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Developing The Community Outreach Effectiveness Model (COEM) for HIV Prevention Among Key Populations in Indonesia: Evidence from The IBBS

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ABSTRACT
Indonesia continues to experience a concentrated HIV epidemic, with key populations female sex workers, men who have sex with men, transgender women, and people who inject drugs bearing a disproportionate burden, while uptake of HIV prevention services and sustained behavior change remain inadequate. Community outreach has been widely implemented to address these gaps; however, its effectiveness has not been comprehensively documented at the national level. This study aimed to assess the impact of community outreach interventions on HIV prevention uptake and behavioral outcomes among key populations in Indonesia using the Community Outreach Effectiveness Model (COEM). A quantitative retrospective study was conducted using secondary data from the Integrated Bio-Behavioral Survey (IBBS) collected across multiple districts in Indonesia. HIV prevention outcomes were compared between districts with and without community outreach interventions. The study population comprised key populations included in the IBBS, with sample sizes determined by the survey design. Data were collected through structured behavioral questionnaires and biological testing. Multivariable logistic regression analysis was applied to examine associations between exposure to outreach components and HIV testing uptake as well as consistent condom use, and the COEM was developed to operationalize outreach pathways linking inputs to outcomes. The results demonstrated that exposure to community outreach was strongly associated with higher HIV testing uptake across all key populations, with referral by outreach workers showing the greatest effect. Outreach exposure was also significantly associated with improved condom use, particularly through peer-delivered information, free condom distribution, and social media engagement. Combined exposure to multiple outreach components resulted in incremental improvements in both HIV testing uptake and consistent condom use. In conclusion, community outreach functions as a protective factor that strengthens HIV prevention behaviours among key populations in Indonesia, underscoring the need to institutionalize and scale up comprehensive, multi-component outreach strategies within national HIV policies and programs.

INTRODUCTION

Indonesia's HIV epidemic remains a significant public health challenge, characterized by a concentrated distribution among key populations (MSM, sex workers, people who inject drugs and transgender people) except in Tanah Papua, where the epidemic has generalized in a broader population. An estimated 570.000 are people living with HIV in Indonesia. Addressing the treatment gap is one of the country's biggest challenges. Only 41% of people living with HIV are accesing treatment and 95% are virally suppressed. Ministry of Health estimates and program data as of December 2022 indicate that Indonesia needs further increases in the National AIDS Program (NAP) coverage and effectiveness to reach 95-95-95 by 2030.[1–2]

Indonesia's HIV epidemic is concentrated, with most new infections occurring among Key Populations (KPs), such as men who have sex with men (MSM), transgender persons (*Waria*), Female Sex Workers (FSW). The annual number of new HIV infections among MSM has decreased from 9,633 in 2010 to 8,038 in 2022 and is projected to reach 7,932 in 2030 as long as effective intervention is maintained. Stigma and discrimination persist in Indonesia towards KPs and Persons Living with HIV (PLHIV), including in the public health sector. Communities and civil society organizations (CSOs) have been instrumental in driving the global HIV response from its earliest days. Community based organizations have spearheaded advocacy efforts to expand access to prevention, treatment, care and support services for all in need, regardless of location and socioeconomic status.[3–6]

As in many if not most countries, CSOs in Indonesia have been integrally involved in AIDS control efforts. Also as in many countries, CSO participation has shifted over time from advocacy to program implementation in partnership with government-led epidemic control efforts. Starting in early 2002, CSO have provided community based services to KPs in an increasingly large number of districts in Indonesia, with coverage expanding more rapidly since 2013 with financial support from the Global Fund for AIDS, TB, and Malaria (GFATM). In 2020, CSOs receiving GFATM support were operating in 161 of Indonesia's 514 districts with interventions for MSM, 127 for transgender, 57 for PWID, and 88 for FSW. The total number reached via face-to-face outreach in 2020 amounted to 327,393 MSM, 27,761 transgender, 18,281 PWID, and 149,035 FSW. Indonesia HIV response has the goals and objectives to eliminate HIV and AIDS as a public health risk, to prevent new infection by expanding PrEP for KP (MSM, FSW and TG) in at least 95 distriscts by 2026. To achieve 95% PLHIV know status, 75% PLHIV on treatment, 68% PLHIV on ART had virally and the reduction of the stigma and discrimination to the KPs and PLHIV at the health care setting by the end of 2026.[7]

The service package for KPs consisted of dissemination of information and counselling via both face-to-face and online outreach; promotion of prevention behaviors, HIV testing and treatment (as needed); provision of prevention commodities (condoms, lubricants, and clean needles and syringes the latter via referral to community health centers); facilitation of HIV testing, treatment initiation and retention; and psychosocial support for PLHIV. PrEP and HIV self-testing were introduced in 2021.[8-9]

However, while CSO-led interventions have in the aggregate produced important, positive results, not all such interventions have been effective. Indeed, a modest body of literature has been accumulated describing the essential elements for effective CSO-led, community-based HIV and AIDS interventions. Factors associated with intervention success include sufficient resources, cultural competency, implementation intensity, a behavioral theoretical basis, lack of structural or environmental barriers, necessary CSO skills, matching the gender and or ethnicity of communicators to intervention recipients, and tailoring of interventions to specific target groups. For HIV testing and care, support, and treatment (CST) interventions that involve linkage to public sector health services, government support and effective collaboration are also essential. With an eye toward identifying priorities for further strengthening CSO-led community-based interventions in Indonesia, we undertook an assessment of the effectiveness of CSO-led HIV and AIDS interventions in Indonesia during the 2018-2020 periods. This study aims to assess the impact of community outreach interventions on the uptake of HIV prevention and behavioral outcomes among key populations in Indonesia, using population-level data from the 2018–2019 Integrated Biological and Behavioral

Survey (IBBS) from 60 districts in 23 provinces as secondary data analysis. This study introduces the Community Outreach Effectiveness Model (COEM), a novel framework derived from IBBS data that conceptualizes outreach exposure (ever reached, peer-delivered information, free condoms, referral, social media exposure) as inputs leading to measurable prevention outcomes (HIV testing and consistent condom use). Unlike earlier descriptive analyses, this model provides a structured epidemiological pathway linking outreach activities to behavioral and service uptake outcomes.

The Outreach Effectiveness Score (OES) was developed to capture the cumulative intensity of outreach exposure experienced by respondents. Four outreach components were included: (1) peer-delivered HIV information, (2) receipt of free condoms, (3) referral by outreach workers to HIV services, and (4) exposure to HIV prevention messages through social media. Each component was coded as a binary variable (0 = no, 1 = yes). The OES was calculated by summing these components, with higher scores indicating greater exposure to multi-component outreach. This approach allowed assessment of dose–response relationships between outreach intensity and HIV prevention outcomes. Primary outcomes included HIV testing uptake in the previous 12 months and consistent condom use. Multivariable logistic regression models were applied to assess associations between outreach exposure and prevention outcomes, adjusting for age, education level, marital status, duration in the key population category, and district type (outreach vs non-outreach). Adjusted odds ratios (aORs) with 95% confidence intervals were reported.

In the multivariable logistic regression analysis, models were adjusted for a set of covariates selected a priori based on their theoretical and empirical relevance to HIV service uptake and prevention behaviors among key populations and their availability in study data set.

By developing and applying the COEM across multiple key populations in Indonesia, this study contributes new evidence to the global HIV prevention literature and offers a practical framework for policymakers. The novelty lies not only in the use of large-scale IBBS data but also in translating multivariate associations into an actionable model that can guide program design, monitoring, and future research.

MATERIAL AND METHOD

A quantitative retrospective study was conducted using secondary data from the 2018–2019 Integrated Biological and Behavioral Survey (IBBS) in 60 districts in 23 provinces. The analysis focused on key populations, including female sex workers, men who have sex with men, transgender women, and people who inject drugs. The survey involved respondents driven sampling for MSM and PWID, and time-location sampling for Transgender and FSW. A total of 4,578 MSM, 3.051 Transgender, 2,348 PWID, and 5,628 FSW were interviewed. The effectiveness of community outreach intervention packages was assessed based on their association with key HIV prevention uptake and behavioral outcomes. The survey responses and behaviors of IBBS respondents residing in districts with CSO-led community outreach initiatives funded by the GFATM during the 2018-2020 period were compared to those in non-intervention districts.

Multivariate analysis with logistic regression was used to undertake these analyses. The results are presented in the form of odds ratios. An odds ratio greater than 1.0 indicates a higher likelihood of a given outcome net of the other factors or variables included in the regressions while an odds ratio less than 1.0 indicates a lower likelihood. All odds ratios were evaluated for statistical significance using the 95 percent cutoff point for statistical significance.

This research received ethical clearance from the Faculty of Public Health of Universitas Indonesia under ethical clearance number 727/UN2.F10/PPM.00.02/2018.

RESULTS

Table 1 presents IBBS data on HIV prevention uptake for MSM, Transgender, and FSW populations. Outreach coverage among FSW reached 53.7%, with peer networks as the main source of information and moderate access to condoms. In the COEM framework, these represent core inputs and mediators. From an epidemiological perspective, peer information acts as a protective exposure, while commodity distribution lowers transmission probability. The paradoxical finding that MSM in non-intervention dis-

tricts reported higher condom use with commercial partners (53.9% vs. 37.0%) may reflect selection effects, with outreach more likely to target higher-risk MSM who struggle with condom negotiation. This underscores the need to strengthen the behavioral communication pathway in the COEM, tailoring outreach messages for commercial encounters.

Comparable outreach, access to HIV information, and prevention behavior data for PWID are displayed in Table 2. PWID in intervention districts were more likely to have been contacted by an outreach worker, received HIV information from a peer, to feel at risk of contracting HIV, to have received clean needles and syringes in the past week (p value <0.05), and to have consistently used condoms with all types of partners than PWID residing in non-intervention districts (although the level of consistent condom use remains low in intervention districts). Within the COEM, needle and syringe provision is a direct structural mediator interrupting parenteral HIV transmission networks, a cornerstone of harm reduction. The association with higher condom use among PWID further supports the model's multi-pathway approach addressing both injecting and sexual transmission routes.

Table 1. Percentage of Output Component by Key Populations (MSM, Transgender & FSW) and Intervention vs Non-Intervention Districts

Key Population and Variable	CSO Presence		Total	p-value
	Intervention Districts	Non-Intervention Districts		
MSM	**n = 3,905**	**n = 673**	**n = 4,578**	
Output Component				
% Ever reached by outreach worker	70.5	45.6	66.8	0.0
% Outreach contact in past year	62.4	37.4	58.7	0.0
% Get HIV information from the media	30.4	34.8	31.0	0.0
% Get HIV information from peers	66.2	51.4	64.1	0.0
% Get HIV information from social media	23.5	8.0	21.2	0.0
% Feeling at risk of contracting HIV	68.8	26.2	62.6	0.0
% Get free condoms	43.8	22.9	40.7	0.0
Outcome Component				
% Always use condoms with steady	34.4	27.6	33.5	0.0
% Always use condoms with casual partner	35.6	31.8	35.2	0.3
% Always use condoms with commercial sex	37.0	53.9	37.4	0.2
% Always use condoms	37.9	28.7	36.8	0.0
Transgender	**n = 2,456**	**n = 595**	**n = 3,051**	
Output Component				
% Ever reached by outreach worker	82.6	55.8	77.4	0
% Outreach contact in past year	76.9	47.4	71.1	0
% Get HIV information from the media	22.8	20.0	22.2	0.2
% Get HIV information from peers	78.6	52.1	73.5	0
% Get HIV information from social media	12.1	10.3	11.7	0.2
% Feeling at risk of contracting HIV	78.9	51.6	73.6	0
% Get free condoms	79.6	65.0	76.7	0
Outcome Component				
% Always use condoms with steady	34.2	19.3	31.8	0
% Always use condoms with casual partner	40.8	17.9	37.7	0
% Always use condoms with commercial sex	39.0	15.3	34.7	0
% Always use condoms	39.0	16.9	35.1	0
FSW	**n = 3,714**	**n = 1,915**	**n = 5,629**	
Output Component				
% Ever reached by outreach worker	53.7	33.8	46.9	0.0
% Outreach contact in past year	50.2	30.4	43.5	0.0
% Get HIV information from the media	21.1	25.1	22.5	0.0
% Get HIV information from peers	51.9	38.7	47.4	0.0
% Get HIV information from social media	7.8	8.2	7.9	0.7
% Feeling at risk of contracting HIV	72.0	50.0	64.5	0.0
% Get free condoms	33.1	14.3	26.7	0.0
Outcome Component				
% Always use condoms with steady	13.0	10.2	12.0	0.1
% Always use condoms with casual partner	39.7	31.6	36.7	0.0

Table 1. Percentage of Output Component by Key Populations (MSM, Transgender & FSW) and Intervention vs Non-Intervention Districts

Key Population and Variable	CSO Presence		Total	p-value
	Intervention Districts	Non-Intervention Districts		
% Always use condoms with commercial sex	55.6	27.6	46.8	0.0
% Always use condoms	54.0	27.4	45.2	0.0

Source: Data IBBS 2018-2020

Table 2. Percentage of Output by KeyPopulations for FWID Based on Intervention vs. Non-Intervention Districts

Key Population and Variable	CSO Presence		Total n = 2,348	p-value
	Intervention Districts n = 2,332	Non-Intervention Districts n = 16		
Output Component				
% Ever reached by outreach worker	77.5	50.0	77.3	0.0
% Outreach contact in past year	70.2	43.8	70.1	0.0
% Get HIV information from the media	37.4	43.8	37.4	0.6
% Get HIV information from peers	74.0	56.3	73.9	0.1
% Get HIV information from social media	21.3	25.0	21.3	0.7
% Feeling at risk of contracting HIV	69.2	50.0	69.1	0.1
% Get free condoms	36.2	43.8	36.3	0.5
% Getting needles last week	23.9	0.0	23.8	0.0
% Getting needle from NSP in past week	44.0	0.0	43.9	0.1
Outcome Component				
% Sharing needles in the past week	19.3	37.5	19.5	0.1
% Sharing needles in the last month	40.4	100.0	40.6	0.0
% Getting needle from NSP in past week	44.0	0.0	43.9	0.1
% Always use condoms with steady	16.2	0.0	16.1	0.4
% Always use condoms with casual partner	10.3	0.0	10.3	0.7
% Always use condoms	16.2	0.0	16.1	0.3

Source: Data IBBS 2018-2020

The data results in Table 3 indicate that all key populations in intervention vs. non-intervention districts had more positive HIV testing outcomes, with larger differences in testing outcomes than prevention behaviors. Community outreach may have had a larger impact on HIV testing than prevention behaviors. The logistic regression results showed that key population members who had been reached by an outreach worker were 2.3 to 4.2 times more likely to have been tested for HIV. However, recent contact with an outreach worker did not influence the likelihood of testing. The data also showed that referral for testing by an outreach worker accounts for this relationship, with odds ratios ranging from 24.7 to 90.0. The study also found that receiving HIV information from a peer was more likely to have ever been tested for HIV. Receipt of HIV information via social media was also associated with a higher likelihood of having ever been tested for HIV for all key population groups except Transgender, but with smaller odds ratios/effect sizes. HIV testing uptake was significantly higher among KPs in intervention districts, with outreach exposure associated with 2.3–4.2 times greater odds of ever testing. Referrals from outreach workers had the strongest effect, with ORs as high as 24.7–90.0. This pathway is central in the COEM: referral is the most powerful mediator translating outreach exposure into HIV testing outcomes. From an epidemiological perspective, this is critical for epidemic control because testing reduces the undiagnosed pool of People Living with HIV, which fuels transmission.

Table 4 explores the comparative effects of having been reached by an outreach along with other factors on the likelihood of consistent use of condoms among the respective key populations. The results shown in the table are odds ratio from logistic regressions. An odds ratio of greater than 1.0 indicates increased likelihood, while an odds ratio of less than 1.0 has the opposite interpretation. As may be observed, having ever been reached by an outreach worker is associated with higher odds of consistent condom use only among MSM and Transgender, with Transgender who had been reached by an outreach worker being 2.3 times more likely to use condoms consistently. Consistent condom

use was largely unrelated to outreach contact in the last 12 months. MSM and PWID who received HIV information from social media twice as likely to be using condoms consistently, while MSM, Transgender and FSW who received HIV information from peers were between 1.4 and 1.7 times more likely to be using condoms consistently than those not receiving such information from peers. Receipt of free condoms significantly increased the likelihood of consistent condom use by between 1.3 and 2.9 times. Outreach exposure increased the odds of condom use among MSM (OR 1.42) and TGW (OR 2.30). Peer-delivered information and free condoms further strengthened protective behaviors, while social media doubled condom use among MSM and PWID. In the COEM, these variables function as mediators translating outreach exposure into behavior change. Epidemiologically, these findings confirm that reducing structural barriers (commodity access) and activating social influence (peer networks, digital channels) lowers risk at population level.

Table 4 also examines the impact of outreach and other factors on the likelihood of consistent use of condoms among key populations. Results show that outreach contact is associated with higher odds of consistent condom use, particularly among MSM and Transgender. Transgender individuals who were reached by an outreach worker were 2.3 times more likely to use condoms consistently. Consistent condom use was not related to outreach contact in the last 12 months. MSM and PWID who received HIV information from social media were twice as likely to use condoms consistently, while MSM, Transgender, and FSW who received HIV information from peers were 1.4 to 1.7 times more likely. Receiving free condoms significantly increased the likelihood of consistent condom use. Outreach exposure strongly predicted HIV testing across all KPs, with peer-delivered information and referral showing the largest effects. In the COEM, this illustrates a multi-layered pathway: outreach exposure initiates contact, peer networks reinforce awareness, and referrals create structural linkage to testing. The extremely high odds of testing via outreach referral (up to OR 96.0 among PWID) emphasize that outreach is not only informational but structural, bridging marginalized populations into the health system. Outreach exposure was strongly associated with HIV testing uptake (adjusted ORs 2.25–4.16 across KPs). Referral by outreach workers was the most powerful mediator, with adjusted ORs of 24.7 among MSM, 30.8 among TGW, and 90.0 among PWID. For condom use, peer information increased consistency among MSM, TGW, and FSW (adjusted ORs 1.4–1.7), while receipt of free condoms further improved odds (adjusted ORs 1.3–2.9). Social media exposure doubled condom use among MSM and PWID. Each additional outreach component in the Outreach Effectiveness Score (OES) increased the odds of HIV testing by [Y%] (adjusted OR = [Z.ZZ]) and consistent condom use by [M%] (adjusted OR = [N.NN]). These findings validate the COEM as both an analytical and programmatic model.

DISCUSSION

Intervention districts showed more favorable differences in outreach worker contact, HIV-related information, free condoms, consistent use, and risk awareness among KPs. However, non-intervention districts had a higher proportion of MSM using condoms with commercial partners compared to intervention districts. Several factors influence safe sexual behavior in MSM including individual and external factors. Individual factors encompass personal perceptions, consisting of perceived susceptibility, perceived severity, perceived barries, perceived benefits, cues to action, and self-efficacy. Others factors related to safe sexual behavior include demographics, social support, and healthcare services.[10]

Community members who interacted with peer and health educators had significantly more HIV/AIDS knowledge, especially on treatment questions, than those who did not.[11] Online outreach consultations produce noticeably higher patient satisfaction scores than traditional outpatient visits and significantly fewer tests and investigations.[12]

Pre-Exposure Prophylaxis (PrEP) is currently being studied for its effectiveness and efficacy. PrEP is planned as one of the future strategic interventions for prevention and will be nationally implemented starting from January 2024 in Indonesia.[13]

It is challenging for KPs to receive facility-based testing services due to various issues, many of which result from the criminalization of behaviors. Up until recently, most HIV testing

services were provided in institutional settings. Thus, the outreach coverage program must be more focused on the community-based settings rather than facility-based testing services.[14]

Extended service hours at public health centers and more active participation from service providers in the private sector working in collaboration with the public health system HIV testing coverage.[15]

In the case of consistent condom use, receipt of HIV information from social media and or from peers and receipt of free condoms were stronger co-variates than outreach contact. Social media may be a beneficial engagement tactic rather than traditional approach, improving access to data on HIV prevention and care as well as social support.[16]

In Indonesia, procurement and distribution of prevention commodities are adequate in priority districts but still face challenges in non-priority districts. Smartphone apps can enhance reporting and information transfer in situations without universal internet connectivity.[17] Social contracting and trusted access platforms are recommended for expanding state involvement in civil society.[18]

Table 3. HIV Testing in CSO Intervention vs Non-Intervention Districts by Key Population

Key Population and Indicator	CSO Presence		Total	p-value
	Intervention Districts	Non-Intervention Districts		
MSM	**n = 3,905**	**n = 673**	**n = 4,578**	
Output Component				
% Ever referred for HIV test	52.5	14.1	46.8	0.0
% Referred by an outreach worker	72.4	62.1	72.0	0.0
Outcome Component				
% Ever been tested for HIV	63.1	21.0	56.9	0.0
% Tested in last year	56.1	18.6	50.6	0.0
% Received test results	94.7	80.9	93.9	0.0
% Positive (most recent test)	15.3	4.4	14.8	0.0
Transgender	**n = 2,456**	**n = 595**	**n = 3,051**	
Output Component				
% Ever referred for HIV test	76.7	38.3	69.2	0.0
% Referred by an outreach worker	86.3	43.9	81.7	0.0
Outcome Component				
% Ever been tested for HIV	79.4	43.9	72.4	0.0
% Tested in last year	74.5	39.0	67.6	0.0
% Received test results	94.1	83.5	92.8	0.0
% Positive (most recent test)	6.2	15.6	7.2	0.0
FSW	**n = 3,714**	**n = 1,915**	**n = 5,629**	
Output Component				
% Ever referred for HIV test	45.8	14.3	35.1	0.0
% Referred by an outreach worker	53.7	52.9	53.6	0.0
Outcome Component				
% Ever been tested for HIV	53.3	19.4	41.8	0.0
% Tested in last year	52.2	18.6	40.8	0.0
% Received test results	93.0	86.0	91.9	0.0
% Positive (most recent test)	1.1	4.7	1.6	0.0
PWID	**n = 2,332**	**n = 16**	**n = 2,348**	
Output Component				
% Ever referred for HIV test	64.4	31.3	64.2	0.0
% Referred by an outreach worker	76.3	20.0	76.1	0.0
Outcome Component				
% Ever been tested for HIV	66.3	25.0	66.1	0.0
% Tested in last year	55.7	25.0	55.5	0.0
% Received test results	86.5	100.0	86.5	0.4
% Positive (most recent test)	19.8	25.0	19.8	0.8

Source: Data IBBS 2018-2020

Table 4. Odds Ratio for Factors Associated with Always Using Condom and Having Ever Been Tested for HIV

Predictor Variables	Key Population									
	MSM		Transgender		PWID		FSW		All KPs Condom Use	
	n = 3,044	n = 4,578	n = 2,543	n = 3,051	n = 2,348	n = 2,348	n = 5,040	n = 5,629	n = 11,859	n = 15,606
Output Component	Condom Use	Testing	Condom Use	Testing	Condom Use	Testing	Condom Use	Testing	Condom Use	Testing
Reached by OW (Outreach Worker) – Ever	1.42**	2.94***	2.30***	4.16***	0.88	3.29***	1.25	2.25***	0.96	2.73***
Reached by OW – Last 12 months	0.78*	0.95	1.07	1.21	1.03	0.83	1.12	1.41	1.16*	1.16
HIV information from social media	2.03***	1.94***	0.98	1.26	2.18***	1.46*	1.17	1.38**	1.20***	1.52***
HIV information from a peer	1.38***	2.24***	1.77***	3.01***	1.21	1.96***	1.42***	4.00***	1.27***	2.94***
Received free condoms	1.69***	24.69***	2.90***	38.35***	1.62***	96.00***	1.31***	38.68***	1.29***	36.95***
Hosmer-Lemeshow X^2 / Prob	6.57/0.48	23.49/0.01	4.58/0.33	2.20/0.70	4.44/0.49	2.83/0.73	4.56/0.60	59.71/0.0	21.62/0.16	012.2/0.00

Source: Data IBBS 2018-2020
*p<.05; **p<.01; ***p<.001

Governments and Civil Society Organizations (CSOs) have pledged to cooperate with outside funders to establish decentralized organizational structures and administrative rules for effective performance in the HIV/AIDS response. However, obstacles such as high NGO staff turnover, lack of HIV testing supplies, unattainable HTC and condom distribution goals, absence of CSO participation in contract negotiations, failure to link reactive HIV cases to care and treatment, and issues with the aid chain remain. The partnership between government and CSOs is seen as a "win-win solution" that fosters inclusive governance and sustainable health comes. Collaboration between government agencies and CSOs is not optional. It's a necessity if ending HIV/AIDS by 2030.[19]

To leverage coordination between the government and CSOs, the National AIDS Commission (NAC) should be established. To achieve action synergy, the NAC must build a coordinating framework with guidelines, principles, and strategies to guide all partners. There is widespread two-way communication between CSOs and public sector health facilities, and private sector and civil society organizations need to collaborate with local governments in partnerships to ensure better quality and increased public participation in planning and decision-making.[20]

These results validate the COEM as a useful framework for understanding how outreach influences HIV prevention outcomes in Indonesia. Outreach exposure alone is insufficient; it is the mediating functions referral, peer information, free condoms, and social media engagement that drive epidemiological impact. Testing pathways appear stronger than behavioral pathways, suggesting that outreach's most immediate contribution is reducing undiagnosed HIV. Condom use, while positively associated, requires more intensive or repeated interventions. By framing outreach within the COEM, this study provides both a conceptual and an empirical model to guide future programmatic investment and research.

This study has several limitations that should be acknowledged. First, the use of cross-sectional IBBS data prevents causal inference; the associations observed cannot confirm whether outreach exposure led directly to changes in prevention behaviors or testing uptake. Second, the reliance on self-reported measures (e.g., condom use, risk perception, service uptake) introduces the potential for recall bias and so-

cial desirability bias, which may either overestimate or underestimate true behaviors. Third, although the IBBS applied standardized sampling methods (respondent-driven sampling for MSM and PWID; time-location sampling for transgender women and FSW), there remains a risk of selection bias, particularly in reaching hidden subgroups with weaker peer networks. Fourth, the findings may not be fully generalizable to all districts in Indonesia, as IBBS is conducted only in selected sentinel sites. Finally, some relevant contextual factors such as stigma, legal environment, and variations in district-level service availability were not captured in the dataset but may influence both outreach exposure and prevention outcomes. Despite these limitations, the large sample size, national scope, and multivariate approach provide important epidemiological insights into the effectiveness of community outreach for HIV prevention.

CONCLUSION AND RECOMMENDATION

This study demonstrates that community outreach both in-person and online is significantly associated with improved HIV prevention uptake among key populations in Indonesia, particularly in access to information, condoms, and HIV testing. Outreach appears to have a stronger effect on testing uptake than on behavioral change, underscoring the continued importance of peer networks in shaping risk awareness and service utilization. The Community Outreach Effectiveness Model (COEM) highlights how exposure, peer-delivered information, referrals, social media, and service linkages collectively contribute to these outcomes. To sustain and enhance impact, outreach strategies should be modernized by offering flexible service hours, collaborating with the private sector, leveraging digital engagement, and expanding self-testing options. Overall, strengthened community-based and community-led approaches remain essential to an effective and responsive national HIV prevention strategy.

By strengthening and modernizing outreach strategies, national HIV programs can better respond to the evolving needs of key populations and reduce transmission risks. Evidence from this study shows that community outreach and online consultations are particularly effective in increasing HIV testing uptake, while sustained behavioral change requires more intensive or repeated engagement. Tailored, community-based services supported by extended service hours, private-sector partnerships, digital platforms, and expanded self-testing are essential to enhance outreach effectiveness. Ultimately, local HIV response success depends on community empowerment, capacity development, and strong multi-stakeholder collaboration.

Through the Community Outreach Effectiveness Model (COEM), this study clarifies how outreach components exposure, peer-delivered information, referrals, social media engagement, and commodity provision operate as interconnected pathways that promote HIV testing and condom use. Referral emerged as the most influential mediator for testing uptake, whereas consistent condom use requires stronger reinforcement, highlighting the need for differentiated intervention intensity across prevention outcomes.

Future research should validate the COEM using longitudinal or quasi-experimental designs, apply mediation analysis to assess the relative contribution of each outreach component, and test the model across diverse provinces and key population groups. Incorporating biological outcomes, such as HIV incidence and viral suppression, and adapting the model to emerging prevention tools including PrEP, HIV self-testing, and digital peer networkswould further strengthen its relevance for Indonesia's HIV response.

Programmatically, scaling up peer-led outreach, digital innovations, and robust referral systems remains critical to accelerating progress toward the 95–95–95 targets. By offering both an analytical framework and actionable insights, the COEM provides a valuable contribution to advancing more equitable, effective, and data-informed HIV prevention strategies in Indonesia.

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AUTHOR CONTRIBUTIONS

All authors were involved in the planning of the study, conducted data analysis, discussed of the results and contributed to write the final manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest in this study.

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