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Community-led, human-centred design to strengthen HIV prevention in Eswatini: A quasi-experimental evaluation of the Local Innovations Scaled through Enterprise Networks process

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Background: Eswatini has made major progress towards HIV epidemic control, but persistent HIV transmission and age- and sex-based inequities highlight the need for locally owned prevention approaches that address behavioural and social determinants of risk.

Objectives: To evaluate whether participation in Local Innovations Scaled through Enterprise Networks (LISTEN), a community-led process integrating human-centred design, Communities of Practice (CoPs) and local data use, improved HIV prevention behaviours and related determinants in Eswatini.

Method: We conducted an endline, quasi-experimental survey among LISTEN CoP members in Manzini and Lubombo and comparison members in Hhohho and Shiselweni regions in June 2024. Crude proportions and mean scores were compared. Nearest-neighbour matching with replacement (2:1) estimated average treatment effects, matching on CoP type, age, sex, marital status, education and sexual initiation.

Results: The analysis included 439 participants: 122 LISTEN members and 317 comparison members. LISTEN participation was associated with higher condom use at last sex and ever use of pre-exposure prophylaxis (PrEP). LISTEN members reported stronger intentions to use condoms, higher perceived behavioural control for condoms, HIV testing and PrEP, and more favourable attitudes and perceived social norms related to HIV prevention. LISTEN members were less likely to report knowing their current HIV status, an unexpected finding.

Conclusion: The LISTEN process was associated with improvements in selected HIV prevention behaviours and psychosocial determinants in Eswatini. Findings support community-led, human-centred approaches as a promising strategy for sustaining prevention gains and addressing remaining last-mile challenges in high-burden settings.

Keywords: HIV prevention; Eswatini; human-centred design; community engagement; community-led intervention; HIV behavioural prevention; pre-exposure prophylaxis; community of practice.

What this study adds: This study provides evidence that a community-centred approach grounded in human-centred design is associated with more favourable HIV prevention behaviours and their determinants in a high-burden setting such as Eswatini. It highlights the value of CoP, local data use and participatory problem-solving for strengthening sustainable, locally owned HIV prevention responses.

Introduction

Eswatini has an adult HIV prevalence estimated at 24.8%, the highest in the world.[1] Despite this, the country was one of the first nations to surpass the Joint United Nations Programme on HIV/AIDS (UNAIDS) 90–90–90 targets ahead of the global benchmark, and data from the most recent Eswatini Population-based HIV Impact Assessment[2] indicate a robust clinical cascade: 93.7% of people with HIV (PWH) are aware of their status, 97.3% of those diagnosed are on

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antiretroviral therapy (ART), and 96.2% of those on treatment have achieved viral suppression.[2] Success in the Prevention of Mother-to-Child Transmission (PMTCT) has been remarkable – vertical transmission rates plummeted from 4.91% in 2020 to 1.34% in 2024.[1]

However, national progress masks inequalities in HIV risk, prevention uptake and service engagement. Estimates suggest approximately 4000 new HIV infections occurred among individuals aged 15 years and older in 2023, underscoring ongoing transmission despite high levels of ART coverage.[3] HIV incidence remains significantly higher among women than men, reflecting entrenched gender disparities in risk and vulnerability.[4] Inequalities persist across the HIV care cascade, with men, particularly younger adult men, less likely to be successfully linked to and retained in care. These disparities highlight the need for more targeted, population-specific interventions, and suggest that the next phase of epidemic control in Eswatini depends not only on maintaining ART coverage and viral suppression, but also on reaching populations in which prevention behaviours, risk perception, social norms and access to services remain uneven.

The sustainability of these gains has also become a central concern. Eswatini's progress was made possible through strong external support, including bilateral and multilateral partnerships, which have provided critical resources for HIV services. However, the issuance of Executive Order Number 14169 by the United States significantly disrupted services, highlighting the vulnerability of the national programme, and reinforcing the urgency of accelerating plans for the transition to sustainable, locally funded HIV services. The disruption occurred in January 2025, more than 6 months after data collection for the present evaluation was completed in June 2024. The disruption therefore could not have affected the outcomes reported in this evaluation, but it highlighted the vulnerability of the national programme, and reinforced the urgency of accelerating plans for the transition to sustainable, locally funded HIV services.[5]

Community engagement is a critical component of effective HIV service delivery as it improves responsiveness to local priorities, increases accountability of health systems, and facilitates delivery strategies that are culturally and socially appropriate. Peer and community-led HIV responses leverage trust, contextual knowledge, social networks and local mobilisation, and have been associated with improved uptake of HIV testing, ART adherence, viral suppression, and reductions in HIV-related stigma, particularly when services are designed and implemented in partnership with affected populations rather than imposed through exclusively facility-based models.[6,7,8,9,10]

Human-centred design (HCD) complements community engagement by providing structured, participatory methods for co-designing HIV interventions with end users and frontline stakeholders. HCD emphasises empathy, iterative problem-solving, rapid prototyping, and adaptation to user experiences, allowing programmes to identify context-specific barriers and develop solutions that are feasible, acceptable, and responsive to community needs. By combining community engagement with HCD methodologies, HIV programmes can create more equitable, person-centred, and sustainable service delivery systems that are better aligned with the realities of the populations they serve.[11,12] When HCD methods are embedded within Communities of Practice (CoP), conceptualised here as a group of people organised around a key purpose (e.g. health, economic empowerment, public safety, etc.), where CoP members do not simply receive a programme but actively co-diagnose problems and co-design solutions, the resulting sense of ownership is theorised to strengthen social norm activation and sustain behaviour change beyond the life of formal programme activities.

Despite growing interest in community-led and HCD-informed health programming, evidence remains limited on whether such approaches produce measurable changes in HIV prevention behaviours and behavioural determinants in high-prevalence, resource-constrained settings.

This study evaluates prevention outcomes among members of Local Innovations Scaled through Enterprise Networks (LISTEN) CoPs in Manzini and Lubombo regions in Eswatini after 4 years of implementation, compared with members of purposively selected comparison CoPs from regions where LISTEN was not implemented. The objective was to assess if LISTEN exposure is associated with differences in HIV prevention behaviours, intentions and psychosocial determinants of prevention. The evaluation captures outcomes within mature (12–18 months), well-established CoPs (groups that have completed multiple problem-solution cycles and in which community norms and practices may have stabilised) rather than newly formed or still-developing community structures.

Research methods and design

The LISTEN process

The LISTEN process incorporates three components: building capacity for the application of HCD to solve priority challenges; fostering community engagement through structured CoPs; and simplifying health data for usability. Funded by the Gates Foundation and led by the Eswatini Ministry of Health (MOH), LISTEN was piloted in 2018 and implemented in Manzini and Lubombo regions between 2020 and 2024. Following multi-stakeholder consultations involving political leaders, healthcare providers, civil society organisations, and community members, adolescents and young people were designated as the target population. Trained facilitators guided communities through iterative problem-solving to identify prevention and care gaps, generate local interventions, and apply continuous learning.

The MOH implemented LISTEN across seven chiefdoms through four types of CoP. These CoPs were already existing structures in the community that had been organised to support specific community needs (for example football clubs or community leadership structures). The supported CoPs were: (1) Leadership CoPs composed of the chiefdom inner council, who act as gatekeepers between the community and traditional authority; (2) Community Development Committee CoPs, appointed by the inner council to lead development activities and containing a health sub-committee; (3) Primary CoPs, which engaged the target audience directly, such as members of football clubs or young women who were part of saving groups; and (4) a wellness CoP formed of nurse focal persons from 16 health worker wellness clinics. Twenty-three CoPs were engaged initially and 19 remained active at the end of implementation.

Each CoP developed a charter identifying priority challenges and potential solutions, then worked iteratively through problem identification, solution design, implementation, and review. HCD capacity was developed through structured training, facilitator preparation, mentorship, and cascade training. Locally designed responses included Youth Know Your Numbers mobile outreach campaigns offering HIV testing and other sexual and reproductive health services; coordination with local health facilities to reduce waiting time; community-based condom distribution; and an entrepreneurship initiative addressing economic vulnerability among young people. Data use was embedded through structured review meetings in which CoPs, health facility staff and community leaders examined locally selected HIV and non-HIV indicators to prioritise problems and assess progress.

LISTEN strengthens the community and implementation environment for HIV prevention rather than delivering direct clinical services. Its expected pathway of effect is behavioural and social: increasing knowledge, improving attitudes, shifting norms, strengthening perceived behavioural control and supporting prevention uptake. This is relevant in Eswatini where prevention gaps and demographic inequalities remain despite strong treatment outcomes. In practice, CoP members engaged in structured routine cycles of problem diagnosis, rapid solution prototyping, and peer-led implementation to address HIV prevention barriers. This was supported by trained facilitators and linked to the MOH for technical guidance and service linkage.

Study design and population

This study employed a quasi-experimental, comparative cross-sectional survey design at endline to assess whether exposure to the LISTEN process was associated with differences in HIV prevention behaviours, intentions, and psychosocial determinants among CoP members in Eswatini. The quantitative survey was conducted in June 2024, following approximately 4 years of LISTEN implementation in Manzini and Lubombo regions. Outcomes among members of CoPs receiving LISTEN implementation were compared with outcomes among members of purposively selected comparison CoPs in Hhohho and Shiselweni regions, where LISTEN had not been implemented. Comparison CoPs were selected to mirror LISTEN CoPs by organisational type, population focus and community context, while reducing the risk of intervention contamination. Both LISTEN and comparison CoP members were eligible for routine government HIV prevention and treatment services, and we are unaware of any additional existing interventions and services that would systematically differentiate the CoPs included in this study. Individuals were eligible for the quantitative survey if they were active members of a selected LISTEN intervention CoP or a comparison CoP and over 18 years.

Study setting

The study was conducted across all four administrative regions of Eswatini: Manzini and Lubombo, where LISTEN was implemented, and Hhohho and Shiselweni, which served as comparison regions. The four regions vary in urbanisation, population density, poverty and service infrastructure; however, they have similar HIV prevalence: 26.0% in Manzini, 25.3% in Lubombo, 21.6% in Hhohho, and 26.5% in Shiselweni.[2] HIV prevention remains a public health priority nationally, with persistent prevention gaps shaped by gender, age, geography, mobility, socioeconomic vulnerability and uneven access to community and health services.

Study sampling strategy

At endline, we conducted a two-stage sampling process, first selecting CoPs, followed by individual CoP members. LISTEN CoPs were purposefully selected for the intervention and for each LISTEN CoP, we selected a comparable CoP not receiving the LISTEN intervention. The study is powered to detect a difference in key HIV prevention outcomes comparing LISTEN and comparison CoP samples.

We used the following formula for the sample size n (Equation 1):

$$n = \left(Z_{\alpha/2} + Z_{\beta}\right)^2 * \frac{\left(p_1\left(1-p_1\right) + p_2\left(1-p_2\right)\right)}{\left(p_1 - p_2\right)^2} \quad \text{[Eqn 1]}$$

In this formula, $Z_{\alpha/2}$ is the critical value of the Normal distribution at $\alpha/2$ (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96); Z_{β} is the critical value of the Normal distribution at β (e.g. for a power of 80%, β is 0.2 and the critical value is 0.84); and p_1 and p_2 are the expected sample proportions of the two groups. Accordingly, a sample size of 200 participants from each of the intervention and comparison CoP populations provides 80% power to detect an estimated 10% increase or greater in the sampling indicator (i.e. comparing LISTEN and comparison CoP), with

an alpha of 0.05, 10% non-response rate, and a conservative estimate of 50% of the sample having received any testing for HIV in the last 12 months. We did not have a basis for estimating intra-cluster correlation and expected it to be low because of the nature of selection of comparison CoP populations.

The achieved sample differed from this target. Applying the 2-year active membership criterion to LISTEN CoP membership rolls yielded a smaller eligible pool than anticipated, and 122 LISTEN CoP members completed the survey. In the comparison regions a larger eligible pool was available and 317 members were enrolled. The larger comparison sample was retained rather than trimmed to parity because matching with replacement at a 2:1 ratio draws repeatedly on the comparison pool and yields closer matches when the donor pool is larger.

Data collection

Eight local data collectors with at least a bachelor's degree and experience in administering quantitative surveys were trained to conduct the survey. Within selected CoPs, participants were randomly sampled from membership rolls, selecting only among members active in the CoP for more than 2 years, based on input from CoP leaders about frequency of involvement in CoP general activities. CoP and local leaders notified selected participants of the study at CoP engagements and facilitated scheduling of interviews. Interviews took place in-person, at a locally convenient and private setting, such as CoP offices or participant households. The respondents received a study sheet containing information about the purpose and procedures of the study. When respondents agreed to participate, an electronic, tablet-based survey was used to collect data. Six selected participants could not be reached on the day of interview for a response rate of 98.7%. The survey was divided into five sections: (1) sociodemographics; (2) HIV prevention, testing, and treatment outcomes and behaviours; (3) HIV prevention, testing, and treatment intentions; (4) attitudes and social norms around condom use, HIV counselling and testing, pre-exposure prophylaxis (PrEP), and circumcision/voluntary medical male circumcision (VMMC); and (5) perceptions of LISTEN (only in LISTEN CoPs). The questionnaire was designed based on existing HIV prevention, testing, and treatment variables in the literature and informed by the Health Belief Model.[13] It was administered in either siSwati or English, depending on the participant's preference. Each interview took approximately 45 min to complete. Since no baseline quantitative survey was conducted and the intervention and comparison groups were not randomly assigned, the analysis compared endline outcomes between exposed and unexposed groups and used matched analysis to improve comparability across measured individual and CoP characteristics.

Data analysis

All quantitative surveys were collected on an electronic platform using an Open Data Kit (ODK)-based data collection platform. After data collection was completed, the data were checked for quality and, subsequently, transferred to STATA 16.0 software (StataCorp, LLC, College Station, Texas, United States) for cleaning, coding and construction of analysis variables. For this article, we conducted crude proportion/mean analysis and matched analysis. Crude proportion or mean analysis was performed to provide an initial comparison of key intervention outcomes between LISTEN and comparison CoP samples. For categorical variables, proportions were calculated for each group, and a chi-square test was conducted to determine whether differences in distributions were statistically significant at the $P < 0.05$ level. For numeric variables, mean values and 95% confidence intervals were computed for each group. Comparisons were then tested using independent t-tests to identify significant differences between LISTEN and comparison CoP members. After conducting crude analyses, we performed sensitivity analyses and compared demographic factors between the two groups. Findings suggested that the two samples were not fully comparable. To improve comparability between LISTEN and non-LISTEN CoP samples, a nearest neighbour matching approach was implemented with an approximate 2:1 selection ratio, such that two comparison CoP members were matched with every one selected LISTEN CoP member, with replacement of selected comparison CoP members. The matching process accounted for key demographic and behavioural variables, including CoP type, gender, ever having sex, age, education level, and marital status. All statistical analyses, including the crude comparisons and the matched analysis, were conducted in R version 4.5.1 (R Foundation for Statistical Computing, Vienna, Austria).

Missing data were handled by complete-case analysis. Each outcome was analysed among respondents with non-missing values for that outcome and for the matching covariates, so denominators vary across measures and are reported separately for each outcome in the tables. Item-level missingness was low (< 1% for all outcomes). Four respondents were missing age, which is both a descriptive variable and a matching covariate; they are excluded from the mean age comparison in Table 1 ($N = 435$) and from the matched analyses. No imputation was performed.

Because the LISTEN and comparison samples differed on several sociodemographic characteristics, we conducted a sensitivity analysis using regression adjustment in place of matching. We first fitted logistic models predicting LISTEN CoP membership in order to establish whether age accounted for the observed differences in educational attainment, marital status and number of children. We then re-estimated the difference between LISTEN and comparison CoP members for every outcome, adjusting first for age alone and then additionally for sex, educational attainment and marital status, using logistic regression for binary outcomes and linear regression for index scores. For binary outcomes we report average marginal effects obtained by g-computation, so that estimates are

TABLE 1: Sociodemographic description of study sample in Eswatini, June 2024.

Variables	*N*	Comparison CoP				LISTEN CoP				*P*
		%	*n*	Mean	95%CI	%	*n*	Mean	95%CI	
Region	439	-	-	-	-	-	-	-	-	-
Manzini	-	-	-	-	-	75.4	92	-	-	-
Lubombo	-	-		-	-	24.6	30	-	-	-
Hhohho	-	51.4	163	-	-	-	-	-	-	-
Shiselweni	-	48.6	154	-	-	-	-	-	-	-
Sex	439	-	-	-	-	-	-	-	-	0.292
Male	-	54.3	172	-	-	59.8	73	-	-	-
Female	-	45.7	145	-	-	40.2	49	-	-	-
Mean age	435	-	-	39.4	37.8, 41.0	-	-	33.1	30.9, 35.4	< 0.001*
Education level	439	-	-	-	-	-	-	-	-	< 0.001*
No formal school	-	5.4	17	-	-	0.0	0	-	-	-
Some primary	-	9.8	31	-	-	3.3	4	-	-	-
Completed primary	-	5.4	17	-	-	6.6	8	-	-	-
Some secondary	-	34.4	109	-	-	28.7	35	-	-	-
Completed secondary	-	27.1	86	-	-	25.4	31	-	-	-
Higher than secondary	-	18.0	57	-	-	36.1	44	-	-	-
Marital status	439	-	-	-	-	-	-	-	-	0.034*
Single	-	46.7	148	-	-	59.0	72	-	-	-
Divorced/separated/widowed	-	15.5	49	-	-	8.2	10	-	-	-
Cohabiting/engaged/married	-	37.9	120	-	-	32.8	40	-	-	-
Ever had sex	439	-	-	92.1	292	-	-	87.7	107	0.150
Currently pregnant/trying to conceive†	160	6.7	8	-	-	5.0	2	-	-	1.000
Mean number of children†	160	-	-	4.6	4.1, 5.2	-	-	3.7	3.1, 4.3	0.033*
Food insecurity in last 1 month	437	-	-	-	-	-	-	-	-	0.723
Never	-	54.8	173	-	-	57.9	70	-	-	-
Once/twice	-	26.9	85	-	-	23.1	28	-	-	-
Three or more times	-	18.4	58	-	-	19.0	23	-	-	-

*, Statistically significant at the $P < 0.05$ level.
CoP, Community of practice; LISTEN, Local Innovations Scaled through Enterprise Networks; CI, confidence interval.
†, Among currently partnered individuals.

expressed on the same difference-in-proportions scale as the matched Average Treatment Effect (ATE). Nearest-neighbour matching remains the primary analytic strategy; regression-adjusted estimates for all outcomes are presented in Online Appendix 1 Table 2-A1.

Following the matching process, analyses focused on estimating the ATE for positive responses across HIV prevention behaviours and correlates. Proportions of positive responses were calculated separately for LISTEN and comparison CoP groups. The ATE was derived as the difference in these proportions between the two groups, using the following formula (Equation 2):

$$ATE = P_{Listen} - P_{Non-Listen} \quad \text{[Eqn 2]}$$

This approach provided an estimate of the difference in outcomes between LISTEN and comparison CoP members after adjustment for the matched characteristics. Because treatment was not randomly assigned, these estimates are adjusted associations and are not interpreted as unbiased causal effects.

Study measures

Study outcomes for this research were adoption or intention to adopt HIV prevention behaviours, including use of condoms, HIV testing, PrEP, and circumcision for men. Likelihood or intention of enacting these behaviours in the next 3 months was assessed with a 4-point Likert scale from 'very unlikely' to 'very likely'. Individual attitudes were assessed by five items for condom use and HIV testing and four items each for PrEP use and VMMC on a 4-point Likert scale from 'strongly disagree' to 'strongly agree'. Social norms measures were developed for both injunctive norms or individual expectations of support or negative sanctions for adopting a behaviour and descriptive norms or respondent perceptions of how common a behaviour is in their community. For each of these four HIV prevention behaviour domains, we asked three items for injunctive norms and three items for descriptive norms. Injunctive norms were assessed similarly to individual attitudes while descriptive norms were asked on a 4-point Likert scale from 'none' to 'most' of the community. Finally, we assessed self-efficacy in adopting each of the four behavioural domains with four items each for condoms and HIV testing and three items each for PrEP and VMMC. For self-efficacy, we assessed items on a 4-point Likert scale similar to individual attitudes and injunctive norms.

For each factor, the constituent items were summed and divided by the number of items answered, producing an unweighted mean index score on the same 4-point metric as the constituent items. No differential item weighting was applied, no factor or principal component scores were

used, and the indices were not categorised into quantiles; retaining the original metric allows differences between groups to be read directly as points on the 4-point scale. This mean-score approach follows conventional operationalisation of attitudes, injunctive and descriptive norms and perceived behavioural control within the Theory of Planned Behaviour (TPB) and the Health Belief Model.[13,14] The approach is not novel to this study, although the individual items were developed for this survey rather than adopted verbatim from a previously validated instrument. Internal consistency was assessed for each index using Cronbach's alpha, which ranged from 0.43 to 0.78 (median 0.61) across the 12 reported indices, with mean inter-item correlations of 0.15–0.56. Reliability was highest for the descriptive norm indices (0.71–0.78) and lowest for the attitude indices (0.44–0.59) and for perceived behavioural control regarding PrEP (0.43) (Online Appendix 1 Table 1-A1). The attitude indices deliberately combine conceptually distinct facets, including perceived effectiveness, perceived safety, anticipated embarrassment and social judgement of those who adopt the behaviour, and are therefore closer to formative than to reflective scales, for which alpha is not the appropriate criterion; several indices also comprise only three items, which depresses alpha independently of item coherence. We therefore report mean inter-item correlations alongside alpha and interpret the attitude and perceived behavioural control indices with corresponding caution. Items were aligned such that higher scores for a factor reflect more individual approval, social approval, and/or self-efficacy for adopting one of the four HIV prevention behaviours.

VMMC-related intentions, attitudes, norms and perceived behavioural control were administered only to male respondents and to women reporting on a male partner, and, for intention items, only to those not already reporting circumcision. The resulting analytic subsamples were small (65 LISTEN and 97 comparison members), matched estimates were correspondingly imprecise, and these items are therefore not interpreted as evidence of effect.

Ethical considerations

Ethical clearance to conduct this study was obtained from Georgetown University (No. STUDY00007564) and the Eswatini Health and Human Research Review Board (No. EHHRRB 044/2024). All participants gave voluntary, informed consent, and interviews were conducted in a private location. Surveys were confidential and identification codes were used in place of participant names. Interviewers were trained in sensitive and ethical interviews and data management procedures, including data security and safety associated with interviewing on sensitive topics such as HIV.

Results

Prior to conducting the matching process, we examined the sociodemographic characteristics of the 439 individuals in the study, comprising 122 LISTEN CoP members and 317 comparison CoP members. The results, summarised in Table 1, were used to assess the comparability of the two samples. Geographically, the samples were split across the four regions of Eswatini, with all LISTEN CoP activities conducted in Manzini and Lubombo, while comparison CoP activities were conducted in Hhohho and Shiselweni.

Nearly three-fifths of the LISTEN CoP sample were men, and the mean age was 33.1 years. Survey eligibility was in addition restricted to adults aged 18 years or older who had been active CoP members for at least 2 years, which excluded adolescent members by design. The mean age of 33.1 years among surveyed LISTEN CoP members therefore reflects the adult composition of community leadership, development and health structures together with the age restriction applied at enrolment. While there were no statistically significant differences ($P = 0.292$) in the proportion of men between the two groups, comparison CoP members exhibited a slightly lower proportion of men. However, we did observe statistically significant differences ($P < 0.01$) in mean age, with comparison CoP members tending to be older. Educational attainment was notably higher among LISTEN CoP members, with 90.2% reporting at least some secondary schooling compared to 79.5% of comparison CoP members. Approximately three-fifths (59.0%) of LISTEN CoP members reported being single, while nearly one-third (32.8%) were engaged, married, or living together as if married. A smaller proportion (8.2%) reported being divorced, separated, or widowed. By contrast, comparison CoP members had a lower proportion of single individuals (46.7%) and higher proportions of those who were engaged, married, or living together (37.9%) and divorced, separated, or widowed (15.5%), a distribution that was statistically significantly different from that of LISTEN CoP members.

Sexual activity was reported by 87.7% of LISTEN CoP members. Among partnered individuals, only 5.0% reported being currently pregnant or actively trying to conceive. No statistically significant differences were observed between LISTEN and comparison CoP members for these variables. However, comparison CoP members reported a higher average number of children (4.6 vs 3.7; $P = 0.033$). In terms of household food insecurity, 19.0% of LISTEN CoP members reported experiencing three or more instances of food insecurity in the past month, while 23.1% reported one or two instances, and 57.9% reported no food insecurity during the same period. No statistically significant differences were observed between the two groups for this variable. Given the observed statistically significant differences in age, education, marital status, and number of children between the two CoP populations, we opted to conduct a matched analysis to account for these disparities and accurately assess intervention outcomes.

HIV prevention and risk behaviours

We assessed key HIV prevention behaviours related to condom use, HIV testing, PrEP use, and male circumcision,

TABLE 2: HIV prevention and risk behaviours outcomes for LISTEN and comparison populations in Eswatini, June 2024.

Variables	Comparison CoP		LISTEN CoP		*P*	ATE¶	95%CI¶	*P*
	%	*n*	%	*n*				
Used condom at last sex†	40.4	118	58.9	63	0.001*	0.14	0.05, 0.23	0.003*
Used condom most of the time in last yr†	30.1	88	35.5	38	0.367	-0.01	-0.10, 0.09	0.914
Tested for HIV in last yr‡	70.5	196	71.6	73	0.822	-0.03	-0.12, 0.06	0.560
Know HIV status‡	89.7	262	88.8	95	0.384	-0.07	-0.13, -0.01	0.016*
HIV+§	20.6	54	16.8	16	0.563	0.02	-0.06, 0.10	0.649
Ever taken PrEP§§	9.9	29	20.6	22	0.011*	0.09	0.02, 0.16	0.012
Ever circumcised†† (lifetime)‡‡	37.6	97	67.0	65	< 0.001*	0.30	0.20, 0.41	< 0.001*

CoP, community of practice; yr, year; PrEP, pre-exposure prophylaxis; LISTEN, Local Innovations Scaled through Enterprise Networks; CI, confidence interval.

*, Statistically significant at the $P < 0.05$ level.

†, Among sexually active individuals who are not currently pregnant (self or partner) or trying to conceive; ‡, Among sexually active individuals not known to be HIV+; §, Among sexually active individuals who have ever tested for HIV and know HIV status; ¶, ATE = Average treatment effect, with 95% confidence interval and associated *P*-value; 2:1 matching with replacement was performed; ATE estimates match on (and control for) CoP type, age, sex, marital status, educational level, sexual initiation; ††, Among men and women (reporting on their male partners) reportedly in a long-term relationship; ‡‡, Lifetime measure – The survey did not record when circumcision occurred, so these outcomes may include events that preceded LISTEN implementation and cannot be attributed to the implementation period; §§, Among sexually active individuals reporting HIV–.

comparing CoP members exposed to the LISTEN process to an unexposed comparison population of CoP members, as shown in Table 2. Sexually active LISTEN CoP members were significantly more likely than comparison CoP members to report using a condom at last sex (58.9% vs 40.4%; $P < 0.01$), and after matching demonstrated a 14 percentage-point higher prevalence of condom use at last sex (ATE = 0.14, 95%CI [0.05, 0.23]; $P < 0.01$). Among sexually active CoP members reporting HIV-negative status, LISTEN CoP members were significantly more likely to report ever having taken PrEP (20.6% vs 9.9%; $P < 0.05$), a difference that persisted after matching as a 9 percentage-point higher prevalence (ATE = 0.09, 95%CI [0.02, 0.16]; $P < 0.05$). Among participants in a long-term relationship, over two-thirds (67.0%) of LISTEN CoP members reported that they or their partners had been circumcised, compared with 37.6% of the comparison population ($P < 0.01$), and the matched analysis showed a difference of the same magnitude and direction, a 30 percentage-point higher prevalence of circumcision (ATE = 0.30, 95%CI [0.20, 0.41]; $P < 0.01$); however, circumcision was recorded as a lifetime event without a date, so this difference is interpreted as descriptive only. In the matched analysis, LISTEN CoP members also showed an unexpected 7 percentage-point lower prevalence of reported awareness of HIV status (ATE = –0.07, 95%CI [–0.13, –0.01]; $P < 0.05$), although the crude difference was not statistically significant (88.8% vs 89.7%; $P = 0.384$). No statistically significant differences were observed, in either crude or matched analyses, for consistent condom use in the past year among those not trying to conceive (35.5% vs 30.1%; $P = 0.367$; ATE = –0.01, 95%CI [–0.10, 0.09]), for HIV testing in the past year (71.6% vs 70.5%; $P = 0.822$; ATE = –0.03, 95%CI [–0.12, 0.06]), or for reporting HIV-positive status (16.8% vs 20.6%; $P = 0.563$; ATE = 0.02, 95%CI [–0.06, 0.10]).

Behavioural intentions and confidence for HIV prevention behaviours

We also assessed reported intentions to adopt HIV prevention behaviours over the next 3 months among survey respondents, as detailed in Table 3. Intentions to use condoms during all sexual encounters were significantly higher among LISTEN CoP members than among comparison CoP members (85.1% vs 71.9%; $P < 0.05$), and the difference persisted after matching, with LISTEN CoP members 16 percentage points more likely to report this intention (ATE = 0.16, 95%CI [0.03, 0.29]; $P < 0.05$). No statistically significant differences were observed between LISTEN and comparison CoP members, in either crude or matched analyses, for intentions to request condom use with a partner (54.8% vs 44.1%; $P = 0.460$; ATE = –0.08, 95%CI [–0.36, 0.19]), to seek information about HIV testing services (82.3% vs 80.7%; $P = 0.941$; ATE = 0.00, 95%CI [–0.09, 0.09]), to get tested for HIV (87.3% vs 86.5%; $P = 0.357$; ATE = –0.02, 95%CI [–0.09, 0.05]), to seek information about PrEP (71.8% vs 55.1%; $P = 0.077$; ATE = 0.08, 95%CI [–0.03, 0.20]), or to obtain and use PrEP (48.7% vs 39.1%; $P = 0.126$; ATE = –0.02, 95%CI [–0.15, 0.12]).

In addition to behavioural intentions, we assessed perceived behavioural control using an index score derived from multiple survey items, where higher scores reflected greater perceived control. In crude analyses, LISTEN CoP members demonstrated significantly higher scores for perceived behavioural control in accessing and receiving condoms (3.29 vs. 3.07; $P < 0.01$), HIV testing (3.64 vs 3.39; $P < 0.01$), and PrEP (3.31 vs 2.90; $P < 0.01$) compared to comparison CoP members. These findings were consistent in the matched analysis. Specifically, LISTEN CoP members scored 0.16 points higher on the 4-point perceived behavioural control over accessing condoms (ATE = 0.16, 95%CI [0.04, 0.28]; $P < 0.01$), 0.37 points higher for HIV testing (ATE = 0.37, 95%CI [0.24, 0.50]; $P < 0.01$), and 0.60 points higher for PrEP access and use (ATE = 0.60, 95%CI [0.42, 0.78]; $P < 0.01$) compared to their unexposed counterparts.

Attitudes and social norms related to HIV prevention behaviours

Finally, we assessed outcomes related to individual attitudes and perceptions of social norms, which we hypothesised are associated with pathways to behaviour change for key HIV prevention behaviours. We hypothesised that the LISTEN Process would lead to improved attitudes and perceptions of social norms relative to the comparison

TABLE 3: Intentions to adopt and perceived behavioural control for HIV prevention behaviours for LISTEN and comparison populations in Eswatini, June 2024.

Variables	Comparison CoP				LISTEN CoP				*P*	ATE¶	95%CI¶	*P*
	%	*n*	Mean score	95%CI	%	*n*	Mean score	95%CI				
Behavioural intentions (in the next 3 months)												
Use condoms during all sexual encounters†	71.9	82	-	-	85.1	40	-	-	0.031*	0.16	0.03, 0.29	0.017*
Request using condoms with partner†	44.1	41	-	-	54.8	17	-	-	0.460	-0.08	-0.36, 0.19	0.539
Seek info on HTS‡	80.7	167	-	-	82.3	65	-	-	0.941	0.00	-0.09, 0.09	1.000
Get tested for HIV‡	86.5	179	-	-	87.3	69	-	-	0.357	-0.02	-0.09, 0.05	0.639
Seek info on PrEP§	55.1	114	-	-	71.8	56	-	-	0.077	0.08	-0.03, 0.20	0.161
Obtain & use PrEP§	39.1	81	-	-	48.7	38	-	-	0.126	-0.02	-0.15, 0.12	0.787
Perceived behavioural control††												
Condoms	-	-	3.07	2.99, 3.15	-	-	3.29	3.17, 3.41	0.003*	0.16	0.04, 0.28	0.008*
HIV testing	-	-	3.39	3.31, 3.48	-	-	3.64	3.53, 3.75	0.001*	0.37	0.24, 0.50	< 0.001*
PrEP	-	-	2.90	2.80, 3.01	-	-	3.31	3.16, 3.46	< 0.001*	0.60	0.42, 0.78	< 0.001*

CoP, community of practice; HTS, HIV testing services; PrEP, pre-exposure prophylaxis; LISTEN, Local Innovations Scaled through Enterprise Networks; CI, confidence interval.

*, Statistically significant at the $P < 0.05$ level.

†, Among sexually active individuals who are not currently pregnant (self or partner) or trying to conceive; ‡, Among sexually active individuals not known to be HIV+; §, Among sexually active individuals reporting HIV−; ¶, ATE = Average treatment effect, with 95% confidence interval and associated *P*-value; 2:1 matching with replacement was performed; ATE estimates match on (and control for) CoP type, age, sex, marital status, educational level, sexual initiation; ††, Summary perceived behavioural control index scores toward condoms & HIV testing & PrEP = 4 items on 4-point Likert Scale; higher score reflects a perception of more behavioural control. Voluntary male medical circumcision-related intentions and perceived behavioural control were also measured; because they were restricted to small subsamples they are not reported here.

TABLE 4: Individual attitudes and perceived social norms related to HIV prevention behaviours for LISTEN and comparison populations in Eswatini, June 2024.

Variables	Comparison CoP		LISTEN CoP		*P*	ATE§	95% CI¶	*P*
	Mean score	95%CI	Mean score	95%CI				
Individual attitudes†								
Condoms	3.13	3.08, 3.19	3.38	3.30, 3.47	< 0.001*	0.22	0.12, 0.32	< 0.001*
HIV testing	3.38	3.33, 3.42	3.57	3.50, 3.64	< 0.001*	0.23	0.16, 0.31	< 0.001*
PrEP	3.14	3.08, 3.20	3.46	3.38, 3.54	< 0.001*	0.30	0.18, 0.41	< 0.001*
Descriptive norms‡								
Condoms	3.09	3.00, 3.18	3.42	3.31, 3.52	< 0.001*	0.31	0.18, 0.44	< 0.001*
HIV testing	3.19	3.11, 3.28	3.38	3.27, 3.49	0.013*	0.16	0.05, 0.28	0.005*
PrEP	3.41	3.33, 3.49	3.54	3.45, 3.64	0.061	0.11	0.00, 0.22	0.041*
Injunctive norms¶								
Condoms	3.10	3.30, 3.47	3.28	3.15, 3.40	0.014*	0.09	-0.04, 0.23	0.181*
HIV testing	3.34	3.50, 3.64	3.50	3.40, 3.61	0.009*	0.23	0.10, 0.35	< 0.001*
PrEP	2.97	3.38, 3.54	3.26	3.11, 3.41	< 0.001*	0.34	0.16, 0.52	< 0.001*

Note: Voluntary male medical circumcision-related intentions and perceived behavioural control were also measured; because they were restricted to small subsamples they are not reported here.

Higher score = more likely to have 'positive' viewpoints: attitudes more conducive to use of condoms, HIV testing, PrEP; descriptive norms that positive behaviours are more typical of community, negative behaviours are less typical of community; injunctive norms that positive behaviours are perceived to be approved of by important social others, negative behaviours are not approved by important social others.

CoP, community of practice; PrEP, pre-exposure prophylaxis; LISTEN, Local Innovations Scaled through Enterprise Networks; CI, confidence interval.

*, Statistically significant at the $P < 0.05$ level.

†, Summary attitudes scores toward condoms & HIV testing = 5 items; PrEP & voluntary male medical circumcision = 4 items on 4-point Likert Scale; ‡, Summary descriptive norms scores consist of 3 items for all behaviours, on a 4-point Likert Scale; §, ATE = Average treatment effect, with 95% confidence interval and associated P-value; 2:1 matching with replacement was performed; ATE estimates match on (and control for) CoP type, age, sex, marital status, educational level, sexual initiation; ¶, Summary injunctive norms scores consist of 3 items for all behaviours, on a 4-point Likert Scale.

population. Two types of social norms were examined: (1) descriptive norms, which reflect respondents' perceptions of how typical a behaviour is within their community; and (2) injunctive norms, which reflect respondents' perceptions of social approval for a behaviour by important social others. These outcomes, along with attitudes, were assessed in Table 4 by aggregating multiple survey items into an index score, where higher scores reflected more supportive attitudes and social norms toward adopting healthy HIV prevention behaviours.

We observed statistically significant differences ($P < 0.01$) in mean scores between LISTEN CoP members and unexposed CoP members for the three key behaviours of condom use, HIV testing, and PrEP use. Specifically, LISTEN CoP members demonstrated greater approval of these behaviours. These differences were also evident in the matched analysis, where LISTEN CoP members scored 0.22 points higher for attitudes toward condom use (ATE = 0.22, 95%CI [0.12, 0.32]; $P < 0.01$), 0.23 points higher for attitudes toward HIV testing (ATE = 0.23, 95%CI [0.16, 0.31]; $P < 0.01$), and 0.30 points higher for attitudes toward PrEP (ATE = 0.30, 95%CI [0.18, 0.41]; $P < 0.01$) compared to the unexposed group.

For descriptive norms, similar results were observed. In crude analysis, LISTEN CoP members reported statistically significantly higher mean scores for perceptions of typical condom use and HIV testing behaviours within their communities ($P < 0.05$). The crude difference in descriptive norms regarding PrEP approached but was ultimately not significant at the 0.05 level (3.54 vs 3.41). These differences persisted in matched analysis, where LISTEN CoP members

scored 0.31 points higher for perceptions of descriptive norms related to condoms (ATE = 0.31, 95%CI [0.18, 0.44]; $P < 0.01$), 0.16 points higher for descriptive norms related to HIV testing (ATE = 0.16, 95%CI [0.05, 0.28]; $P < 0.01$), and 0.11 points higher for descriptive norms related to PrEP use (ATE = 0.11, 95%CI [0.00, 0.22]; $P < 0.05$) compared to comparison CoP members.

We assessed injunctive norms, which reflect perceived acceptability of behaviours by influential social others. Similar trends were observed in crude mean scores, with LISTEN CoP members reporting statistically significantly higher scores for injunctive norms related to each of the three behaviours ($P < 0.05$). However, in matched analysis, no statistically significant differences were observed for injunctive norms related to condoms. In contrast, statistically significant differences remained for injunctive norms related to HIV testing (ATE = 0.23, 95%CI [0.10, 0.35]; $P < 0.01$) and PrEP use (ATE = 0.34, 95%CI [0.16, 0.52]; $P < 0.01$), with LISTEN CoP members demonstrating 0.23 points higher for HIV testing and 0.34 points higher for PrEP use, compared to unexposed CoP members.

Sensitivity analysis

Sociodemographic differences between the two samples were driven more by educational attainment than by age. In a logistic model predicting LISTEN CoP membership, educational attainment was strongly associated with exposure ($\beta = 0.41$, $P < 0.001$) and its coefficient was essentially unchanged when age was added to the model ($\beta = 0.43$, $P < 0.001$), while age itself contributed little ($\beta = 0.002$, $P = 0.047$). Marital status was not associated with exposure in either specification.

Regression-adjusted estimates were consistent with the matched analysis for most outcomes (Online Appendix 1 Table 2-A1). After adjustment for age alone, and then additionally for sex, educational attainment and marital status, the differences in condom use at last sex (adjusted difference 0.14, $P = 0.012$), ever having taken PrEP (adjusted difference 0.09, $P = 0.014$), ever circumcision (adjusted difference 0.26, $P < 0.001$), all three attitude indices (adjusted difference 0.16–0.35, all $P < 0.001$), all three descriptive norm indices (adjusted difference 0.11–0.33) and perceived behavioural control for condom use (adjusted difference 0.15, $P = 0.046$) retained the direction, approximate magnitude, and statistical significance observed after matching.

Several findings were, however, sensitive to the analytic approach. The lower reported awareness of HIV status among LISTEN CoP members, which was statistically significant in the matched analysis, attenuated to near zero under regression adjustment (adjusted difference −0.02, $P = 0.570$), as did the difference in intentions to use condoms ($P = 0.10$, not statistically significant). Estimated differences in perceived behavioural control were also smaller under regression adjustment than after matching, substantially so for HIV testing (adjusted difference 0.03, $P = 0.719$) and for PrEP (adjusted difference 0.27, $P = 0.003$, compared with a matched ATE of 0.60). Conversely, injunctive norms regarding condom use and intentions to seek information about PrEP, neither of which reached significance after matching, were statistically significant under regression adjustment (adjusted difference 0.19, $P = 0.006$ and adjusted difference 0.17, $P = 0.016$ respectively).

Discussion

This study provides evidence that the LISTEN process, an integrated model combining HCD, community engagement, and localised data use, is associated with more favourable HIV prevention behaviours and their underlying psychosocial determinants in Eswatini. We observed statistically significant differences in several key prevention outcomes among LISTEN CoP members compared to matched counterparts, including condom use at last sex and use of PrEP. These findings are complemented by consistent gains across intermediate behavioural determinants, including attitudes, perceived social norms, and self-efficacy, which are well-established predictors of behaviour change.

Members of LISTEN CoPs reported substantially higher condom use at last sex than comparison CoP members (58.9% vs 40.4%; ATE = 0.14, $P < 0.01$). This finding aligns with evidence that community-based and participatory interventions can effectively shift both individual behaviours and normative environments.[15,16] Wang et al. found that individual-only interventions frequently face limitations because they ignore the relational power dynamics and situational factors governing sexual behaviour. Conversely, interventions operating at the community or network level successfully reshape localised group norms, making condom use more socially accepted and supported.[17] The 14-percentage-point absolute difference in condom use is programmatically meaningful in a high-prevalence setting, where even modest behaviour changes can have population-level effects on transmission dynamics.

Similarly, the statistically significant increase in PrEP uptake among LISTEN participants is notable given historically low uptake of biomedical prevention tools among general populations in sub-Saharan Africa. Embedding demand generation within trusted community structures has been shown to be effective,[18] and coupled with tailored messaging informed by HCD, can address persistent barriers related to awareness, stigma, and perceived risk.[19] However, the survey did not record when PrEP was first taken.

The large difference observed in reported male circumcision (ATE = 0.30) warrants careful interpretation. Circumcision was recorded as a lifetime event, self-reported by men or by women reporting on a male partner, and the survey

did not capture when it occurred. Men circumcised before LISTEN began therefore contribute to this estimate, and the measure cannot distinguish uptake during the 4-year implementation period from pre-existing prevalence. Since a circumcision performed before 2020 cannot have been caused by the programme, the comparison is in effect a cross-sectional prevalence contrast between regions. Eswatini's VMMC programme has been scaled through national campaigns since 2011 with documented regional variation in coverage, so the observed difference is at least as consistent with pre-existing regional differences in circumcision prevalence as with LISTEN's referral activity. VMMC-related intentions, attitudes and norms were measured but could not be estimated with acceptable precision in the matched subsamples, so no corroborating evidence on the hypothesised behavioural pathway is available. We therefore do not interpret this difference as an effect of the LISTEN process, and present it as descriptive only. LISTEN did not provide VMMC services directly but referred male clients as part of community engagement and outreach; VMMC reduces heterosexual HIV acquisition by an estimated 60%,[20,21] so uptake remains an important programmatic objective even though this study cannot quantify LISTEN's contribution to it. This interpretation should not be taken to dismiss LISTEN's potential contribution to circumcision uptake. Community engagement that normalises VMMC, connects men with services, and sustains referral pathways over 4 years may contribute meaningfully to cumulative uptake; and these mechanisms are plausible and worth continued investigation. However, testing them requires measures the present study did not collect: the date of circumcision, region-level baseline VMMC prevalence, and verification against VMMC service records. Future evaluations should incorporate all three.

Beyond behavioural outcomes, this study contributes to the growing body of evidence highlighting the importance of psychosocial pathways in HIV prevention. LISTEN CoP members reported significantly higher scores across attitudes, descriptive norms, and perceived behavioural control for condom use, HIV testing, and PrEP. These findings are consistent with social and behavioural theories, including the TPB, which posits that shifts in norms and self-efficacy are critical precursors to sustained behaviour change.[14] The magnitude and consistency of these differences across multiple domains suggest that LISTEN is associated not only with discrete behaviours but also with the broader social context in which these behaviours occur. Critically, the pattern of findings across TPB antecedents (consistent positive differences on attitudes, descriptive norms, injunctive norms, and perceived behavioural control across multiple behaviours) is consistent with what theory predicts if the CoP structure is genuinely shifting the community normative environment rather than producing isolated individual-level attitude changes. This internal coherence across constructs strengthens the theoretical interpretation of LISTEN as a community-level normative change mechanism, not merely an individual behaviour change programme, although it does not by itself establish that mechanism.

From a health systems perspective, the findings highlight the potential of community platforms as vehicles for strengthening resilience and sustainability. As Eswatini navigates a transition away from reliance on external funding, models like LISTEN offer a pathway for embedding capacity within local institutions and communities. The integration of simplified, actionable data into community decision-making processes is particularly promising, as it addresses longstanding challenges related to data accessibility and use at decentralised levels of the health system.

However, not all findings were uniformly positive. The statistically significant reduction in self-reported knowledge of HIV status among LISTEN CoP members in matched analysis (ATE = −0.07, P = 0.016) is the study's most provocative finding. One possible explanation is that LISTEN CoP members, through increased engagement and awareness, may have developed a more nuanced understanding of HIV risk and the importance of recent testing, leading to more conservative self-reporting. Alternatively, these findings may reflect broader contextual factors, including disruptions to HIV testing services during the COVID-19 pandemic, which have been widely documented to affect service utilisation across sub-Saharan Africa.[22] It is possible that LISTEN CoP members, more attuned to the health system through programme participation, were more aware of lapsed testing and therefore less likely to report known status. Third, comparison CoP members may systematically over-report knowledge of HIV status, particularly if community organisation membership is itself associated with greater perceived need to appear engaged with health services. Future evaluations should include objective testing record linkage and qualitative investigation of how CoP members conceptualise and communicate about HIV status knowledge. This finding should, in any case, be treated with caution: it did not persist when age and other sociodemographic characteristics were adjusted for by regression rather than matching (adjusted difference −0.02, P = 0.570), and it may therefore reflect the composition of the matched sample rather than a difference between the two populations.

Taken together, the behavioural findings reveal a coherent pattern: LISTEN was most consistently associated with more favourable outcomes in domains that depend primarily on individual and social-normative factors (condom use, behavioural intentions, attitudes, and perceived behavioural control) while outcomes requiring reliable health system access, such as HIV testing and PrEP initiation, showed smaller or non-significant differences. This is consistent with a programme model that operates through community-level demand generation and referral rather than direct service provision. It also suggests that realising the full prevention impact of community-led

models like LISTEN requires complementary investment in health system readiness and service availability, particularly in contexts where facility access remains uneven.

Strengths and limitations

This study has several strengths. First, it evaluates a mature community-led intervention after approximately 4 years of implementation, allowing assessment of outcomes after LISTEN CoPs had completed multiple cycles of problem diagnosis, solution design, implementation and learning. Second, the evaluation included a comparison population from non-LISTEN regions and randomly selected participants from CoP membership rolls, strengthening the internal consistency of the comparison between exposed and unexposed groups. Third, the analysis combined crude comparisons with matched analysis to improve comparability between LISTEN and comparison participants on measured demographic and behavioural characteristics. Finally, the study assessed both HIV prevention behaviours and theoretically relevant psychosocial determinants, including behavioural intentions, attitudes, perceived social norms and perceived behavioural control, providing insight into plausible pathways through which LISTEN may influence prevention outcomes.

These findings should nevertheless be interpreted in light of several limitations. The evaluation used an endline-only, quasi-experimental design without baseline quantitative measures or random assignment; therefore, pre-intervention equivalence between LISTEN and comparison CoPs could not be established, and observed differences cannot be attributed solely to the LISTEN process. Geographic confounding is also a key concern, as LISTEN was implemented in Manzini and Lubombo while comparison CoPs were drawn from Hhohho and Shiselweni; these regions may differ in HIV programme history, service infrastructure, socioeconomic context and baseline prevention uptake. Although matching improved balance on measured characteristics, it could not account for unmeasured individual-, organisational- or regional-level differences. In addition, outcomes were self-reported and may be affected by recall error or social desirability bias, particularly for sensitive HIV prevention behaviours. Two behavioural outcomes, use of PrEP and circumcision, were measures whose timing relative to implementation was not recorded, so they may capture events that preceded the intervention. The ATEs should therefore be interpreted as adjusted associations rather than unbiased causal effects, and their magnitudes should be treated as uncertain for planning purposes.

The final LISTEN sample was smaller than originally targeted, reducing statistical power, widening confidence intervals for some outcomes, limiting stratified analyses by region or subgroup, and constraining the ability to account for clustering within CoPs. Finally, because the study population was limited to members of selected CoPs, findings may not be generalisable to the broader population of Eswatini or to communities without organised community structures. Future evaluations would be strengthened by baseline measurement, objective service-use data where feasible, dated rather than lifetime measurement of prevention behaviours, and designs that better account for regional and organisational differences. Finally, several findings proved sensitive to the analytic strategy: the differences in reported awareness of HIV status, intentions to use condoms and perceived behavioural control were attenuated when the analysis used regression adjustment rather than matching, while two further differences reached significance only under regression adjustment. We therefore place greater weight on the outcomes that were robust across both approaches and treat the remainder as provisional.

Implications

The study offers important contributions to both the evidence base and programmatic practice. It provides preliminary evidence that a structured, community-centred approach grounded in HCD is associated with more favourable HIV prevention behaviours and their determinants in a high-burden setting. Future research should explore longitudinal impacts, cost-effectiveness, and scalability of the LISTEN model, as well as its applicability to other health domains. As Eswatini advances toward sustained epidemic control, addressing the 'last mile' will require approaches that go beyond care and treatment to tackle underlying social, behavioural, and structural drivers of HIV risk. The LISTEN process represents a promising model for achieving this by placing communities at the centre of innovation, fostering local ownership, and translating data into action. For programme offices and ministries considering replication, the current evidence suggests that meaningful differences in psychosocial determinants and selected behaviours are achievable within CoPs meeting consistently over a minimum of 2–3 years; changes in upstream normative outcomes may appear earlier than changes in clinic-dependent behaviours such as testing and PrEP initiation, which require parallel investment in health system readiness. Geographic embeddedness, ensuring that CoPs are anchored within recognised community structures rather than standing alone as programme entities, appears to be an important design feature for sustainability beyond the funding period.

Conclusion

This study adds to the evidence that community-led approaches implemented in structured CoPs, facilitated by HCD and linked to health systems, can strengthen behavioural intentions and their determinants for HIV prevention. While the findings should be interpreted within the study's design limitations, they demonstrate that the LISTEN process was associated with meaningful improvements in community participation, confidence in accessing services, and uptake of selected prevention behaviours. Findings reinforce the value of embedding

CoPs within existing community structures, where local ownership, continuous learning, and the use of community-generated data can support more responsive and sustainable programming.

As Eswatini moves closer to sustained epidemic control, reaching the remaining populations at greatest risk will require interventions that complement clinical services by addressing the social, behavioural, and structural factors that shape health-seeking behaviours. The LISTEN process offers a practical implementation model for doing so, demonstrating that upstream changes in trust, agency, and community engagement may create the conditions necessary for longer-term improvements in service utilisation. Future research should examine the model's longitudinal impact, cost-effectiveness, and scalability, as well as its applicability to other health priorities where community-led problem-solving and adaptive implementation are essential.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

CRediT authorship contribution

Sharon Kibwana: Investigation, Project administration, Supervision, Writing – original draft, Writing – review & editing. Bryan C. Shaw: Data curation, Investigation, Software, Writing – original draft, Writing – review & editing. Steve Kretschmer: Conceptualisation, Writing – review & editing. Lindiwe Mkhatshwa: Investigation, Project administration, Writing – review & editing. Herbert Chomutare: Investigation, Project administration, Writing – review & editing. Jiaqin Wu: Data curation, Software, Visualisation, Writing – original draft, Writing – review & editing. Sylvia Ojoo: Investigation, Writing – review & editing. Mark Dybul: Conceptualisation, Investigation, Supervision, Writing – review & editing. All authors reviewed the article, contributed to the discussion of results, approved the final version for submission and publication, and take responsibility for the integrity of its findings.

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Data availability

The data that support the findings of this study are not publicly available due to privacy and ethical restrictions, as they contain information that could compromise the confidentiality of research participants. The data are held by the study team and may be made available from the corresponding author, Sharon Kibwana, on reasonable request and subject to the necessary ethical approvals.

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