Impact of TI Programmes Intervention under National AIDS Control Programme among Female Sex Workers in India: Evidence from Integrated Biological and Behavioural Survey, 2014-15

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Abstract

Background: A better understanding of the impact of Targeted Interventions (TI) services on Female Sex Worker (FSW) behaviours can help in informing and strengthening future TI efforts under National AIDS Control Programme (NACP). **Methods:** National Integrated Biological and Behavioural Survey (IBBS) 2014-15 has been analysed in the paper. Descriptive statistics and logistic regression analysis were used to understand factors affecting condom use. Propensity score matching (PSM) was done to understand the impact of the TI services on condom use at the last act and consistent condom use in the last three months among FSWs. **Results:** Younger FSWs aged 15 - 25 years were 1.4 times (95% CI: 1.04 - 1.77) more likely to use consistent condoms in the last three months compared to older over 45 years after controlling for other socio-economic and programme variables. The matched samples estimate ATET *i.e.* the average treatment effect on treated for consistent condom use in the last three months shows that a 6.0% (CI: 4.7 - 7.3) increase in consistent condom use in the last three months in the FSWs who received information on STI/HIV from peer educator and outreach worker. There is also a 6.0% (4.7 - 7.2) increase in condom use in the last act for FSWs who received the referral services at STI clinics, HIV testing, and detox centres. **Conclusions**: It is evident that the TI programme has a positive impact on

behavior change among FSWs which can prove beneficial to curtail the spread of HIV to the partners and onward transmission to the general population.

Keywords

1. Introduction

India has a huge HIV epidemic and an estimated 2.35 million people living with HIV, with an adult (15 - 49 years) HIV prevalence of 0.22% [1]. The prevalence of HIV remains high among key populations and is a key driver of the concentrated epidemic in India [2] [3]. Under National AIDS Control Programme (NACP), Female Sex Workers (FSWs) are the largest population among key populations covered, with an estimated size of 868 thousand and a high HIV prevalence of 2.2% and inter-state variations (ranges from 0.7% - 7.4%) [4] [5] [6]. The huge burden and rapid transmission of infections among FSWs remain an enormous cause of concern for health experts.

Female Sex Workers are aged 15 years or more engaged in consensual sex in exchange for cash/kind in the last one month [5]. Heterosexual contact is the major mode of HIV transmission reported in India, and FSWs are considered a core group for transmission of HIV and other Sexually Transmitted Diseases (STDs) [7] [8] [9]. The high risk for HIV can be attributed to a large number of multiple sexual partners and prevailing socio-demographic factors, sex work characteristics with condom use or safe sex practices and stigma associated with the sex work make them most vulnerable [10] [11]. The complete and elaborate information about the factors is of utmost importance to halt the transmission of infection to the general population.

Since the inception of the National AIDS Control Programme (NACP) in 1992 by the National AIDS Control Organization (NACO), tremendous efforts have been put in place to battle the menace of HIV by understanding the HIV burden, epidemiological trends and introduction of treatment and prevention programmes [12] [13] [14] [15]. Comprehensive package of prevention, support and linkage services have been introduced through Targeted Interventions (TIs) under NACP since 1999 among key populations, *i.e.*, female sex workers (FSWs), Men who have Sex with Men (MSMs), Injecting Drug Users (IDUs) and migrants and truck drivers. The TIs programme's intervention aims toward the more rapid decline of HIV prevalence by providing information, means and skills to curtail the HIV transmission and improve access to care, support and treatment services [8] [9] [10] [16]. The overall coverage of the TIs Programme for FSWs has been observed at 77.4% in 2015-16 [17]. The community engage-

ment and participation over the years have also resulted in substantial gains and improvements.

Despite the documented HIV prevalence among the FSWs, there exist considerable gaps in the information regarding the risk factors in the FSWs which may serve to guide appropriate HIV prevention and treatment interventions. They are also indispensable to be ascertained for effective policymaking and programme initiatives and robust surveillance systems and are central to the effective national response for controlling HIV.

With an aim to examine the impact of key services provided through TIs programmes intervention under NACP, an in-depth analysis of the National Integrated Biological and Behavioural Surveillance (IBBS) 2014-15 has been done among the FSW population.

2. Methods

The data used in this study comes from the National Integrated Behavioural and Biological Survey (IBBS)conducted by NACO, MoHFW, Government of India during the years 2014-2015. The IBBS was a cross sectional survey design and used conventional or time location clusters as a sampling frame, to draw sample FSWs using probability proportion to size (PPS) method. The survey unit under the IBBS comprise of a domain, a geographical unit for which representative estimates were generated for the risk group. The details of IBBS survey design and implementation may be seen elsewhere [5].

Outcome Measures: We have considered two outcome measures to assess the impact of TI programmes intervention under NACP *i.e.*, 1) Condom use at last act and 2) consistent condom use in the last three months. The question "last time you had sexual intercourse with an occasional, or regular client or regular non-paying partner" was asked to all the participants, If "yes" to all the three partners then it was coded as Yes (1) for condom use at last act and else No (0). Similarly, for the consistent condom use in the last three months the question "how often have you used condoms with your occasional, or regular client or main regular non-paying partner?" was asked, If the response was "every time" to all the three partners then it was coded as Yes (1) for consistent condom use and else No (0).

The Socio-economic and Demographic Factors are 1) individual level factors: age of women (15 - 24, 25 - 34, 35 - 44 and >45 years), education status (literate and illiterate), marital status (never married, currently married and widowed/divorced/separated), living status (living alone, living with family/spouse and with others; 2) sex work related factors: age at sexual debut (<17, 18 - 24 and >25 years), age at the start of sex work (<17, 18 - 24 and >25 years), duration of commercial sex (<1, 2 - 3, 4 - 9 and >10 years), sex clients per day (<2 and >3), place of solicitation (home, public places/lodge/hotels, brothels, highway and others),the lodge/hotels and bar night clubs were clubbed to public places and rented room clubbed with home option. Besides, substance use (al-

cohol and drugs), knowledge of STIs and comprehensive knowledge of HIV were other independent variables. Comprehensive knowledge is a composite indicator constructed by information collected from FSWs on five questions. The questions asked were, can a person prevent getting infected with HIV: 1) by having only one uninfected sex partner who has no other sex partners; and 2) by always using condom while engaging in sex; 3) do you think that a healthy-looking person can be infected with HIV, the virus that causes AIDS? And can a person get HIV; 4) through mosquito bites; and 5) by sharing a meal with someone who is infected. If yes to the first three questions and no to the two questions about the misconceptions (can HIV spreads through mosquito bite and sharing a meal with infected person), then it was coded as yes (1) for comprehensive knowledge and else no (1). Besides, the participants also received comprehensive package of preventive services for FSWs in the last 12 months the details of which are mentioned elsewhere [5]. The preventive services provided to the FSWs were received information on STI/HIV from a peer educator or an outreach worker from the NGO/Programme, received condoms from the peer educator or outreach workers of the NGO/Programme, seen a demonstration on correct condom use by a peer educator/NGO outreach worker, received check-up and counselling for STIs, received free medicine for STIs, visited drop in centre, referred to other services (STI clinic, HIV testing, detox centre etc.) from the NGO/Programme, received help and support when faced with physical or sexual violence [5].

Statistical Analysis

Statistical analysis involved basic descriptive analysis to study the sociodemographic profile of the Female Sex Workers, Sexual Risk Behaviours and Programme exposure components. Multivariate logistic regression was done along with 95% confidence intervals. Propensity Score matching analysis (PSM)was performed to examine the impact of targeted interventions *i.e.* prevention, care and linkage services on the outcome condom use at last act and Consistent condom use in the last three months and. All statistical analysis was done using STATA ver. 16.0.

Propensity Score Matching (PSM)

The propensity score analysis is a statistical technique proposed by Rosenbaum and Rubin [18] [19] that estimates causal effect of treatment in the observational study [20]. It is a conditional probability that a unit having certain characteristics will be assigned to a particular treatment group. It entails the matched sets of treated and untreated subjects who share a similar value of propensity scores. This probability or scores can be used to reduce selection bias in observational studies by balancing the covariates between treated and control groups [19] [21]. The PSM allows one to estimate ATT which is average treatment affect for treated and attempts to estimate effect of treatment or intervention by accounting for covariates that predict receiving the treatment [18] [22] [23].

We have analysed the impact of the TI programme components on the condom use at last and consistent condom use in the last three months using the

propensity score analysis. After the balance was achieved on the propensity scores and covariates, the two groups were directly compared on the outcome of interest *i.e.* condoms used at last act and consistent use of condom in the last three months. One to one nearest neighbourhood matching was performed using range of covariates after assessing multicollinearity and the variables found to be correlated were dropped for matching. By using t effects ps match we have estimated average treatment effects (ATE) and Average treatment effect on treated (ATET). The ATE is the average effect of treatment for entire population moving from untreated to treated and is analysis at the population level. However, ATET is the average effect of treatment on those subjects who ultimately received the treatment.

Ethical Issues and Consent Process

Informed consent was obtained from participants and was given the clear and precise information regarding the voluntary participation in the survey. Data confidentiality was ensured by maintaining anonymous IBBS data and all specimens being labelled with unique identifier number. The ethical approval for the National IBBS 2014-15 was taken by National AIDS Control organization (NACO) during the study period. However, permission was sought from NACO for the use of secondary data to develop this research paper.

3. Results

Overall, 27,007 respondents were interviewed in the IBBS survey (2014-15). The analysis however was restricted to 23,980 participants who received at least one component of TIs programmes intervention services, under the Programmes Intervention for FSWs.

The characteristics of study population are given in Table 1. The mean age of the participants was 30.6 years (SD 7.1). More than half (51.0 %) of the participants were in 25 - 34 years age group and quarter of the participants in 35 - 44-years age group. Around 66% were literate and 65% of the participants currently married while less than 20% of the participants were unmarried. Mostly (around 78%) the participants were living with their family/spouse and only 13.4% of the participants were living alone. Mean age of first sex for the participants was 25.6 years (SD: 24.0). More than 40% of the participants reported sexual debut before the age of 18 years. Mean age of initiation of sex work was 29.4 years (SD: 22.0). Overall, 11.6% of the FSW had started sex work before the age of 18 years. Mean duration of sex work was 1.2 years (SD: 22.1) and three fourth (72%) respondents were in the sex work for the duration of less than 10 years. More than 80% of FSWs had knowledge about STIs and less than half had comprehensive knowledge of HIV.

Table 2 provides details of the percentage distribution of participants, percentage of condom used at last act among FSWs, and consistent condom used in last 3 months by exposure to TI programme. Overall, it was found that 27.9% and 12.6% of the participants used condom at last act and consistent

Table 1. Sociodemographic description of the participants.

Background Characteristic	Number (N = 23,980)	Percentage
Age of the participant		
15 - 24	4474	18.7%
25 - 34	12,240	51.0%
35 - 44	6138	25.6%
>45	1128	4.7%
Educational Status		
Literate	8042	33.6%
Illiterate	15,910	66.4%
Marital Status		
Never Married	3844	16.0%
Currently Married	15,559	64.9%
Widowed/Divorced/Separated	4564	19.0%
Living Status		
Living alone	3211	13.4%
With family/Spouse	18,635	77.8%
With others	2120	8.9%
Age at first Sex		
<17	10,178	42.5%
18 - 24	10,833	45.2%
>25	2964	12.4%
Age at initiation of Sex work		
<17	2780	11.6%
18 - 24	11,450	47.8%
>25	9738	40.6%
Duration of Commercial Sex (in years)		
<1	3580	14.9%
2 - 3	4201	17.5%
4 - 9	9282	38.7%
>10	6905	28.8%
No. of Sexual partner per day		
<2	12,345	51.5%
>3	11,610	48.5%
Knowledge of STI		
Yes	19,975	83.3%
No	4005	16.7%

Continued

Substance Use (alcohol and drugs)		
Yes	8030	33.5%
No	15,950	66.5%
Comprehensive Knowledge of HIV		
Yes	9943	41.5%
No	14,037	58.5%

Table 2. % distribution of participants, %of condom used at last act among FSWs, and % of consistent condom in last 3 months by exposure to TI programme intervention.

Type of TI Programme intervention	% of participants	Condom used at last act	Consistent condom used in last 3 months
	N (%)	N (%)	N (%)
	N = 23,980	6686 (27.9%)	3011 (12.6%)
Received information on STI/HIV by Peer Educator/Outreach Worker			
Yes	20,800 (86.7%)	6013 (28.9%)	2785 (13.4%)
No	3180 (13.3%)	673 (21.2%)	226 (7.1%)
Received condoms from Peer Educator/Outreach Worker			
Yes	20,135 (83.9%)	5860 (29.1%)	2762 (13.7%)
No	3845 (16.1%)	826 (21.5%)	249 (6.5%)
Seen demonstration on correct condom use by Peer Educator/Outreach Worker			
Yes	17,621 (73.5%)	5217 (29.6%)	2497 (14.2%)
No	6359 (26.5%)	1469 (23.1%)	514 (8.1%)
Received check-up & counselling for STIs at clinics			
Yes	16,139 (67.3%)	4647 (28.8%)	2206 (13.7%)
No	7841 (32.7%)	2039 (26.0%)	805 (10.3%)
Received free medicine for STIs			
Yes	13,523 (56.4%)	4095 (30.3%)	1949 (14.4%)
No	10,457 (43.6%)	2591 (24.8%)	1062 (10.2%)
Visited drop-in Centre			
Yes	10,753 (44.8%)	3190 (29.7%)	1644 (15.3%)
No	13,227 (55.2%)	3496 (26.4%)	1367 (10.3%)
Referred to other Services (STI clinic, HIV testing, detox centre, etc.)			
Yes	11,896 (49.6%)	3754 (31.6%)	1834 (15.4%)
No	12,084 (50.4%)	2932 (24.3%)	1177 (9.7%)
Received support when faced with physical or sexual violence			
Yes	8609 (35.9%)	2608 (30.3%)	1199 (13.9%)
No	15,371 (64.1%)	4078 (26.5%)	1812 (11.8%)

condom in the last three months respectively. Majority of the participants (87% and 84%) received information on STI/HIV and received condoms from peer educator/outreach worker from NGO/programme respectively. Another 74% and 67% of participants had seen demonstration of condom use and received checkup and counselling for STIs respectively. More than half of the participants were referred to the other services (STI clinic, HIV testing, detox centre etc.) and relatively less almost 36% of the participants received support when faced with physical or sexual violence.

Table 3 provides details about the univariate and multivariate logistic regression carried out to examine the association between the socioeconomic factors and consistent condom use in the last three months and condom use at last act with regular partner and regular and occasional clients. It has been found that the participants who received condoms from peer educator/outreach worker were 1.17 and 1.64 times more likely of using condom at last act (AOR: 1.17, CI: 1.06 - 1.28) and condom use in the last three months (AOR: 1.64, CI: 1.42 - 1.89) respectively than the participants who did not receive the services. Also, participants who had

Table 3. Unadjusted and adjusted odds ratio (CI 95%) to determine condom used at last act and consistent condom used in the last three months among female sex workers by types of TI's Programme intervention.

Type of TI's Programme intervention	Condom used at last act		Consistent condom used in the last three months	
	Unadjusted OR (CI 95%)	Adjusted OR@ (CI 95%)	Unadjusted OR (CI 95%)	Adjusted OR@ (CI 95%)
Received information on STI/HIV/AIDS from PE/ORW				
Yes	1.51 (1.38 - 1.66)***	0.86 (0.80 - 0.93)***	2.02 (1.75 - 2.33)***	1.13 (0.97 - 1.32)
Received condoms from PE/ORW				
Yes	1.50 (1.38 - 1.63)***	1.17 (1.06 - 1.28)***	2.30 (2.01 - 2.63)***	1.64 (1.42 - 1.89)***
Seen demonstration on correct condom use by PE/ORW				
Yes	1.40 (1.31 - 1.5)***	1.15 (1.07 - 1.24)***	1.88 (1.7 - 2.07)***	1.34 (1.20 - 1.50)***
Received check-up & counselling for STIs at clinic				
Yes	1.15 (1.08 - 1.22)***	1.08 (0.97 - 1.20)	1.38 (1.27 - 1.51)***	0.92 (0.83 - 1.02)
Received free medicines for STIs				
Yes	1.32 (1.24 - 1.4)***	1.17 (1.08 - 1.25)***	1.49 (1.38 - 1.61)***	1.12 (1.02 - 1.24)*
Visited drop in Centre				
Yes	1.17 (1.11 - 1.24)***	0.95 (0.89 - 1.02)	1.57 (1.45 - 1.69)***	1.16 (1.06 - 1.27)**
Referred to other Services (STI clinic, HIV testing, detox centre etc.)				
Yes	1.44 (1.36 - 1.52)***	1.30 (1.22 - 1.4)***	1.69 (1.56 - 1.83)***	1.28 (1.16 - 1.41)***
Received help and support when faced with Physical/Sexual Violence				
Yes	1.20 (1.14 - 1.28)***	1.21 (1.12 - 1.3)***	1.21 (1.12 - 1.31)***	0.99 (0.91 - 1.07)

#No is the reference category. @Adjusted for all socio-economic variables: age of participants, educational status, marital status, living status, age at first sex, age at initiation of sex work, duration of sex work, number of sexual partners per day, place of solicitation, knowledge of STI, substance use, comprehensive knowledge of HIV. P-value: *<0.05; **<0.01; ***<0.001.

seen demonstration of correct condom use by PE/ORW were also more likely to use condom at last act (AOR: 1.15, CI: 1.07 - 1.24) and consistent condoms in the last three months (AOR: 1.34, CI: 1.20 - 1.50) respectively. Further, the participants who received information on STI/HIV/AIDS from peer educator and outreach worker were also more likely of using consistent condom in the last three months (AOR: 1.13, CI: 0.97 - 1.32). There has also been seen association between participants who were referred to other services STI clinic, HIV testing, detox centres etc. and condom used at last act (AOR: 1.30, CI: 1.22 - 1.40) and consistent condoms used in the last three months (AOR: 1.28, CI: 1.16 - 1.41) and found to be more likely of using condoms.

Results from Propensity Score Analysis

The results of the propensity score analysis are shown in Table 4. The matched samples estimate (ATET *i.e.* the average treatment effect on treated) for

Table 4. Average treatment effects, average treatment effect on treated among study participants who used condom at last act and used consistent condom in the last three months by types of TI's Programme intervention services.

Type of TIs Programme intervention services	ATE/ATET	Condom used at last act**		Consistent condom used in last three months***	
		Coefficient (%) 95% CI	p-value	Coefficient (%) 95% CI	p-value
Received information on STI/HIV from Peer Educator/Outreach worker	ATE	4.5 (2.6 - 6.5)	<0.001	5.8 (4.6 - 7.1)	<0.001
	ATET	4.7 (2.6 - 6.8)	<0.001	6.0 (4.7 - 7.3)	<0.001
Received condoms from Peer Educator/Outreach Worker	ATE	3.7 (1.8 - 5.6)	<0.001	6.3 (5.2 - 7.4)	<0.001
	ATET	3.4 (1.4 - 5.5)	0.001	6.3 (5.1 - 7.4)	<0.001
Seen demonstration on correct condom use by Peer Educator/Outreach Worker	ATE	4.2 (2.9 - 5.6)	<0.001	5.3 (4.4 - 6.3)	<0.001
	ATET	4.2 (2.7 - 5.7)	<0.001	5.4 (4.4 - 6.4)	<0.001
Received check-up and counselling for STIs at clinics	ATE	0.55 (−0.75 - 1.9)	0.407	2.5 (1.6 - 3.4)	<0.001
	ATET	0.59 (−0.85 - 2.0)	0.423	2.6 (1.6 - 3.6)	<0.001
Received free medicine for STIs	ATE	3.4 (2.2 - 4.6)	<0.001	3.5 (2.7 - 4.3)	<0.001
	ATET	3.3 (2.0 - 4.5)	<0.001	3.7 (2.8 - 4.6)	<0.001
Visited drop-in centre*	ATE	1.8 (0.66 - 3.0)	0.002	4.1 (3.2 - 5.0)	<0.001
	ATET	1.7 (0.45 - 3.0)	0.008	4.0 (3.1 - 4.9)	<0.001
Referred to other services (STI clinic, HIV testing, detox centres etc.)	ATE	6.1 (4.9 - 7.2)	<0.001	4.8 (3.9 - 5.6)	<0.001
	ATET	6.0 (4.7 - 7.2)	<0.001	4.8 (3.9 - 5.7)	<0.001
Received support when faced with physical or sexual violence	ATE	2.4 (1.2 - 3.6)	<0.001	1.5 (0.62 - 2.4)	0.001
	ATET	2.6 (1.3 - 3.8)	<0.001	1.6 (0.65 - 2.5)	0.001

*Drop-in centre: Centres run by network of People Living with HIVs where PLHIVs are given counselling, psychosocial support and legal advice. The centres also provide information about available services and facilities to PLHIV. **For condom use at last act: age of participant, marital status, living status, age of initiation of sex work, duration of sex work, no. of sexual partners per day, knowledge of STIs, comprehensive knowledge of HIV. ***For consistent condom use in the last three months: age of participants, literacy status, marital status, no. of sexual partners, knowledge of STIs, place of solicitation, comprehensive knowledge of HIV.

the condom use at last act and consistent condom use in the last three months shows that the difference in the condom use at last act and condom use in the last three months by those who received the condoms from peer educator and outreach worker and those who did not receive is 0.034 (3.4%, CI: 1.4 - 5.5) and 0.063 (6.3%, CI: 5.1 - 7.4) respectively. This indicates that FSWs who received condoms from peer educator/outreach worker are more likely to use condom at last act and consistent condom to those who did not receive condoms. The estimated ATE values in treated and control groups are 0.287 and 0.250 respectively thus indicating that condom use at last act increased by 3.7% points because of condoms received from the PE/ORW. Similarly, ATE values in treated and control groups are 0.136 and 0.073 respectively also indicating that consistent condom use in the last three months increased by 6.3% as they received condoms from PE/ORW.

Further, ATET for the condom use at last act and consistent condom use in the last three months shows that the difference by those who were referred to other services (STI clinic, HIV testing, detox centres etc.) was 0.06 (6.0%, CI: 4.7 - 7.2) and 0.048 (4.8%, CI: 3.9 - 5.7) respectively. The estimated ATE value in treated and control groups are 0.310 and 0.249 respectively which indicates increase in condom use at last act by 6.1% because of referral to other services (STI clinic, HIV testing, detox centres etc.) and also ATE value in treated and control group are 0.149 and 0.101 respectively indicating an increase in use of consistent condom by 4.8% because of referral to other services (STI clinic, HIV testing, detox centres, etc.).

Furthermore, the FSWs who received information on STI/HIV and had seen demonstration of condom use also showed increase in the condom use in last act and consistent condom use in the last three months.

4. Discussion

This paper examines the impact of the TI programme interventions services which offer prevention care and linkage services to FSWs under NACP by National AIDS Control Organization (NACO) on the condom use at last act and consistent condom use in the last three months. This is among the first studies to evaluate the effect of TI programme interventions on the behaviour change of the FSWs using propensity score matching (PSM) analysis which allows the data of the observational study to be analysed in a way so as it corresponds with the Randomized Control Trials (RCTs). The study presents findings on the impact of the TI Programme interventions on the enhancement of condoms use among FSWs providing the strong evidence for the behaviour change. The association between the exposure to the TI programme interventions and the HIV risk reduction in terms of condom use has also been reflected. The findings indicate that the participants exposed to these programme interventions were significantly more likely to report the use consistent condom and condom use at last act. These results present the strong evidence in support of the impact of the TI

programme intervention on the use of the condom and thereby behaviour change.

It has been highlighted in this study that the participants who received the HIV/AIDS related services such as condom distribution, seen demonstration of correct condom use, received checkup and counselling for STIs at clinics under the preventive TI programme interventions were found more likely of using condoms in last sexual act and consistent condom use in the last three months. The improvement in the condom use with the commercial partners is due to the apparent impact of the combination of the services under the comprehensive preventive programme services. This in turns encourages the scale up of programme for the behaviour change and reducing the prevalence of HIV/AIDS. Reaching more FSWs under the purview of these preventive services can prove beneficial to achieve programme targets. As majority of the FSWs start sex work at the young age before 25 years, it becomes utmost important to initiate the preventive programs especially for the young girls to change sexual attitudes and risky behaviors and thereby prevent and curtail the HIV transmission. Moreover, it may be easier to change the attitude behaviors at young age by introducing them programme activities tailored to their needs. These findings hold concurrence with the other studies of the assessments of HIV prevention programmes with FSWs, indicating the improvement in condom use with the commercial partners [16] [24].

These large-scale intervention programme have been a great initiative in changing the risky sexual behaviors and thereby limiting the spread of the HIV to the partners and onward transmission to the general population. It has been indicated in other studies as well that by intensive implementation of such programme services to the key populations have proved very beneficial in more rapid decline in the HIV prevalence [25] [26]. Also, change in the risk behaviours have been observed after the implementation of TI programme in southern states of Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra between 2001 and 2009 where among FSW consistent condom use with last paying clients also increased from 58.6% to 83.7% [27]. The study based on the mathematical models also suggest that by introduction of package of interventions for the condom use in commercial sex can predict the reduction in the HIV transmission and thereby elimination of HIV epidemic in India [28]. The results of our study also aligns with the outcomes of the previous research corroborating to the change in the risk behaviors and impact of the TI programme interventions as substantiated by propensity score analysis.

The rapid scale up of the TI programme for the HRGs individuals in India made the process more standardized. It has been supported by standard core group theory related to the sexual networks of African and Western societies, predictions based on mathematical models and observational studies which substantiate this fact that these preventive services are responsible for the significant decline in the HIV prevalence in the vulnerable High-risk Groups indicat-

ing the behavior change among the HRGs population [27] [28] [29]. The evaluation of these preventive services in a standardized manner further reinforces the overall programme. PSM gives a statistically accurate method to ascertain and quantify the magnitude of the impact of these interventions. Presenting results based on such robust statistical methods is an excellent way of presenting evidence which in turns paves the way for the robust policy formulation. These scientific accurate and appropriate studies not only have strong policy implications but also paves for the better programme mangement.

The programme evaluation based on the propensity score matching exercise authenticates the impact of the TI programme interventions on the behaviour change. It is a great initiative in enabling behavior change among FSWs and adoption of safer sex behaviors among them under the programme. Our study has clearly accentuated the programme components which have strong implications on the behavior change. In future, these TI programme can be strategized and revised well by emphasizing on the specific components which demonstrated the strong behaviors change. It will be indeed uplifting to expand the research in this aspect to further improvise the programme and thereby targeting the heterogeneity of the virus transmission with precision and evidence. Further scope of more granular research in this domain can be explored and additional research towards the evaluation of programme will supplement to the authenticity and validity of this critical work.

Limitation: The source of bias was tried to minimize by engaging trained field investigators with good experience of working with FSWs. But certain limitations may be due to chance of recall bias subject to the self-reported data being provided by the FSWs. There is also chance of social desirability bias affecting the results particularly pertaining to sexual behaviors.

5. Conclusion

It is evident that the TI's programme intervention services have a positive impact on female sex workers using condoms during sex acts compared to those who were not availing of TI's services. The important services which are showing positive impact are referred services at STI clinics, HIV testing, detox centres, etc., seeing a demonstration of correct condom use and receiving information on STI/HIV by peer educators and outreach workers with the impact of these services on the use of condom ranges from 4.2% to 6.0%. More emphasis can be given to these services and FSWs may be encouraged to avail these services. These services have undoubtedly demonstrated the impact of the TI services on the behaviour change of the FSWs. We emphasize further strengthening of these services under NACP for achieving global Sustainable Development Goal 3 of ending AIDS epidemic as a public health threat 2030.

Conflicts of Interest

The authors declare that there is no potential conflict of interest with regard to the research, authorship and/or publication of this article.

References

[1] National AIDS Control Organization & ICMR-National Institute of Medical Statistics (2020) HIV Estimations 2019: Technical Report.

[2] Boily, M.C., Pickles, M., Lowndes, C.M., *et al.* (2013) Positive Impact of a Large-Scale HIV Prevention Programme among Female Sex Workers and Clients in South India. *AIDS*, **27**, 1449-1460. https://doi.org/10.1097/QAD.0b013e32835fba81

[3] Charles, B., Jeyaseelan, L., Edwin Sam, A., *et al.* (2013) Trends in Risk Behaviors among Female Sex Workers in South India: Priorities for Sustaining the Reversal of HIV Epidemic. *AIDS Care*, **25**, 1129-1137. https://doi.org/10.1080/09540121.2012.752562

[4] GOI (2014) Annual Report 2013-14. Department of AIDS Control, Ministry of Health and Family Welfare (MoHFW).

[5] GOI (2015) National Integrated Biological and Behavioural Surveillance (IBBS) 2014-15.

[6] Shannon, K., Goldenberg, S.M., Deering, K.N., *et al.* (2014) HIV Infection among Female Sex Workers in Concentrated and High Prevalence Epidemics: Why a Structural Determinants Framework Is Needed. *Current Opinion in HIV and AIDS*, **9**, 174-182. https://doi.org/10.1097/COH.0000000000000042

[7] Ramesh, B.M., Beattie, T.S., Shajy, I., *et al.* (2010) Changes in Risk Behaviours and Prevalence of Sexually Transmitted Infections Following HIV Preventive Interventions among Female Sex Workers in Five Districts in Karnataka State, South India. *Sexually Transmitted Infections*, **86**, i17-i24. https://doi.org/10.1136/sti.2009.038513

[8] Ramesh, B.M., Moses, S., Washington, R., *et al.* (2008) Determinants of HIV Prevalence among Female Sex Workers in Four South Indian States: Analysis of Cross-Sectional Surveys in Twenty-Three Districts. *AIDS*, **22**, S35-S44. https://doi.org/10.1097/01.aids.0000343762.54831.5c

[9] Thilakavathi, S., Boopathi, K., Girish Kumar, C.P., *et al.* (2011) Assessment of the Scale, Coverage and Outcomes of the Avahan HIV Prevention Program for Female Sex Workers in Tamil Nadu, India: Is There Evidence of an Effect? *BMC Public Health*, **11**, S3. https://doi.org/10.1186/1471-2458-11-S6-S3

[10] Jadhav, A., Bhattacharjee, P., Raghavendra, T., *et al.* (2013) Risky Behaviors among HIV-Positive Female Sex Workers in Northern Karnataka, India. *AIDS Research and Treatment*, **2013**, Article ID: 878151. https://doi.org/10.1155/2013/878151.

[11] Misra, G., Sahu, D., Reddy, U.S., *et al.* (2019) Correlates of HIV Prevalence among Female Sex Workers in Four North and East Indian States: Findings of a National Bio-Behavioural Survey. *International Journal of STD & AIDS*, **30**, 120-130. https://doi.org/10.1177/0956462418799018

[12] Tanwar, S., Rewari, B.B., Rao, C.D., *et al.* (2016) India's HIV Programme: Successes and Challenges. *Journal of Virus Eradication*, **2**, 15-19. https://doi.org/10.1016/S2055-6640(20)31094-3

[13] Chandrasekaran, P., Dallabetta, G., Loo, V., *et al.* (2006) Containing HIV/AIDS in India: the Unfinished Agenda. *The Lancet Infectious Diseases*, **6**, 508-521. https://doi.org/10.1016/S1473-3099(06)70551-5

[14] Ramakrishnan, L., Gautam, A., Goswami, P., *et al.* (2010) Programme Coverage, Condom Use and STI Treatment among FSWs in a Large-Scale HIV Prevention Programme: Results from Cross-Sectional Surveys in 22 Districts in Southern India. *Sexually Transmitted Infections*, **86**, i62-i68. https://doi.org/10.1136/sti.2009.038760

[15] Saidel, T., Adhikary, R., Mainkar, M., *et al.* (2008) Baseline Integrated Behavioural

and Biological Assessment among Most At-Risk Populations in Six High-Prevalence States of India: Design and Implementation Challenges. *AIDS*, **22**, S17-S34. https://doi.org/10.1097/01.aids.0000343761.77702.04

[16] Rachakulla, H.K., Kodavalla, V., Rajkumar, H., *et al.* (2011) Condom Use and Prevalence of Syphilis and HIV among Female Sex Workers in Andhra Pradesh, India—Following a Large-Scale HIV Prevention Intervention. *BMC Public Health*, **11**, S1. https://doi.org/10.1186/1471-2458-11-S6-S1

[17] GOI (2016) Annual Report 2015-16. Department of Health and Family Welfare, Ministry of Health and Family Welfare (MoHFW).

[18] Rosenbaum, P.R. and Rubin, D.B. (1983) The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika*, **70**, 41-55. https://doi.org/10.1093/biomet/70.1.41

[19] Rosenbaum, P.R. and Rubin, D.B. (1984) Reducing Bias in Observational Studies Using Subclassification on the Propensity Score. *Journal of the American Statistical Association*, **79**, 516-524. https://doi.org/10.1080/01621459.1984.10478078

[20] Okamoto, M., Ishigami, H., Tokimoto, K., *et al.* (2013) Early Parenting Program as Intervention Strategy for Emotional Distress in First-Time Mothers: A Propensity Score Analysis. *Maternal and Child Health Journal*, **17**, 1059-1070. https://doi.org/10.1007/s10995-012-1088-6

[21] Thavaneswaran, A. and Lix, L. (2008) Propensity Score Matching in Observational Studies. Manitoba Centre for Health Policy, University of Manitoba, Winnipeg.

[22] Austin, P.C. (2011) An Introduction to Propensity Score Methods for Reducing the Effects of Confounding in Observational Studies. *Multivariate Behavioral Research*, **46**, 399-424. https://doi.org/10.1080/00273171.2011.568786

[23] Dehejia, R.H. and Wahba, S. (2002) Propensity Score-Matching Methods for Non-experimental Causal Studies. *The Review of Economics and Statistics*, **84**, 151-161. https://doi.org/10.1162/003465302317331982

[24] Mainkar, M.M., Pardeshi, D.B., Dale, J., Deshpande, S., Khazi, S., Gautam, A., *et al.* (2011) Targeted Interventions of the Avahan Program and Their Association with Intermediate Outcomes among Female Sex Workers in Maharashtra, India. *BMC Public Health*, **11**, S2. https://doi.org/10.1186/1471-2458-11-S6-S2

[25] Basu, I., Jana, S., Rotheram-Borus, M.J., *et al.* (2004) HIV Prevention among Sex Workers in India. *Journal of Acquired Immune Deficiency Syndromes*, **36**, 845-852. https://doi.org/10.1097/00126334-200407010-00012

[26] Dandona, R., Dandona, L., Gutierrez, J.P., *et al.* (2005) High Risk of HIV in Non-Brothel Based Female Sex Workers in India. *BMC Public Health*, **5**, Article No. 87. https://doi.org/10.1186/1471-2458-5-87

[27] Kumar, R., Mehendale, S.M., Panda, S., *et al.* (2011) Impact of Targeted Interventions on Heterosexual Transmission of HIV in India. *BMC Public Health*, **11**, Article No. 549. https://doi.org/10.1186/1471-2458-11-549

[28] Nagelkerke, N.J., Jha, P., de Vlas, S.J., *et al.* (2002) Modelling HIV/AIDS Epidemics in Botswana and India: Impact of Interventions to Prevent Transmission. *Bulletin of the World Health Organization*, **80**, 89-96.

[29] Mishra, S., Steen, R., Gerbase, A., Lo, Y.R. and Boily, M.C. (2012) Impact of High-Risk Sex and Focused Interventions in Heterosexual HIV Epidemics: A Systematic Review of Mathematical Models. *PLoS ONE*, **7**, e50691. https://doi.org/10.1371/journal.pone.0050691