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An assessment of a large-scale HIV prevention programme for high-risk men who have sex with men and transgenders in Andhra Pradesh, India: using data from routine programme monitoring and repeated cross-sectional surveys

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To cite: Goswami P, Rachakulla HK, Ramakrishnan L, *et al*. An assessment of a large-scale HIV prevention programme for high-risk men who have sex with men and transgenders in Andhra Pradesh, India: using data from routine programme monitoring and repeated cross-sectional surveys. *BMJ Open* 2013;**3**:e002183. doi:10.1136/bmjopen-2012-002183

▸ Prepublication history for this paper are available online. To view these files please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2012-002183).

Received 27 October 2012
Accepted 4 March 2013

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ABSTRACT

Objectives: To assess a large-scale intervention, the Avahan intervention, using an evaluation framework that included programme coverage, condom use and changes in sexually transmitted infection (STI) and HIV prevalence among high-risk men who have sex with men/transgender (HR-MSM/TG) in the state of Andhra Pradesh, India.

Design: Programme monitoring data and results from two rounds of cross-sectional integrated biological and behavioural assessment (IBBA) in 2006 (Round 1) and 2009 (Round 2) were used for current analysis.

Setting: Programme monitoring data and cross-sectional surveys from Andhra Pradesh, India.

Participants: Data from 1218 and 1203 participants in Rounds 1 and 2 of the IBBA, respectively, and field level programme monitoring data from the intervention districts.

Primary and secondary outcomes: (1) Assess the reach of intervention in the HR-MSM/TG population; (2) evaluate the association between intervention and the intermediate outcomes (such as condom use and STIs) and (3) assess the association between HIV/STIs and the intervention.

Results: By July 2008, the intervention contacted 83% of the estimated HR-MSM/TG population monthly and 16% were attending the STI clinic monthly. HR-MSM/TG exposed to the intervention were significantly more likely to use condom consistently with a regular male partner (adjusted OR 4.62, 95% CI 1.40 to 15.22). Consistent condom use with all types of male partners increased significantly in survey Round 2 compared with Round 1. The proportion of HR-MSM/TG who tested positive for HIV-1 antibodies was similar in both rounds (15.5% in Round 1 vs 17.3% in Round 2, p=0.52).

ARTICLE SUMMARY

Article focus

- Assessment of the Avahan initiative, a large-scale intervention programme, on HIV prevention among high-risk men who have sex with men and male-to-female transgenders (HR-MSM/TG) in Andhra Pradesh (AP), India.

Key messages

- Avahan successfully implemented a programme for HR-MSM/TG. The intervention rapidly achieved good coverage in the community, ensured adequate condom supply and delivered high-intensity peer and STI clinical services.
- Important achievements of Avahan include: high consistent condom use with male partners and relative stabilisation of the HIV and STI prevalence in the community. Concerns, however, remain about low consistent condom use with regular female partners and the high prevalence of HIV among HR-MSM/TG.
- There is a need to maintain the intensity of large-scale community interventions to ensure high STI clinic attendance and long-term reduction of HIV and STIs in this population in India.

Strengths and limitations of this study

- This paper presents a systematic assessment, the first of its kind, of a large-scale HIV prevention intervention by the Avahan programme for HR-MSM/TG in AP.
- The Avahan implementation and evaluation design was not a classical 'intervention-control two group' design; thus, this assessment did not allow for any control groups.

Conclusion: The Avahan intervention achieved a good population coverage, and delivered high-intensity peer and STI clinical services in Andhra Pradesh in the highly mobile target population of HR-MSM/TG; this also resulted in positive behavioural outcomes including increased condom use. However, the high prevalence of HIV in this group is an important public health priority.

INTRODUCTION

India has an estimated 2.4 million people living with HIV/AIDS; the adult HIV prevalence was 0.31% in 2009. HIV prevalence among high-risk groups such as female sex workers (FSWs), men who have sex with men (MSM), male-to-female transgenders (TGs) and injecting drug users (IDUs) is about 10–20 times higher than the general population.[1] Though the HIV prevalence is declining among FSWs, evidence shows that MSM and IDUs are emerging as vulnerable groups to HIV infection with an increasing prevalence in many states of India.[1 2] With an estimated 0.4 million high-risk MSM in India, the National AIDS Control Organisation of India has increased the emphasis on the MSM and TG interventions in the country.[1]

Avahan, the India AIDS Initiative, initiated a focused large-scale HIV prevention programme in 2004 in six high prevalence states of India: Karnataka, Andhra Pradesh (AP), Maharashtra, Tamil Nadu, Manipur and Nagaland.[3] The programme targeted FSWs and their clients, high-risk MSM and TGs, IDUs, and long-distance truck drivers along the national highways. The main components of Avahan's intervention were (1) to achieve a high coverage of outreach; (2) to deliver a package of proven prevention services (such as clinic services for treatment of sexually transmitted infections, condom promotion and distribution and support for community mobilisation) and (3) to address proximate and distal determinants of HIV risk (such as condom use, multiple partners and advocacy to reduce structural barriers to safer sex practices). All the intervention districts were selected in consultation with state governments.[4 5] Avahan supported peer-led outreach and education, promotion and availability of condoms, management and counselling of sexually transmitted infections (STIs), and interventions to address structural and environmental barriers.[6]

The Andhra Pradesh State AIDS Control Society (APSACS) had initiated interventions for FSWs and MSM in 2001.[7] Avahan implemented HR-MSM/TG programmes in 20 of 23 districts in AP in conjunction with APSACS. Avahan's evaluation framework was based on approaches for large-scale public health programmes and followed the programme's logic model: assess scale-up and coverage, changes in intermediate outcomes (such as condom use and STIs), changes in HIV prevalence among general population and Avahan's possible association with these changes.[5 8 9] Multiple rounds of cross-sectional surveys (termed Integrated Behavioural and Biological Assessments (IBBA)) were conducted to assess these intermediate outcomes.[10] First round of IBBA was conducted in 2006 when HR-MSM/TG programmes had just been implemented in some of the districts.

The present assessment was conducted to understand the overall effect of the Avahan initiative on HIV prevention among HR-MSM/TG in AP. More specifically we aimed to (1) assess the reach of Avahan in the HR-MSM/TG population in AP; (2) evaluate the association between Avahan programme and the intermediate outcomes and (3) assess the association between HIV/STIs and the Avahan programme.

METHODS

The present paper discusses the assessment of a large-scale HIV prevention programme, using programme monitoring data and data from two cross-sectional surveys. Based on Avahan's programme evaluation framework, we had three key outcomes in this assessment. These were (1) scale and intensity of coverage of the Avahan programme; (2) self-reported consistent condom use (defined as always use of a condom during each and every sex act, and measured as yes/no) and (3) prevalence of STIs including HIV. We have provided detailed explanation for each of these outcomes in table 1.

Data sources

Data from two different sources were used for the current analyses (table 1).

(1) Avahan Programme Computerized Management Information System (CMIS): Non-governmental organisation (NGO) partners, implementing the Avahan programme, reported monthly data on programme inputs and infrastructure, outreach services and clinical service utilisation. These data were reported to the lead implementing partners at the state level and then aggregated at the state as well as central level. The data collected by the CMIS from 20 Avahan implementing districts between January 2005 and March 2009 (the end of Avahan Phase I) were used for the assessment of programme-monitoring data—such as proportion of HR-MSM/TG ever and monthly contacted, ever visited the clinic and peer to HR-MSM/TG ratio.[11 12] The estimated HR-MSM/TG population of 33 600 was used as the denominator for estimating the programme assessment outcomes. The size estimation of the population was undertaken through mapping exercises done at the grass root level by the local non-governmental organisations.[11 12] The CMIS data were collected only from the Avahan intervention areas.

(2) IBBA: Data on demographics, sexual behaviours, condom use, exposure to HIV/AIDS programmes, STIs including HIV (Rapid Plasma Reagin (RPR), *Treponema pallidum* Hemagglutination Assay (TPHA) and nucleic acid amplification (Gen-Probe APTIMA COMBO 2) of

Table 1 Framework for Avahan programme evaluation

Evaluation question	Indicator	Data source
1. Is coverage of Avahan adequate?	A. Scale	
	a. *Geographical coverage*—Description of rollout in number of districts and change in number of implementing NGOs over time	CMIS
	b. *Proportion of high risk men who have sex with men (HR-MSM)/male-to-female transgenders (TG) ever contacted and ever visited clinic*—number of HR-MSM/TG ever contacted by Avahan peer educators or ever visited Avahan programme STI clinics divided by the estimated size of HR-MSM/TG as of March 2009	CMIS
	c. Proportion of HR-MSM/TG c*ontacted monthly by peer educators o r visited programme STI clinics for STI consultations*—number of HR-MSM/TG contacted monthly by peer educators or visited programme STI clinics monthly divided by the estimated size of HR-MSM/TG as of March 2009	CMIS
	d. *Proportion of HR-MSM/TG contacted in last month*—percentage of HR-MSM/TG from IBBA who reported that they had been contacted by Avahan peer educators in the month preceding the survey	IBBA
	B. Intensity	
	a. *Number of peer educator/outreach worker and ratio of HR-MSM/TG to peer educators*—the total number of active outreach workers and peer educators in the Avahan intervention areas across implementation districts in Andhra Pradesh; and number of estimated MSM/TG covered per peer educator in the coverage area	CMIS
	b. *Condom distribution and availability*—absolute number of free condoms distributed by Avahan programme annually	CMIS
2. Has there been an increase in condom use in MSM/TGs?	Change in condom use pattern	
	a. Proportion of HR-MSM/TGs reporting last time condom use with paying male partners from two rounds of IBBAs	IBBA
	b. Proportion of HR-MSM/TGs reporting last time and consistent condom use with paid male/hijra partners from two rounds of IBBAs	IBBA
	c. Proportion of HR-MSM/TG reporting last time and consistent condom use with regular male partners from two rounds of IBBAs	IBBA
	d. Proportion of HR-MSM/TG reporting last time and consistent condom use with other non-commercial male/hijra partners from two rounds of IBBAs	IBBA
3. Has there been reduction in STIs and HIV prevalence?	Change in STI prevalence and visits to clinic with STI symptoms	
	STI prevalence (reactive syphilis serology, high-titer syphilis, *Neisseria gonorrhoeae* NG), chlamydia (CT)	IBBA
	Change in HIV prevalence	
	a. HIV prevalence among HR-MSM/TGs aggregated from all districts in two rounds of IBBAs	IBBA
4. Is Avahan exposure associated with increase in condom use and declining STIs?	Association of programme exposure with intermediate outcomes and STIs	IBBA
	a. Programme exposures, defined as exposure to any one of ever contacted by peer, ever visited programme clinic and ever received condoms from peer educators. Its association with consistent condom use with commercial and non-commercial partners across two rounds of IBBA	
	b. Programme exposure, as defined above, its association with having any STI (*NG*, CT or high-titre syphilis)	

CMIS,Computerized Management Information System; HR-MSM/TGs,high risk men who have sex with men/transgender; IBBA,integrated biological and behavioural assessment; STI,sexually transmitted infection.

urine samples for chlamydia and gonorrhoea) prevalence were collected from HR-MSM/TG who were aged 18 years or older having any type of sex (manual/oral/anal) recruited from the cruising sites and public places, as a part of the IBBA in selected four districts of AP (East Godavari, Guntur, Hyderabad and Vishakhapatnam) for the assessment of Avahan programme. However, Hyderabad was excluded from the analysis as it was not an Avahan focus district for HR-MSM/TG intervention. The other three IBBA districts data we analysed were solo Avahan districts; thus, no other MSM interventions were being implemented during that period. The first round of IBBA was conducted between November 2005 and December 2006 (close to the baseline for HR-MSM/TG programmes), and the second round between March and October 2009. Both rounds used identical study methodologies and probability-based two-stage time–location cluster sampling method was used following a comprehensive sampling frame development exercise spanning the

entire district.[10 13] IBBA data were used for the assessment of the behavioural (eg, condom use and type of partner) and biological outcomes (such as HIV and STIs). IBBA data were collected from a representative sample of HR-MSM/TG from the entire district irrespective of the Avahan intervention area.

Data were collected by research agencies under the supervision of the Indian Council of Medical Research, National Institute of Nutrition, National AIDS Research Institute and technical assistance by FHI 360. All the participants of the IBBA signed an informed written consent. Furthermore, test results for syphilis were returned to the respondents and treatment was provided. The respondents were also referred to the Integrated Counselling and Testing Centres for HIV testing and collecting results. The test results for other STIs could not be given to the respondents because it was practically not possible as it takes time to test urine samples due to the lack of infrastructure at the field. However, syndromic management was recommended and adopted at the referral centres. Additional methodological details of data collection in both these surveys have been described elsewhere.[9 10 11 12] Clearance for the study was taken from Protection of Human Subjects Committee (FHI 360), Health Ministry Screening Committee (Indian Council for Medical Research) and the Institutional Ethical Committee of National Institute of Nutrition. Data from 1218 and 1203 HR-MSM/TG in Round 1 and Round 2, respectively, were used for the present analyses.

Statistical analyses

Descriptive statistics included proportions for categorical variables, means for continuous variables. The difference in proportions was tested using the χ^2 test and the difference in means was tested using t tests. We used logistic regression models to measure the association between the outcome variables and the independent explanatory variables. The models were built in the following sequence: (1) univariate models using the primary explanatory variable, etc; and (2) multivariate models which adjusted for potential confounders (age, marital status, income, literacy, district of interview, age of first sexual activity, sex outside the current place of residence and sexual identity). The level of significance used for entering independent variable was 0.05 or less except for some demographic profiles and 95% CI was calculated for the OR. The ORs across two rounds of the IBBA were compared using the methods described by Altman and Bland.[14] We calculated aggregate weights combining three districts and used it for all the analyses that used data from IBBA sources. All the analyses were performed using SPSS V.15.0.1 (SPSS, Inc). The calculation of weights was done considering clustering effect of the samples and the analysis was carried out using complex samples module in SPSS which account for the clustering effect. Further details on the procedure of calculating weights have been provided in the IBBA operational manual.[15]

RESULTS

The mean age of the HR-MSM/TG in IBBA Round 1 was 27.6 years (95% CI 26.7 to 28.5) and in IBBA Round 2 it was 28.0 years (95% CI 27.0 to 29.1). There was no significant difference in literacy and marital status between Round 1 and Round 2. A smaller proportion of HR-MSM/TG reported having paying and paid male partners in Round 2 compared with Round 1, while a higher proportion of them reported having non-commercial male partners (table 2). The proportion of HR-MSM who identified themselves as bisexual had declined significantly in Round 2 compared with Round 1 (29.4% vs 68.0%, $p<0.001$). Additional demographic, sexual behaviours, condom use, exposure to Avahan programme and STIs can be found in table 2.

Avahan programme coverage

CMIS data in January 2005 indicated that about 8% of the estimated HR-MSM/TG population (estimated denominator of 33 600) were ever contacted by peers of the intervention programme. However, the extent of this coverage had increased to 85% by January 2007 and reached 100% coverage between January 2007 and July 2007 (figure 1A). Additionally, the peers were able to contact 83% of the estimated population of HR-MSM/TG every month by July 2008. Similarly, the proportion of HR-MSM/TG having ever visited an STI clinic had increased from less than 1% in January 2005 to about 80% in July 2008. The proportion of MSM attending the STI clinic monthly remained at about 16% (July 2008; figure 1B). The Avahan programme in AP registered about 32 000 HR-MSM/TG; about 45 000 (includes both registered and non-registered) were reached at least once through peer contacts and 29 800 MSM through STI clinical services by March 2009. The number of peer educators and outreach workers under the Avahan programme increased and the ratio of one peer educator to 50 HR-MSM/TG was reached by January 2008 (figure 1C).

IBBA data also showed that about 67.1% and 73% of the participants in Rounds 1 and 2, respectively, reported that they had been contacted by peer educators or outreach workers. Furthermore, in the same IBBA data, we also found that about 38.3% had visited the NGO clinic in Round 1; however, this proportion had significantly increased to 72.1% in Round 2 ($p<0.001$; table 2).

Condom use

We found that HR-MSM/TG were significantly more likely to report last time condom use with regular male partners (adjusted OR(AOR) 2.93, 95% CI 1.70 to 5.06), paying male partners (AOR 2.82, 95% CI 1.16 to 6.84) and non-commercial male partners (AOR 4.07, 95% CI 1.51 to 6.59) in Round 2 of the IBBA compared with

Table 2 Descriptive statistics (demographics, sexual behaviours, condom use, exposure to the programme and sexually transmitted infections including HIV) of high-risk men who have sex with men/male-to-female transgenders in Rounds 1 and 2 of the integrated biological and behavioural assessment, Andhra Pradesh, India*

	Round 1 (N=1218) %	Round 2 (N=1203) %	p Value
A. Demographics			
Age (years)			
18–24	43.8	37.9	
25–29	24.3	28.7	
30–34	13.0	15.6	
35–39	8.4	7.7	
≥40	10.6	10.1	0.48
Literacy status			
Literate (can read and write)	76.9	80.3	
Illiterate	23.1	19.7	0.26
Marital status			
Currently married	47.1	42.9	
Never married	52.1	56.3	
Others	0.7	0.8	0.42
Main occupation			
Unemployed/student	13.1	9.4	
Self-employed/business/trade	20.2	29.1	
Non-agricultural/agricultural labour	37.5	28.7	
Service (govt./pvt.)	18.6	26.6	
Sex work	4.2	4.3	
Others (massagers/transport workers)	6.5	1.9	<0.001
Local dweller			
Yes	97.0	98.9	
No	3.0	1.1	0.21
B. Sexual behaviours			
Age at first sexual exposure, (year)			
<15	13.0	8.9	
≥15	87.0	91.1	0.04
Had sex outside the current place of residence			
Yes	72.6	25.7	
No	27.4	74.3	<0.001
Types of sexual partners (ever)			
Have a regular male partner	52.2	57.7	0.18
Have a paying male partner	51.5	37.9	0.004
Have a paid male partner	35.5	17.9	<0.001
Have other non-commercial male partner	90.7	95.6	0.002
Have a regular female partner	55.3	51.3	0.32
Self-reported sexual identity			
Kothi (predominantly anal-receptive)	20.0	33.4	
Panthi (predominantly anal-insertive)	2.8	23.8	
Double decker (both anal-receptive and insertive)	8.3	11.1	
Bisexual	68.0	29.4	
Hijra (male-to-female transgender)	0.9	2.3	<0.001
C. Condom use			
Condom use during the last sex act			
With regular male partner	87.0	81.7	0.10
With paying male partner	88.7	90.9	0.44
With paid male/hijra partners	82.1	94.3	0.006
With other non-commercial male/hijra partner	78.9	91.7	<0.001
Consistent condom use			
With regular male partner	6.9	80.0	<0.001
With paid male/hijra partners	17.5	92.6	<0.001
With other non-commercial male/hijra partner	10.6	85.1	<0.001
D. Exposure to the Avahan programme			
Contacted by any peer educator	67.1	73.0	0.14
Visited NGO clinic	38.3	72.1	<0.001

Continued

Table 2 Continued

	Round 1 (N=1218) %	Round 2 (N=1203) %	p Value
Received condoms from peer Educator/outreach worker	65.5	72.5	0.08
Exposed to any intervention	68.7	73.0	0.28
E. Sexually transmitted infections (including HIV)			
Syphilis—Yes†	8.1	6.1	0.29
High—titre syphilis (titre≥1 : 8)‡	3.0	1.4	0.01
Urethral chlamydia infection—Yes	1.1	1.8	0.48
Urethral *Neisseria gonorrhoeae* infection—Yes	0.3	0.1	0.07
HIV-1 infection—Yes	15.5	17.3	0.52

*All the proportions shown are weighted.
†Any person with a reactive Reactive Plasma Reagin (RPR) and *Treponema pallidum* haemagglutination assay (TPHA).
‡The titre obtained on RPR was used to measure this variable.

Round 1 (table 3). Moreover, the increase in consistent condom use with these male partners was found to be highly significant in IBBA Round 2 compared with IBBA Round 1. We also found that, in general, HR-MSM/TG who were exposed to Avahan intervention were more likely to use condoms with their regular male partners, paying male partners and other non-commercial male/TG partners compared with those who were not exposed to the intervention; this behaviour was seen in both rounds of IBBA (table 4). Furthermore, as seen in table 4, even though the ORs while examining the associations between last time/consistent condom use and exposure to the intervention differed in two rounds of IBBA, these differences were not statistically significant for most of the male partner types. We also found that HR-MSM/TG who were exposed to individual components of the Avahan intervention (such as contacted by peer, provided condoms by peer/outreach worker and visited a clinic) were more likely to report consistent condom use compared with those who were not exposed

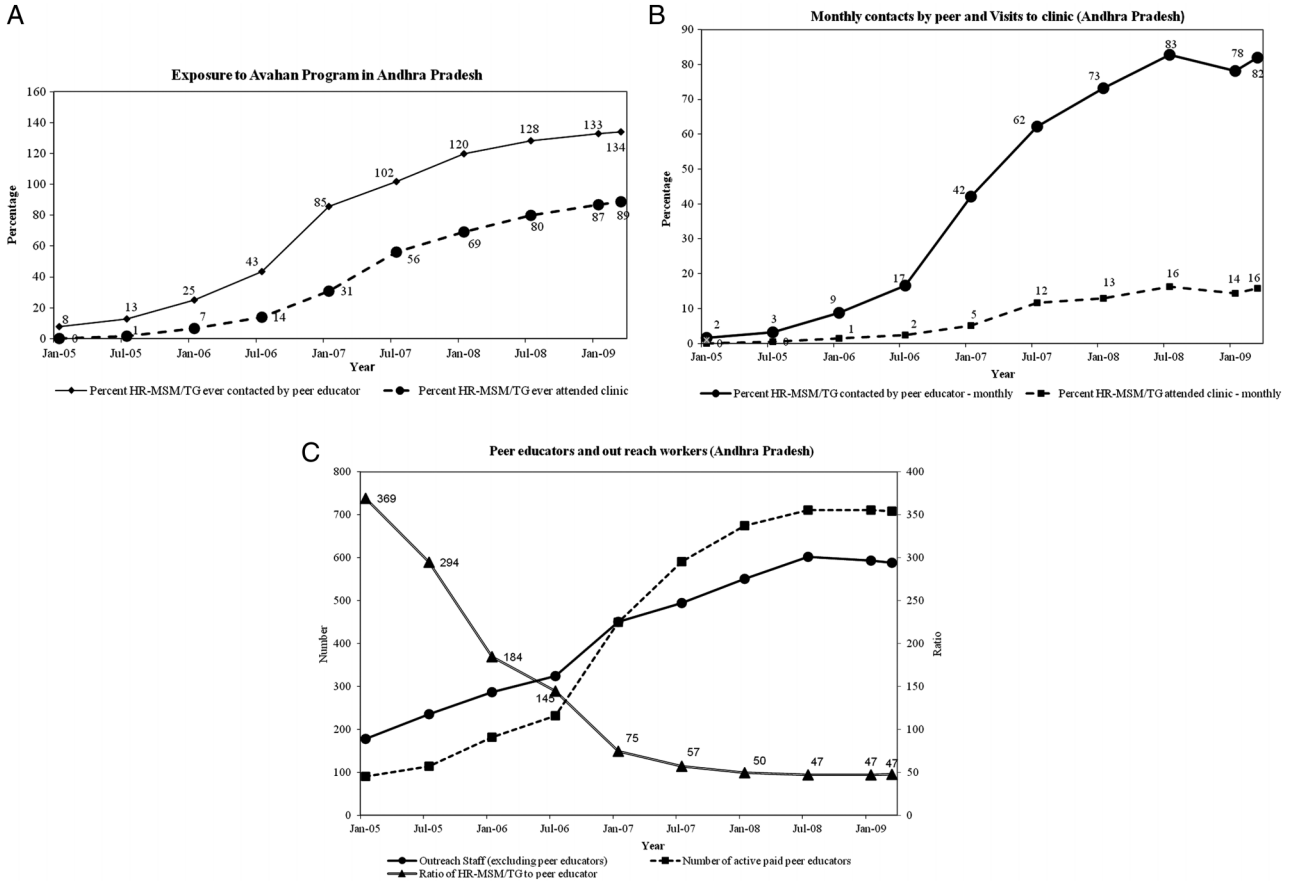

Figure 1 A, B, and C: Figures showing the scale and extent of coverage of different components of the Avahan programme for high-risk men who have sex with men/transgenders (HR-MSM/TG) in Andhra Pradesh, India 2005–2009.

Table 3 Association between outcomes (condom use and STIs including HIV), and the two rounds of IBBA among high-risk men who have sex with men/male-to-female transgenders in Andhra Pradesh, India†‡

	OR (95% CI) Unadjusted models	OR (95% CI) Adjusted models§
A. Condom use		
Condom use during the last sex act		
With regular male partner	1.50 (0.92 to 2.43)	2.93 (1.70 to 5.06)**
With paying male partner	1.30 (0.69 to 2.35)	2.82 (1.16 to 6.84)*
With paid male/hijra partners	3.59 (1.37 to 9.43)*	7.73 (1.44 to 41.38)*
With other non-commercial male/hijra partner	2.96 (1.95 to 4.51)**	4.07 (2.51 to 6.59)**
Consistent condom use		
With regular male partner	53.96 (32.15 to 90.58)**	103.72 (44.13 to 243.78)**
With paid male/hijra partners	59.26 (24.81 to 141.49)**	189.49 (41.44 to 866.58)**
With other non-commercial male/hijra partner	48.16 (27.13 to 85.50)*	66.33 (34.59 to 127.20)**
B. Sexually transmitted infections (including HIV)		
Syphilis¶	0.74 (0.42 to 1.30)	0.56 (0.30 to 1.05)
Syphilis titre≥1 : 8††	0.46 (0.24 to 0.87)*	0.49 (0.22 to 1.09)
Chlamydia infection	1.56 (0.46 to 5.34)	1.42 (0.38 to 5.39)
Neisseria gonorrhoeae infection	0.25 (0.05 to 1.25)	0.30 (0.001 to 0.975)*
HIV-1 infection	1.14 (0.77 to 1.69)	0.94 (0.58 to 1.52)

*p<0.05.
**p<0.01.
†The estimates shown here are weighted estimates.
‡The reference for each of the estimate is Round 1 of the IBBA. Thus, for consistent condom use with a regular male partner the interpretation will be as follows: Subjects in Round 2 of IBBA were significantly more likely to report consistent condom use with a regular male partner compared with those in Round 1 of IBBA (OR 53.96, 95% CI 32.15 to 90.58).
§The models were adjusted for age, marital status, income, literacy, district of interview, local dweller, sexual identity, age of first sexual activity and sex outside the place of current residence.
¶Any person reactive on RPR and TPHA.
††The titre obtained on reactive RPR was used to measure this variable.
IBBA,integrated biological and behavioural assessment;RPR, Reactive Plasma Reagin; TPHA, *Treponema pallidum* haemagglutination assay.

to these interventions in each round (data not shown). Even though reported consistent condom use with regular female partners increased in Round 2 compared with Round 1, it remained low (15.3% vs 2.4%, p<0.001).

We also found that the last time condom use with certain categories of male partners was significantly associated with an increase in the number of contacts with peer educators. Indeed, a unit increase of contact with the peer educator was associated with condom use

Table 4 Association between condom use (during last sex act and consistent condom use) and exposure to various components of the Avahan intervention in Rounds 1 and 2 of the IBBA among high-risk men who have sex with men/male-to-female transgenders according to different types of male partners in Andhra Pradesh, India†‡

	Round 1 IBBA OR (95% CI) Adjusted models§	Round 2 IBBA OR (95% CI)	p Value¶
Condom use during the last sex act			
With regular male partner	1.69 (0.74 to 3.87)	4.59 (1.40 to 15.05)*	0.18
With paying male partner	2.54 (0.83 to 7.81)	5.78 (1.10 to 30.37)*	0.42
With other non-commercial male/hijra partner	4.01 (2.17 to 7.41)**	1.35 (0.42 to 4.32)	0.11
Consistent condom use			
With regular male partner	3.21 (1.08 to 9.54)*	4.62 (1.40 to 15.22)*	0.66
With other non-commercial male/hijra partner	1.24 (0.54 to 2.86)	1.31 (0.43 to 3.96)	0.94

*p<0.05.
**p<0.01.
†The estimates shown here are weighted estimates.
‡The reference for each of the estimate is not being exposed to that particular component of the programme. Thus, for consistent condom use with a regular male partner the interpretation will be as follows: Subjects who were exposed to Avahan intervention in Round 2 of IBBA were significantly more likely to report consistent condom use with a regular male partner compared with those unexposed (adjusted OR 4.62, 95% CI 1.40 to 15.22).
§The models were adjusted for age, marital status, income, literacy, district of interview, local dweller, sexual identity, age of first sexual activity and sex outside the place of current residence.
¶The p value is to indicate the difference in ORs between two rounds of IBBA.
IBBA,integrated biological and behavioural assessment.

during the last sex act with a 'regular partner' (OR 1.04, 90% CI 1.00 to 1.08), 'paying male partner' (OR 1.12, 90% CI 1.05 to 1.19), 'paid male partner' (OR 1.07, 90% CI 1.00 to 1.13) and 'other non-paid male partner' (OR 1.05, 90% CI 1.01 to 1.09). However, no such significant association between condom use and duration of knowledge of intervention was observed (data not shown).

STIs including HIV

None of the STIs showed significant differences between two rounds of IBBA (tables 1 and 2). As seen in table 2, the proportion of reactive syphilis serology in these HR-MSM/TG was 8.1% and 6.1% (p=0.29) in Rounds 1 and 2 of IBBA. The proportion of high-titre syphilis (RPR≥1 : 8 and TPHA reactive) was lower in Round 2 compared with Round 1 (1.4% vs 3%, p=0.01). However, it did not show significant difference after adjusting for confounding explanatory variables across the two rounds (AOR 0.49, 95% CI 0.22 to 1.09). In Round 2 of the IBBA, HR-MSM/TG who were exposed to the Avahan intervention were significantly less likely to have high-titre syphilis compared with those who were not exposed to the intervention (AOR 0.33, 95% CI 0.13 to 0.85). On analysing the data at the district level, we found that the prevalence of syphilis reduced in two districts: East Godavari (13.0% in Round 1 vs 5.0% in Round 2, p < 0.01) and Visakhapatnam (5.6% in Round 1 vs 1.9% in Round 2, p < 0.05). The proportion of HR-MSM/TG who tested positive for HIV-1 antibodies was not significantly different across the two rounds of IBBA (15.5% in Round 1 vs17.3% in Round 2, p=0.52).

DISCUSSION

This assessment of the Avahan initiative, using multiple data sources, provides information on the role of Avahan initiative in HIV prevention efforts among the HR-MSM/TG population in AP. Avahan's intervention for HR-MSM/TG was able to reach the intended target of monthly contact of 80% of the estimated HR-MSM/TG by 2008. HR-MSM/TG were more likely to be exposed to various components of the Avahan programme by Round 2 of the IBBA. They also reported a higher consistent condom use with various male and TG partners in Round 2 of the IBBA compared with Round 1. HR-MSM/TG who were exposed to various components of the Avahan programme were more likely to report consistent use condoms with their male partners compared with those who were not exposed. The estimated HIV prevalence remained high in both the rounds of IBBA; there was no significant difference in the HIV prevalence and other STI prevalence between the two rounds of survey.

An important achievement of this Avahan intervention was the rapid scale-up of the prevention programmes for HR-MSM/TG in AP; the proportion of HR-MSM/TG reporting 'ever contacted' by the intervention was >100% in the second year of the programme. This probably also indicates the high degree of the mobility in the population: the denominator was the quarterly size estimates of HR-MSM/TG population, whereas the numerator included all unique HR-MSM/TG who were ever contacted in the districts where Avahan had an intervention (and they may include HR-MSM/TG who were temporarily resided in the district). The increase in coverage as observed in the programmatic data is also supported by the findings from the IBBA. HR-MSM/TG reporting exposure to various components of the Avahan programme increased significantly in the Round 2 of IBBA compared with Round 1. These estimates are higher than the average estimate of 33% programme reach in the MSM population in low and middle income countries.[16] Along with scaling up the coverage, the programme was also able to improve the ratio of HR-MSM/TG to peer educators, improve the monthly contact by peers (80% or more) and increase the condom use to cover the estimated commercial sex acts. It will be important to monitor the coverage as the programme is transitioned during Phase 2 of Avahan.

Such improvements in programme coverage and services have also been reported in FSW interventions.[12 17 18] These studies found that not only did the clinic attendees increase across all the Avahan STI clinics but also there was a significant improvement in the quality of services received at these clinics. Since the quality assessment of these clinics was combined (included all the high-risk groups), this improvement in the scores also reflects improved quality of services in the MSM clinics.[19 20] Even though the programme fared well in these areas, low monthly STI clinic attendance of these groups remained an area of concern. Avahan had set a target of 20% monthly clinic attendance; however, the programme could achieve about 16%. Thus, there is an urgent need to continue these initiatives in the HR-MSM/TG population with an increased emphasis for regular STI check-ups and follow-ups, especially since there was no significant decline in HIV and STIs in this study.

It has been noticed that behavioural interventions are useful tools for HIV prevention in the HR-MSM/TG population globally.[21 22] We found that improvements in the outreach and service delivery were associated with the improvements in the reported condom use by the HR-MSM/TG population—which had ranged from 47% to 94% in earlier reports[23 24] Interestingly, even in the first round of IBBA, HR-MSM/TG exposed to the Avahan initiative were significantly more likely to use condoms. Thus, potentially increased outreach and availability of condoms did translate into increased condom use. Notwithstanding these encouraging findings, an issue of ongoing concern and challenge was low consistent condom use with regular female partners. Similar findings of low condom use with women have also been reported from other areas of India.[23 25] Thus, the intervention programmes need to stress the importance of condom use with men, women, as well as male-to-female TGs/*hijras*.

Another important area of concern was the high prevalence of HIV and syphilis in both the rounds of IBBA. Incidentally, such a high prevalence of HIV in the MSM population in AP has also been reported by the sentinel surveillance. They have found that the HIV prevalence among MSM in AP has shown an increasing trend from 2005 onwards.[26] However, this was not the case in these three IBBA districts, where the analysis has shown that the HIV prevalence remained stable between the two rounds of IBBA. These findings are in contrast with the FSW population in AP. Indeed, Rachakulla *et al*[20] found that there were significant reductions in the overall prevalence of HIV and syphilis in the FSWs in AP. In addition, Ng *et al*[27] have demonstrated that a high intensity of Avahan programme was significantly associated with lower HIV prevalence in AP. Even though we did not observe a decline in the HIV prevalence, we did observe a significant decline in 'Active syphilis' (ie, high-titre syphilis) and *Neisseria gonorrhoeae*. It is important to state over here that there was a slight delay in the roll out of the MSM intervention programme in AP. Hence, to see a significant change in the HIV prevalence, we may require more time than the time gap between the two rounds of the survey presented in the paper. Additionally, an incidence measure would probably be a better measure of the decline of HIV in this population. As stated earlier, even though the prevalence of HIV has declined in FSWs in India, the same trend has not been observed in the MSM/TG groups.[1] Thus, efforts to contain HIV and STI transmission in the MSM/TG population need to be continued, and perhaps even newer approaches and additional prevention modalities are needed for the MSM population.

This assessment had several limitations. As stated earlier, the programme CMIS captured data on HR-MSM/TG who were covered by Avahan in its implementation areas, whereas the sampling design of IBBA included the entire district. However, results from different data sources facilitated data triangulation. In addition, the Avahan implementation and evaluation design was not a classical 'intervention-control two group' design; thus, this assessment did not allow for any control groups. This was due to ethical concerns of withholding known HIV prevention services, the state goal of rapid scale up and the political issue of using government districts as controls.[5] Hence, given these constrains, a design that was appropriate for the current assessment and feasible for a large scale-public health programmes was adopted.[8] In such a scenario, where multiple interventions are aiming to reach vulnerable populations to rapidly scale up coverage, such evaluation designs using different sources of evidence have been recommended as an alternative to randomised controlled trials.[28–32] Though we did collect urethral and serological sample for STIs, we could not collect rectal specimens due to logistic difficulties; thus, we may have missed some rectal STIs in both the rounds. Additionally, some of the results in Round 2 may be attributed to the changes in the population composition (as seen by a decrease in the proportion of bisexuals in Round 2 of the IBBA). One potential reason for this change could be due to migration and mobility of MSM in the region. However, we adjusted for identity in our multivariate models. Finally, it is quite likely that some of the responses—particularly condom use—may be influenced by social desirability bias and we may have overestimated these outcomes specifically in Round 2 as the programme had scaled up rapidly during that period. However, we compared two rounds of data; thus, presumably, the bias was similar in both these settings. Furthermore, we did find that HR-MSM/TG reported low levels of condom use with regular female partners. Even though some of the IBBA districts were solo Avahan districts, we cannot rule out the role of some small/independent interventions in the increase of condom use. Nonetheless, it is important to note that safe sex behaviours such as consistent condom use increased in the same geographical areas over a period of time.

In spite of these limitations, this assessment has several strengths; this is one of the few assessments of a large-scale HIV intervention on HR-MSM/TG in India. The analysis was based on the Avahan evaluation design and presented evidence along the programme's logical model: examined coverage, outputs and intermediate outcomes followed by associations with the programme exposure. This was done using programme monitoring data and independent survey data for validation of trends, and provided evidence for programme effectiveness based on the congruency of trends.[8]

In conclusion, Avahan implemented a programme for HR-MSM/TG in AP which scaled up rapidly to achieve coverage in the context of a highly mobile target population, ensured adequate condom supply and delivered high-intensity peer and STI clinical services resulting in positive behavioural outcomes including increased condom use. Some of the important achievements of the Avahan intervention include high consistent condom use with different types of male partners and relative stabilisation of the HIV and STI prevalence in the community. Challenges, however, remain about low consistent condom use with regular female partners and relatively high prevalence of HIV among HR-MSM/TG in AP. Thus, there is a need to maintain the intensity of these programmes to ensure high STI clinic attendance and long-term reduction of HIV and STIs in this population in India.

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Acknowledgements We thank the principal investigators and project staff from ICMR Institutes and National Institute of Nutrition who implemented IBBA in Andhra Pradesh. Support for reviewing the manuscript was provided by Dr Maninder Singh Setia and Dr Philippe Girault. Thanks to AC Nielsen

ORG-MARG for carrying out field data collection. We also thank Avahan state implementing partners and NGOs and the MSM respondents.

Contributors PG contributed to the concept development, data analysis and interpretation, writing and finalising the manuscript. HR, LR, SR, KV, RH contributed to concept design, reviewing the manuscript. SM provided support to data analysis, GNV, PR, BG and RA contributed to development and finalisation of manuscript.

Funding This work was supported by the Bill & Melinda Gates Foundation.

Competing interests None.

Ethics approval Clearance for the study was taken from Protection of Human Subjects Committee (PHSC), FHI360 HQ, Washington DC and Health Ministry Screening Committee (HMSC), Government of India.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement IBBA Round 1 and Round 2 data are available at: http://www.nari-icmr.res.in/IBBAdataaccess.php through application process. Other IBBA-related documents are available at www.ibbainfo.in.

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