



# Analysis of a Targeted Intervention Programme on the Risk Behaviours of Injecting Drug Users in India: Evidence From the National Integrated Biological and Behavioural Surveillance Survey

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**Objectives:** This study provides insights on the impact of a targeted intervention (TI) programme on behaviour change among injecting drug users (IDUs) in India.

**Methods:** This paper examined the data from the Integrated Biological and Behavioural Surveillance 2014-2015 for IDUs in India. Logistic regression was performed to understand the factors (TI programme services) that affected injecting risk behaviours by adjusting for covariates. Propensity score matching was conducted to understand the impact of the TI programme on using new needles/syringes and sharing needles/syringes in the most recent injecting episode by accounting for the covariates that predicted receiving the intervention.

**Results:** Participants who received new needles and syringes from peer educators or outreach workers were 1.3 times (adjusted odds ratio, 1.29; 95% confidence interval [CI], 1.09 to 1.53) more likely to use new needles/syringes during most recent injecting episode than participants who did not receive needles/syringes. The matched-samples estimate (i.e., average treatment effect on treated) of using new needles in the most recent injecting episode showed a 2.8% (95% CI, 0.0 to 5.6) increase in the use of new needles and a 6.5% (95% CI, -9.7 to -3.3) decrease in needle sharing in the most recent injecting episode in participants who received new needles/syringes. There was a 2.2% (95% CI, -3.8 to -0.6) decrease in needle sharing in the most recent injecting episode among participants who were referred to other services (integrated counselling and testing centre, detox centres, etc.).

**Conclusions:** The TI programme proved to be effective for behaviour change among IDUs, as substantiated by the use of new needles/syringes and sharing of needles/syringes.

**Key words:** Program evaluation, Injecting drug users, Propensity score matching, Average treatment effect, Targeted interventions

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## INTRODUCTION

Injecting drug users (IDUs) comprise a major high-risk group (HRG) with a persistently high rate of human immunodeficiency virus (HIV), and they are considered key drivers of HIV transmission and the current HIV epidemic in India [1,2]. The prevalence rate of HIV among IDUs based on a 2010-2011 HIV Sentinel Surveillance was 7.14% [3,4]. According to the 2014-

2015 National Integrated Biological and Behavioural Surveillance (IBBS), India has a high population of IDUs at approximately 177 000 people (the third largest among HRGs), and IDUs have the highest prevalence of HIV among HRGs at 9.9%, and there is wide variation in the prevalence of HIV across states in India, ranging from 0.8% to 27.2% [5]. The high-risk of HIV infection among IDUs has been a primary focus for policymakers, and IDUs remain a pivotal group for targeted interventions (TIs) to prevent the transmission of HIV infection. Understanding injection-related and sex-related risk factors responsible for the persistently high rate of HIV among IDUs is also critical for curtailing the transmission of HIV infection among IDUs and the general population.

A comprehensive package of preventive services using TIs for HRGs has been the landmark initiative of the National AIDS Control Programme (NACP) of India's Ministry of Health and Family Welfare (MoHFW) [6,7]. The key services offered to IDUs under the programme are outreach services, needle and syringe exchange programmes, opioid substitution therapy (OST), abscess management, condom distribution, and HIV testing [7-9]. Per the 2015-2016 annual report of the MoHFW, the reported overall coverage of TIs for IDUs was 72.32% [10]. Though this coverage is substantial and has shown success, there is a need to further expand the programme coverage to include the total IDU population and determine the impact of the TI services, as well as developing strategies to further strengthen the programme.

Prevention and control of HIV among IDUs through the decreased use of injecting drugs, reduced sharing of injecting equipment, and promotion of safe sex through consistent condom use are essential transmission control strategies for IDUs that would also minimise the transmission of HIV among the general population [7,11]. TIs developed specifically for HRGs require periodic evaluation to further reinforce and expand the programme to maximise its benefits among the entire population.

While previous studies have analysed the association between TIs and behavioural changes, no studies have yet evaluated the overall impact of TI programmes on IDUs in India. Previous study have been conducted in limited study areas restricted to specific districts in 2 states [12]. However, our study analysed data for the entire country, and our results represent the national population. Our assessment of the impact of TIs on behavioural changes makes this study unique and contributes to a strong body of evidence that can inform policy deci-

sions.

Against this backdrop, this study aimed to understand the impact of key services provided through the TI programme under the NACP on the risk behaviours of IDUs.

## METHODS

We examined data from the IBBS, conducted in 2014-2015 by the National AIDS Control Organization (NACO) of the MoHFW, Government of India. The IBBS is a cross-sectional survey that uses conventional clustering sampling and time-location clustering sampling methods to construct the desired sample and a probability-based sampling method to estimate behavioural and biological indicators. Further details of the IBBS survey design and implementation can be found elsewhere [5].

Two outcome measures were used to assess the impact of the TI programme under the NACP: whether a new or shared needle/syringe was used in IDUs' most recent injecting episodes. Both outcome variables were measured based on the participants' answers to questions on needle-sharing practices.

The socioeconomic and demographic factors included in this study were (1) individual-level factors, including the age of the respondent (15-24, 25-34, 35-44, and  $\geq 45$  years), literacy status (literate and illiterate), marital status (never married, currently married, widowed/divorced/separated), occupation (unemployed, labourer, transport worker, or other), cohabitation status (lives alone, lives with family/relatives without a sexual partner, lives with a spouse, lives with others), (2) drug use-related factors, including age at the initiation of drug use (<17, 18-24, and  $\geq 25$  years), age at the initiation of injection drug use (<17, 18-24, and  $\geq 25$  years), duration of injection drug use (<1, 2-4, 5-9, and  $\geq 10$  years), number of injections during the most recent episode of injection drug use (once, twice, and 3 or more times), location of injection drug use (home, abandoned buildings, places of worship, streets/parks, and other), (3) sexual behaviours and sexual partnerships, including age of one's first experience of sexual intercourse (<17, 18-24, and  $\geq 25$  years) and comprehensive knowledge of HIV/acquired immune deficiency syndrome (AIDS), which served as a composite indicator constructed using information collected from IDUs based on 5 questions about HIV/AIDS, and (4) exposure to a comprehensive package of preventive services (TIs) within the previous 12 months. Further details about the variables included in the survey can be found elsewhere [5].

## Targeted Intervention Programme Under the National AIDS Control Programme

Given the pattern of the HIV epidemic, prevention efforts have been directed toward HRGs to minimise new infections and prevent transmission to low-risk populations. These highly focused prevention programmes for HRGs supported by the NACP are considered TIs that provide information and skills for the prevention of HIV infection and improve access to care support and treatment. TIs provide a package of prevention, support, and linkage services through an outreach-based service delivery model.

The specific services offered to HRGs through TIs include behaviour change communication, condom promotion and distribution, screening and treatment for sexually transmitted infections, linkages to integrated counselling and testing centres for HIV counselling and testing, linkages to care and support services for HIV-positive individuals from HRGs, an enabling environment through community involvement and participation, community mobilisation and ownership-building, distribution of clean needles and syringes, abscess prevention and management, and OST.

### Statistical Analysis

Basic descriptive analysis and multivariate binary logistic regression were performed by calculating adjusted odds ratios (aORs) and controlling for other independent variables. Propensity score matching (PSM) analysis was also performed to examine the impact of TIs on needle-sharing practices. All data were analysed using Stata version 16.0 (Stata Corp., College Station, TX, USA).

### Propensity Score Matching

PSM is a statistical technique devised by Rosenbaum and Rubin [13,14] that estimates the causal effect of treatment in an observational study [15]. It compares matched sets of treatment and non-treatment subjects who share similar propensity score values by balancing the covariates between treatment and control groups [16]. PSM allows researchers to estimate the average treatment effect on the treated (ATET) and attempt to estimate the effect of treatment or intervention by accounting for covariates that predict treatment outcomes [13]. We used PSM method for analysis, in which simple nearest-neighbour matching was performed with 1 neighbour using a range of covariates after multicollinearity was assessed and the variables found to be correlated were dropped for matching.

**Table 1.** Distribution of participants who used new and shared needles/syringes during their most recent injecting episodes according to exposure to the TI programme

Type of TI programme service	Total	Used new needle/syringe during most recent injecting episode	Shared needle/syringe during most recent injecting episode
		Yes	Yes
Total	15 152	13 239 (87.4)	2602 (17.2)
Received new needles/syringes from peer educators and outreach workers			
Yes	13 556 (89.5)	11 911 (87.9)	2224 (12.1)
No	1596 (10.5)	1328 (83.2)	378 (16.8)
Received condoms from peer educators or outreach workers			
Yes	11 783 (77.8)	10 421 (88.4)	1933 (11.6)
No	3369 (22.2)	2818 (83.6)	669 (16.4)
Received information on STIs/HIV/AIDS by peer educators or outreach workers			
Yes	10 606 (70.0)	9381 (88.4)	1705 (11.6)
No	4546 (30.0)	3858 (84.9)	897 (15.1)
Received OST			
Yes	5514 (36.4)	4869 (88.3)	871 (11.7)
No	9638 (63.6)	8370 (86.8)	1731 (13.2)
Received abscess management services			
Yes	4312 (28.5)	3763 (87.3)	734 (12.7)
No	10 840 (71.5)	9476 (87.4)	1868 (12.6)
Referred for overdose management			
Yes	4538 (30.0)	3928 (86.6)	737 (13.4)
No	10 614 (70.1)	9311 (87.7)	1865 (12.3)
Referred to other services (ICTC, detox centres, etc.)			
Yes	5761 (38.0)	5094 (88.4)	847 (11.6)
No	9391 (62.0)	8145 (86.7)	1755 (13.3)
Received check-up and counselling for STIs			
Yes	6195 (40.9)	5410 (87.3)	1048 (12.7)
No	8957 (59.1)	7829 (87.4)	1554 (12.6)
Received free medicine and counselling for STIs			
Yes	5439 (35.9)	4740 (87.1)	921 (12.9)
No	9713 (64.1)	8499 (87.5)	1681 (12.5)
Observed a demonstration on correct condom use by a peer educator/outreach worker			
Yes	8647 (57.1)	7656 (88.5)	1301 (11.5)
No	6505 (42.9)	5583 (85.8)	1301 (14.2)
Received help and support when faced with physical violence			
Yes	5388 (35.6)	4719 (87.6)	937 (12.4)
No	9764 (64.4)	8520 (87.3)	1665 (12.7)
Received help and support when faced with trouble from police			
Yes	3975 (26.2)	3466 (87.2)	694 (12.8)
No	11 177 (73.8)	9773 (87.4)	1908 (12.6)

Values are presented as number (%).

TI, targeted intervention; STI, sexually-transmitted infection; HIV, human immunodeficiency virus; AIDS, acquired immune deficiency syndrome; OST, opioid substitution therapy; ICTC, integrated counselling and testing centres.

## Ethics Statement

Informed consent was obtained from all of the participants, to whom the risks and benefits of participating in the national IBBS were explained. Ethical approval was granted during the study period of the 2014-2015 IBBS by the NACO. However, permission was also sought from the NACO for the use of secondary data to develop this research paper.

## RESULTS

A total of 19 902 respondents were interviewed for the 2014-2015 IBBS. However, the analysis in this research paper was

limited to 15 152 participants who received at least 1 component of the TI programme's intervention services for IDUs.

The mean  $\pm$  standard deviation (SD) age of the participants was  $30.4 \pm 8.1$  years. A plurality of the participants (48.3%) was aged 25-34 years, and more than 80% of the participants were literate. Fewer than half of the participants were never married or currently married. One-fifth of the respondents were unemployed, and more than half of the participants were labourers. The mean  $\pm$  SD ages at the initiation of drug use and injection drug use were  $24.2 \pm 18.1$  years, and  $26.9 \pm 17.2$  years, respectively. The age at the initiation of drug use was less than 17 years for approximately one-fourth of the participants, and nearly

**Table 2.** Unadjusted and adjusted<sup>1</sup> odds ratios and 95% confidence intervals of new and shared needle/syringe use during the participants' most recent injecting episodes by type of TI programme service

Type of TI programme service <sup>2</sup>	Used new needle/syringe during most recent injecting episode			Shared needle/syringe during most recent injecting episode		
	Unadjusted	Adjusted		Unadjusted	Adjusted	
		Model 1	Model 2		Model 1	Model 2
Received new needles/syringes from peer educators and outreach workers						
Yes	1.46 (1.27, 1.68)***	1.33 (1.10, 1.61)**	1.29 (1.09, 1.53)**	0.63 (0.56, 0.72)***	0.62 (0.53, 0.74)***	0.74 (0.64, 0.85)***
Received condoms from peer educators and outreach workers						
Yes	1.50 (1.34, 1.67)***	-	-	0.79 (0.72, 0.87)***	-	-
Received information on STIs/HIV/AIDS by peer educators or outreach workers						
Yes	1.37 (1.24, 1.51)***	1.14 (0.99, 1.32)	1.21 (1.06, 1.37)**	0.78 (0.71, 0.85)***	0.95 (0.84, 1.08)	1.00 (0.90, 1.12)
Received OST						
Yes	1.15 (1.04, 1.27)**	1.08 (0.94, 1.25)	1.14 (1.01, 1.28)*	0.86 (0.78, 0.94)***	0.82 (0.72, 0.94)**	0.89 (0.80, 0.99)*
Received abscess management services						
Yes	0.98 (0.88, 1.09)	-	-	0.99 (0.90, 1.08)	-	-
Referred to overdose management						
Yes	0.90 (0.81, 0.99)*	0.92 (0.79, 1.06)	0.86 (0.76, 0.97)*	0.91 (0.83, 1.00)*	1.01 (0.88, 1.16)	0.99 (0.88, 1.11)
Referred to other services (ICTC, detox centres, etc.)						
Yes	1.17 (1.06, 1.29)**	1.18 (1.02, 1.37)*	-	0.75 (0.69, 0.82)***	0.91 (0.80, 1.04)	0.80 (0.72, 0.89)***
Received check-up and counselling for STIs						
Yes	0.99 (0.90, 1.09)	-	-	0.97 (0.89, 1.06)	-	-
Received free medicine and counselling for STIs						
Yes	0.96 (0.87, 1.07)	-	-	0.97 (0.89, 1.06)	-	-
Observed a demonstration on correct condom use by a peer educator/outreach worker						
Yes	1.28 (1.16, 1.41)***	-	-	0.71 (0.65, 0.77)***	-	-
Received help and support when faced with physical violence						
Yes	1.04 (0.94, 1.15)	-	-	1.02 (0.94, 1.12)	-	-
Received help and support when faced trouble from police						
Yes	0.98 (0.88, 1.10)	-	-	1.03 (0.93, 1.13)	-	-

Values are presented as odds ratio (95% confidence interval).

TI, targeted intervention; STI, sexually-transmitted infection; OST, opioid substitution therapy; ICTC, Integrated counselling and testing centre; HIV, human immunodeficiency virus; AIDS, acquired immune deficiency syndrome.

<sup>1</sup>Adjusted for all socioeconomic variables: age, literacy status, marital status, cohabitation status, occupation, age at the initiation of drug use, age at the initiation of injection drug use, duration of injection drug use (years), number of injections during the most recent injection episode, location of injection drug use, age at first experience of sexual intercourse, and comprehensive knowledge of HIV/AIDS.

<sup>2</sup>"No" is the reference category.

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

half of the participants started using and injecting drugs between the ages of 18 years and 24 years. More than a quarter of the participants used drugs for more than 10 years, and less than 20% used drugs for less than 1 year.

Overall, 87.4% of the participants used a new needle/syringe in their most recent injecting episodes, and only 17.2% shared a needle/syringe in their most recent injecting episodes (Table 1). Logistic regression showed that the participants who received new needles and syringes from peer educators or outreach workers were 1.3 times (aOR, 1.29; 95% confidence interval [CI], 1.09 to 1.53) more likely to use new needles than participants who did not receive needles/syringes. Participants who received information on STIs/HIV from peer educators were also more likely to use new needles and syringes (aOR, 1.21; 95% CI, 1.06 to 1.37) and less likely to share needles (Table 2).

### Results From Propensity Score Analysis

We evaluated the impact of the TI programme on the 2 outcome variables of new needle/syringe use and shared needle/syringe use in the most recent injecting episode. The covariates used in the model for PSM analysis were literacy status, marital status, duration of injecting drug use, number of injections during the most recent injection episode, location of injection drug use, and comprehensive knowledge of HIV/AIDS for assessing their impact on new needle/syringe use in the participants' most recent injection episodes. Literacy status, age at injection drug use, number of injections during the most recent injection episode, location of injection drug use, age at one's first experience of sexual intercourse, and comprehensive knowledge of HIV/AIDS were used as covariates in the model to understand the impact on shared needle/syringe use during the participants' most recent injecting episodes. These covariates were analysed for multicollinearity, and variables found to be correlated were dropped from PSM analysis.

By using t-effects PSM, we estimated the average treatment effect (ATE) and ATET. The matched samples estimating the ATET showed that the difference in new and shared needle use during the participants' most recent injecting episode between those who received needles/syringes from peer educators or outreach workers and those who did not was 0.028 (2.8%; 95% CI, 0.0 to 5.6) and -0.065 (-6.5%; 95% CI, -9.7 to -3.3), respectively. This indicates that IDUs who received new needles/syringes from peer educators and outreach workers were more likely to use new needles/syringes and less likely to

share needles/syringes than those who did not receive new needles/syringes. The estimated ATE values for the treatment and control groups were 0.8746 and 0.8447, respectively, indicating an increase in new needle use by 3.0% as a result of the distribution of new needles/syringes from peer educators and outreach workers. Similarly, the ATE values for the treatment and control groups related to needle sharing were 0.1573 and 0.2259, respectively, indicating that needle-sharing during participants' most recent injection episodes decreased by 6.7%

**Table 3.** Average treatment effect and average treatment effect of the treated among study participants who used new and shared needle/syringes in their most recent injecting episode according to the type TI programme service

Type of TI programme service	Used new needle/syringe during most recent injecting episode <sup>1</sup>		Shared needle/syringe during most recent injecting episode <sup>2</sup>	
	Coefficient (%) 95% CI	p-value	Coefficient (%) 95% CI	p-value
Received new needles/syringes from peer educators and outreach workers				
ATE	3.0 (0.3, 5.7)	0.028	-6.7 (-9.8, -3.6)	<0.001
ATET	2.8 (0.0, 5.6)	0.046	-6.5 (-9.7, -3.3)	<0.001
Received condoms from peer educators and outreach workers				
ATE	2.1 (0.4, 3.8)	0.016	-4.6 (-6.9, -2.4)	<0.001
ATET	1.8 (-0.0, 3.6)	0.052	-4.8 (-7.2, -2.5)	<0.001
Received information on STIs/HIV/AIDS by peer educators or outreach workers				
ATE	2.0 (0.5, 3.5)	0.008	-1.9 (-3.6, -0.1)	0.038
ATET	1.9 (0.4, 3.4)	0.015	-1.7 (-3.5, 0.1)	0.070
Received OST				
ATE	1.2 (-1.6, 2.5)	0.085	-3.5 (-5.1, -1.9)	<0.001
ATET	0.6 (-0.7, 2.0)	0.354	-3.4 (-5.0, -1.8)	<0.001
Referred to other services (ICTC, detox centres, etc.)				
ATE	1.6 (0.2, 2.9)	0.020	-2.1 (-3.7, -0.5)	0.009
ATET	1.2 (-0.1, 2.6)	0.075	-2.2 (-3.8, 0.6)	0.008
Observed a demonstration on correct condom use by a peer educator/outreach worker				
ATE	2.6 (1.2, 4.0)	<0.001	-4.7 (-6.4, -3.0)	<0.001
ATET	2.7 (1.2, 4.2)	<0.001	-4.5 (-6.3, -2.7)	<0.001

TI, targeted intervention; ATE, average treatment effect; ATET, average treatment effect of the treated; CI, confidence interval; STI, sexually-transmitted infection; OST, opioid substitution therapy; ICTC, integrated counselling and testing centre; HIV, human immunodeficiency virus; AIDS, acquired immune deficiency syndrome.

<sup>1</sup>Used new needle/syringe during most recent injecting episode: Literacy status, marital status, duration of injection drug use, number of injections during the most recent injection episode, location of injection drug use, comprehensive knowledge of HIV/AIDS.

<sup>2</sup>Shared needle/syringe during most recent injecting episode: Literacy status, age at the initiation of injection drug use, number of injections in the most recent injection episode, location of injection drug use, age at first experience of sexual intercourse, comprehensive knowledge of HIV/AIDS.

after receiving new needles/syringes from peer educators and outreach workers (Table 3).

## DISCUSSION

The study provides details about the impact of the TI programme and its wide range of preventive care and linkage services for IDUs under the NACO's NACP by examining the programme's effect on new and shared needle/syringe use during the participants' most recent injecting episodes. This is among the first studies to evaluate the impact of the programme on behavioural changes among IDUs using PSM analysis, which enables the analysis of observational data by examining differences in baseline characteristics between treated and untreated groups. The study observed a strong association between the TI programme and behavioural changes in terms of needle-sharing practices. In addition, strong evidence of the impact of the TI programme on needle-sharing practices was observed, thereby indicating behavioural changes.

The analysis suggests an association between exposure to comprehensive preventive services and a reduced likelihood of sharing needles and an increased likelihood of using new needles. This specific association was indicated by the effect the distribution of new needles/syringes and information on STIs/HIV by peer educators and outreach workers had on participants. The results are in line with the findings of a previous study on the effects of intervention programmes on IDUs [17]. The programme had a positive impact on the behavioural changes required to reverse the trajectory of the HIV epidemic.

The impact of the HIV prevention programme on injecting risk behaviours clearly indicates improvements in needle-sharing practices. Preventive services included in the TI programme for IDUs have proven to be an effective initiative leading to behavioural change, and this study highlighted the impact of these services and TIs. Our study findings correspond to those of other studies as well. A previous study observed changes in risk behaviours among IDUs after exposure to an expanded TI programme in the states of Manipur and Nagaland in north-eastern India in 2007 and 2009. In particular, an increase in the percentage of IDUs reporting the use of sterile injecting equipment at the time of their most recent injection episodes was observed. There was also a substantial increase in the percentage of IDUs (45 to 74%) who reported that they did not share needles/syringes at the time of their most recent injection episodes in 1 district in Nagaland. These results provide evidence

of an association between exposure to HIV prevention services and a reduced likelihood of engaging in HIV risk behaviours [12]. The coverage and scope of the programme should be expanded to further reach IDUs in need and sustain the progress made so far in controlling HIV. Through a granular-level analysis of the impact of the programme on behavioural change, the functioning of the programme can be analysed for future reference to further strengthen and rapidly expand the programme.

This study had several limitations. The subjects in this study may have had recall bias since the participants provided self-reported data, and social desirability bias may have affected the results, particularly those pertaining to sexual behaviours. However, the sources of bias were minimised due to the participation of a trained field investigator with substantial experience working with IDUs.

In conclusion, the TI programme is a resource-effective initiative for HIV prevention and care intervention under the NACP for enabling behavioural change among IDUs. By adopting safe sex behaviours and responsible needle-sharing practices, the chain of transmission can be broken, thus curtailing transmission to the general population. Participants with exposure to various elements of the TI programme, such as new needles/syringes and information on STIs, HIV, and AIDS from peer educators and outreach workers corresponded to significant improvements in risky injecting behaviours, thereby demonstrating the impact of the TI programme on IDUs.

## CONFLICT OF INTEREST

The authors have no conflicts of interest associated with the material presented in this paper.

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## AUTHOR CONTRIBUTIONS

Conceptualization: Sahu D, Rao MVV. Data curation: Sahu D, Arumugam E. Formal analysis: Sahu D, Kumar A, Ranjan V. Funding acquisition: None. Methodology: Sahu D, Ranjan V. Project administration: Sahu D. Visualization: Sahu D, Ranjan V. Writing – original draft: Sahu D, Ranjan V, Chandra N, Nair S. Writing – review & editing: Sahu D, Ranjan V, Chandra N, Nair S, Kumar A, Arumugam E, Rao MVV.

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