Population-Level Impact of Zimbabwe's National Behavioural Change Programme

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Objective: To assess the impact of Zimbabwe's National Behavioural Change Programme (NBCP) on biological and behavioral outcomes.

Methods: Representative household biobehavioral surveys of 18- to 44-year-olds were conducted in randomly selected enumeration areas in 2007 and 2011 to 2012. We examined program impact on HIV prevalence among young women, nonregular partnerships, condom use with nonregular partners, and HIV testing, distinguishing between highly exposed and low-exposed communities and individuals. We conducted (1) difference-in-differences analyses with communities as unit of analysis and (2) analyses of key outcomes by individual-level program exposure.

Results: Four thousand seven hundred seventy-six people were recruited in 2007 and 10,059 in 2011 to 2012. We found high exposure to NBCP in 2011. Prevalence of HIV and reported risky behaviors declined between 2007 and 2011. Community-level analyses showed a smaller decline in HIV prevalence among young women in highly exposed areas (11.0%–10.1%) than low-exposed areas (16.9%–10.3%, $P = 0.078$). Among young men, uptake of nonregular partners declined more in highly exposed areas (25%–16.8%) than low-exposed areas (21.9%–20.7%, $P = 0.055$) and HIV testing increased (27.2%–46.1% vs. 31.0%–34.4%, $P = 0.004$). Individual-level analyses showed higher reported condom use with nonregular partners among highly exposed young women (53% vs. 21% of unexposed counterparts, $P = 0.037$).

Conclusions: We conducted the first impact evaluation of a NBCP and found positive effects of program exposure on key behaviors among certain gender and age groups. HIV prevalence among young women declined but could not be attributed to program exposure. These findings suggest substantial program effects regarding demand creation and justify program expansion.

Key Words: impact evaluation, behavior change, Zimbabwe

INTRODUCTION

Zimbabwe experiences a generalized HIV epidemic with most transmissions (92%) occurring as a result of heterosexual sex.[1] Against this background, in 2007, Zimbabwe launched its 5-year National Behaviour Change Programme (NBCP) with the aim of reducing new HIV infections through the combined approach of creating an enabling environment for behavior change and promoting adoption of safe sexual behavior, risk behavior reduction, and utilization of HIV prevention services (eg, HIV testing, prevention of mother-to-child HIV transmission services, voluntary medical male circumcision).

After sensitization, advocacy with and training of district-level and community-level leadership, the NBCP was implemented by Behavior Change Facilitators (BCFs), who held community-level meetings to explain the program and its messages, organized the "Love and Respect" community courses on HIV prevention-related topics, and visited people in their homes to promote NBCP messages. Each BCF was expected to cover an area with 550 adults in rural areas or 1200 in urban settings.[2] In addition, the key NBCP messages were distributed through radio programming (eg, "Love carefully") and printed materials. The assumption underpinning the NBCP program was that these activities would reach a majority of the general population (output), thereby improving their HIV-related knowledge, risk perception and self-efficacy, altering community norms, resulting in safer sexual practices (outcomes), and ultimately a reduction in new HIV infections (impact).[3]

Between 2007 and 2009, the NBCP was implemented using funding from the Expanded Support Programme in 26 districts (3–4 per province, henceforth "phase 1 districts"). In 2010, with funding from the Global Fund for AIDS, TB, and

Malaria, the program was expanded to the remaining 35 districts in Zimbabwe (henceforth "phase 2 districts"). According to program records, 9176 BCFs and 13,504 religious, traditional, and other leaders were trained between 2007 and 2011.

An impact evaluation was designed to assess the effect of the NBCP on cumulative HIV incidence among 18- to 24-year-olds over the first 4 years of the program using serial population-level cross-sectional surveys. It was initially planned that phase 2 communities would act as comparison communities for those where the NBCP was implemented in phase 1. However, after rapid national scale-up of the program in 2010, all districts became exposed to program activities, requiring adjustments to our analytic plan.

In this article, we assess the impact of the NBCP on both biological and behavioral outcomes using community-level and individual-level analyses. Botswana, Lesotho, Malawi, Nigeria, Sierra Leone, Swaziland, and Tanzania are among the countries that have developed national behavioral change strategies in the last decade.[4–10] However, to our knowledge, this is the first attempt to conduct an impact evaluation of a national behavioral change program. Moreover, most evaluations of behavioral change programs are small scale and/or lack biological outcomes.[11] The Zimbabwe's NBCP evaluation is strengthened by the inclusion of HIV data and its large sample size.

METHODS

Study Design

Cross-sectional biobehavioral surveys were conducted at baseline (2007) and on completion of the initial phase of rollout (2011 to 2012 end line survey). Both surveys covered 2 phase 1 districts and 2 phase 2 districts from Mashonaland East, Masvingo, Matabeleland North, and Midlands provinces (4 districts per province). In each district, the same randomly selected 10 enumeration areas (EAs, each expected to house approximately 100 households) were visited in both survey rounds (3 urban/peri-urban and 7 rural EAs per district) (160 EAs in total).

Survey Procedures

All 18- to 24-year-olds ("youth") and a proportion of 25- to 44-year-olds ("adults") were enrolled in the study. After written informed consent, all participants self-completed audio computer-assisted questionnaires on laptops (baseline)/personal digital assistants (end line). The questionnaire enquired about demographic characteristics, HIV-related knowledge and attitudes, HIV-related stigma, HIV testing history, use of HIV prevention and care services, sexual behavior, community norms, and community leadership. In addition, the end line questionnaire collected information on program exposure. Youth provided finger-prick blood samples for HIV antibody testing. The survey was conducted anonymously. Additionally, named HIV testing by trained nurse counselors was offered alongside the survey site. The study was approved by the Medical Research Council of Zimbabwe and University College London's Ethics Committees.

Laboratory Procedures

Blood samples were air-dried, stored at room temperature, and transported biweekly to the National Microbiology Reference Laboratory, where they were stored at −80°C. At baseline, samples were tested using Vironostika HIV Microelisa (SystemBioMerieux, Inc, Durham, NC) and AniLabsytems EIA kit (AniLabsystems Ltd, Vantaa, Finland) with discrepant results resolved by Western blot. At end line, samples were tested using AniLabsytems EIA kit and Enzygnost EIA kits with discrepant results resolved by Western blot.

Data Processing and Analysis

Data were downloaded from laptops/personal digital assistants onto the database daily; range and consistency checks were conducted throughout data collection. For the individual-level analysis, data were analyzed using STATA survey functions, to account for EA-level clustering and with weighting to adjust for having oversampled youth, and urban/rural, gender, and province representation (using the 2002 Census population distribution within each selected district and the 4 provinces as a whole). All analyses were conducted using STATA 12 (STATA Corp, College Station, TX).

As outlined previously, in our initial impact evaluation design, phase 2 districts would act as "control" communities to those in phase 1 districts. The impact of the program would then have been assessed using a difference-in-differences (DD) approach (which compares the changes in outcomes over time between the intervention group and the comparison group).[12,13] The NBCP was scaled-up in phase 2 districts in 2010, and as a result, the counterfactual group represented by phase 2 districts was eliminated. However, assessing whether the program had the intended effects and was worth the investment of public health resources remained critical. To address this challenge, we assessed the impact of the intervention using 2 analytical strategies.

Community-Level Analysis

Because the same EAs were surveyed at both baseline and end line and there is variability in their exposure to NBCP activities, we conducted a quasi-experimental DD analysis to leverage the natural experiment.[12,13] Because all EAs had some level of exposure to the program by the 2010 end line survey, the goal of this analysis was to determine whether higher coverage of program activities was associated with changes in outcomes. The EA was the unit of analysis, as the program was implemented at community level. The outcomes at baseline and end line were simultaneously modeled, and according to the DD approach, program impact was measured by the coefficient of the interaction between survey round (baseline vs. end line) and EA-level program exposure (low vs. high). Essentially, we compared the change in outcomes in EAs with high and low program coverage over time relative to the outcomes observed at baseline.

For this analysis, we examined 3 outcomes: (1) the natural log-transformed EA-level HIV prevalence among 18- to 24-year-olds (as proxy for incidence), (2) the natural log-transformed EA-level proportion of people who reported nonregular partners in the previous year, and (3) the EA-level proportion of people who ever tested for HIV. Outcomes (1) and (2) were logarithmically transformed to deal with non-normal distributions because of their low prevalence, and

therefore for these outcomes, the measure of program impact (the "DD estimator") is the natural log of the multiplicative effect of the program on the end line prevalence. Exposure to NBCP activities at the EA level in the end line survey was determined by assessing the aggregate level of exposure to the program among participants within each EA. Thus, we first assessed the proportions of respondents within each EA that had reported exposure to the following 3 coverage indicators in the last year: (1) read any NBCP booklet, (2) participated in BCF community meetings, and (3) had a BCF home visit. Based on the distribution of these 3 indicators across all EAs, we classified EAs that were above the 50th percentile for all 3 indicators as having high levels of NBCP coverage versus low coverage. Participation in "Love and Respect" courses was not included in this composite variable, as it is more indicative of individuals' interest in the program rather than of this activity's availability.

DD estimates were generated using linear regression models, controlling for community-level aggregate variables, namely the EA-level number of people surveyed, percent of respondents who completed O-level education (equivalent to 10 years of schooling) or higher, percent of Shona ethnicity members, percent of married people, and percent of respondents from households with 4–9 sellable assets (of 9 assets).

Individual-Level Analysis

In addition to the community-level analysis, we examined key outcomes depending on self-reported individual-level exposure to NBCP activities/materials, using only the end line cross-sectional survey data. We conducted cross-tabulations and multivariate regression analyses using survey functions: logistic regression for rare outcomes, that is, <10% and Poisson regression for less rare outcomes, that is, >10%. In Poisson models with cross-sectional data, the exponentiated parameter estimates represent prevalence ratios (PR), a conservative and more interpretable measure of association than odds ratio (OR) if the outcome is common.[14–17] OR/PR estimates of the NBCP exposure dummy variables provide the measure of program impact.

For this analysis, we examined 4 outcomes: (1) HIV status (among 18- to 24-year-olds), (2) number of nonregular partners in the previous year, (3) condom use at last sex with nonregular partners, and (4) lifetime uptake of HIV testing. We used "opportunistic" exposure to the program to measure intensity of exposure. Opportunistic exposure aimed to measure exposure to NBCP messages and activities that did not involve the active participation of survey respondents (and so did not include Love and Respect course attenders). Specifically, NBCP exposure was measured by an additive variable of the same 3 indicators used in the community-level analysis: attending a BCF meeting, being visited by a BCF at home, and reading a NBCP brochure. Each of these activities was attributed equal weight, and the summary scores (ranging from 0 to 3) were categorized into 0 (no exposure), 1 (low exposure), and 2–3 (high exposure). Notably, BCF meetings are community events attended by most members, BCF home visits are "random" (not targeted toward low-risk or high-risk individuals), and NBCP brochures were made easily available throughout communities.

We examined age, education, occupation, number of sellable assets, marital status, ethnicity, religion, sexually active status, number of lifetime sexual partners, and exposure to mass media as possible confounders or effect modifiers of the association of interest (ie, NBCP exposure and each outcome variable). The final models only controlled for the variables that either confounded the OR/PR estimates of the NBCP exposure dummy variables by ≥10% or interacted with the exposure variable ($P < 0.1$).

RESULTS

After excluding 4 EAs where either baseline or end line data were not collected, 4776 people from the same 16 districts participated in the baseline survey and 10,059 in the end line survey, representing 79% and 72% of those eligible, respectively.

Because the surveys were representative and were conducted in the same areas using the same methodology, participants selected in the 2 rounds should have similar sociodemographic profiles. Table S1 (see **Supplemental Digital Content,** http://links.lww.com/QAI/A575) describes the survey samples and presents the results of this comparison for the entire sample and for key subgroups (male youth, female youth).

Figure 1 shows the distribution of exposure to specific components of the NBCP at the EA level. Although in most EAs at least 50% of the surveyed participants had read NBCP booklets, in the majority of EAs less than 20% of people had received home visits from BCFs. Table 1 presents data on "opportunistic" exposure to program activities/materials by type of district and shows high levels of reported program exposure in phase 2 districts (40% low exposure and 31% high exposure among youth). This partially explains why the analysis corresponding to the initial study design—DD approach with phase 2 districts as control groups—was not appropriate.

Community-Level Analysis

Between baseline and end line surveys, there has been a decline in both HIV prevalence among young women and in reporting of sex with nonregular partners; there has been an increase in uptake of HIV testing (Fig. 2, average EA-level prevalences). Prevalence in young men was low and did not change significantly between survey rounds. We examined whether exposure to NBCP may have contributed to these positive trends (Table 2). We found a smaller decline in HIV prevalence among young women from highly exposed areas (11.0%–10.1%) compared with low-exposed areas (16.9%–10.3%), indicating a lack of effect of high levels of NBCP exposure on HIV prevalence based on the DD estimator [β = 0.60, 95% confidence interval (CI): −0.07 to 1.27, $P = 0.078$]. We also found that reported number of nonregular partners among young men declined more in EAs with high levels of exposure to the program (25%–16.8%) than in low-exposed EAs (21.9%–20.7%), suggesting an effect of high NBCP exposure on this behavior based on the DD estimator (β = −0.73, 95% CI: −1.48 to 0.02, $P = 0.055$). Moreover, HIV testing among young men in highly exposed communities (27.2%–46.1%) increased more than in low-exposed areas (31%–34.4%) (β = 14.92, 95% CI: 4.82 to 25.03, $P = 0.004$), as among adult women (34.1%–80% vs. 35.9%–75.1%, β = 7.93, 95% CI: 0.61 to 15.26, $P = 0.034$).
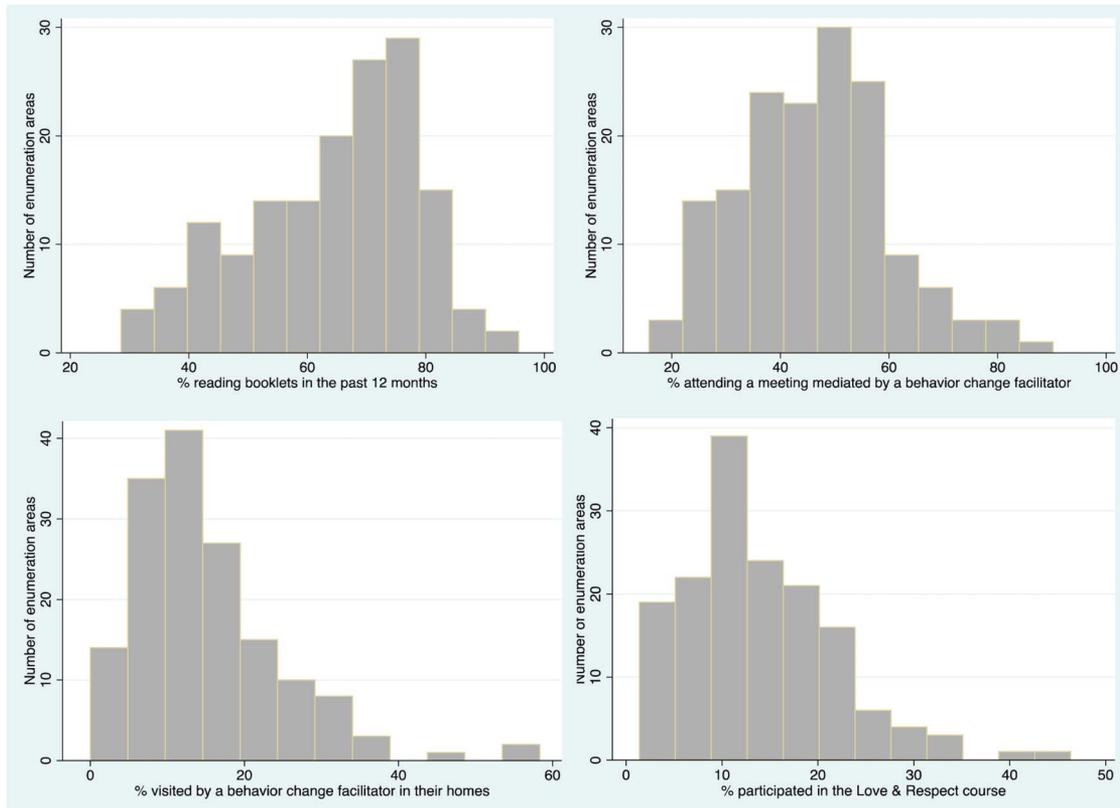
FIGURE 1. Exposure to specific NBCP components (EA-level frequency distributions).

Individual-Level Analysis

We compared laboratory-confirmed HIV status and key behavioral outcomes among end line participants, depending on their self-reported level of exposure to NBCP activities (Table 3). HIV prevalence among highly exposed women was slightly lower than that of the unexposed (8.4% vs. 10.2%, OR: 0.81, 95% CI: 0.55–1.19) and "low-exposed" women (10.5%), but the association between NBCP exposure and HIV status was not significant ($P = 0.342$). Reporting of nonregular sex partners in the past year was slightly lower among highly exposed adult men (7.2% vs. 14.5% of unexposed counterparts, $P = 0.085$). Reported condom use with nonregular partners was higher among highly exposed young women (53.4% vs. 21% of unexposed counterparts, $P = 0.037$). Uptake of HIV testing was higher among highly exposed individuals irrespective of gender and age group. For men, marital status modifies the relationship between NBCP exposure and HIV testing. Highly exposed *unmarried* young men (PR = 1.74, 95% CI: 1.25 to 2.43, $P = 0.002$) and *unmarried* adult men (PR = 3.34, 95% CI: 1.58 to 7.07, $P = 0.004$) were more likely to report uptake of HIV testing compared with their unexposed counterparts, although highly exposed married men reported similar levels of HIV testing as those unexposed.

DISCUSSION

In this article, we report on the first impact evaluation of a *national* behavior change program aimed at reducing HIV risk behaviors in sub-Saharan Africa. These population-level data clearly demonstrate that the program achieved high levels of coverage across the country and that the second phase of scale-up in 2010 was successfully and rapidly implemented. These findings are consistent with programmatic data showing that targets were surpassed: 20.55 million person exposures were recorded by BCFs against the target of 9.75 million exposures and 710,000 people completed the Love and Respect course against the target of 335,000. As it has already been well documented,[18–20] we found a significant decrease in HIV prevalence among young women between 2007 and 2011, continuing the downward trend that started in the 1990s.[21,22] Similarly, we show a decrease in reported risky sexual behaviors over the period of program implementation coupled with an increase in protective behaviors. Previous studies have demonstrated that the observed decline in HIV prevalence in Zimbabwe is likely partially due to behavior change among the Zimbabwean population[23–26] and that is in part due to HIV prevention efforts.[27] In this study, we examined whether recent changes in HIV prevalence and behaviors can be attributed to a specific program, namely Zimbabwe's NBCP.

We showed high self-reported exposure to NBCP activities and materials, suggesting high coverage of the program by 2011, an important accomplishment given the scale of the intervention. In communities where the program has been implemented since 2007, 44% of people were highly exposed to program activities and materials and an additional

TABLE 1. Exposure to NBCP by Type of District (Weighted %), End Line Survey

	Entire Sample			Youth Sample		
	Phase 1 (n = 4671)	Phase 2 (n = 5360)	*P*	Phase 1 (n = 1983)	Phase 2 (n = 2275)	*P*
Have heard of NBCP	45.9	39.4	0.014	36.7	33.3	0.240
Have been to a meeting where a BCF talked about HIV or behavior change	48.3	43.0	0.021	37.4	35.1	0.311
What did the BCF talk about at this meeting (multiple answers)	n = 2260	n = 2317		n = 739	n = 791	
How to know my risk for HIV infection	32.4	36.6	0.026	34.0	36.3	0.436
How to communicate/discuss with my partner about HIV	31.4	31.1	0.904	31.6	28.2	0.181
Being faithful	46.9	43.1	0.137	43.7	41.1	0.501
Limiting the number of sexual partners	19.4	17.3	0.262	21.9	16.1	0.075
Condoms	16.1	16.5	0.831	16.8	15.8	0.745
Stigma and discrimination (respect for people living with HIV)	9.6	8.4	0.458	10.3	7.7	0.237
HIV testing	13.7	12.9	0.592	16.3	11.9	0.065
Male circumcision	6.0	6.7	0.588	6.9	6.8	0.955
Prevention of mother-to-child-transmission of HIV	10.0	10.3	0.829	11.1	9.0	0.345
Other	3.5	3.9	0.635	5.1	4.6	0.796
I don't remember	1.4	3.0	0.008	1.6	4.0	0.024
Found the information received from the BCF useful	91.9	90.4	0.376	89.8	85.1	0.090
Have participated in the "Love & Respect" course (held by BCFs and has several sessions)	15.1	12.4	0.064	11.8	10.6	0.317
"Love & Respect" course participants who received a certificate for completing the course	n = 706; 44.4	n = 663; 33.1	0.003	n = 233; 37.7	n = 239; 39.1	0.785
Had a BCF visit their home in the last year	16.1	12.3	0.003	11.4	10.9	0.687
Number of NBCP booklets read in the past 12 mo						
None	34.5	37.0	0.307	36.0	36.9	0.528
1–3 booklets	21.0	21.9		22.1	23.9	
4–6 booklets	20.7	20.2		21.3	21.1	
7–8 booklets	23.9	21.0		20.6	18.1	
Opportunistic exposure to NBCP activities (attended a BCF meeting, visited by a BCF in own home, read a NBCP brochure)						
No exposure (0 of 3)	25.3	27.7	0.038	29.2	29.0	0.204
Low exposure (1 of 3)	31.2	34.8		36.3	40.4	
High exposure (2–3 of 3)	43.5	37.5		34.5	30.7	

These questions have only been asked during the final survey.

31% received some exposure to NBCP. Moreover, even in the communities where the program had only been implemented since 2010, 38% of people were highly exposed and 35% had some exposure to program activities, indicative of the speed and reach of the rollout during phase 2 of the NBCP.

After 4 years of program implementation, we were unable to demonstrate that the NBCP had had a positive impact on HIV incidence but showed positive effects on behavior outcomes for certain age and gender groups. Community-level analyses showed a decrease in reporting of nonregular partners among young men and increased uptake of HIV testing among young men and adult women from EAs with high levels of NBCP exposure compared with communities with low levels of NBCP exposure. Moreover, individual-level analyses showed that young women participating in the end line survey who were highly exposed to NBCP activities and materials were more likely to use condoms with nonregular partners compared with unexposed young women. Among the program outcomes examined, the strongest impact was on uptake of HIV testing, suggesting that the program was effective in terms of demand creation. Changes related to people's sexual behavior are likely to be more difficult to accomplish, which may explain the partial success in this respect. In addition, HIV testing is a one-time event that can be achieved after exposure to program activities, although condom use or avoidance of multiple partnerships would have needed to be sustained up to the time of the survey to be captured in our data. The lack of impact on HIV prevalence among 18- to 24-year-olds (used as a proxy for population-level cumulative HIV incidence) may be due to the relatively short period of program implementation (ie, 4 years) and to the fact that the program was implemented against a background of declining HIV prevalence in Zimbabwe, which had been ongoing since the 1990s.[18–22] Moreover, the initial phase of the NBCP was implemented while Zimbabwe
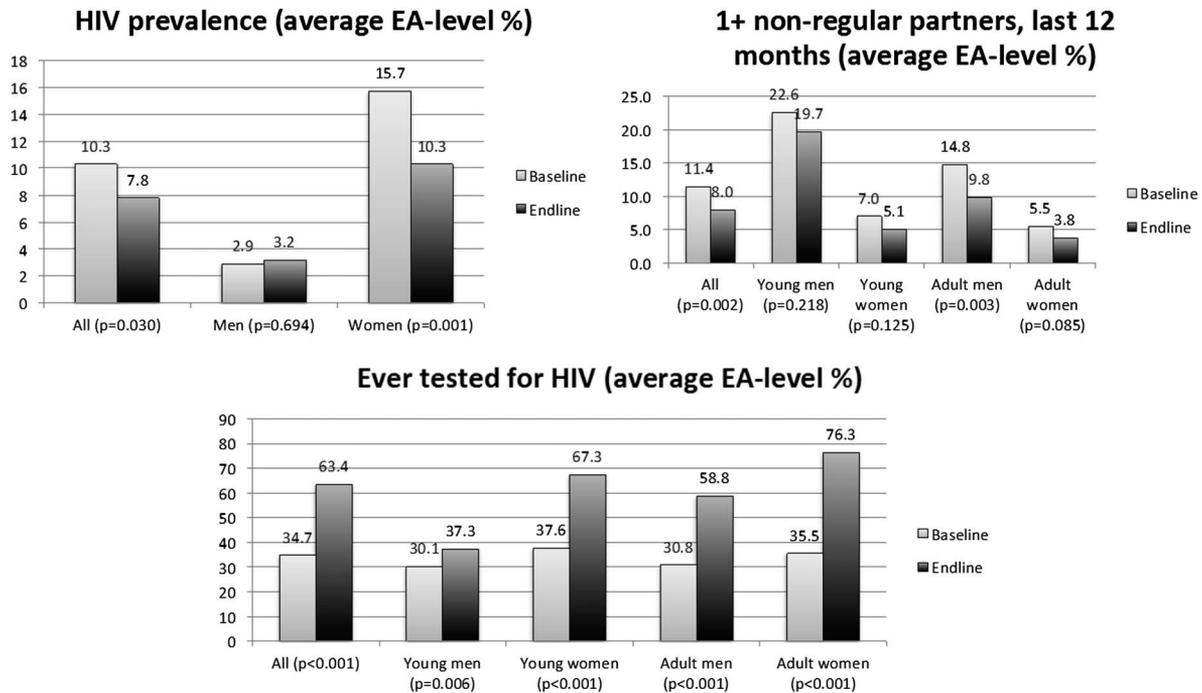
FIGURE 2. Key outcomes by gender and age group (average EA-level percentage). Note: we distinguish between 2 age groups: youth (18–24 years) and adults (25–44 years). HIV prevalence was only assessed among study participants aged 18–24 years.

suffered staggering economic decline, which negatively affected rollout activities, particularly during 2008.

Although there is increasing pressure from donors to evaluate and document effectiveness of their programs,[28] this can be difficult to accomplish in practice, as exemplified by this evaluation. In the real world, implementation of large-scale programs is not determined by impact evaluation design but by other more pragmatic considerations, such as the availability of funding and the perceived need for scale-up. Here, we adapted our analytical approach in response to the programmatic changes that were introduced. Although our ability to undertake comparative analyses was compromised by the

TABLE 2. Key Outcomes by Opportunistic Exposure to NBCP Messages, Stratified by Gender and Age Group: Results of Community-Level Analysis (EA as Unit of Analysis)

	EAs With Low NBCP Exposure (Average %)		EAs With High NBCP Exposure (Average %)			
	Baseline	End Line	Baseline	Endline	DD Estimator (95% CI)	*P*
HIV prevalence (among 18- to 24-year-olds)						
Men	2.9	3.4	3.2	2.9	−0.12 (−0.69 to 0.45)	0.679*
Women	16.9	10.3	11.0	10.1	0.60 (−0.07 to 1.27)	0.078*
One or more nonregular partners, last 12 months (among sexually active people)						
Young men	21.9	20.7	25.0	16.8	−0.73 (−1.48 to 0.02)	0.055*
Young women	6.8	4.4	7.8	7.8	0.30 (−0.45 to 1.04)	0.434*
Adult men	14.7	10.1	15.5	8.5	−0.29 (−1.05 to 0.47)	0.451*
Adult women	5.4	3.6	5.9	4.4	0.26 (−0.33 to 0.84)	0.388*
Ever tested for HIV						
Young men	31.0	34.4	27.2	46.1	14.92 (4.82 to 25.03)	0.004†
Young women	35.6	65.1	45.2	75.3	0.50 (−10.14 to 11.13)	0.927†
Adult men	31.8	57.7	26.3	63.9	9.78 (−3.38 to 22.93)	0.144†
Adult women	35.9	75.1	34.1	80.0	7.93 (0.61 to 15.26)	0.034†

*Adjusted linear regression model with natural log-transformed outcome and controlled for the EA-level number of people surveyed, percent of respondents who had completed O-level education or higher, percent of Shona ethnicity members, percent of married people, and percent of respondents from households with 4–9 sellable assets (of 9 assets).

†Adjusted linear regression model controlled for the EA-level number of people surveyed, percent of respondents who had completed O-level education or higher, percent of Shona ethnicity members, percent of married people, and percent of respondents from households with 4–9 sellable assets (of 9 assets).

TABLE 3. Key Outcomes by Opportunistic Exposure to NBCP Messages, Stratified by Gender and Age Group, End Line Survey (Weighted Estimates): Results of Individual-Level Analysis (Study Participants as Unit of Analysis)

	% Exposure			PR/OR (95% CI)			
	None	Low	High	None*	Low	High	P
HIV status (among 18- to 24-year-olds)							
Men	n = 566; 3.7	n = 761; 2.6	n = 624; 3.7	1.00	0.68 (0.26 to 1.77)	1.00 (0.41 to 2.42)	0.682†
Women	n = 613; 10.2	n = 782; 10.5	n = 704; 8.4	1.00	1.03 (0.70 to 1.51)	0.81 (0.55 to 1.19)	0.342†
One or more nonregular partners, last 12 months (among sexually active people)							
Young men	n = 338; 22.8	n = 539; 19.7	n = 483; 20.6	1.00	0.86 (0.61 to 1.23)	0.90 (0.58 to 1.40)	0.719‡
Young women	n = 465; 5.0	n = 629; 4.7	n = 602; 5.8	1.00	0.86 (0.43 to 1.73)	1.27 (0.71 to 2.27)	0.387§
Adult men	n = 531; 14.5	n = 691; 11.3	n = 1176; 7.2	1.00	0.74 (0.39 to 1.40)	0.53 (0.30 to 0.95)	0.085‖
Adult women	n = 833; 3.0	n = 945; 2.2	n = 1412; 2.9	1.00	0.81 (0.41 to 1.59)	1.17 (0.60 to 2.31)	0.497¶
Used condom at last sex with nonregular partners, last 12 months (among people with nonregular partners in the last year)							
Young men	n = 77; 55.7	n = 106; 55.1	n = 99; 60.8	1.00	0.99 (0.67 to 1.47)	1.09 (0.77 to 1.55)	0.806‡
Young women	n = 23; 21.0	n = 29; 48.5	n = 35; 53.4	1.00	2.30 (1.18 to 4.51)	2.54 (1.21 to 5.34)	0.037‡
Adult men	n = 77; 51.6	n = 78; 72.3	n = 85; 61.8	1.00	1.40 (0.98 to 2.00)	1.20 (0.78 to 1.85)	0.133‡
Adult women #	n = 31; 48.4	n = 23; 47.8	n = 52; 50.0	1.00	0.99 (0.45 to 2.15)	1.03 (0.55 to 1.95)	0.990‡
Ever tested for HIV							
Young men	n = 594; 27.3	n = 807; 32.2	n = 637; 47.4	1.00			
Stratified by marital status							
Married				1.00	1.44 (0.94 to 1.21)	1.31 (0.86 to 1.99)	0.245‡
Previously married				1.00	1.62 (0.78 to 3.34)	2.11 (0.99 to 4.52)	0.127‡
Never married				1.00	0.95 (0.68 to 1.34)	1.74 (1.25 to 2.43)	0.002‡
Young women	n = 637; 58.3	n = 821; 62.3	n = 733; 74.3	1.00	1.07 (0.96 to 1.19)	1.28 (1.16 to 1.40)	<0.001‡
Adult men	n = 580; 42.8	n = 739; 55.2	n = 1124; 63.9	1.00			
Stratified by marital status							
Married				1.00	1.11 (0.96 to 1.29)	1.27 (1.09 to 1.47)	0.004‡
Previously married				1.00	1.55 (0.97 to 2.46)	1.98 (1.37 to 2.87)	0.002‡
Never married				1.00	3.26 (1.60 to 6.61)	3.34 (1.58 to 7.07)	0.004‡
Adult women	n = 867; 69.3	n = 971; 71.4	n = 1452; 79.6	1.00	1.03 (0.95 to 1.11)	1.15 (1.08 to 1.23)	<0.001‡

*Reference category.
†Logistic regression model, no control variables.
‡Poisson regression model, no control variables.
§Logistic regression model, controlled for marital status and exposure to mass media.
‖Logistic regression model, controlled for marital status.
¶Logistic regression model, controlled for marital status, education level, and exposure to mass media.
#Unweighted estimates.

early scale-up of the program, we were still able to glean useful information about the likely impact through use of alternative analytic approaches. Lacking "control" EAs, we used the reported exposure to NBCP activities to distinguish between highly exposed and unexposed communities and individuals. The community-level analysis used a DD approach that adjusted for baseline outcome values, whereas the individual-level analysis used only end line data. Although individual-level exposure is to some extent likely to reflect an individual's ability or willingness to engage with the program, we tried to take account of this by assigning individual exposure categories in terms of "opportunistic exposure" only. By contrast, community-level exposure will likely reflect the extent to which the program was being implemented in that EA rather than the individuals' willingness to engage. By

using both community and individual approaches to analysis, we are able to build a picture of how exposure to the program may have affected behavior.

Our analysis does not account for exposure to similar messages from other behavioral change interventions rolled out simultaneously with the NBCP, which may complicate impact attribution. As with all analyses using cross-sectional data, the individual-level analysis cannot establish causality, only associations between the variables of interest. Except for HIV status, all data are self-reported and thus subject to potential social desirability and recall biases. Nevertheless, data were collected using audio computer-assisted self-interviewing software, shown to improve validity of self-reporting in this setting.[29,30] Although HIV data are available for youth, we cannot assess whether they were infected before or after

program exposure. The assumption is that most youth would have been recently infected (note the rise in prevalence by age); however, we cannot exclude the possibility that some youth were long-term survivors of mother-to-child transmission.[31,32] We acknowledge the difference in sample size between the two survey rounds, which is likely due to large outmigration from communities during the economic crisis that afflicted Zimbabwe in 2007 to 2008. At the same time, our analysis benefits from important strengths such as our large countrywide representative sample size and the availability of laboratory-confirmed HIV status.

We were able to demonstrate high coverage of the NBCP by 2011. After 4 years of program implementation, we found that the NBCP had a positive impact on safe behaviors for certain age and gender groups, especially on HIV testing uptake, although we were unable to detect an impact on HIV incidence. As the NBCP moves into its third phase (2012 to 2015), the role of BCFs is being augmented to include demand creation for a range of HIV prevention and other health interventions being scaled-up nationally and for which high coverage is critical, including male circumcision, prevention of mother-to-child transmission services, contraception, and cervical cancer screening. The data presented here suggest that the program had important effects in terms of demand creation and provide justification for this expansion in scope of the program going forward.

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