



Health Education Training Embedded in a Microfinance Platform Associated with Safer Sexual Behavior in Haitian Women

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Abstract

Sexual health education interventions have generally yielded modest impact, but may be more successful when integrated into programs designed to alleviate poverty and empower women. Between December 2017 and February 2018, we interviewed 304 Haitian female microfinance clients, 75 of whom had received health education training delivered within their regular meetings. Participants reported six key sexual health outcomes. We used log-binomial models to estimate the association between health education training and each outcome, and tested for interaction by age and literacy status. Women with health education training reported more condom use with unfaithful partners [PR (95% CI) 1.78 (1.04, 3.02)], more HIV testing [PR (95% CI) 1.56 (1.28, 1.90)], and fewer STI symptoms [PR (95% CI) 0.37 (0.19, 0.73)], compared to women with no training. Some of the associations were stronger among older women [e.g. HIV testing: PR (95% CI) 2.09 (1.49, 2.82)] and illiterate women [e.g. condom use: PR (95% CI) 3.46 (1.05, 11.38)]. These findings add to the growing body of evidence demonstrating the potential to use microfinance programs as platforms for health education delivery, and provide the first evidence for the association in Haiti.

Keywords Microfinance · HIV · STI · Sexual behavior · Haiti

Introduction

Despite decades of public health education and intervention, global HIV and sexually transmitted infection (STI) prevalence remain unacceptably high, particularly in resource-poor settings like Haiti [1]. In 2016, approximately 150,000 Haitians were living with HIV, accounting for more than half of all HIV infections and AIDS-related deaths in the Caribbean [2–4]. The burden of HIV disproportionately affects Haitian women. In 2016, the prevalence of HIV in Haitian women was estimated at 2.3% compared to 1.9% among Haitian men [3]. Other STIs also occur at high rates in Haitian women. Chlamydia, gonorrhea, syphilis, and trichomoniasis have all been documented as common infections in Haitian women in multiple studies from 2000 to 2014 [5–8]. Educational campaigns have long been deployed

in attempt to reduce the spread of HIV and STIs. Yet few evidence-based educational interventions have proven to be effective at increasing uptake of safer sexual behaviors [9]. For example, despite widespread condom campaigns in Haiti, condom use among Haitians remains quite low. In the most recent Demographic and Health Survey (DHS) in 2016–2017, less than half of Haitian women with multiple sexual partnerships reported using a condom at last sex [10]; these estimates were essentially unchanged from those measured in the previous DHS survey in 2012 [11]. One potential explanation for the low efficacy of educational interventions for sexual health promotion is that they fail to address the underlying structural drivers of HIV and STI transmission.

Poverty is consistently identified as an upstream driver of HIV and STI transmission, particularly among vulnerable women [12, 13]. This study was conducted in Haiti, a low-income country with 60% of the 10 million inhabitants living below the poverty line [14]. In Haiti, STI and HIV rates tend to be higher among people with lower socioeconomic status [5, 8, 15]. One plausible mechanism for the relationship between socioeconomic status and poor sexual health outcomes is that insufficient financial resources could limit access to condoms, HIV testing, and STI treatment and

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care [16]. Another plausible mechanism, in line with the Theory of Gender and Power [17], is that women who are economically dependent on their male partners are unable to negotiate for safer sex within their relationships for fear of losing economic stability [18, 19]. For these reasons, poverty alleviation has become a key target for HIV prevention and sexual health promotion in lower-income countries [20].

Thus, it is possible that sexual health education interventions may be more successful when combined with programs designed to alleviate poverty and empower women [21–23]. Microfinance organizations are designed to alleviate poverty by lending small amounts of money to fund income generation projects and foster economic independence in resource poor settings [24]. These microfinance programs almost exclusively serve women and often have an explicit goal to improve the health and well-being of clients [24–26]. To that end, additional health-promotional activities like health education are often incorporated into and delivered through the microfinance framework [22, 25]. Generally positive findings about the effectiveness of delivering sexual health education through a microfinance platform have been observed in Mongolia [27], and India [28], more mixed results were observed in South Africa [29] and Colombia [30]. However, no prior studies have been conducted on the subject in Haiti [31, 32].

In this study, we analyze survey data provided by clients of a Haitian microfinance organization to better understand the relationship between health education training and sexual health behaviors in a microfinance program context.

Methods

Study Setting and Study Population

This study was conducted in partnership with Fonkoze, Haiti's largest microfinance organization, which has been serving Haitians living in poverty since 1994 [33]. Fonkoze has wide geographic reach with 44 branch offices across all 10 departments of Haiti and serves primarily women. Fonkoze's most utilized service is the solidarity lending program, in which groups of five women organize together to take out and repay loans. In general, Fonkoze provides clients with increasing loan sizes and opportunities as they progress through the program; solidarity group loans range in size from US\$100 up to US\$1300. Fonkoze also has a history of integrating educational programs and training into its framework, offering separate training modules on business skills (e.g. asset management and strategic planning), life skills (e.g. disaster preparedness), literacy (e.g. reading and writing), and health education (e.g. nutrition and HIV/STI prevention).

Between December 2017 and February 2018, we conducted a cross-sectional survey with clients served by the Fonkoze branch office in Okay, Haiti. Okay is a port city on Haiti's southern peninsula with a population of approximately 70,000. Fonkoze has served clients in the Okay area since 1996. There are over 200 smaller client centers served by this regional branch office, and, in total, the Okay branch office currently serves over 6200 Fonkoze clients in the city of Okay and surrounding towns. This branch office was selected because the large population it serves allowed us a sufficient target population size from which to sample, because the length of time it has offered services in the area meant that we would expect to see intervention impact if it existed, and because local branch leadership were interested and willing to collaborate on the project.

We used the complete client database of the Okay Fonkoze branch office in 2017 as a sampling frame to identify a random sample of current clients for interview. Clients were eligible to participate if they were current Fonkoze clients served by the Okay branch office, female, and between the ages of 18–49 years. This age range was chosen to limit the study population to women of reproductive age, and to maximize the chance that we would enroll a study population for whom questions about sexual and reproductive health would be most relevant.

Households of potential participants were contacted in person up to three times. If the potential participant was home, fieldworkers gave her information about the study. Study information scripts emphasized that participation in the study would be completely voluntary and that refusal would have no influence on Fonkoze membership or future access to microloans. Those who elected to participate provided written informed consent. Ethical approval for this study's protocol was obtained from Indiana University's Human Subjects Office (Protocol #1705661852). The study protocol was further reviewed and approved internally by Fonkoze.

Health Education Training

Fonkoze trainings are delivered at the client center level and client center chiefs make the decisions about whether their members receive health education training. Client centers are collections of around 8–12 solidarity groups (approximately 40–60 total members) that meet together bi-monthly to repay loans and receive training. Client center chiefs are Fonkoze clients chosen by the client center members to represent them. The health education training is delivered over the course of approximately 12 monthly meetings by the center chiefs who have volunteered to facilitate the education delivery. Interested center chiefs travel to the branch office for initial training in the curriculum by a nurse. The curriculum was developed by Fonkoze health programmers

in partnership with USAID and the Haitian Ministry of Health, and based on material originally developed by UNICEF [34]. It covers a broad range of topics including: child nutrition, hygiene, HIV/AIDS, and reproductive health, and is presented in picture-based handbooks. Much of the relevant sexual health education is given in the HIV/AIDS module, including sub-topics on: modes of transmission; testing and counselling; prevention of sexual transmission (reducing sex partners, practicing mutual monogamy, and using condoms consistently and correctly); and identifying, testing, and treating other STIs. The sexual health education content is generally delivered over the course of 3–4 monthly meetings.

Data Collection Procedures

Four local fieldworkers were recruited and hired using Fonkoze's standard hiring procedures based on previous experience with monitoring and evaluation. Prior to study start, a 3-day training, led by the study investigators, educated the fieldworkers on research ethics, and familiarized them with the study instruments and standard operating procedures. All data used in this study were collected electronically in tablet-based surveys, designed and administered with REDCap web and off-line mobile applications. The instrument was translated from English to Haitian Creole with back-translation to ensure proper translation, and the survey was conducted exclusively in Haitian Creole. The surveys were conducted in a private location in the participant's home though other private locations were made available as requested by the participant. Data were collected on a broad range of topics including physical and economic well-being: sociodemographics, infectious disease risk, microfinance experience, natural disaster resilience, and sexual behavior.

Key Variables

The primary exposure of interest was receipt of the Fonkoze *health education training*. Participants were asked about which of four possible Fonkoze trainings they had received. Those who responded 'yes' to having received the health education training were considered exposed.

We assessed six sexual health outcomes. Of the women who reported having a sex partner in the last 12 months, (1) *condom use* was measured by the self-reported response to the question: 'Did you use a condom the last time you had sex with your most recent partner (Yes/No)?' Because some women may choose not to use condoms if they feel confident in the monogamous nature of their relationship, we also assessed (2) *condom use with an unfaithful partner*, considering condom use at last sex in the sub-population of women who reported their most recent partner had sex with

someone else during their relationship, or who were unsure about their partners' outside partnership sexual activity. We assessed (3) *HIV test status* by identifying the women who reported ever having tested for HIV and who's most recent test dates were within the last 12 months from their interview date. We assessed (4) *transactional sex* based on participant responses to a query about if they felt obligated to have sex with a partner because of gifts or money they were provided. This broad definition encompasses both formal and informal transactional sex, and has been previously used in multiple HIV prevention studies across a range of low-resource settings [35–40]. We assessed (5) *recent STI diagnosis* by querying if participants had a doctor tell them they had any of the following STIs: chlamydia, gonorrhea, syphilis, or trichomoniasis within the last 12 months from the interview date. Finally, we assessed (6) *recent STI symptoms* by querying whether participants had any of the following symptoms suggestive of a STI in the last 12 months: bad-smelling abnormal genital discharge, genital sore, or genital ulcer.

To contextualize the study population and to control for potential confounding, we also assessed several key socio-demographic covariates: Age, in years; marital status, categorized as currently married or living as married, divorced or separated, and never married; educational attainment, categorized as none, preschool or primary, and secondary and higher; literacy, defined as the self-reported ability to read, verified with a test sentence in Haitian Creole; household size, defined as the number of people sharing the participant's household; and household assets, defined as the self-reported value (in Haitian gourdes, at time of purchase) of 20 potential items in the participants' households. Example items in the list of household items we queried were oven, television, radio, and refrigerator. If the household did not contain an item, the value was coded as 0. We categorized the household asset index in quartiles, from lowest (Q1) to highest (Q4). We also assessed several variables to characterize the participants' experiences with the microfinance program, including the duration of program membership (in months), the size of their most recent microloan (in Haitian Gourdes), and the size of their savings account (in Haitian Gourdes).

Statistical Analysis

We used log-binomial models to estimate prevalence ratios for the relationship between exposure to the health education training program and each of the six sexual health outcomes. Because of the way the health education training exposure was allocated (decisions not by individual clients but by client center chiefs), we expected those who received and did not receive the training to be fairly well-balanced in terms of covariates. As a sensitivity analysis to test this assumption,

we also adjusted the log-binomial models for age and education to compare the magnitude of the associations between adjusted and unadjusted analyses. We chose to run the sensitivity analyses with age and education as they are both strong predictors of sexual health outcomes.

We conducted two post hoc subgroup analyses to assess whether the relationship between health education training and sexual health differed by age and by literacy status. To do so, we incorporated interaction terms between health education training (yes/no) and age (above/below median age of 36), and between health education training (yes/no) and literacy (yes/no). We assessed whether the effect estimates for the subgroups (by age and literacy status) were statistically different from each other with Wald tests for the interaction terms. Wald test statistics with p -values < 0.05 were considered statistically significant. All statistical analyses were performed using SAS 9.4 (Cary, NC) [41].

We georeferenced the location of each household survey using ArcGIS Online mapping tools to visually assess the geographic distribution of households of clients who did and did not receive the health education training. We further checked for spatial clustering of locations using Kull-dorff's spatial scan statistic in SaTScan software (Information Management Services, Boston, MA, USA) in order to ensure similar geographic distributions among those who did and did not receive the health education training [42]. Specifically, a Bernoulli model was used to scan for clustering of household locations in each group. A maximum spatial cluster size of 50% of the total population was used. For statistical inference, 999 Monte Carlo replications were performed. The null hypothesis of no spatial clustering was rejected when the simulated p value ≤ 0.05 .

Results

We approached 349 women for potential participation (Fig. 1). We excluded 41 women because they did not meet eligibility criteria (outside of age range 18–49 or no longer a Fonkoze client), we were unable to locate three women, and one woman refused to participate. A total of 304 Fonkoze clients enrolled in this study and completed surveys for an overall participation rate of 98.7% among those eligible to participate.

The participants ranged in age from 20 to 49 with a median age of 36 years (interquartile range 30.0 to 42.5 years) (Table 1). Most of the women were currently married (55.0%). Educational attainment was relatively low, with 16.9% of women reporting no formal education and 39.5% reporting attainment at the preschool or primary school level. Over a quarter of the women (25.9%) reported being unable to read. The participants shared households with an average of 4.9 members. With respect to their

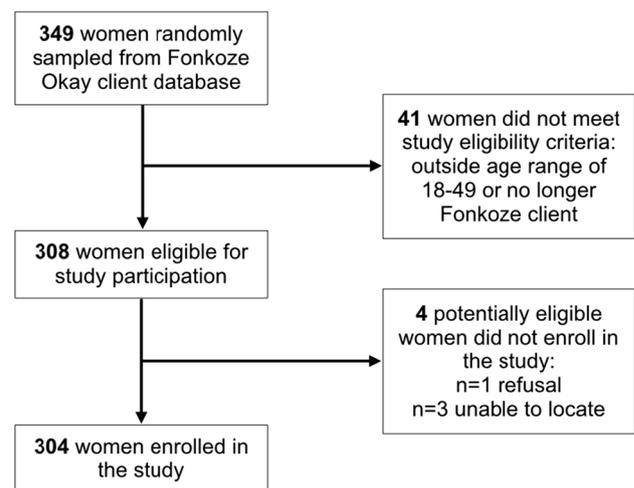


Fig. 1 Flowchart detailing recruitment and enrollment of 304 female Haitian microfinance clients, 2017–2018

experience with the microfinance program, the average participant had been a member for 29.3 months, with an average loan size of 8478 Haitian Gourdes (approximately USD\$135), and an average savings account size of 2128 Haitian Gourdes (approximately USD\$34).

One quarter (24.7%) of the participants reported receiving the health education training. Visual inspection of the geographic distribution of the health education training suggested it was similar to the overall distribution of the surveys we conducted (Fig. 2). This was confirmed statistically; no clusters were detected with our cluster analysis.

There were no significant sociodemographic differences between participants who received and did not receive the health education training. Women who received the training were similar to women who did not with respect to marital status, literacy status, household asset quartiles, household size, duration of Fonkoze membership, and savings account size. Although the differences were not statistically significant, women who received the training tended to be slightly older, slightly less educated, and had slightly larger loan sizes than women who did not receive the training.

Sexual behaviors and sexual risk outcomes reported by the participants were consistent with ongoing STI transmission (Table 1). Only one-fifth of the participants reported using a condom at last sex (20.7%) and condom use did not markedly increase when they reported being unsure if their partner had outside sex partners (21.5%). Slightly more than half of the participants had been tested for HIV in the last 12 months (53.7%), while more than 40% reported feeling obligated to have sex with their partners in return for gifts or money (41.2%). A quarter of participants reported symptoms consistent with an STI in the last 12 months (25.0%), and just over 10% of the participants had been diagnosed with an STI in the last 12 months (10.8%).

Table 1 Characteristics of the study population of 304 female Haitian microfinance clients, 2017–2018

Socio-demographic characteristics	Total N = 304 N (%)	Health education training		p ^a
		Yes N = 75 N (%)	No N = 229 N (%)	
Age				0.2
20–29	69 (22.7)	12 (16.0)	57 (24.9)	
30–39	127 (41.8)	32 (42.7)	95 (41.5)	
40–49	108 (35.5)	31 (41.3)	77 (33.6)	
Marital status				0.8
Currently married	164 (55.0)	42 (57.5)	122 (54.2)	
Divorced/separated	26 (8.7)	7 (9.6)	19 (8.4)	
Never married	108 (36.2)	24 (32.9)	84 (37.3)	
Missing	6	2	4	
Education				0.3
None	51 (16.9)	17 (22.0)	34 (15.0)	
Preschool/Primary	119 (39.5)	26 (35.1)	93 (40.0)	
HS or more	131 (43.5)	31 (41.9)	100 (44.1)	
Missing	3	1	2	
Literacy				0.6
Yes	223 (74.1)	54 (72.0)	169 (74.8)	
No	78 (25.9)	21 (28.0)	57 (25.2)	
Missing	3	0	3	
Household asset quartile ^b				0.5
Q1	75 (24.8)	23 (31.1)	52 (22.8)	
Q2	76 (25.2)	18 (24.3)	58 (25.4)	
Q3	75 (24.8)	16 (21.6)	59 (25.9)	
Q4	76 (25.2)	17 (23.0)	59 (25.9)	
Missing	2	1	1	
	Mean (SD)	Mean (SD)	Mean (SD)	p ^a
Household size	4.9 (1.86)	4.9 (1.66)	4.9 (1.93)	1.0
Microfinance membership characteristics	Mean (SD)	Mean (SD)	Mean (SD)	p ^a
Duration of microfinance membership (months)	29.3 (36.2)	25.8 (27.4)	30.4 (38.7)	0.3
Current loan size (Haitian gourdes ^c)	8478 (7663.5)	9747 (7579.9)	8062 (7661.4)	0.1
Savings account balance (Haitian gourdes ^c)	2128 (1885.2)	2259 (1544.2)	2085 (1985.4)	0.5
Sexual health outcomes	N (%)	N (%)	N (%)	p ^a
Condom use at last sex ^d				0.08
Yes	48 (20.7)	18 (28.1)	30 (17.9)	
No	184 (79.3)	46 (71.9)	138 (82.1)	
Missing	11	0	11	
Condom use at last sex with unfaithful partner ^e				0.04
Yes	42 (21.5)	17 (31.5)	25 (17.7)	
No	153 (78.5)	37 (68.5)	116 (82.3)	
Missing	1	0	1	
HIV test ^f				<0.0001
Yes	158 (53.7)	55 (73.3)	103 (47.0)	
No	136 (46.3)	20 (26.7)	116 (53.0)	
Missing	10	0	10	
Transactional sex ^g				0.7
Yes	112 (41.2)	32 (43.2)	80 (40.4)	

Table 1 (continued)

Sexual health outcomes	N (%)	N (%)	N (%)	p ^a
No	160 (58.8)	42 (56.8)	118 (59.6)	
Missing	32	1	31	
STI diagnosis ^f				0.5
Yes	30 (10.8)	6 (8.6)	24 (11.5)	
No	248 (89.2)	64 (91.4)	184 (88.5)	
Missing	26	5	21	
STI symptoms ^f				0.001
Yes	74 (25.0)	8 (11.0)	66 (29.6)	
No	222 (75.0)	65 (89.0)	157 (70.4)	
Missing	8	2	6	

^ap-value reported for Chi square test for categorical variables and t-test for continuous variables. p-values calculated among observations with non-missing values

^bMeasured by adding up the self-reported value (at time of purchase) of 20 key items in participant's household

^cIn January 2018 (midpoint of study), USD\$1 was roughly equivalent to 62.5 Haitian gourdes

^dAmong those with at least one sex partner in the last year (n = 243)

^eAmong those who endorsed that their most recent partner (in last 12 months) had sex with others or who were unsure whether they had sex with others (n = 196)

^fIn last 12 months

^gReports feeling obligated to have sex with most recent partner (in last 12 months) in return for gifts or money

Receipt of health education training was generally associated with less risky sexual behaviors (Table 2). Women with health education training were 58% more likely to report condom use at last sex compared to women with no health education training [PR (95% CI) 1.58 (0.95, 2.62)], though the confidence intervals for this association included the null. When restricted to women whose partners may have had outside sex partners, receipt of health education training was associated more strongly with condom use at last sex [PR (95% CI) 1.78 (1.04, 3.02)]. Women who received health education training were 56% more likely to have recently tested for HIV [PR (95% CI) 1.56 (1.28, 1.90)], and 63% less likely to report recent STI symptoms [PR (95% CI) 0.37 (0.19, 0.73)]. No significant associations were observed between health education training and either transactional sex or STI diagnosis. After adjustment for age and education, the magnitudes of the associations were essentially unchanged.

Some differences existed in the associations by age and literacy status (Table 3). The associations between health education training and the two condom use outcomes were particularly strong for older women (ages 36–49 years). For example, older women with health education training were more than two times as likely to have a recent HIV test compared to older women with no training [PR (95% CI) 2.05 (1.49, 2.82)] while the association for younger women was closer to the null: [PR (95% CI) 1.27 (0.99, 1.62)]. The associations between health education training also tended to be stronger among illiterate women, however these interactions

were not statistically significant. For example, among illiterate women, health education training was associated with a nearly 3.5 fold increase in condom use at last sex [PR (95% CI) 3.46 (1.05, 11.38)] while only a 30% increase among literate women [PR (95% CI) 1.29 (0.62, 2.29)]. The interaction terms between age and health education training were statistically different from zero for the following outcomes: Condom use at last sex with unfaithful partner (p = 0.03) and HIV testing (p = 0.02). None of the interaction terms between literacy and health education training were statistically different from zero at p < 0.05, but the following outcomes were borderline significant: condom use at last sex (p = 0.1) and condom use at last sex with unfaithful partner (p = 0.09).

Discussion

In this study of 304 Haitian microfinance clients, we found that women who received health education training generally reported safer sexual health outcomes than women who did not. Even though the training was not exclusively focused on sexual health, we saw strong associations with specific sexual health outcomes. Women who received the training were over 50% more likely to use condoms, over 50% more likely to have a recent HIV test, and over 60% less likely to report recent STI symptoms. These findings add to the growing body of evidence that demonstrates the potential for microfinance programs to be used as an effective platform

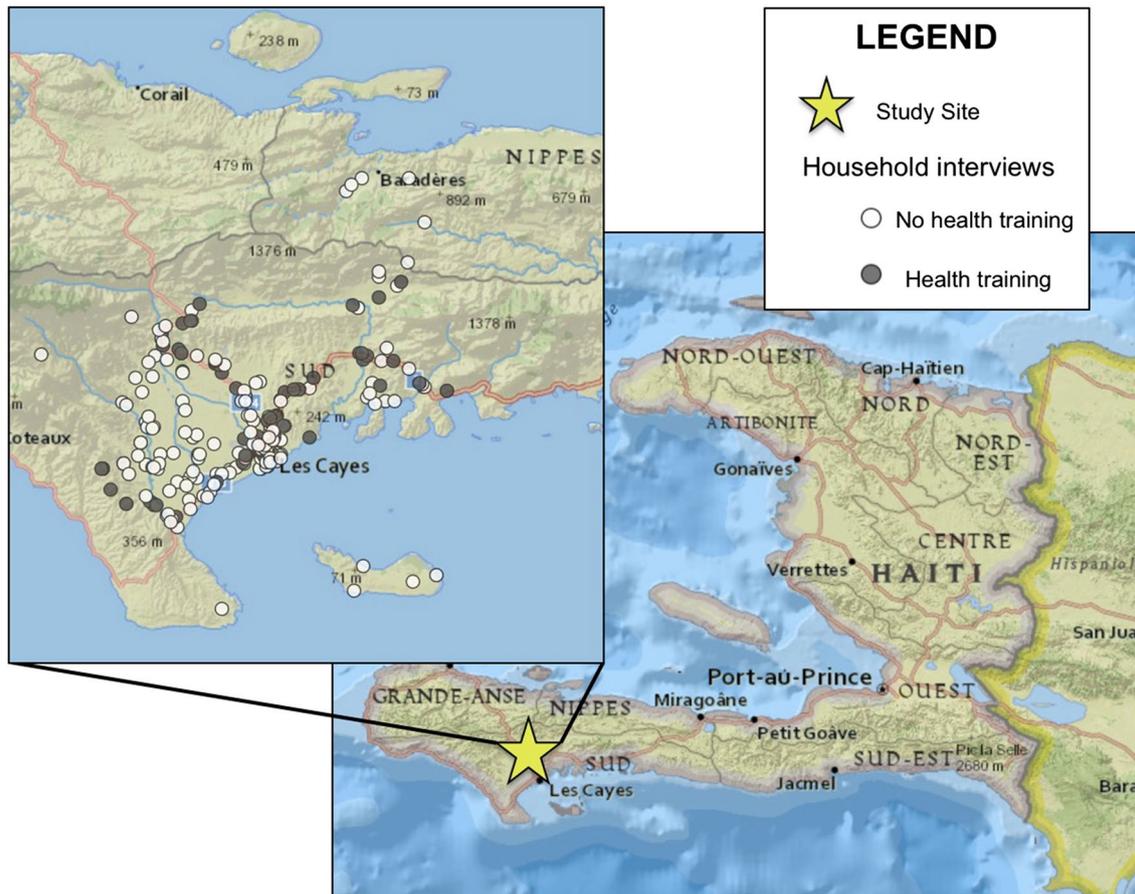


Fig. 2 Map of study site and geographic distribution of the household surveys and health education training. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC

Table 2 Relationship between receipt of health education training and sexual health outcomes

	Unadjusted			Age + education adjusted ^a		
	PR (95% CI)	p		aPR (95% CI)	p	
Condom use at last sex ^b	1.58 (0.95, 2.62)	0.08		1.54 (0.94, 2.55)	0.09	
Condom use at last sex with unfaithful partner ^c	1.78 (1.04, 3.02)	0.03		1.70 (1.00, 2.86)	0.05	
HIV test ^d	1.56 (1.28, 1.90)	<0.0001		1.50 (1.23, 1.81)	<0.0001	
Transactional sex ^e	1.07 (0.78, 1.46)	0.7		1.08 (0.79, 1.47)	0.6	
STI diagnosis ^d	0.74 (0.32, 1.74)	0.5		0.73 (0.31, 1.71)	0.5	
STI symptoms ^d	0.37 (0.19, 0.73)	0.004		0.36 (0.18, 0.72)	0.004	

^aAdjusted for age with cutpoint at above/below median age of 36 and for education with cutpoint at any versus no formal schooling

^bAmong those with at least one sex partner in the last year (n=243)

^cAmong those who endorsed that their most recent partner (in last 12 months) had sex with others or were unsure whether they had sex with others (n=196)

^dIn last 12 months

^eReports feeling obligated to have sex with most recent partner (in last 12 months) in return for gifts or money

Table 3 Relationship between receipt of health education training and sexual health outcomes, stratified by age and literacy status

	Age 20–35			Age 36–49			Literate			Illiterate		
	PR (95% CI)	P		PR (95% CI)	P		PR (95% CI)	P		PR (95% CI)	P	
Condom use at last sex ^a	1.15	(0.60, 2.20)	0.7	2.78	(1.17, 6.60)	0.02	1.29	(0.72, 2.29)	0.4	3.46	(1.05, 11.38)	0.04
Wald p-value for interaction term			0.1			0.004			0.2			0.1
Condom use at last sex with unfaithful partner ^b	1.11	(0.56, 2.22)	0.8	4.40	(1.62, 11.93)	0.004	1.41	(0.79, 2.50)	0.2	6.00	(1.62, 29.04)	0.03
Wald p-value for interaction term			0.03			0.03			<0.0001			0.09
HIV test ^c	1.27	(0.99, 1.62)	0.06	2.05	(1.49, 2.82)	<0.0001	1.55	(1.25, 1.91)	<0.0001	1.62	(1.01, 2.61)	0.05
Wald p-value for interaction term			0.02			0.8			0.8			0.9
Transactional sex ^d	1.23	(0.80, 1.87)	0.3	0.95	(0.60, 1.50)	0.8	1.04	(0.72, 1.50)	0.8	1.09	(0.60, 1.99)	0.8
Wald p-value for interaction term			0.4			0.4			0.6			0.9
STI diagnosis ^e	0.79	(0.24, 2.62)	0.7	0.71	(0.21, 2.2.37)	0.6	1.01	(0.38, 2.63)	0.6	0.30	(0.04, 2.20)	0.2
Wald p-value for interaction term			0.9			0.9			0.03			0.3
STI symptoms ^c	0.21	(0.05, 0.83)	0.03	0.50	(0.23, 1.09)	0.08	0.41	(0.19, 0.91)	0.03	0.29	(0.08, 1.15)	0.08
Wald p-value for interaction term			0.3			0.3			0.7			0.7

^aAmong those with at least one sex partner in the last year (n = 243)^bAmong those who endorsed that their most recent partner (in last 12 months) had sex with others or were unsure whether they had sex with others (n = 196)^cIn last 12 months^dReports feeling obligated to have sex with most recent partner (in last 12 months) in return for gifts or money

for health education delivery [32, 43–45], and provides the first evidence for the association in a Haitian microfinance context.

Some of the associations we observed were unexpectedly strong given the broad focus of the health education training. Even more targeted sexual health interventions have rarely demonstrated effect sizes of this magnitude [46, 47]. There are several potential explanations for this discrepancy. First, the health education training was integrated into a microfinance program. As noted previously, this integration could increase the effectiveness of health messages because they were conducted within a program designed to empower women and provide them with the financial resources needed to implement some sexual health improvement measures (e.g. purchase of condoms or travel to clinic for HIV testing).

Second, women in microfinance groups may be particularly receptive to self-help messages. Our study population consisted of women who had self-selected into the Fonkoze microfinance program. Women who are inclined to enroll in financial improvement programs like these may also be open to adopting behavior changes suggested in the trainings.

Finally, unmeasured and uncontrolled confounding could plausibly account for the strength of our findings if those who received the training differed systematically from those who did not. This concern is mitigated because health education training receipt appeared to be relatively exogenous to the individual participant. The decision to undergo health education training was made by the leaders of each client center, not individual participants. We did not collect data on the reasoning behind a center leader's choice to engage in health education training. However, informal observations from Fonkoze staff reveal that the choice may be driven by the availability of the center chief to receive the initial training. This training requires an additional time commitment from the center chief of approximately 2 days a month. In line with this hypothesis of somewhat random allocation of the health education training exposure, we found no evidence for geographic or socio-demographic differences between the members who did and did not receive the training.

We also found that some of the associations between health education training and sexual health outcomes were stronger among older women and illiterate women. Specifically, for older women, the association was particularly strong between health education training and both condom use and HIV testing. Although the interaction was not statistically significant, illiterate women tended to have stronger associations between health education training and condom use. One potential explanation for these interactions is that older women and illiterate women may have particularly large room for improvement to be made by health education. Younger women and literate women may be more likely to already be exposed to the health messages presented in

the training, either through formal education or through generational differences. Another potential explanation for these interactions is that the style of education delivery may have been particularly effective at reaching illiterate women [48, 49]. The health education training is centered around a picture-based handbook and verbal delivery of the content. Women without the ability to read would still be able to engage with and process the material of this educational training, though they may be excluded from more cognitive and literacy-demanding styles of education delivery. There has been a large focus on reaching young adults with HIV prevention and sexual health promotion messages, but it is also important to reach older adults, who may have differing educational backgrounds than young adults, with these messages [50]. Educational interventions like the one evaluated in this study that appear to be particularly effective in older women will be important to examine further.

Due to the design of the study, cautious interpretation of the findings is warranted. This was a cross-sectional study so the temporal relationship between receipt of the health education training and sexual health outcomes is not clear. This was also an observational study and the health education training was not randomly assigned. However, the way the health education training exposure was allocated appears to have been somewhat random in that socio-demographic covariates were balanced between those who did and did not receive the training. This finding, in concert with our sensitivity analysis adjusting for age and education, reduces the concern that our findings are biased due to confounding. Finally, all covariates of interest were self-reported in an interviewer administered quantitative survey. It is possible that interviewer bias and social desirability bias influenced our results, particularly given the sensitive nature of the sexual health outcomes. It is also possible that there is some misclassification of the health education training exposure as we did not finely assess the number of training sessions the clients received.

Another potential source of bias is that clustering of the data by client center could have artificially inflated the precision of our estimates. Unfortunately, we did not collect identifying information about client center membership, so were unable to statistically test this hypothesis. However, the total number of client centers ($n = 229$) was relatively large compared to our overall sample size ($n = 304$), indicating that the size of each cluster would likely be small (average size = 1.3). It is therefore unlikely that clustering would have a large effect on the standard errors of our effect estimates.

On the other hand, some of the design choices we used were stronger than common designs used in health education impact evaluation. We randomly sampled women from all clients of a Haitian microfinance branch office and obtained an extremely high participation rate (98.7%). Given this, we are confident that our study population was representative of

the population from which we were sampling. Further, participants were not aware that we were evaluating the health education program as it was not the focus of the overall survey. The survey queried a broad array of topics, ranging from malaria to recent hurricane experience. Thus, participant responses about their sexual health outcomes were not likely to be affected by social desirability or response shift bias in ways that systematically differed by health education training status.

Conclusions

Our findings suggest that a simple, low-cost health education training program has the potential to improve sexual health outcomes when delivered using an existing microfinance program. The global HIV response costs more than \$20 billion per year and between 15 and 25% of those funds are spent on HIV prevention [51–53.] Identifying more effective and sustainable modes of delivering prevention messages to vulnerable populations will be critical to reducing the global HIV burden [54.] We found that delivering prevention messages within a program designed to alleviate poverty has the potential to improve the impact of these programs on sexual health outcomes. The health education training program we evaluated was broad and covered topics beyond those focused on sexual and reproductive health. Perhaps more targeted sexual health educational programs could be even more effective at improving the sexual health of women in resource-poor settings. Future studies incorporating a longitudinal design and more objective measures of sexual health outcomes should be conducted to better understand the relationship between health education trainings conducted within a microfinance platform and the adoption of safer sexual practices.

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