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ORIGINAL ARTICLE

An assessment of the Francois-Xavier Bagnoud poverty alleviation program in Rwanda and Uganda

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Abstract
Objectives We evaluate the three-year community-based FXBVillage poverty-alleviation model, which provides extremely poor families with sustained social support and graduated material support for education, healthcare, housing, nutrition, and income-generation.
Methods We combine a pre/post analysis of participant households in Rwanda ($n = 912$) and Uganda ($n = 628$) with construction and assessment of a combined multivariable household wealth index comparing FXBVillage data with national Demographic Health Surveys.
Results Many FXBVillage households shifted to higher household wealth quintiles. This shift was particularly strong in Rwanda. Increases among relevant household characteristics included (in Rwanda/Uganda): ≥3 meals/day (5–88%)/(44–86%), school attendance 5–17 years (79–97%)/(64–89%), adequate school supplies (7–97%)/(4–71%), and communal financial support if needed (27–98%)/(29–87%). Universal bednet ownership and water treatment was nearly attained; vaccine coverage was not, especially in Uganda.
Conclusions The model likely supports poverty-alleviation among participants. The variability of improvements, across indicators and countries, highlights the need for better understanding of interactions within programs and between programs and implementation settings, as well as how these interactions matter to poverty-reduction strategies.

Keywords Poverty reduction · Rwanda · Uganda · Evaluation · Graduation program · Ultra-poor

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Introduction

The multi-dimensional conditions and consequences of poverty are interactive and persistent. At the same time that poverty is implicated in the erosion of quality of life and inequitable morbidity and mortality in vulnerable communities, these contribute to the perpetuation of poverty over generations (Banerjee and Duflo 2007; Haushofer and Fehr 2014; Kim and Loury 2014; Ngonghala et al. 2014). Devising and implementing strategies that can break communities out of what has been conceptualized as a "poverty trap" and promote long-term economic security has become a priority of global development initiatives. Popular programmatic interventions toward poverty reduction include microfinance strategies, cash transfers, and direct food aid (Banerjee et al. 2015; Cobbinah et al. 2013; Handley et al. 2009). There is no consensus on the best approach. There has been increasing interest in programs that are able to effectively link immediate relief and lasting economic security with community-based initiatives. Such hybrid and locally tailored programs are limited, and thus, their implementation and improvement requires detailed assessments and dissemination of approaches so that other programs can learn from successes and failures. However, there is little empirical data for such programs, presenting a need for studies that may inform current and future programs and their assessment.

The Francois-Xavier Bagnoud (FXB) Village program is a three-year, multi-dimensional poverty-alleviation model that simultaneously targets overlapping deprivations in health, education, and living standards linked to sustained poverty, poor quality of life, high morbidity and mortality, and lack of financial empowerment (Table 1, S1). An initiative of the non-governmental organization FXB International, it has gone through a number of iterations in nine different countries since its initial implementation in Rwanda in 1991. This model initially provides full material support for basic resources. Over time, material support decreases while support for engagement in local microfinance initiatives and income-generation activities (IGAs) increases. In this way the program transforms from offering 'relief' to promoting economic security and locally valued development at the household and community level.

The purpose of this manuscript is to use FXB data to compare the status of beneficiary households and their members before and after (i.e., a pre/post analysis) the FXBVillage programs in Rwanda and Uganda. To augment this assessment, we compare the FXBVillage data against national data collected by the Demographic and Health Surveys (DHS) during the time of the FXB programs, using a standardized country-specific asset-based wealth index.

Methods

This report adheres to the guidelines for *Transparent Reporting of Evaluations with Nonrandomized Designs* (TREND) protocol (Des Jarlais et al. 2004). Additional information about the FXBVillages program, household selection, and the empirical analysis is provided online in the Electronic Supplementary Material.

Setting and study population

In December 2008, FXB was selected into the New Partnership Initiative of the United States Government's President's Emergency Plan for AIDS Relief (PEPFAR), establishing twenty new FXBVillage programs in Rwanda and Uganda. These constituted the participant households referred to in this study. In Rwanda, FXBVillages were located in 12 rural communities in the Muhanga, Nyamagabe, and Rubavu districts (45, 183 and 144 km, respectively, from the capital city, Kigali). In Uganda, the villages were located in four rural communities in the Kyenjojo district (220 km from Kampala) and four poor urban communities in Kampala itself. In each community, approximately 80 beneficiary households were selected non-randomly into the program based on eligibility criteria including relative poverty level in their communities, motivation or willingness shown to achieve the program objectives by the head of the household, community reputation, having orphan or vulnerable children in the household, and no articulated desire or plan to migrate (see Electronic Supplementary Material for more details on household selection).

Household surveys and assessment

A structured face-to-face interview was administered to every head-of-household by local staff at the onset ($n = 1597$) and culmination ($n = 1540$) of the 3-year program (2009–2012). In addition, a random sample ($n = 510$, 33.1%), constructed by selecting every 3rd household from each FXBVillage, participated in follow-up surveys in 2010 and 2011 (years 1 and 2). The survey included the following sections, to align with FXBVillage targets and activities: (1) household demographics, (2) nutrition, (3) general health, (4) HIV, (5) water, sanitation, and environment, (6) psychosocial perceptions and views, (7) children's health (anthropometrics and vaccinations received), education and support (separately <5 years and 5–17 years of age), (8) household finances and economics, and (9) collective IGAs. Questions were largely derived and adapted from the DHS questionnaires (http://dhsprogram.com/). Sections that derived items from other

Table 1 Description of the FXBVillage poverty-alleviation model

General	
Duration of program	3 years
Per-person cost per year	~140 USD
Per-person cost per program	~420 USD
Number of participants per program	500–600 people
Graduation timeline	
Year 1 contribution (FXB contribution = 100% Participant contribution = 0%)	Participants receive material and social support for nutritional, educational, and other health and household needs (Table S1). Emphasis is placed on alleviating malnutrition and all immediate financial burdens so families can focus on launching income-generating activities (IGAs), which begin the second semester of year 1. In-kind material support (valued at approximately USD $120–160) helps program participants purchase the durable goods, such as livestock, necessary to start IGAs. Nutritional supplementation is also provided for the first nine months. Nurses conduct home visits to assess whether child malnutrition or illness exists in the household, and also to facilitate referrals for care if necessary. Participants are provided instruction and supplies regarding adequate kitchen ventilation, water treatment, sanitation, use of mosquito nets, nutrition and safe food preparation. The nurse counselor also provides psychosocial support, which aims to improve emotional well-being. HIV testing and prevention is also encouraged as another component of the nurse counselor's services
Year 2 contribution (FXB contribution = 75% Participant contribution = 25%)	With guidance and support from FXB staff members, participants begin their IGAs and contribute 25% to their household's educational and health fees. Ongoing home visits support families' transition out of poverty. Participants are also encouraged to set up and maintain vegetable gardens; direct nutritional support is phased out after nine months. Additional focus is placed on helping participants develop various business skills including financial literacy (individual and collective), management, investing, marketing, partnerships in the public and private sectors, and gender equality awareness
Year 3 contribution (FXB contribution = 50% Participant contribution = 50%)	Participants contribute to 50% of all educational and medical expenses. FXB provides continued support for IGA projects. Ongoing home visits aim to support families in their transition out of poverty through programmatic activities on an as-needed basis

Details regarding each component are provided in Table S1 in the supporting information. Additional information can be found at https://fxb.org/toolkit/

FXB Francois-Xavier Bagnoud

sources included nutrition (Dehghan et al. 2012) and psychosocial perceptions and views (Steger et al. 2006; Synder et al. 1991).

Empirical strategy for evaluation

The statistical analysis needed to account for geographic (country) and temporal (same household over time) correlation (Rabe-Hesketh and Skrondal 2012) because several outcomes differed between countries and pooled analyses suggested that changes occurred at different rates over the duration of the FXB program. Separate analyses were, therefore, conducted for Rwanda and Uganda and repeated measures in the same household over time were accounted for using generalized estimating equations (GEE) with robust standard errors and an exchangeable correlation (corresponding to equal-correlation models) as our regression framework (Hardin and Hilbe 2013). Since many outcomes were binary and relative measures can mask or exaggerate small changes based on the prevalence at baseline, we did not display regression coefficients but rather the sample size and percent with p values for changes between survey waves (baseline versus year 3, the culmination of the FXBVillage program) generated using a log-binomial model specification since baseline prevalence was greater than 10% for most outcomes. For each outcome measure we assessed all completed responses and noted the number missing where relevant for interpretation. For each set of domains we used the Holm-Bonferroni method (Holm 1979) to adjust our level of statistical significance for multiple comparisons, which did not alter our results.

In the absence of a control group—a decision made by FXB on ethical grounds related to the extremely vulnerable conditions of the families targeted by this model—we sought to examine how FXBVillages compared to the overall economic status of a large sample of households in Uganda and Rwanda around a similar time period. To do so, we merged FXBVillage data with the 2010–11 DHS in Rwanda ($n = 2009$ urban and $n = 10{,}531$ rural households) and the 2011 DHS in Uganda ($n = 2250$ urban and $n = 9090$ rural households) (National Institute of Statistics of Rwanda, Rwanda Ministry of Health, ICF International 2012; Uganda Bureau of Statistics and ICF International

2012). As part of the DHS program, which has conducted over 250 national surveys in low and middle-income countries since the 1980s, a generalized "wealth index" has been created (Rutstein and Johnson 2004). We estimated a country-specific asset-based household wealth score in the combined FXBVillage and DHS samples using principal components analysis as detailed in the Electronic Supplementary Material (O'Donnell et al. 2008). We then compared the position of beneficiary FXBVillage households in the overall distribution of asset-based household wealth at the onset and culmination of participation to the DHS sample collected at approximately the mid-point of FXBVillage participation.

Ethical review

This analysis used de-identified data and was reviewed and approved by the Institutional Review Board at the University of Pennsylvania and Harvard University.

Results

Baseline characteristics of the targeted sample

Nearly one-third of the selected heads of beneficiary households reported that they had no formal education (24% in Uganda and 31% in Rwanda) and 6% were child-headed households in both countries. The majority of households in the rural communities said that agriculture was their primary occupation, whereas households in the urban communities (in Kampala) were not involved with agriculture but had a range of other primary occupations, including selling food and charcoal. The median household size was six (range 1–21), with 83% of households in Uganda and 42% in Rwanda reporting at least one orphan and 1.7 beds on average, with only 29% (21% in Uganda; 34% in Rwanda) of households indicating that all household members could sleep in a bed on a consistent basis (Table S2).

Longitudinal results

Household sample

Of the initial 1597 households, 1540 (96.4%) completed follow-up at the end of year 3, when the FXBVillage program culminated. Attrition was similar in each country (11/639 = 1.7% of initial Ugandan households, 46/958 = 4.8% of initial Rwandan households). For ease of presentation, we primarily report pre/post data on these 1540 households at baseline and year 3, stratified by country. Analyses of the smaller ($n = 510$) household sample surveyed each year are quantitatively indistinguishable.

Food security and production

At baseline, 44 and 5% of households in Uganda and Rwanda, respectively, reported having at least three meals on an average day, whereas at the end of the program period these estimates increased to 86 and 88% ($p < 0.001$) (Table 2). The percent of households that reported having a day in the prior 3 months with no food dropped from 47 to 9% in Uganda and 74 to 2% in Rwanda ($p < 0.001$). In Rwanda, the number of households that reported that the food consumed was grown at home increased from 29 to 83%; for Uganda, these rates (43–48%) increased slightly.

General health, water and sanitation

Nearly every household reported access to health care services with an increase in access to free care from 28 to 93% overall, with similarly large within-country increases (Table 2). Approximately all heads of households reported having been tested for HIV and using mosquito nets by the end of year 1. There was a large increase in reported knowledge of family planning methods (62–94% overall).

At baseline, 50 and 67% of households in Uganda and Rwanda treated their drinking water, and at each subsequent follow-up year nearly every household reported treating their water to make it safer to drink (Table 2). Though water access differed between and within countries at baseline, significant increases in the use of protected water sources was achieved across both countries. The pooled percentage increased among households reportedly using a protected well (31–34%), a public tap/standpipe (25–31%), or a protected spring (9–16%). Declines were observed in households using an unprotected well (15–11%) or unprotected spring (7–0.7%). In Rwanda the percent of households using a flush toilet or ventilated improved pit latrine increased from 21 to 94% ($p < 0.001$) by the end of the program, but in Uganda only a few households reported greater access to these types of facilities (15–19%; $p = 0.07$).

Psychosocial well-being among adults

The percent of respondents who reported to *never* have (1) a good sense of what makes life meaningful, (2) a satisfying purpose in life, (3) a strategy to get out of difficult situations, (4) get the things important to them, or (5) ability to solve problems when others are discouraged was nearly zero in both countries at the culmination of the program. Perceived social, emotional and material support

Table 2 Nutrition, health, water and sanitation characteristics of FXBVillage households (Rwanda and Uganda, 2009–2012)

	Rwanda ($n = 912$ households)			Uganda ($n = 628$ households)			Total households with missing data
	Baseline	Year 3	p value for change*	Baseline	Year 3	p value for change*	
Nutrition (in the past 3 months)							
≥3 meals per day on average	42 (5)	805 (88)	<0.001	279 (44)	537 (86)	<0.001	2
Household had a day with no food	672 (74)	19 (2)	<0.001	295 (47)	56 (9)	<0.001	0
Quantity of food available for household deemed "plenty" or "just enough"	228 (25)	869 (95)	<0.001	138 (22)	569 (91)	<0.001	1
Food consumed by household has been mostly home grown	262 (29)	758 (83)	<0.001	272 (43)	302 (48)	<0.001	0
General health							
Currently has access to healthcare services[a]	768 (84)	906 (99)	<0.001	548 (87)	621 (99)	<0.001	1
Travel time to nearest health care facility			<0.001			<0.001	14
<30 min	257 (28)	483 (53)		187 (30)	422 (67)		
30–60 min	423 (47)	333 (37)		98 (16)	164 (26)		
>1 h	229 (25)	95 (10)		333 (54)	42 (7)		
Access to free health care in past 6 months	139 (15)	845 (93)	<0.001	286 (46)	594 (95)	<0.001	8
Reported having health insurance in past 6 months	689 (76)	910 (100)	<0.001	31 (5)	100 (16)	<0.001	63
Health events of children <5 years in household in the past month							
Zero episodes of diarrhea[b]	671 (74)	891 (98)	<0.001	318 (51)	588 (94)	<0.001	1
Zero overnight hospital stays due to diarrhea[b]	861 (94)	908 (100)	<0.001	380 (61)	621 (99)	<0.001	1
Zero episodes of severe cough or difficulty breathing	739 (81)	904 (99)	<0.001	347 (55)	603 (96)	<0.001	1
Zero overnight hospital stays due to severe cough or difficulty breathing	863 (95)	909 (100)	<0.001	394 (63)	622 (99)	<0.001	1
Health and HIV							
Head of household has been tested for HIV	706 (77)	909 (100)	<0.001	385 (61)	612 (97)	<0.001	0
Reports to know of family planning (birth control) methods	591 (65)	881 (97)	<0.001	368 (59)	570 (91)	<0.001	0
Reports to have used methods of family planning[c]	389 (66)	656 (74)	<0.001	255 (69)	347 (61)	0.109	52
Water and sanitation							
Received education and training about hygiene and sanitation	287 (31)	908 (100)	<0.001	362 (58)	623 (99)	<0.001	0
Takes >30 min to acquire potable water and return	200 (22)	106 (12)	<0.001	152 (25)	99 (16)	<0.001	51
Household treats water to make it safer to drink	613 (67)	902 (99)	<0.001	316 (50)	623 (99)	<0.001	0
Uses flush or ventilated improved pit latrine as toilet facility	187 (21)	858 (94)	<0.001	97 (15)	120 (19)	0.069	1
Cooking facilities have appropriate ventilation	279 (32)	856 (95)	<0.001	313 (53)	598 (97)	<0.001	69[d]
Reports ownership of a bednet for use in household[e]	501 (55)	910 (100)	<0.001	282 (45)	612 (98)	<0.001	11

This table reports the number and (%) for each question in each year. The percentages represent the prevalence of the response among those who had a recorded answer to the survey question. The frequency of missing data is indicated in the final column of this table and was limited and non-differential across years

* The p value was estimated using a generalized estimating equation (GEE) that used robust standard errors to account for the clustering resulting from repeated measures of the same household over time

[a] For example, access to vaccinations for children, care in the event of fever or diarrhea

[b] Diarrhea is defined here as three or more loose or watery stools in one day

[c] Only those who reported that they knew of family planning methods were asked to answer this question

[d] 69 households ($n = 47$ at baseline and $n = 22$ in year 3) used electricity ($n = 33$ and $n = 5$ at baseline and year 3) or liquid gas propane ($n = 14$ and $n = 17$ at baseline and year 3) and were not included because this question did not apply to them

[e] Includes both untreated and insecticide-treated bednets

also improved (Table S3), based on the rise in those who reported having a confidant, somewhere to stay if needed, or who could lend them money if they needed it. At the end of the program, household heads in Uganda and Rwanda still reported at least some difficulty with usual activities, such as self-care, work or recreation (61 and 17%, respectively).

Child health and schooling

Among children 12–59 months of age, rates for most vaccines were near or above 80% in Rwanda at baseline and increased to about 90% with the exception of measles (Fig. 1). The baseline rates for all immunizations increased from roughly 50% to above 70% in Uganda (Fig. 1). The percent of children with kwashiorkor decreased from 14 to 1% overall.

School attendance reported as "always" among those aged 5–17 years increased to over 90% (from 71%) overall, with similarly large increases in each country. An improvement was observed in the percent of respondents reporting that their children had adequate school supplies (4–71% in Uganda, and 7–97% in Rwanda) and fewer respondents reported their children could not attend school regularly due to financial constraints (57–6% in Uganda, and 30–0% in Rwanda) or illness (Table 4).

Household economics and durable goods

Home ownership increased in Uganda (59–65%) and Rwanda (57–89%) as did ownership of several personal and household assets, such as a cell phone, household furniture and mattress, small and large livestock, and, in Rwanda only, a large increase in the ownership of additional land (Table 4). This corresponded with more households participating in IGAs for agriculture (4–48% in Uganda and 18–68% in Rwanda) and working with livestock (2–61% in Uganda and 2–28% in Rwanda) over the same time period.

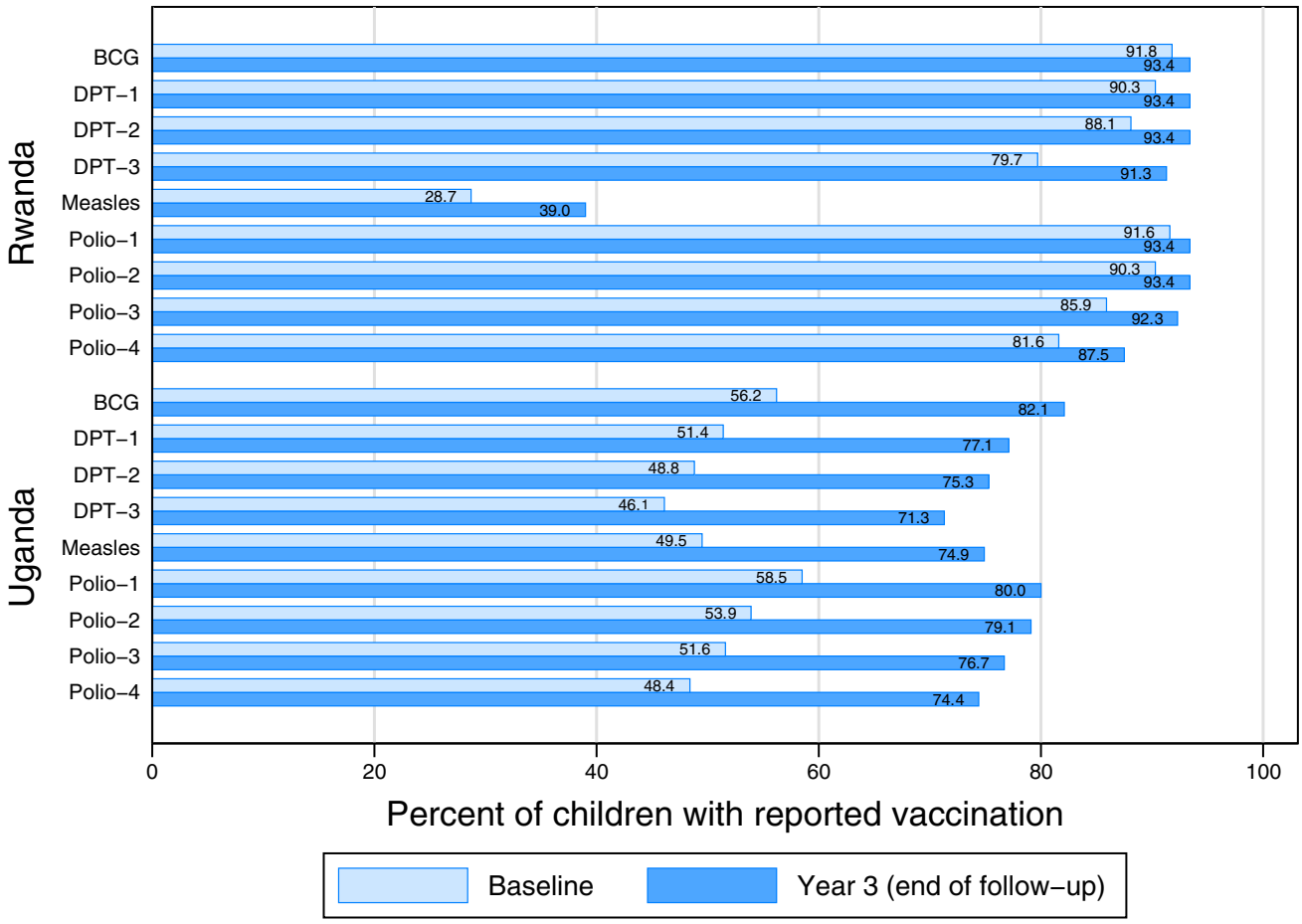

Fig. 1 Rates of vaccine coverage for children 12–59 months of age in FXBVillage households (Rwanda and Uganda, 2009–2012). All children >1 year of age were surveyed to acquire the status of their measles, bacille Calmette–Guérin (BCG), DTP (Diphtheria, Tetanus and Pertussis) [3 doses] and Polio [4 doses] vaccines using the WHO vaccination schedules (World Health Organization 2015)

Comparing changes among FXB households using DHS households

In Rwanda, where we compared the FXB households to the rural households surveyed in the 2010–2011 Rwanda DHS, a positive shift in the distribution of the wealth index from baseline to year 3 is visible for the FXBVillage households (Fig. 2). At baseline, FXB households were to the left of the DHS distribution, indicating they would be among the poorest rural DHS households sampled. The shift moves some of the households from being among the poorest towards the middle of the rural wealth distribution for Rwanda overall by year 3.

In Uganda, the asset index was more complicated to estimate because of significant differences in a few indicators, making the comparisons difficult. Additionally, several indicators were much higher at baseline in the FXB households than the DHS sample. For instance, almost all FXB households were reported as having a metal roof, but almost none of the DHS households reported a metal roof. Further, almost every household in both surveys reported cooking with wood or charcoal, so limited information could be derived from such assets. Moreover, some FXB households were near Kampala, so a countrywide wealth index might be overly conservative and a rural-only index may be too liberal, and both are susceptible to

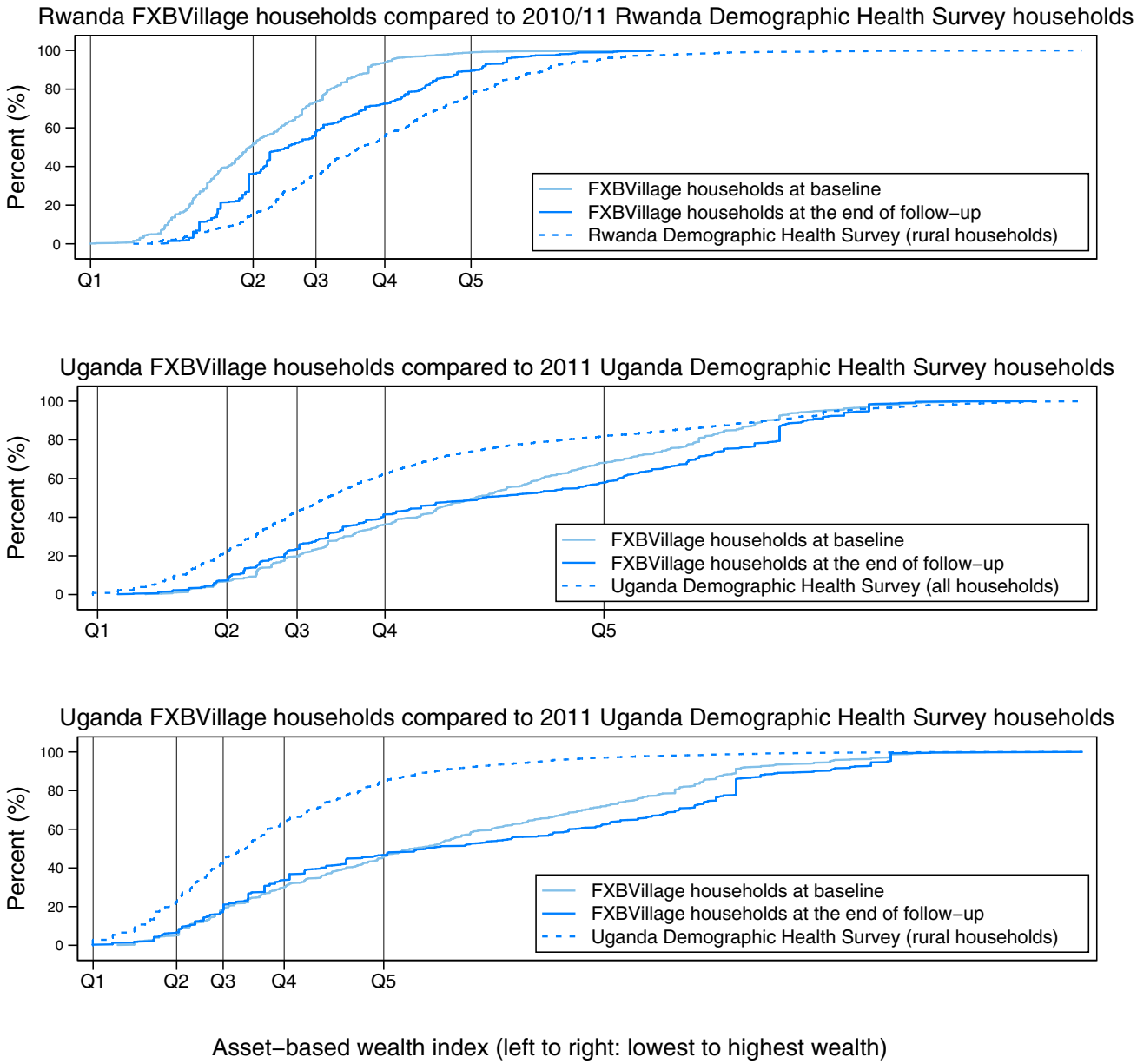

Fig. 2 Cumulative density functions of an asset-based wealth index in a pooled sample of FXBVillage and Demographic Health Survey households (Rwanda and Uganda, 2009–2012). Q1–Q5 reference the first to fifth quintile of the asset-based wealth index

misinterpretation. Thus, we compare the FXB households with the DHS data from Uganda using both all households and rural households, and using a modified wealth index without including roof material and cooking fuel. The bimodal distribution in both comparisons suggests that, over the course of the FXB initiative, about half of the Ugandan FXB households shifted their position away from poverty, while the other half did not (Fig. 2).

Discussion

The overall findings of this pre/post analysis of the FXBVillage program are encouraging. Relative to baseline, the evidence herein suggests that the FXBVillage program likely had a positive impact on participating households in both Rwanda and Uganda across a broad range of indicators. The magnitude of the positive changes may be related to the context. On a number of indicators greater advances were observed in Rwandan than Ugandan program sites.

Key findings of the pre/post analysis

Decreases in the occurrence (and attendant hospitalizations) of children with diarrheal disease and respiratory distress corresponded with increases in the percentage of households that treated their drinking water, used an improved latrine, and owned mosquito nets. Access to health care also appeared to improve, with substantial increases in up-to-date immunizations (especially in Rwanda; Fig. 1), HIV testing, knowledge of contraception, and health insurance coverage. Further, most psychosocial outcomes appeared to improve, suggesting greater emotional and financial empowerment among respondents. The inclusion of similar psychosocial questions in future initiatives would open opportunities to investigate the underlying mechanisms of economic development and potential contributions to success (and failure) of programs.

Improvement in school enrollment, attendance, and availability of adequate school supplies was observed during the first year of the FXBVillage program and sustained through follow-up (Tables 3, 4). The emerging evidence on educational initiatives suggests that targeting several domains is necessary to increase and sustain schooling (Kremer et al. 2013). It is notable that there was no increase in secondary school attendance, perhaps reflecting limits of local school infrastructure and opportunities or limited labor force prospects to motivate it.

The data suggest more stable food availability among participating households, evidenced by a significant

Table 3 Health and education status of FXBVillage youths, ages 0–17 years (Rwanda and Uganda, 2009–2012)

	Rwanda (n = 912 households)			Uganda (n = 628 households)		
	Baseline	Year 3	p value for change*	Baseline	Year 3	p value for change*
Children <age 5 (0–59 months)						
Total children in all households (n)	777	462		556	469	
Has been tested for HIV	135 (17)	378 (82)	<0.001	117 (21)	229 (49)	<0.001
Able to produce immunization card to staff	543 (70)	409 (89)	<0.001	227 (41)	336 (72)	<0.001
Immunization card up-to-date	484 (62)	413 (89)	<0.001	179 (32)	313 (67)	<0.001
Child has symptoms of kwashiorkor	160 (21)	10 (2)	<0.001	25 (4)	0 (0)	<0.001
Children ages 5–17						
Total children in all households (n)	2337	2425		2352	2674	
Official birth registration	1917 (82)	2366 (98)	<0.001	639 (27)	791 (30)	0.20
Has been tested for HIV	596 (26)	2212 (91)	<0.001	516 (22)	2173 (81)	<0.001
Currently enrolled in school	1765 (76)	2097 (86)	<0.001	1915 (81)	2354 (88)	<0.001
School attendance reported as "always"	1501 (79)	2123 (97)	<0.001	1405 (64)	2314 (89)	<0.001
Children ages 12–17						
Total children in all households (n)	1057	1021		1230	1387	
Highest level of school attended			0.94			<0.001
Primary	767 (81)	787 (81)		752 (63)	760 (55)	
Secondary	141 (15)	169 (17)		278 (23)	409 (30)	
School attendance reported as "always"	728 (77)	944 (97)	<0.001	751 (63)	1184 (86)	<0.001

This table reports the number and (%) for each question in each year

* The p value was estimated using a generalized estimating equation (GEE) that used robust standard errors to account for the clustering resulting from repeated measures of the same household over time

Table 4 FXBVillage household economics and durable goods (Rwanda and Uganda, 2009–2012)

	Rwanda ($n = 912$ households)			Uganda ($n = 628$ households)		
	Baseline	Year 3	p value for change*	Baseline	Year 3	p value for change*
Children have adequate school supplies[a]	65 (7)	883 (97)	<0.001	24 (4)	444 (71)	<0.001
Reason any child in household does not attend school						
Lack of financial means	277 (30)	1 (0)	<0.001	357 (57)	38 (6)	<0.001
Illness	47 (5)	3 (0)	<0.001	50 (8)	21 (3)	<0.001
Household assets						
Radio	368 (40)	746 (82)	<0.001	362 (58)	486 (77)	<0.001
Mobile phone	79 (9)	480 (53)	<0.001	248 (39)	423 (67)	<0.001
Bicycle	39 (4)	101 (11)	<0.001	123 (20)	168 (27)	<0.001
Furniture	231 (25)	600 (66)	<0.001	353 (56)	442 (70)	<0.001
Mattress	140 (15)	423 (46)	<0.001	488 (78)	577 (92)	<0.001
Refrigerator	6 (1)	7 (1)	0.782	33 (5)	30 (5)	0.681
Home	516 (57)	815 (89)	<0.001	371 (59)	410 (65)	0.002
Additional land	475 (52)	795 (87)	<0.001	329 (52)	305 (49)	0.052
Small livestock	257 (28)	647 (71)	<0.001	203 (32)	312 (50)	<0.001
Large livestock	155 (17)	573 (63)	<0.001	97 (15)	203 (32)	<0.001
Workforce participation and training						
Household member works for outside enterprise	568 (62)	345 (38)	<0.001	117 (19)	172 (27)	<0.001
Household member works for themselves or the household	635 (70)	678 (74)	<0.001	169 (27)	324 (52)	<0.001
Microcredit training	40 (4)	844 (93)	<0.001	197 (31)	606 (97)	<0.001
Member of income generation activity group	256 (28)	897 (98)	<0.001	1 (0)	473 (76)	<0.001
Agriculture	18%	68%		4%	48%	
Livestock	2%	28%		2%	61%	
Commerce	0.3%	2%		0.8%	7%	

This table reports the number and (%) for each question in each year

* The p value was estimated using a generalized estimating equation (GEE) that used robust standard errors to account for the clustering resulting from repeated measures of the same household over time

[a] This includes uniform, shoes, notebook, pencils, etc

decrease in the percentage of households that went without food for at least one day, and a significant increase in the average number of meals consumed per day in the past three months (Table 2). It is important to note that this was not the case for all households. Expanded assistance may be needed for households that cannot cultivate household gardens, as encouraged by FXB. Examination of the data by year shows that the rate of success in food stability and quantity increased monotonically over time, and not immediately, suggesting household change and not merely externally provided support.

Wealth index comparison

Applying the wealth index approach to DHS and FXBVillage data, our analysis suggests that, among a large sample of households in each country, there was an observable change in the relative poverty status of the FXB households at the end of the program relative to their starting position.

There are methodological limitations to this part of our analysis. First, considering the observed shift in FXB household wealth relative to the DHS data, it is possible that some of the lag to the left of the DHS distribution shown by the FXB households at baseline is an artifact of economic and social development that occurred in the country after the baseline survey and before the DHS survey. However, it is unlikely that such large changes in household economics as were seen among the FXBVillage households would be seen within 1–1.5 years across the nation. Nonetheless, the imperfect alignment of the available DHS surveys to the time of FXBVillage data collection is a limitation. Second, the DHS households were analyzed without their survey weights, so they may

not be nationally representative, and can only be considered as a cohort of households surveyed in both countries. A third important limitation is the omission of several important assets that could impact the distribution of the wealth index. This limitation can be seen by comparing Fig. 2, panel b to c, where the shape of the wealth index changes substantially with the removal of urban households in Uganda. Similar changes could occur with additions of other commonly collected assets that the FXB survey did not capture (Rutstein 2008; Rutstein and Johnson 2004). Acknowledging the above limitations, these results complement the primary pre/post results and suggest that the changes in FXB beneficiary households were meaningful, even when considering the additional limitations discussed below.

Limitations

There are good reasons to not infer strong conclusions about program impact from pre/post comparisons, which do not disentangle the effects of the program from the influence of context. A drought can change agricultural productivity, or a presidential campaign can inspire rapid injection of capital into a health system; these and other kinds of factors external to the articulated program can bias the observed outcomes. To understand how and why programs do and do not work, these interactions can indeed be crucial considerations. Advances in the overall health system in Rwanda as compared to Uganda, for example, could in part explain why greater improvements on a number of outcomes were observed in Rwanda compared with Uganda. In Rwanda the FXBVillage Program staff had the opportunity to work within the context of a supportive government, sharing the same goal of poverty reduction and advancing health outcomes. The context may have either contributed to improvements or synergistically enabled the program to perform better (Binagwaho et al. 2013). In either case, given that improvements were also observed in Uganda without the same level of government commitment understood to exist in Rwanda, the evidence suggests that the FXB program may have had a positive effect on a number of health, education, and economic outcomes. Further, neither quantitative nor qualitative data was collected to assess the implementation of different FXBVillage components to beneficiary households. Some of the variability may be attributable to meaningful differences in the implementation of program components.

The potential for bias is inherent in this study. The assessed indicators are largely self-reported by program participants, and 'social desirability' may artificially inflate the observed improvements (Zwane et al. 2011). Use of items, such as bednets, may vary from what program implementers understand to be "best practices." Still, concrete outcomes, such as the increase in home assets like a radio or mattress or mobile phone, are less prone to bias and were also positive. Finally, there are other indicators that were not collected or could not be evaluated, and these could potentially be informative. For example, MUAC data was collected but analyses were too limited by collection design to include in the study results.

Conclusions and implications for ultra-poor poverty alleviation programs

Although very few poverty reduction programs share the combination used in the FXB model, specific microfinancing initiatives (Imai et al. 2012; van Rooyen et al. 2012) and cash transfer programs have been widely used (Baird et al. 2013). Success rates vary, but these are generally seen as promising economic initiatives that improve spending power and retention of household assets among participant households. The FXBVillage program provides integrated support in nutrition, health, housing, and education to meet the participants' basic needs for three years. The pillar of the program is economic empowerment of households through startup capital and training to launch income-generating activities (IGA). Over the three years of the program, FXB's financial support is scaled down as participants increasingly contribute to their families' nutritional, educational, and medical costs, taking an active role in building lives of greater self-sufficiency.

There have been similar 'hybrid' approaches pursued, including the Bangladesh Rural Advancement Committee's (BRAC's) "Challenging the frontiers of poverty reduction/targeting ultra-poor, targeting social constraints" and the Millennium Villages Project (MVP), that aim to combine aspects of initial immediate assistance (or capital investment) while providing training intended to prepare households for transitioning to long-term economic security. Working with the 'ultra-poor' in Bangladesh, BRAC provides up front 'capital' inputs as well as improved health services to increase the capacity of households to transition to their standard microfinancing program (Ahmed 2009). Similarly, contributions of fertilizer, improved seeds, and agricultural training in the MVP led to improvements in crop yields and farmers' profits in Mali, Tanzania, Senegal, and Kenya (Buse et al. 2008; Sanchez et al. 2007).

The integrated transition that this program has employed has been successful in other settings (Mulenga 2002; Schenk 2009). Integration requires work, however, and this aspect of the program needs more attentive study. A key aspect of the FXB program is the strong social relationships among staff and household members; the nature and quality of these relationships is likely important to the short and long-term effectiveness of the program. Community involvement from the organizing stages may also be

important. Furthermore, income-generation is one goal in a program aimed at comprehensive well-being and community strengthening across households. This study suggests that working within the context of a supportive environment, such as a government with progressive social policies, may result in greater improvements. These are important areas for future programs and evaluations to consider.

In summary, the results of this initial assessment suggest that the presence of the FXBVillage Program is associated with an improvement in many indicators of poverty in the targeted Ugandan and Rwandan households measured in this study. Future work is necessary to make stronger statements about the effects of the FXBVillage program, including whether positive effects can be sustained over time and if and how to intervene upon the domains that were not successful. This should involve the study of interactions within programs and between programs and implementation settings.

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Compliance with ethical standards

Conflict of interest We have read the journal's policy and the authors of this manuscript have the following competing interests: SJ, DN and WK are paid employees of FXB. These authors did not have a direct role in the evaluation design, methods or reporting of the results, but were responsible for the collection of the data, providing a local relevance and interpretation of the results and in drafting the introduction and discussion and other important intellectual contributions to the manuscript. DSS was paid by FXB a consulting fee for conducting an evaluation of FXB's program. Having received funding from FXB, the consultancy could reasonably be perceived as a financial competing interest. MOH, MCSF and EAA declare that he/she has no conflict of interest.

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Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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