions answer in this category
	7	Trust Scale	Total standardized by number of questions answer in this category
	8	Relationship quality	Proportion of questions answered with time to time or often out of total questions answer, and standardized weighted index.
	9	Relationship quality	Dichotomous for each one of the questions include in this category
Sisterhood and Polygamous Marriage	10	Interaction with co-wife is intimate, congenial or loyal.	Polygamous marriage binary variable (Yes or No). For households in polygamous marriages (23% of the baseline sample) we will also examine the relationship quality with co-wives using direct questions about relationship quality and a hypothetical question about sharing money with co-wives.
	11	Hypothetical cooperation	Very likely or completely likely to share money with cowives
M7. Sharing of a transfer			
Hypothetical money sharing	1	Proportion shared with each member of the household when the money received is by a relative.	Percentage retained by female respondent will be compared to amount retained from the cash transfer among cash transfer households. The amount the female keeps for herself might indicate her control over money.
	2	Proportion shared with each member of the household when the money received is by an NGO.	Percentage retained by female respondent used as a proxy for amount likely shared if they received a cash transfer. Amount compared to the actual amount retained from the FNLP cash transfer among the treatment households.