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The cost-effectiveness of a resilience-based psychosocial intervention for HIV prevention among men who have sex with men in India

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Conflicts of Interest
The authors declare no conflicts of interest.

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Abstract

Objective: Men who have sex with men (MSM) in India are at high risk for HIV infection given psychosocial challenges, sexual orientation stress, and stigma. We examined the cost-effectiveness of a novel resilience-based psychosocial intervention for MSM in India.

Design: We parameterized a validated microsimulation model (CEPAC) with India-specific data and results from a randomized trial and examined two strategies for MSM: 1) status quo HIV care (*SQ*), and 2) a trial-based psychosocial intervention (*INT*) focused on building resilience to stress, improving mental health, and reducing condomless anal sex (CAS).

Methods: We projected lifetime clinical and economic outcomes for MSM without HIV initially. Intervention effectiveness, defined as reduction in self-reported CAS, was estimated at 38%; cost was $49.37/participant. We used a willingness-to-pay threshold of US$2,100 (2019 Indian *per capita* GDP) per year of life saved (YLS) to define cost-effectiveness. We also assessed the 5-year budget impact of offering this intervention to 20% of Indian MSM.

Results: Model projections showed the intervention would avert 2,940 HIV infections among MSM over 10 years. Over a lifetime horizon, the intervention was cost-effective (ICER=$900/YLS). Results were most sensitive to intervention effectiveness and cost; the intervention remained cost-effective under plausible ranges of these parameters. Offering this intervention in the public sector would require an additional US$28M over five years compared to *SQ*.

Conclusions: A resilience-based psychosocial intervention integrated with HIV risk reduction counseling among MSM in India would reduce HIV infections and be cost-effective. Programs using this approach should be expanded as part of comprehensive HIV prevention in India.

Keywords

HIV infections; MSM; India; Psychosocial Intervention; Cost-effectiveness

INTRODUCTION

The HIV/AIDS epidemic is a major public health challenge in India, with over 2.3 million prevalent cases and over 69,000 new HIV infections per year [1]. Men who have sex with men (MSM) experience particularly high HIV incidence in India, with an annual HIV incidence rate of approximately 0.9/100 person years (PY) [2]. Due to continued high incidence and a desire among communities of Indian MSM for multi-layered approaches to HIV prevention, researchers have partnered with community-based organizations to understand sociocultural norms that challenge MSM: particularly how co-occurring "syndemics" of psychosocial health problems accelerate HIV acquisition [3,4].

MSM in India face many psychosocial stressors, including homophobia and discrimination, predisposing them to a variety of mental health challenges, including internalized homophobia, low self-esteem, and increased distress [5–9]. As a result, MSM in India often experience difficulties in disclosing their identity to others and discussing HIV testing status with sexual partners before encounters [3], which increases risk for HIV transmission among MSM and others in their sexual networks [10–13].

HIV prevention interventions for Indian MSM have primarily focused on condom distribution and HIV education, and more recently on pre-exposure prophylaxis (PrEP) [14–16]. However, these interventions do not address the unique psychosocial challenges faced by Indian MSM. Through a community-based participatory project with Indian MSM and their providers [15,17], Safren and colleagues designed and piloted a novel psychosocial intervention focusing on self-acceptance and self-esteem as resilience factors in fostering HIV-related self-care and decreasing mental health-related distress among MSM in India [18]. They conducted a randomized efficacy trial in Mumbai and Chennai, comparing this psychosocial intervention with routine voluntary STI/HIV counseling and testing. Although the trial was not powered to evaluate reductions in HIV incidence, participants reported a reduction in condomless anal sex (CAS) with insertive partners of serodiscordant or unknown HIV status [19]. Our objective was to project the long-term clinical outcomes, costs, and cost-effectiveness of offering this psychosocial intervention to Indian MSM compared to current HIV care in India.

METHODS

Analytic Overview

We used the Cost-Effectiveness of Preventing AIDS Complications (CEPAC) model to project the clinical and economic impact of a resilience-based psychosocial intervention as an HIV prevention strategy for MSM in India. We modeled two strategies targeted to MSM without HIV: 1) status quo HIV care in India (*SQ*), and 2) participation in the psychosocial intervention in addition to status quo HIV care (*INT*). In the base case analysis, we assessed the impact of 20% of MSM living without HIV in India receiving the intervention; we varied this "uptake" parameter in sensitivity analysis.

The trial protocol for the psychosocial intervention included six individual counseling sessions and four group counseling sessions over a 10-week period. During the trial, 608 men were enrolled, 85% of whom completed a 12-month assessment [19]. Participants in the intervention arm attended an average of 4.8 individual sessions and 2.5 group sessions, or a total of 7.3 sessions out of the 10 sessions offered [19]. The intervention resulted in a 38% (95% CI: 20–52) reduction in CAS with insertive partners of serodiscordant or unknown HIV status [19]. Because the trial was not powered to evaluate a reduction in HIV incidence, we extrapolated these behavioral outcomes to HIV-related outcomes using data from the EXPLORE trial [20]. The EXPLORE trial was powered to evaluate both reductions in CAS and HIV incidence among MSM and reported that reductions in both of these measures were approximately equivalent over a 12–18-month follow-up period after the psychosocial intervention's implementation (Supplementary Appendix). We therefore assumed that reductions in CAS from the psychosocial intervention trial could be linearly related to reductions in HIV incidence over the same period.

Modeled clinical outcomes include life expectancy and number of averted HIV infections among the cohort of MSM as well as averted transmissions among cisgender women (CGW) and transgender women (TGW) in their sexual networks. Economic outcomes include costs of the intervention, standard-of-care HIV testing in India, antiretroviral therapy (ART), and other HIV care costs, as well as cost savings from averted HIV infections. We assessed these outcomes over a lifetime horizon.

We measured comparative value using incremental cost-effectiveness ratios (ICERs), defined as the additional cost per year-of-life saved (YLS), discounting costs and life expectancy 3% per year [21]. To define cost-effectiveness, we used a willingness-to-pay (WTP) threshold of US$2,100, the 2019 Indian *per capita* GDP.

Participants in the original clinical trial signed informed consents approved by local and international partner IRBs. Other data sources for this analysis were from published literature and did not entail obtaining informed consent. This study was approved by the Partners Human Research Committee.

Microsimulation Model

CEPAC is a Monte Carlo state-transition microsimulation model of HIV prevention, infection, detection, progression, and treatment [22–24]. The model advances monthly and tracks all individuals in a hypothetical cohort from model entry until death. Model components, such as natural history of HIV disease, HIV testing and detection, prevention, treatment, toxicity, adherence, and costs, are parameterized with clinical trial, cohort and/or other published data [22–25].

Simulated individuals are followed in the model one at a time, with the model tracking each individual's clinical progression. When an individual dies, the model tallies their clinical events, total life months, and accrued costs before a new individual enters the model. Ten million individuals are simulated for each intervention strategy to obtain stable estimates of long-term outcomes. The model has been used to assess HIV testing, antiretroviral therapy, and PrEP in India, among other analyses [26,27].

HIV Transmission and Incidence

In the model, MSM can acquire HIV from either other MSM or TGW [28]. At the beginning of the simulation, incidence for MSM is set to current epidemiological estimates from India [2]. The model also determines HIV transmissions from the primary (simulated) cohort of MSM to sexual partners outside the primary cohort, specifically from MSM to CGW and TGW [28].

MSM who participate in the psychosocial intervention experience a “direct individual benefit,” namely an individual-level reduction in HIV infection risk, attributed to having fewer CAS acts. Over time, this direct benefit of the intervention results in fewer MSM living with HIV in India. This then results in an “indirect community benefit,” which is a lower HIV infection risk for all MSM in India, regardless of their intervention participation status, and for their sexual partners [29].

Model Input Parameters

Cohort characteristics and natural history—The simulated cohort, representing the 3.0 million MSM without HIV in India (initial HIV prevalence 0%), is characterized using India-specific demographic data. Mean age at model start is 27.6 years [30,31].

In each month of simulation, individuals face age-dependent monthly probabilities of HIV infection, opportunistic infection, and mortality [32]. The weighted average HIV incidence rate at model start, across age strata, is 0.9/100 PY [2]. Incidence varies by age based on published risk ratios fit to a Gaussian curve; those aged 25–29 are subject to the highest infection risk.

Intervention effectiveness—The intervention resulted in fewer acts of CAS with insertive partners of serodiscordant or unknown HIV status [19], and we model its effect as a reduction in the monthly probability of HIV infection, with those receiving the intervention experiencing a lower HIV incidence that lasts for a median of 12 months [20].

We combine intervention efficacy and participant adherence into a single “effectiveness” parameter, defined as a participant’s percent reduction in HIV incidence attributed to the intervention. The base case intervention effectiveness is a 38% reduction in CAS with insertive partners of serodiscordant or unknown HIV status (i.e., a risk ratio of 0.62) [19]. This benefit is represented in the model as a decrease in each intervention participant’s probability of HIV infection.

HIV transmission—The weighted average transmission rate to MSM, across viral load strata at model start, is 17.6/100 PY. The weighted average transmission rates to other sexual partners of MSM, across viral load strata at model start, are 0.6/100 PY (MSM to CGW) and 6.2/100 PY (MSM to TGW) (Table 1).

Costs—All costs are in 2019 US dollars. Personnel costs for the intervention are $37.12/participant, and overhead and space costs are $12.25/participant, yielding a total intervention cost of $49.37/participant. For a description of the full cost derivation, see the Supplementary Appendix. HIV tests cost $4.60/test, and associated clinic visits are $6.28/

visit [33]. ART regimen costs are $9.54/month for non-nucleoside transcriptase inhibitor (NNRTI)-based first-line and $23.85/month for protease inhibitor (PI)-based second-line [34].

Sensitivity analysis

We conducted one-way sensitivity analyses on HIV incidence, intervention effectiveness, median duration of intervention effectiveness, intervention uptake, intervention costs, first-line ART costs, background HIV testing rate, and other model parameters, varying each across literature-derived or plausible ranges to reflect parameter uncertainty and heterogeneity among MSM in India. We then identified the three most influential parameters and subjected them to multi-way sensitivity analyses. We also projected clinical outcomes and cost-effectiveness for two different versions of *INT* (Table 2).

Budget impact analysis

We conducted a budget impact analysis from the health care sector perspective of offering the intervention to MSM in India (with 20% participant uptake) over a 5-year time horizon [35]. We considered all intervention-related expenditures, which include personnel costs and overhead and space costs, as well as all HIV care costs.

RESULTS

Clinical outcomes

The psychosocial intervention strategy (*INT*) would increase undiscounted life expectancy in MSM without HIV from 495.49 life months (41.29 years) in the status quo to 495.67 months (41.31 years) in the intervention group (Table 2). Over a 10-year time horizon, 2,940 new HIV infections would be averted among MSM with *INT* compared to status quo HIV care (*SQ*). *INT* would avert an estimated additional 866 HIV transmissions from MSM to TGW and 78 transmissions from MSM to CGW over 10 years.

Cost, cost-effectiveness, and sensitivity analysis

For MSM, the discounted per-person lifetime costs would be $381 for *SQ* and $386 for the intervention (Table 2). Over a lifetime horizon, the ICER for *INT* compared to *SQ* for MSM would be $900/YLS.

In one-way sensitivity analysis, we varied intervention and treatment-related parameters to examine the robustness of our conclusions and to account for uncertainty. The results were most sensitive to intervention effectiveness and cost (Fig. 1). At the base case effectiveness of 38%, the intervention would have an ICER compared to *SQ* below the India per capita GDP up to a cost of $80 per person (base case: $49 per person). At the base case intervention cost, the intervention would remain cost-effective if it is at least 27% effective. Varying intervention effectiveness and cost simultaneously, the intervention would become cost-saving at $20 per person and remain cost-effective with costs as high as $70 per person, provided that intervention effectiveness is at least 35% (Fig. 2). We also varied intervention effectiveness and HIV incidence simultaneously (Fig. S1). The intervention would be cost-effective for incidences within the range 0.8–1.2 infections/100PY if the intervention effectiveness is at least 30%. The intervention would be cost-effective at all HIV incidence rates within the interquartile range reported in India (0.4–1.2 infections/100PY) if intervention effectiveness is at least 45%.

We also considered two key *INT* scenarios other than the base case. In one scenario, we assumed the intervention had 0.75x the effectiveness of the base case. In the other scenario, we assumed the intervention had 1.5x the base case cost. With 0.75x the effectiveness, the intervention would still be cost-effective over a lifetime time horizon with an ICER of $1,700/YLS. Similarly, with a 1.5x cost, the intervention would remain cost-effective over a lifetime time horizon with an ICER of $1,900/YLS (Table 2).

Budget impact analysis

We estimated the budget impact if the intervention were made available to 20% of the estimated 3.0 million MSM without HIV in India. Over a 5-year horizon, the intervention would increase HIV care expenditures for MSM from $69M to $97M, or by $28M (41%) compared to *SQ* (Fig. 3). Expenditures would increase by the same amount ($28M) with 0.75x base case effectiveness. If the intervention cost is halved, HIV outlays would increase to $82M, or by $13M (19%). With an intervention cost of 1.5x base case, expenditures would increase to $111M, or by $42M (61%).

DISCUSSION

The incidence of HIV among MSM in India is a major concern of the Indian National AIDS Control Organization (NACO), which has focused on slowing the HIV epidemic in this risk group through implementation of traditional prevention interventions including condom distribution, HIV education, and more recently PrEP [14–16]. Newer interventions have attempted to address the underlying psychosocial variables that occur in the context of sexual behavior that may increase risk for HIV acquisition and transmission among MSM. The novel psychosocial intervention developed by Safren et al. was designed to foster self-acceptance and resilience and reduce feelings of distress among MSM in India. In a randomized controlled efficacy trial, it was found to reduce CAS with insertive partners of serodiscordant or unknown HIV status in Mumbai and Chennai by 38% [19].

Using a validated microsimulation model of HIV disease and treatment, we evaluated the cost-effectiveness of this intervention for HIV prevention among MSM in India. Over a 10-year horizon, we demonstrated that 2,940 HIV infections could be averted in India. Over a lifetime horizon, we demonstrated that the intervention had an incremental cost-effectiveness ratio of $900/YLS, well below the annual per capita GDP of India. While we used 1x GDP as the cost-effectiveness threshold in this analysis per common practice in health economic research [26,36,37], we acknowledge that there is substantial debate surrounding the appropriate threshold for various countries [38–40]. However, the resilience-based psychosocial intervention is cost-effective even at 50% of India's per capita GDP, as recommended by Woods et al. for low to middle-income countries [41].

We found that results were most sensitive to intervention effectiveness and cost. With the base case effectiveness of 38%, the intervention would still be cost-effective at a cost as high as $80/person. At the base case cost of $49/person the intervention would still be cost-effective with an effectiveness as low as 27%. The intervention had the potential to be cost-saving at a cost of $20/person if the effectiveness is at least 35%. These findings are consistent with those of Herbst et al., whose systematic review reported that individual-, group-, and community-level HIV behavioral interventions reduced the odds of condomless anal intercourse by 27% to 43% [42]. Moreover, a meta-analysis by Herbst et al. found that such interventions were also associated with a significant increase in condom use during anal intercourse (OR = 1.61) [43]. This evidence from the literature, coupled with our findings, supports the position that behavioral interventions for adult MSM are effective in reducing the odds of CAS and are not only cost-effective, but can also be cost-saving [42,43].

We also conducted a budget impact analysis for this type of intervention if it were to be implemented nationwide for 20% of Indian MSM over five years. We found that the intervention would require additional expenditures of $28M and would avert more than 2,200 infections over five years. Because the resilience-based psychosocial intervention was a one-time intervention and the intervention effectiveness (in terms of reduced HIV incidence) was assumed to last no more than 24 months (median of 12 months), we limited the budget impact analysis to 5 years. Implementation cost at the local level was included in our analysis. Scaling up the intervention would likely involve some additional start-up costs for training, which would be small compared to total program costs, as well as cost savings due to economies of scale.

This study has several limitations. Because the primary efficacy trial of the psychosocial intervention was not powered to determine a change in HIV incidence, we used data from another study, the EXPLORE trial, to assess the relationship between behavioral outcomes and reductions in HIV incidence [20]. We then extrapolated this approximately linear relationship to project HIV-related outcomes in response to the intervention for MSM in India. Moreover, the reduction in HIV risk-taking observed in the trial was based on self-report. Because of social desirability bias and denial of stigmatized behaviors, some individuals may potentially under-report their high-risk behaviors to external interviewers, hence biasing the outcome [44]. We note that the trial itself was not powered on rectal STI incidence but on overall STI rates. In the efficacy analyses, there was no significant difference between the two arms in terms of overall STIs. Because STIs (oral, anal, and pharyngeal combined) have different risk factors than HIV, we cannot determine the degree to which social desirability could have influenced the self-report data [45]. Future studies of prevention interventions, including psychosocial interventions, should be powered to assess changes in both HIV and STI incidence, and should minimize reliance on self-reported data. The duration of effectiveness of the intervention is also uncertain, so we extrapolated a conservative median value of 12 months from the EXPLORE trial to account for this [20]. We also accounted for uncertainty in the effectiveness of the intervention in extensive one- and two-way sensitivity analyses, with the main findings robust to variation in estimates of effectiveness and other parameters of interest.

Scaling the intervention from a clinical trial to a broadly available treatment across India could result in lower intervention effectiveness than seen in the trial. We did, however, assume that only 20% of eligible individuals would choose to participate in the program, so the average effectiveness may not be substantially different from that in the trial. While uptake of an HIV prevention program by 20% of eligible MSM in India may be viewed as optimistic, the Avahan initiative, funded by the Bill & Melinda Gates Foundation, did reach a broad cross-section of at-risk people in India. This initiative was started in 2003 with the goal of reducing HIV spread in India; responsibility was transferred to the Indian government between 2009 and 2012. By increasing the coverage of HIV preventive interventions in high-risk groups, including MSM, female sex workers, and people who inject drugs, Avahan sought to decrease HIV spread more broadly. These prevention efforts were focused on safer-sex counselling, prevention education, clinical services including treatment for STIs, condom distribution, and community mobilization and advocacy [46,47]. According to Avahan and the Indian National AIDS Control Organization, their combined efforts reached 91% of MSM, 86% of female sex workers, and 84% of people who inject drugs in the target areas [48]. Moreover, about 20–25% of at-risk individuals attended the clinics regularly between 2008 and 2011 [46]. Those data were cited by the National AIDS Control Organization in their detailed published operational guidelines to community-based organizations for targeted interventions among men who have sex with men in India [49].

Since we do not have available utilities for this population to estimate QALYs, we report life expectancy in years of life saved (YLS). While in general, QALYs would be lower, and ICERs higher, than when using YLS, in a study of a similar intervention in South Africa the intervention itself improved quality of life significantly in the participants [50]. That improvement would offset some or all of the decrease in total QALYS that one sees compared to YLS. The analysis also does not account for the considerable heterogeneity across India's MSM population. For example, considering different urban hubs in India, where MSM are more likely to congregate [3], and understanding the various demographic, socioeconomic, and cultural characteristics of these different locations, could help inform the future use of this intervention for this marginalized population.

In summary, we found that a ten-session (four group, six individual) resilience-based psychosocial intervention would be a cost-effective strategy for HIV prevention among MSM in India, with relatively modest increases in the HIV prevention budget. Additional refinement of the intervention, including modifying the number of sessions needed, increasing attendance, and/or adding later booster sessions, may further increase its cost-effectiveness. Based on these findings, programs using such resilience-based psychosocial interventions should be expanded as part of comprehensive HIV prevention across India.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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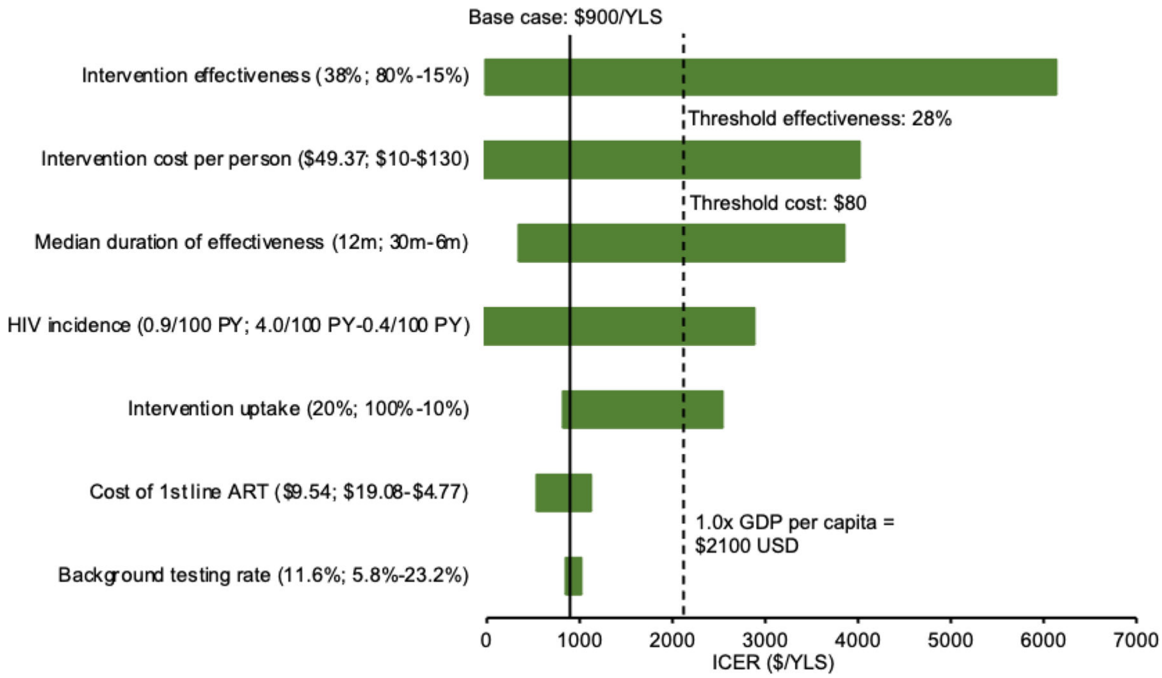

Figure 1. One-way sensitivity analyses on the cost-effectiveness of a psychosocial HIV intervention for MSM in India.

This "tornado" diagram portrays the results of a series of one-way sensitivity analyses. Each horizontal bar represents the range of incremental cost-effectiveness ratios (ICERs) for the intervention compared to *SQ* when a given model parameter is varied across a wide range. Ranges examined are presented next to the parameter name as (parameter input corresponding to the lowest ICER - parameter input corresponding to the highest ICER; base case parameter value). Parameters are arranged along the vertical axis in order of their impact on the ICER, with the most influential parameters at the top of the figure. The vertical black line represents the base case ICER of $900/YLS for the intervention; the dashed line represents the 2019 Indian *per capita* gross-domestic product (GDP) of $2,100. ICERs to the left of the dashed line are considered "cost-effective." **MSM:** men who have sex with men; **YLS:** year of life saved, **ICER:** incremental cost-effectiveness ratio; ***SQ*:** status quo HIV care

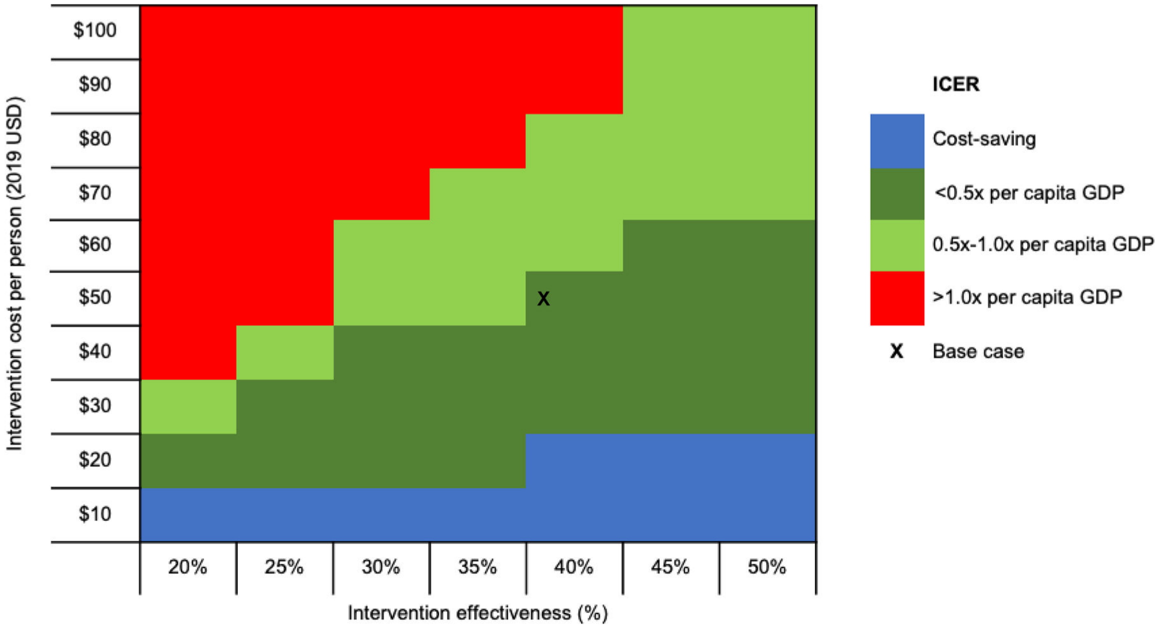

Figure 2. Multi-way sensitivity analysis on the cost-effectiveness of a psychosocial HIV intervention for MSM in India, varying intervention effectiveness and cost.

This shows the cost-effectiveness of the intervention compared to *SQ* when the intervention effectiveness and intervention cost are varied simultaneously. Intervention effectiveness is varied from the base case value of 38% along the horizontal axis. Intervention cost is varied along the vertical axis across a range of per-person costs, from the base case of $49. Blue indicates ranges where the intervention would be cost saving (i.e., costs less and confers greater life-years than *SQ*); dark green indicates that the ICER is <0.5 times the 2019 Indian *per capita* GDP, i.e., <US$1,050; light green indicates that the ICER is between 0.5 and 1.0 times the 2019 *per capita* GDP; red indicates that the ICER is >1.0 times the annual *per capita* GDP. The **X** on the figure marks the base case value. We considered ICERs below the annual Indian *per capita* GDP to be cost-effective (see Methods).

MSM: men who have sex with men; **ICER:** incremental cost-effectiveness ratio; ***SQ*:** status quo HIV care

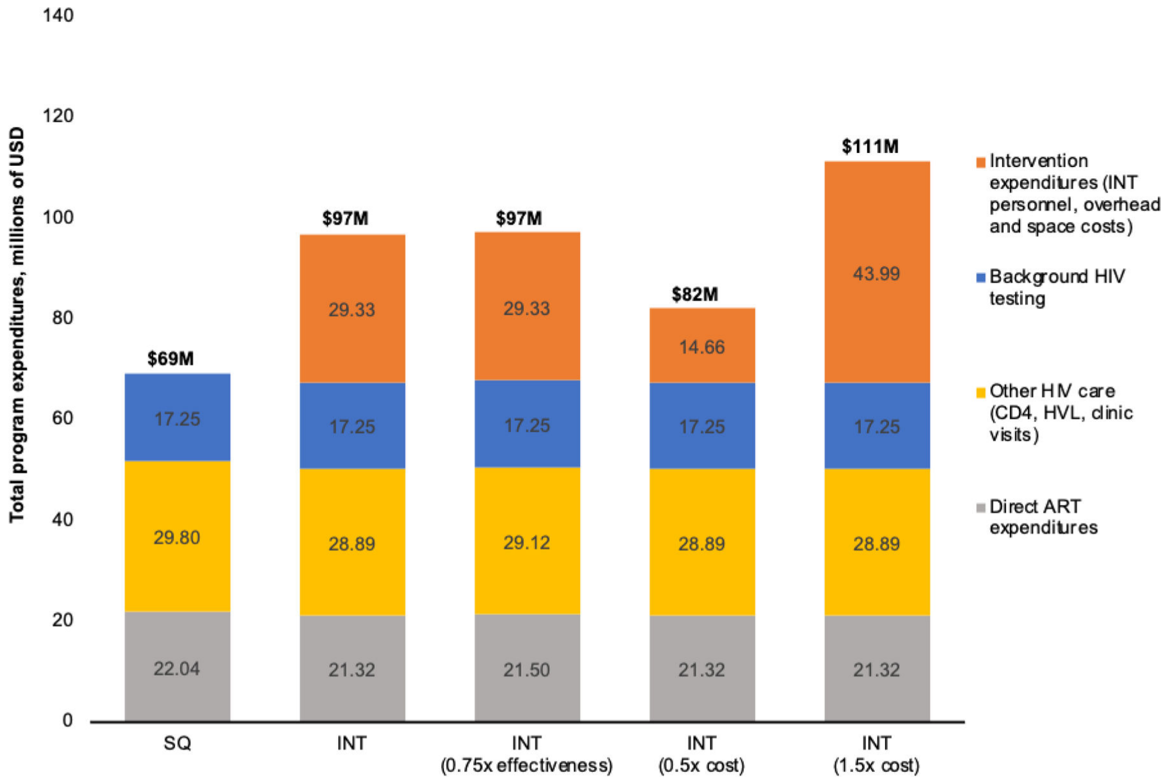

Figure 3. Five-year budget impact of a psychosocial HIV intervention for MSM in India compared to status quo.

This shows the total undiscounted HIV program expenditures over five years for 3.0 million MSM without HIV in India, with 20% uptake of the intervention. Strategies include *SQ*, *INT*, *INT (0.75x effectiveness)*, *INT (0.5x cost)*, and *INT (1.5x cost)*. Expenditures are stratified into four categories: 1) Expenditures directly attributed to the intervention, which includes intervention personnel, overhead, and space costs; 2) antiretroviral therapy (ART) expenditures, which include the cost of ART drugs for those who acquire HIV; 3) other HIV care expenditures, which include all other associated HIV medical costs, such as CD4 count testing, viral load testing, clinic visits, and costs associated with treatment of opportunistic diseases; and 4) HIV testing expenditures, including costs associated with current levels of HIV screening in India. In the four bars reflecting the intervention, total expenditures reflect savings from reduced transmission among MSM.

MSM: men who have sex with men; **HVL:** HIV viral load test; **M:** millions; **USD:** US dollars; **ART:** antiretroviral therapy; ***SQ*:** status quo HIV care; ***INT*:** psychosocial intervention with background HIV testing

Table 1.

Model input parameters for the analysis of a psychosocial intervention for HIV prevention among MSM in India

Parameter	Value		Source
Characteristics of primary cohort	**MSM**		
Age, years, mean (SD)	27.6 (6.1)		[31]
Estimated size of population, millions	3.0		[3]
HIV incidence, infections per 100 PY, mean (IQR)	0.9 (0.4–1.2)		[2]
Background testing rate, % per year	11.6		[51]
Linkage to care, %	87.5		[52]
Characteristics of sexual network members	**CGW**	**TGW**	
Age, years, mean (SD)	22.3 (5.7)	29.4 (5.7)	[30,31,53]
Background testing rate, % per year	3.2	11.5	[54]
Linkage to care, %	80.0	91.5	[55,56]
Intervention parameters			
Intervention uptake, %	20		Assumption
Duration of effectiveness, months, median-maximum	12–24		[20]
Intervention effectiveness, % HIV incidence reduction	38		[19]
Transmission dynamics			
Transmission to other MSM, per 100 PY	17.6		[2]
Transmission to other sexual partners, per 100 PY	0.6 (to CGW) 6.2 (to TGW)		[2,57–62]
Acute HIV infection, off-ART transmission RR	5.3		[63]
Clinical characteristics post-HIV infection			
Acute CD4 count, cell/microliter, mean (SD)	553 (230)		[54]
First-line overall virologic suppression at 48 weeks, %	90.1		[64]
Monthly CD4 increase on first-line ART			
First month, mean (SD)	107 (30)		[64]

Parameter	Value	Source
After first month, mean (SD)	5 (2)	
Intervention and HIV-associated costs		
Intervention cost, $/participant	49.37	[19]
HIV test cost with clinic visit, $/test	10.88	[54,65]
First-line ART, NNRTI-based regimen, $/month	9.54	[34]
Second-line ART, PI-based regimen, $/month	23.85	[34]
HIV viral load test, $/test	23.43	[66]
CD4 count test, $/test	3.92	[66]
Routine care cost, conditional on CD4 count, $/month	7.94–27.41	[33]

MSM: men who have sex with men; **SD:** standard deviation; **PY:** person-years; **IQR** : interquartile range; **CGW:** cisgender women; **TGW:** transgender women; **RR:** risk-ratio; **ART:** antiretroviral therapy; **NNRTI:** non-nucleoside reverse transcriptase inhibitor; **PI:** protease inhibitor

Table 2.

Clinical and economic outcomes of a psychosocial HIV intervention for MSM in India compared to status quo: base case and key one-way sensitivity analyses

Strategy	HIV infections averted over 10 years among MSM	Transmissions averted over 10 years among TGW and CGW		Average per-person LMs, MSM (undiscounted, $)	Average per-person LMs, MSM (discounted, $)	Average per-person lifetime costs, MSM (discounted, $)	ICER, lifetime ($/YLS)
		TGW	CGW				
SQ	-	-	-	495.49	270.79	381	-
INT (base case)	2,940	866	78	495.67	270.85	386	900
INT (0.75x effectiveness)	2,154	643	58	495.62	270.83	387	1,700
INT (1.5x cost)	2,940	866	78	495.67	270.85	391	1,900

MSM: men who have sex with men; **TGW:** transgender women; **CGW:** cisgender women; **LM:** life-months, **ICER:** incremental cost-effectiveness ratio; **YLS:** year of life saved; ***SQ*:** status quo HIV care; ***INT*:** psychosocial intervention with background HIV testing

All costs and life-years are reported over a lifetime horizon; costs are in 2019 US dollars. Discounted costs and life years are reported using a discount rate of 3%/year. ICERs are for MSM and are rounded to the nearest $100. A strategy is defined as "cost-effective" if its ICER does not exceed the willingness-to-pay (WTP) for an additional year of life. In this analysis, we use a WTP threshold of US$2,100, equal to the 2019 Indian per capita gross domestic product (GDP).