Shaping the Epidemic: Application of Proximate Determinant Framework in Understanding the factors affecting the HIV epidemic in Maharashtra

Abstract: *Indian HIV epidemic is exhibiting a declining trend, providing an opportunity for meta-analysis and data-synthesis by triangulation to delineate the comprehensive picture and understand drivers of epidemic. Proximate determinant (PD) framework is used to tease-out factors affecting HIV vulnerability and application of decomposition analysis segregating interplay of multiple factors operating within the framework. Study focuses at low-risk general males and high-risk male clients who form bridges between high-risk and low-risk population. Data from NFHS-III, IBBA-1 and BSS have been used. Findings underscore multi-partner, condom-use and partner-mixing as PD for general men, with coital frequency an additional determinant for clients. Partner type and number of lifetime partners are significant determinants for both groups. Significant underlying determinants, after adjustment for PDs, are younger age ($p<0.1$), marital status ($p<0.05$) and alcohol ($p<0.05$) for general men and marital status ($p<0.05$), education ($p<0.01$), age at first intercourse ($p<0.05$) and prior HIV testing ($p<0.05$) for clients.*

Key Words: HIV, Proximate determinants, Male clients of female sex workers, General population men and sexual transmitted diseases

Introduction

HIV epidemic is almost completing its quarter century since the first case of HIV was identified way back in 1986 in India but epidemic is not yet contained and prevention in populations most at risk (high-risk groups) needs to be enhanced and expanded. Since its inception, a plethora of initiatives have been taken to tame the growth of this epidemic. Majority of programmes aims to reduce new infections in all categories and prevent spread of HIV from High Risk Groups (HRG) to the general populations (BSS report 2006, NACO). The factors that influence the Indian epidemic are the size, behaviours, and disease burdens of high-risk groups, their interaction with bridge and general population, sexual networks, and migration and mobility of both bridge populations and high-risk groups. The interplay of these forces has resulted in substantial epidemics in several pockets of many Indian states that could potentially ignite sub-epidemics in other currently low prevalent parts of the *country (Chandrasekaran et, al, 2006)*. Though the understanding of the virus is growing, but many behavioural aspects of the epidemic remain undocumented and poorly understood. These behaviours are also dynamic in nature, sometimes altering radically in short periods of time as social and economic changes sweep through the country. But they are the engines driving the epidemic. Unless efforts are made to understand and quantify these behaviours more thoroughly, it will not be possible to gauge who in the population is at risk of infection or to measure changes in behaviour that may increase or reduce people's risk of and vulnerability to HIV (*FHI/UNAIDS, 1998.*

Literature review

The number of people living with HIV worldwide continued to grow in 2008, reaching an estimated 33.4 million [31.1 million –35.8 million]. The total number of people living with the virus in 2008 was more than 20% higher than the number in 2000, and the prevalence was roughly threefold higher than in 1990 (WHO,2009)

Globally, despite several decades of advocacy, awareness raising and investment in programmes to control the spread of HIV, the HIV epidemic grows as the number of new infections outstrips the AIDS related deaths (*UNAIDS*, 2006 Global Report on the AIDS Epidemic, 2006). The result has been largely ineffective targeting of prevention interventions,

misapplication of available resources and the loss of early opportunities to address the unique factors driving infection in the populations most at risk within the country (*study of transmission, UNFPA).* There is plethora of documented proofs and literature on various aspects of HIV epidemic. Studies of the distribution and determinants of HIV infection in populations have included a wide range of factors that may affect the risk of transmission. Comparative studies, such as the Joint United Nations Programme on HIV/AIDS UNAIDS 4-city study to explain differences in the spread of HIV in urban Africa MEASURE Evaluation project and efforts to explain the conflicting outcomes of intervention trials in Uganda and Tanzania, *WHO* have included socio behavioural, epidemiological, and biomedical factors. In addition, the importance of the role of underlying socioeconomic and cultural determinants has been increasingly acknowledged, and contextual variables have been receiving more attention in epidemiological research on the distribution and determinants of HIV and other sexually transmitted infections (STIs) *(Boerma, WHO).* In the context of HIV/AIDS research, a thorough understanding of varied aspects of sexual behaviour is necessary. A variety of factors may influence the transmission of HIV including, prevalence of HIV infection among sex workers and their clients, availability, acceptability and use of appropriate condoms, frequency of unprotected sex, prevalence of other behaviours like sharing of unsterilized drug injecting equipment, economic status and migrant status *(UNICEF, 1997).*

According to new data in the *AIDS epidemic update 2009*, new HIV infections have been reduced by 17% over the past eight years. Since 2001, when the United Nations Declaration of Commitment on HIV/AIDS was signed, the number of new infections in sub-Saharan Africa is approximately 15% lower, which is about 400, 000 fewer infections in 2008. In East Asia HIV incidence has declined by nearly 25% and in South and South East Asia by 10% in the same time period (*AIDS epidemic update 2009, WHO).* Asia's epidemic has long been concentrated in specific populations, namely injecting drug users, sex workers and their clients, and men who have sex with men. The proportion of women living with HIV in the region rose from 19% in 2000 to 35% in 2008. In particular countries, the growth in HIV infections among women has been especially striking. In India, women accounted for an estimated 39% of prevalence in 2007 *(National AIDS Control Organisation, 2008)*. Transmission among sex workers and their clients is helping to drive a much broader epidemic of heterosexually acquired HIV, resulting in extensive transmission among individuals who engage in low levels of risk behaviour (Wang et al., 2009)

There is extensive literature on sexual behaviour of HIV but unfortunately most of these studies are centred specifically on sex workers and man having sex with men. To date very few studies have been conducted where the focus is on understanding the behaviour driving the epidemic in general men and in the clients of sex workers. Given the critical bridge role as potential carriers of the HIV virus to low risk populations that can be assigned to both these population groups, this unavailability is a serious research lacuna. In India studies on actual clients are few and far between. Of late, one study based on 100 semi-structured interviews with brothel clients in Pune, was found that the clientele differed in terms of their socio-economic status. Piecemeal research efforts have been taken by organizations like Population Services International (PSI) to launch HIV/AIDS prevention interventions but little formal research with male clients is available in India (Mondal, 2009). Lately in 2006, Family Health International (FHI), funded by the Bill and Melinda Gates Foundation as part of its Avahan program, the India AIDS Initiative has conducted a series of Integrated Behavioural and Biological Assessment (IBBA) in 29 select districts with five high risk groups namely, female sex workers, men having sex with men, truckers, clients and injecting drug users. In 11 districts IBBA was conducted for actual clients of female sex workers (IBBA 1, 2005-2007, ICMR & FHI). IBBA has thrown light on the key biological and behavioural parameters.

Rationale of the study

In the last one decade, the country has witnessed the massive private and public efforts in the form of vertical and horizontal programs in one hand and improvement in surveillance on the other. Now India has a multiple source of data to understand the level and trends of the epidemic across different geographic locations and among various population groups. This improved data sources coupled with heightened programmatic effort provides an opportunity to resort to meta analysis and data synthesis that enable to delineate a comprehensive picture of the current epidemic.

Recent reports on HIV epidemic scenario in India coming out from various national and international agencies exhibit a declining trend in HIV incidence and prevalence over past few years (UNAIDS Welcome Trust Centre for the Epidemiology of Infectious Diseases). However, the larger question that draws the attention of public health practitioners in the field of HIV whether this decline is a result of natural course of the epidemic or can be attributed to behaviour change taking place among the sexually active masses in the country. Probably the use of proximate determinant framework offers us better opportunity to study different population groups and enriches our understanding of the relative strength of various factors shaping the epidemic. In fact, the use of this framework teases out the factors at different layers and provides us the explanation of how different factors affect vulnerability to HIV and what drives the infection in a population in India. However, in this study main focus has been laid to low-risk general males and high-risk male clients since they are main force that works as a bridge population to carry the infection mainly from high-risk women mostly female sex workers and same sex partners to low risk women, wives and girl friends. In terms of transmission dynamics especially in Maharashtra where more than 86% of all the infections route through sexual contacts, men occupy a special niche in spreading the infection. This is more so because of the nature of the epidemic which is mainly concentrated among certain high-risk groups and transmitted through the men who work as a link between HRG and general population. Application of proximate determinant framework thus assumes larger importance in studying the interplay of multiple factors being operational at various levels of the framework. This study is not only going to enrich existing body of literature but also expand the scope of future studies in this field. Finally, it will be useful in improving the strategies to combat this epidemic in India.

Objectives

With regards to the rationale laid down above, this study aims to understand the major factors affecting HIV epidemic in Maharashtra with a special focus to men who acts as bridge between low and high risk population. Accordingly, the study exploits the data collected from general men as well as from high risk men who are the clients of female sex workers. We also aim to design a proximate determinant framework to understand the dynamics of HIV transmission in these two groups and relative contribution of behavioural as well as epidemiological transition. However, the specific objectives of the study are:

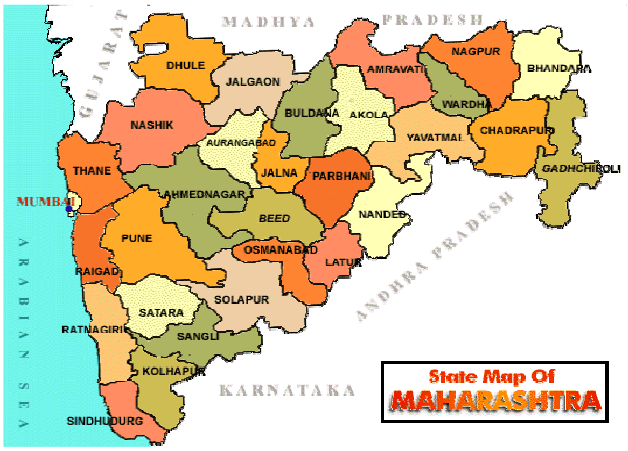
1. *To understand HIV epidemic in Maharashtra focusing on males by triangulating data from NFHS III IBBA I and BSS*
2. *To understand factors affecting HIV epidemic using the proximate determinant framework*
3. *To study the effect of behaviour and epidemiological transition on the level of HIV epidemic in Maharashtra*

Methods and Materials

The present study relies on the secondary source of information since under NACP-III, there are multiple sources of data available for understanding the HIV prevalence rate in one hand and behavioural aspects on the other. The study employs quantitative techniques using standard statistical tools to substantiate the laid down objectives. The major

technique used in this paper is bivariate and multivariate statistical methods used in formulation and application of proximate determinant framework through triangulation of data from different sources.

Locale of the study area: *Maharashtra*



Maharashtra is a state in the Western part of India. It is bordered by the Arabian Sea to the west, Goa to the southwest, Karnataka and Andhra Pradesh to the South, Gujarat and Madhya Pradesh to the north. The state covers an area of 307,713 km², or 9.8% of the total geographical area of India. It is the second largest state by population. According to the 2001 census of India, the total population of Maharashtra is about 96.9 million, with a sex ratio of 922 females per 1,000 males. The literacy rate is 77% with 86% of males and 67% of females, 86% of the urban and 70% of the rural populations being literate. In 2001, 42% of the population lived in 378 cities/towns, and the remaining 58% lived in 43,711 villages. The administrative quarters of the state are located in Mumbai city.

According to the 2008 HIV sentinel surveillance, HIV prevalence among the 29,976 pregnant women seeking antenatal care who were tested in 74designated sentinel sites (2 sites per district, except in district Mumbai Suburb which had 6 sites) was 0.61% (the 95% confidence intervals being 0.52 and 0.70). HIV positivity among the 793,893 pregnant women tested at PPTCT centres in the state in 2008 was 0.52%. Among the 876,374 individuals (92% of whom were males and 83% were voluntary blood donors) tested in the state Blood Banks, HIV positivity was 0.50%, less than the positivity among the ANC women tested in HSS and similar to the positivity observed in PPTCT.

Another important source of data on HIV prevalence in the general population is the Third National Family Health Survey (NFHS-3) which tested a representative sample of women and men age 15-49 in Maharashtra, during 2005-06. Accordingly, 0.62% of adults' ages 15-49 years were infected with HIV, the prevalence being somewhat lower among women than men (0.48% compared with 0.77%). Prevalence among youth (age 15-24), at 0.24%, was lower than for the reproductive age population as a whole.

Data Sources

- *NFHS III conducted in year 2005-06*
- *IBBA round 1 conducted in year 2005-2006*
- *BSS data for year 2001 to 2006*

National Family Health Survey III

The third National Family Health Survey (NFHS-3) was conducted in 2005-06. NFHS-3 collected information from a nationally representative sample of 124,385 women age 15-49 and 74,369 men age 15-54 in 109,041 households. The survey provides data on key indicators of HIV prevalence, high-risk sexual behaviour, along with many other variables.

Integrated Behavioural and Biological Assessment (IBBA) Round I*: An Sexually Transmitted and Blood-borne Infection Prevalence Assessment in High Risk Populations in India*

The first round of IBBA was conducted in year 2005-06 by the Indian Council of Medical Research, National AIDS Research Institute, in partnership with Family Health International and was implemented in close collaboration with National AIDS Control Organization (NACO) and State AIDS Control Societies (SACS). The first round of IBBA, funded by the Bill and Melinda Gates Foundation (BMGF), was conducted in Avahan project states of Andhra Pradesh, Maharashtra, Tamil Nadu, Karnataka, Manipur and Nagaland and along the selected stretch of National Highways.

IBBA populations

- Female Sex Workers Brothel Based (FSW-BB)
- Female Sex Workers Non-Brothel Based (FSW-NBB)
- Male Who Have Sex With Men (MSM)/Male Sex Workers (MSW)
- Male clients of Female Sex Workers
- Male Injecting Drug Users (IDU)

National Highway

- Truckers Drivers and helper (TD/H)
- Female Sex Workers Highway-Based (FSW-HB)

The present study uses IBBA client survey data of all the four districts, Mumbai, Pune, Parbhani and Yavatmal in Maharashtra. The operational definitions used for FSWs and clients in the study are as follows:

Operational Definitions of IBBA Populations

- **Female Sex Workers (FSW):** Females aged 18 years or older, either brothel or non-brothel based, who sold sex in exchange for cash at least once in the past one month.
- **Clients of FSWs:** Men aged 18 years or older recruited from red-light districts and other commercial sex access points that have paid cash in exchange for sex with a female at least once in the past one month

Sampling technique

For clients, Time-location Sampling (TLS) along with existing information from all existing sources was used to make a time-location sampling frame consisting of venue/time slots was constructed. Subsequently a random or systematic sample of primary sampling units, (i.e. venue/time slots) was chosen and data on behavioural and biological indicators was gathered from a random or systematic sample of population sub-group members appearing at those venues during fixed-length observation periods (e.g., three-hour time segments). A total of 400 sample was planned for drawing from each district for each population group.

However, the final dataset contains a total 1598 complete interviews with clients of FSWs from these four districts.

Behavioural Sentinel Surveillance (BSS)

In conformity with the National AIDS Prevention and Control Policy, National AIDS Control Organisation (NACO) commissioned the first Behavioural Surveillance Survey (BSS) in 2001 as a part of NACP-II. This provided the baseline information on high risk behavioural patterns, knowledge, awareness and practices related to spread of HIV/AIDS in the

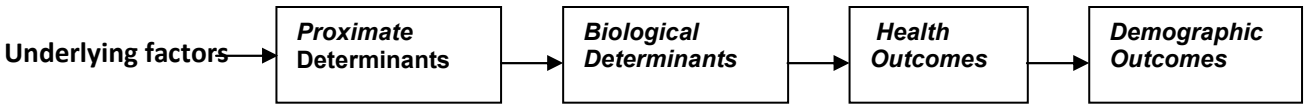
country. Towards the end of NACP-II, after a gap of five years since the first wave of BSS, NACO commissioned the second wave of BSS in 2006 to measure the changes in behavioural indicators. The second generation surveillance for HIV emphasizes the significance of understanding the behavioural patterns and trends that increase the emergence of the HIV epidemic. They give direction to the programmatic efforts by showing the impact of the interventions and areas that need focus of different initiatives. Behavioural Surveillance aids national as well as sub-national planners and administrators in planning, implementation as well as monitoring the interventions to tackle the HIV epidemic.

The data from the above three sources has been triangulated to get the epidemiological and the behavioural trends which are further used for understanding the factors that are driving the HIV epidemic in Maharashtra. The study groups mainly comprise of general males and clients of female sex workers in Maharashtra. The estimates of factors affecting HIV prevalence in two groups of men are compared and the differences in the estimates and their major determinants are analysed in terms of behavioural and epidemiological transitions using the BSS data.

Proximate determinant framework for HIV transmission

This paper attempts to develop a conceptual framework for the study of the major determinants of HIV infection in populations, by combining demographic, behavioural and epidemiological approaches. The proximate-determinants framework has been applied extensively in the study of fertility and child survival in developing countries. Key to the framework is the identification of a set of variables, called "proximate determinants," that can be influenced by changes in contextual variables or by interventions that have a direct effect on biological mechanisms to influence health outcomes. The proximate-determinants framework can be used in study design, in the analysis and interpretation of risk factors or intervention studies that include both biological and behavioural data, and in ecological studies. In this study, we aim to develop a framework to explain the HIV scenario in the study population and its determinants. Through extensive literature review of the use and application of framework, we further fine tuned it using the data available and existing literature relating to the transmission of the virus and modified the framework to make it applicable to capture the prevailing situation in Maharashtra. This paper is an attempt to quantify these effects operating within the variables at each stage of framework to support the qualitative hierarchy of the framework.

Fig 1: Diagram of proposed causal linkages among a set of concepts believed to be related to a particular public health problem: Transmission Framework



Results and discussion

The profile of men interviewed in both the surveys are analysed in three stages according to the framework, the determinants operate essentially at three stages viz. underlying contextual factors, behavioural factors and epidemiological factors. To see how the health outcome in terms of HIV epidemic will be shaped by epidemiological and behavioural proximate determinants, which are again affected by the contextual factors, a comparative analysis is carried out for each interoperating stage of the frame work. To substantiate the findings from NFHS-III about general population men and IBBA for male clients of female sex workers, it is essential to use transitional data to fill up the gaps

using information from BSS. Data from BSS gives estimates of some of the high risk indicators for general population as well as the clients for two points of time.

Behavioural Proximate determinants of HIV transmission: Underlying Contextual, socio-economic and demographic factors

The holistic picture of behavioural proximate determinants of risky sexual behaviour for the general men in Maharashtra is seen using the following three set of factors:

- Multi-partner behaviour: indicator- number of life time sexual partners;
- Condom use practices: indicator- condom use in the last sex; and
- Partner mixing: indicator- relationship with last sexual partner

Owing to the different vulnerabilities, the behavioural proximate determinants of risky sexual behaviour for the clients of female sex workers in Maharashtra are seen using the following four factors:

- Multi-partner behaviour: indicator- number of sexual partners in last one month;
- Condom use practices: indicator- condom use in the last sex with all partners; and
- Partner mixing: indicator- type of partners had sex with in last one month.
- Coital frequency: indicator- no. of times had sexual intercourse in last one month

The underlying factors are in essence the socio-economic, demographic and the behavioural characteristics of individuals, shaping their risk taking behaviour.

An analysis of the multi-partner behaviour of general men from NFHS III reveals, as also mentioned in the table no. 1, as a whole 13.4 percent general population men engage in multi partner sex. Men belonging to age group less than 25 shows higher prevalence of risky sexual behaviour, as 24.6 percent of them reported having more than two life time. Occupation shows a strong bearing on the risky sexual behaviour of men in Maharashtra as 23.4 percent of unemployed men have reported to have more than one sexual partner as compared to 13.2 percent men who have one or other occupation. Never married men as opposed to ever married men show a higher degree of risky behaviour. A high proportion of never married men (37.7 percent) reported having more than two sexual partners as compared to 11.5 percent men who are ever married. Men who were married early i.e. before the age 18 shows higher tendency (16.4) towards more than two lifetime sexual partners as compared to men married after 18. Number of children is important predictor of the risky sexual behaviour. Almost 24 percent men who do have any child, reported to have two or more than two life time sexual partners which is almost double of men with 2 or less children. Proportion of Men who use alcohol and smoke, is twice in number to have two or more life time sexual partners as compared to men who do not smoke and consume alcohol. Early onset of sexual activity is a strong predictor of the overall sexual behaviour of the men in general. Men who had their sexual debut before age 16 as against 21 are at three times more in number to have multiple sexual partners. Prior HIV testing can be taken as the proxy for self perception of risk and knowledge about HIV testing. When comparing men who were tested against not tested ever, we can add another variable in it which is tested and received results and tested and did not receive results. Men who did not receive the test results show the highest prevalence of multi partner behaviour with 25 percent men of this category reporting two or more partners against 15.5 percent of who received the results and 13.2 percent of those who were never tested. Wife beating attitude of men is taken as a proxy indicator of gender asymmetry. Gender equity is an important underlying variable in our framework

and to measure this we have taken this variable. Men who show higher degree of gender asymmetry have reported to have no multi partner behaviour whereas those with intermediate symmetry have reported high (17.7 percent) multi-partner relationship. It is evident from the analysis that men who indulged in premarital sex are 4 times more in number to have two or more partners.

Condom use practises reflected in 'condom use in last sex' shows that 6.2 percent men used condom in their last sexual activity. As also seen in the above determinant, condom use is reported highest (9 percent) among the oldest age group and lowest (4 percent) among the men aged less than 25 putting younger ones at a greater risk. If we analyse by the educational background, it is seen that reported condom use in last sex is 4 times high among men with at least 10 years of education as against those with less than 5 years of education. Effect of place of residence on condom use in last sex shows greater difference between urban men (8.1 percent) and rural men (3.9). Likewise, condom use also varies by standard of living index where only 1.9 percent of the poorest men as against 9.7 percent of the richest men have reportedly used condom in last sex. Mass media campaigns seems to be working positively for the condom use practice, as men with media exposure reported six times higher use of condoms as compared to those with no media exposure. Condom use is strongly affected by the age of marriage. As a whole, expectedly, condom use is seen quite low in married men and adding to that is years of marriage since larger duration of marriage increases the chance of adopting permanent method of contraception and the role of condom as contraceptive goes down. In marital sex, prophylactic measure is hardly taken. Hence, it is no wonder that more years of marriage shows less prevalence of condom use in last sex. For men married for more than 20 years, it is as low as 2.4 percent whereas for men married for 10 years it is 11 percent, which is almost five times higher. Following the same argument it is important to site here that condom use in last sex is very low among sterilized men (only 1.3 percent) as against non-sterilised men (8.1 percent). On an encouraging note, men who indulge in substance abuse have shown higher level of condom use in last sex. Prior HIV testing is also an important indicator as condom use in last sex is almost three times higher in men who received results of HIV testing as compared to men who belong to other two categories. Following the argument of gender asymmetry, it is observed that condom use in last sex is shown lowest (1.2 percent) by men who show highest degree of gender asymmetry and highest (7.5 percent) by men who show highest degree of symmetry. This highlights the need and importance of education to men about gender equity and equality.

Information on last sexual partners offers a scope to study the contemporary variation in sexual partnership of these men, which may not always be captured through the use of life time partnerships. The experience of having last sexual partner other than their spouse perhaps puts them on the higher pedestal of risk. Again, non-spousal sexual partners can further be divided as 'unpaid' and 'paid' partners. The bracket of unpaid partners may largely consist of two types, one emotionally attached with these men and the other roughly casual in nature. The paid partners include mainly female sex workers. Interestingly, the study of partnership seems to occupy pivotal role since different partners exhibit the disproportionate degree of risk, not only for himself but also his ability to transmit the infection to other members in the society. However, when just individual risk is considered, having sex with paid partners mainly sex workers seems to augment his odds of acquiring STIs including HIV. Moreover, the risk of spreading the HIV in general population is the highest when these men have sex with multi-partners including paid and un-paid partners.

The reported sex with FSWs is highest among men in the youngest age group i.e., below 25 years. The casual sex is seen to be high in the youngest age group with only 69 percent reporting the sex with wife and rest 31 percent with girlfriend/ fiancée/ live-in partner (18.6), other friend/ relative (7.4), casual acquaintance (1.2) and female sex worker (3.7). Higher proportions of men who indulge in drug abuse have reported their last sexual partner as female sex

workers. Prior research shows that migration is a factor that is important for making a person prone to risky sexual behaviour. Men in Maharashtra also show more or less the same pattern as migrants show lowest proportion of having spouse as the last sexual partners. The relationship between last partner and education seems to operate in reverse direction. The higher the education, the higher is the sexual activity reported outside the marriage. There is a high percent of unemployed men reporting sex with female sex workers (6.9 percent) whereas it is comparatively less (0.3 percent) for all other categories. Relationship with last sexual partner when analysed in the light of economic condition shows that men from middle wealth classes reported to have highest proportion having last partner other than wife and fiancée and also the percent reporting female sex worker as the last partner is highest among these groups. Alarmingly, a significantly high proportion 11.3 percent never married men reported female sex worker as their last sexual partner. Whereas in case of ever married 99.8 percent men reported spouse as the last sexual partner.

Clients of female sex workers are the high risk population group for which different set of underlying factors and socio-economic and demographic and individual level factors will operate. When studying the proximate determinants of clients the factors included should be able to address the high risk activities and higher vulnerability. It is also important to clearly understand the justification for choosing clients to understand the importance and operating of a particular proximate determinant. As for general men, the results, as is evident in table 2, are discussed in the same sequence but following a slightly different proximate determinant framework to deal with the issues of clients.

The number of life time partners of clients ranges from 1 to 25 so we have taken the men partner for categorising the life time partner into two categories for sake of analysis. Nearly 64 percent men in the age group 35 and above reported having three or more sexual partners whereas those in younger ages i.e. less than 25 years 58 percent of them reported having three or more than three partners. Knowledge about HIV shows that men who have knowledge of HIV are lesser in number to have large number of partners. For clients who have the knowledge of HIV, 57 percent had more than two partners whereas 70% of men with no knowledge have more than two partners. Exposure to intervention also plays a crucial role as the number of sexual partners for men who have exposure to intervention is only 56.3 percent compared to 70 percent in no exposure category. Age of sexual debut and age at first paid intercourse is an important indicator for studying clients. Men who experienced paid sex after 20 years of age show tendency to have lesser number of partners (less than two) as compared to those who initiated early. Prior HIV testing seems to have negative effect on the number of partner as the men who have already taken testing have higher proportion (71 percent) of multiple partners. Also, 85 percent of men who had undertaken prior HIV testing reported coital frequency more than two.

In multi-partner sex, the types of partnership play a crucial role. Men often visit to different types of sexual partners ranging from commercial to casual to spousal to same-sex. Engaging in more than one such type of partners may be termed as partner mixing. Partner types reported by men were female sex worker, regular female partner, and male sexual partner. There were further sub categories in these based on the regularity of visit and the money transaction involved in the sexual activity. But major types of partners emerged to be these three types. Interestingly, the men of higher ages (>35) show highest percent of relationship with female sex worker, female regular partner and MSM with 17.1 percent reporting having all three types of partners. 33.6 percent of men from this category reported having only female sex worker as their partner and almost half reported at least one non paying regular partner. This age group are mostly working as the bridge population as half of them are involved into relationship with general population women. In age group 25 to 34, 46.3 percent reported having relation with both female regular partner and female sex worker. Almost 14 percent reported having all three types of partners and 39 percent reported only female sex worker as their sexual partner. Knowledge of HIV is also seen to affect the type of partner as 75 percent men who do not have

knowledge have only female sex worker as their partner and 22 percent have both female regular partner and female sex worker as their partner. Whereas for men who had knowledge of HIV, 44 percent had female sex worker and female regular partner as partners, 41 percent had only female sex worker and 15 percent had all three partners. Mobility though not a very important predictor of number of partners but talks important about the type of partner. Majority of men (58 percent) who are mobile have sexual partners in the form of female regular partner and female sex workers as opposed to XX percent of immobile men. Nearly 7 percent of men abusing drug have a regular female non paying partner along with female sex worker partner. Majority of them (57 percent) have only female sex worker partner. Alarmingly, a high proportion of them, 35.7 percent, have female sex worker, female regular partner and MSM as partners. This increases the risk of these men by manifolds.

The reported coital frequencies of these men were divided into two categories based on the mean of the sample. The range of coital frequency was from 1 to 40 for which the mean was 2. Almost one third of these men in all ages reported having more than two coital frequencies in last one month. Coital frequency is seen highest in the youngest age group. As high as 90 percent men in the age group less than 16 reported having coital frequency more than two whereas this decreases to 60 percent as we move to age group 21 and above. Coital frequency is seen to be very high in men who do not have knowledge of HIV. Close to 90 percent of men in this category reported to have more than two coital frequencies. Coital frequency is also affected by age of sexual debut as the data shows that men who had early sexual debut have greater tendency to have high coital frequency. For the men with sexual debut at age less than 16 years the coital frequency is much lower (63 percent) than the ones in (87 percent) other age debut category. Prior HIV testing seems to have negative effect on coital frequency as nearly 71 percent of men who have already taken testing have more than two partners. Also, 85 percent of men who had taken prior HIV testing report coital frequency of more than two.

Condom use practices are measured by a aggregate of the indicator of condom use for all partners. Condom use in last sex for each kind of partner was asked and if condom was used with all types of partner, condom use has been considered as 'yes'. This was done as the data on last sexual partner is not available and considering the number of sexual partners and coital frequency and type of partners, it is difficult for respondent as well as for researcher to get that data. Alarmingly condom use in clients is dangerously low. It is less than 99 percent for all age groups, this seems to be ominous and calls for an immediate action on programme point of view. The condom use with female sex workers is quite high but it is very low with the regular and non –paying partner which essentially are the general population females this again rings an alarm for dealing with and educating the bridge population.

Both these groups under study have different dynamics operating and factors operating that is affecting the aetiology of the HIV. If we try to make a comparative picture of these two groups, we will get age is an important determinant affecting the risky sexual behaviour of general population men as well for the clients of sex worker. Men belonging to age group less than 25 shows higher prevalence of risky sexual practices as they practise multi partner sexual behaviour, low condom use and reported sex with FSWs and the casual sex is highest in this group. Another major factor operating in both these groups is knowledge of HIV which is associated with reducing the risk of HIV. Marital status though an important factor affecting the behavioural proximate determinant of, as a matter of concern, condom use in last sex is dangerously low if seen for all the partners together and especially with regular partners. In total, it is less than 99 percent for all age groups.

Underlying factors and behavioural proximate determinants operating on epidemiological outcome

Age as an predicator of STI is showing a strong effect on its prevalence as it is reported to be almost double in age groups 25 and above as compared to the younger age groups. As can be seen in table 3, men who belong to working class have more prevalence of STIs as compared to their counterparts, with a prevalence of 1.9 in working and 0.2 in unemployed men. Men belonging to lower caste show high prevalence of STI as compared to men who belong to general a caste. This may be attributed to their access to health care. Also it puts a question about the programme reach and again if we see the rural urban residence of these STI infected people, the argument becomes stronger. Rural men have twice the prevalence of STI as compared to urban men, which puts a question on percolation of programmes to the rural level. This also opens an avenue for discussion on the stigma attached to sexual health issues in Indian conservative rural society. Media exposure and the comprehensive knowledge can be considered together as the prior leads to building the latter. As expected both these have protective effect on STI prevalence as nearly 2.5 percent men who do not have media exposure suffer from STI as compared to 1.6 percent of men with media exposure. This gives an opportunity for focussed programme planning and implementation. Men who are married show much higher prevalence (2.2) of STI as compared to men who are never married (0.8). In comparison to migrant and non-migrant men visitors men have twice the prevalence of STI as in other two groups. Men who smoke and consume alcohol the prevalence of STI among them is 2.5 and 2.9 as compared to 1.2 and 1.4 in those who do not do any the use mentioned. Age at first intercourse has come up as a positive indicator of STI as lesser the age at first intercourse higher is the prevalence of STI. It is more than two times higher in men who had their sexual debutant age less than 16 as compared to those with sexual debut after 21 years of age. Prior HIV testing can be an indicator of self perception of risk and supporting this is the fact that men who were tested but did not get the results of test have 4 percent positivity for STI whereas only 1.9 percent of men having received results are positive, almost half of the earlier group. Men who have reported to have engaged in premarital sex are more than two times higher in showing positivity with a prevalence of 3.5 for any STI as compared to the other group with 1.5 percent positivity. Interestingly, when examined relationship with last partner as the partner mixing behaviour, a proximate determinant for prevalence of STI, men who have reported last sexual partner as girlfriend/fiancé/live-in partner have reported 8 percent prevalence for any STI which is highest in all other partner categories and also very high from the point of view of proximate determinant of HIV perspective. Men who have reported more than one life time sexual partner have STI prevalence of 4.4 as compared to 2.1 in those who have only one partner reported. Condom use practise when measured by condom use in the last sex shows that men who used condom in last sex have a prevalence of 2.6 percent and those who use condoms are quite low at 1.6 percent.

Similar to general men, age continues to be an important predictor for STIs in case of clients. Table 4 shows that higher age is seems to be associated with higher prevalence of STIs. The STI prevalence in 35 and above age group is 18.3 percent and 9 percent in less than 25 years age group. Men who are working have more than two times higher prevalence of STI as compared to those who are unemployed. It can be said that risky behaviour is higher in men who are working. Men who have knowledge of HIV/AIDS have almost half the prevalence of STIs as compared to those who do not have the knowledge. Surprisingly, mobile men and migrants have lower prevalence of STI as compared to their counterparts. Injecting drug users have higher prevalence of STI as compared to the non drug users. STI prevalence is very high (34 percent) in men who had sexual debut before 16 years of age and 10 percent in men with sexual debut between 21 to 52 age. Men who have taken prior HIV testing, the prevalence of STI in them is 16 whereas it is 11 percent in those who do not have taken prior HIV testing. Type of partner is showing to be a strong association with STIs. Men who have female and male partners both STI prevalence in them is as high as 26.5 whereas those who have only female partners it is 8.3. Higher coital frequency is also affecting the STI but vey marginally. Condom use has come as a

strong predictor of STI as data shows that men who did not use condom in last sex with any of the partner have STI prevalence of 12 percent. Type of sexual activity also strongly affects the STI prevalence. Men who have reported having anal sex in last one month, the prevalence of STI in them is 15 percent as compared to 11 percent of men who did not engage in this type of sexual activity. Circumcision also shows a protective effect on STI as expected. The prevalence of STI is 2.5 percent lower in men with circumcision. Men who reported any symptom of STI the prevalence of tested STI in them is 12.2 percent and surprisingly the percent of men who did not report any symptom is also 12 percent.

Binary Logistic Model for determinants of STIs

To find the adjusted effects of different proximate determinants and to trace out the important variables, which have significant bearing on dependent variables binary logistic regressions has been carried out at two stages for both the study groups separately. First, to find the adjusted effect of underlying socio-economic, contextual and behavioural proximate determinants on the biological proximate determinant, which is the prevalence of STI and second, at the final stage of framework to measure the adjusted effects of underlying contextual factors, the behavioural proximate determinants and biological proximate determinant on the health outcome of the framework which is, in this case, HIV sero-positivity. This section deals with the former situation dealing with adjusted effects of different predictors on prevalence of STIs among two groups of men and its programmatic implications

Logistic regression odds ratios for prevalence of ant STI among for general men of Maharashtra portrays that men living in rural areas are 1.65 times more likely (with 90 percent confidence interval) to suffer with the any STI symptoms as against their urban counter parts . Religion is another factor having highly significant impact on the prevalence of STIs where men who belong to other religions are 2.4 times more likely to have STI as compared to those belonging to Hindu religion, the reference category. Another important predictors having significantly larger adjusted effects on the prevalence of STIs, measured in terms of logistic regression odds ratios and demanding for urgent programmatic response for early diagnosis and treatment of STIs are alcohol consumption and premarital sexual intercourse. It is evident from table 3 that those reported alcohol consumption are over two times more likely to suffer with STI as compared to those who do not consume alcohol. Similarly, those reported premarital sexual intercourse are almost two times more likely to report suffering with STIs in the last 12 months prior to the survey. Of course there may not be one to one correspondence in these two variables in terms of time of reference but still analysing this relationship has a cognitive importance in view of attitude and behaviours. However, it is encouraging to note that the adjusted effects of condom use in the last sex reduce the STI prevalence by half among general men in Maharashtra. It is against our expectation that those having comprehensive knowledge of HIV/AIDS are more likely to experience any STI in the last 12 months prior to the survey. Of course, there is no reason why such relationship should emerge except that the better reporting.

The adjusted effects of age among the high risk men , as against the odds in case of general men population, is significant and those having higher age (35 years and above), who are probably having larger exposure to be client of female sex workers are over two times more likely to suffer with STIs. Clients having occupation category as 'others' are almost four times more likely to suffer with any STI as against those who were not working. In proximate determinants, number of life time sexual partners equals to or more than three have significant but negative association with prevalence of any STI. However, age at first intercourse is extremely important among clients of female sex workers as those who had their sexual debut in the age groups 16 to 20 after attaining age 21` are 0.4 and 0.3 times less likely than those who had their first sexual intercourse before age 16 to suffering from any STI. Men who are

circumcised are 0.6 times less likely to have STIs. Prior HIV testing also seems to affect the STI status as men who had undergone HIV testing earlier are 1.63 times more likely to have STIs, which may have implication due to their behavioural traits.

A comparative analysis of both these groups shows that age plays major role in both the groups with people below the age of 25 showing the highest degree of the risk behaviour. Men who are working show higher prevalence of STIs. This statement can also be supported by the arguments laid in section above. As expected general men as well s the clients who have the comprehensive knowledge of HIV are at lower risk of STIs. Premarital sex and age at first intercourse have emerged as two important factors that are affecting both the groups. Contradicting to each other is the fact that migrant men from general population show high prevalence of STI whereas migrant clients show low prevalence.

Behavioural and epidemiological proximate determinants of HIV

Underlying contextual variables seem to operate on health outcome, HIV sero-positivity, it is important to know how these underlying factors affect the ultimate outcome. Earlier we have analysed how these factors are affecting the behavioural and epidemiological proximate determinants which, in turn, affect the health out come. Here we will discuss how these underlying factors affect the health outcomes directly.

Analysis of general men in table 3 shows that men in age group 25 and above shows an HIV positivity of 1 percent whereas it is comparatively low in the age group 15 to 24 being 0.3 percent. Media exposure seems to have an impact on HIV prevalence as more media exposure is seen to be associated with the risky behaviour in some way. The men who have media exposure show a prevalence of 0.7 percent whereas who do not have show a prevalence of 1.2 percent. HIV prevalence is seen very high, 1.0 percent in married men, whereas it is lowing unmarried men (0.3 percent). As high as 7.7 percent of ever married men currently not in marital union (widowed/divorced/separated/deserted) and 3.1 percent of men who stay away from their spouses are HIV positive. positivity of HIV in general men in Maharashtra is 0.7. The positivity of 7.7 and 3.1 is very high if compared with the overall positivity and it calls for immediate attention HIV positivity arte among men with longer duration of marriage is 0.5 as against 1.2 in men with shorter duration of marriage (less than 20 years). Men who are sterilised have almost double the positivity rate. Nearly 1.1 percent sterilized men as 0.6 percent of non-sterilized men. HIV positivity in migrants is also very high at 1.8 percent which is more than twice the positivity among the non-migrants. Migrants seem to be more vulnerable to HIV than their in-situ counterparts.

The positivity rate of HIV in men who smoke and use alcohol is 1.1 percent as against those who smoke (0.6 percent) and drink (0.7 percent). Men who had gone for prior HIV testing and received results show a positivity of 2 percent whereas men who were tested but did not take results show a positivity of 4.3 percent which is more than double of the earlier category. Interestingly, men who reported last sexual partner as girlfriend/fiancé/live-in partner showed highest positivity of HIV at 1.7 percent whereas men whose last sexual partner was spouse was just 0.8 percent. Blood transfusion is an important route of HIV transmission. It is an important proximate determinant to study the transmission dynamics of the epidemic. It is seen that people who ever had a blood transfusion in their life time have a positivity of 1.5 which is double the positivity among those who did not have any history of transfusion. Surprisingly, the men who have STIs have shown no cases of HIV among them whereas the men who do not had any STI in last 12 months have a positivity of 0.8 percent. This can be answered from early detection and prompt treatment of STI approach.

Investigating the proximate and epidemiological determinants for clients of sex workers from table 4, HIV positivity is seen to be highest in men with age 35 and above. The positivity in this age group is 11.4 percent whereas it is 8.2 percent in the age group 25 to 34 years and 7.1 percent in less than 25 years of age. Uneducated men show two times higher positivity of HIV as compared to men who have some kind of education. positivity is 18 percent and 6.8 percent respectively for these two groups of men. Men who are married show twice the positivity of HIV as compared to never married men. Married men have a positivity of 11.2 percent and never married have positivity of 6 percent. Men who have sexual debut at age less than 16 have twice the positivity of HIV as compared to men with later debutant ages. Age at first intercourse also follows the same trend of HIV positivity in men. HIV positivity rate among men with sexual debut age less than 16 years is 15 percent and it is 8 percent for more than r 16 years. Nearly 13% men have men who have prior HIV testing have been found HIV positive as opposed to 3.5 percent of men who did not take HIV test earlier. Men who are staying with spouse show a positivity of 3.5 percent whereas those who stay away from their spouses, the positivity is as high as 14.5 percent.

Men who reported having more than two sexual partners have a HIV positivity of 10.5 percent and those who reported less than two partners have positivity of 5.7 percent. This shows the effect of multi partner behaviour on the HIV prevalence. In terms of coital frequency, the men with higher coital frequency have higher HIV positivity rate (9 percent) as compared to men with two or less coital frequency (7 percent). Also, 8.6% of men reported of not using condom in last sex happened to be HIV positive. Men who reported any symptom of STI, HIV positivity in them is 5 percent and men who were tested positive for any STI has positivity of 10.9 percent. Those who were not diagnosed with any STI have a positivity of 8.3 percent and those who did not report any STI symptom, the HIV positivity rate is 9.4 percent.

The married men and men from the age cohort above 25 in both the groups show higher prevalence. A comparative picture of proximate determinates of HIV for both the study groups highlights that men from client group whose sexual debut age is less than 16 years show twice the positivity of HIV whereas it is not true for the men of general population as they show higher positivity for later debutant ages. STI seems to have a profound effect on the HIV positivity among clients whereas it is not so in case of general men. Sterilisation is another important factor that s affects the HIV positivity in general population. Other proximate determinants like multi partner behaviour, condom use and partner mixing are the common determining factors for both the groups.

Binary Logistic Model for determinants of HIV

As mentioned in the earlier section, logistic regression odds ratios at the final stage of framework measure the adjusted effects of underlying contextual factors, the behavioural proximate determinants and biological proximate determinant on the health outcome of the framework i.e. HIV sero-positivity. Logistic model for these general men at the second stage i.e. for HIV status shows that men within age group between 25 and 34 are 2.6 times more likely to be HIV sero-positive as compared to men belonging to age group less than 25. Age is 5 percent significant level. Marital status is significant at 5 percent level and men who are married are 2.6 times likely to be HIV infected as compared to their unmarried counterparts. On the other hand the behavioural factors indicate that men who consume alcohol are 1.6 times more likely to be infected with HIV. The blood transfusion, one of the routes of HIV transmission, is highly significant at 1 percent level and beta value shows that men having blood transfusion are 2.2 times more likely to be HIV sero-positive as compared to those who did not have any transfusion.

For HIV prevalence, men who are educated are 3.2 times more likely to be positive at 1 percent significant level. The education for these men is calculated on the basis of working knowledge to read and write and not on no. of years attended school. Another significant variable for HIV status in clients is the marital status. Men who are married are 0.5 times less likely to be infected with HIV. Mobility seems to put men at higher pedestal of risk as men who are not mobile are 0.5 times less likely to be HIV positive.

Age at first intercourse is significant for HIV infectiveness of these men. Men who had sexual debut between the ages 16 to 20 are 1.8 times and those who had sexual debut after 21, 2.1 times more likely to be HIV sero-positive. Men who had gone for prior HIV testing are 0.5 times less likely to be HIV infected as compared to men who had not gone for HIV testing before.

Comparing the Outcomes of the logistic: a snap-shot of variation in significance of variables

A comparison of outcomes of logit model for two groups, as in table 5, clearly states that there is difference in risk factors for two groups resulting in different vulnerabilities and different aetiology of same condition for these groups. This calls for different programmes and policy for these two groups.

If the variables responsible for positivity for STI in both the study groups are carefully diagnosed, it is evident that the factors responsible for STIs in general men and high risk men are different. Age is a significant variable for clients whereas it is not significant for general men. Rural residence and marital status are highly significant for general men whereas religion and comprehensive knowledge are other significant variables affecting the STI status. Use of sterilisation is also seen significant in these men whereas for clients it is not significant at all. In behavioural characteristics, substance abuse in the form of alcohol consumption is significant for general men. In sexual behaviour, premarital sex and condom use are significant variables whereas for behavioural proximate determinants for HRG men, more than 3 sexual partners, age at sexual debut, prior HIV testing and circumcision are the most significant variables. Interestingly, not a single variable seems to be significant for both the groups. Same analysis, when done for HIV, shows that the variables play a significant role in explaining their chance of acquiring HIV completely differ between two groups of men, clients and general men. In contextual factors, age group 25 to 34 is significant for general men whereas education is highly significant for clients. Marital status is significant variable for both the groups at same (5 percent) level of significance. Mobility is significant for clients and is putting them at higher risk. In behavioural factors, alcohol is significant for general men along with history of blood transfusion. On the contrary, age at first intercourse and prior HIV testing are significant variables for clients. Interestingly, commonly expected variables like condom use and STI are not significant for any of the groups. The above mentioned variations and the non-occurrence of some of the expected behavioural variables, which form important proximate determinants in our framework too, this can be the important issue for further research.

Discussion: triangulating with findings from BSS data

Comprehensive knowledge of HIV, condom use in last sex, which are showing upward trend in BSS, is perceived as important proximate behaviour in IBBA. There is almost fivefold increase in the positivity of coital frequency with non regular paying partner which has shown an impact on infection and also there is a tremendous increase (double) in self reported STI from 18 percent to 29 percent reported by BSS. In IBBA, men with self reported STIs are showing double the positivity of HIV. Condom use consistency as well as the condom use in last sex is reported quite high in BSS data. Condom use in last sex has witnessed an increasing trend from 81 to 96 percent. Whereas, consistent condom use based

on three months' recall period is 95 percent in 2006. Condom non-users are showing 8.6 positivity of HIV against no cases in the other group.

When we examine the BSS for general population, the performance of few of the indicators are improving while others are moving in the other direction. Percent of people ever heard of HIV has increased from 83 percent to 96 percent. Comprehensive and correct Knowledge about HIV transmission and prevention has increased from 21 percent to 44.5 percent. The risky sexual behaviour is also at rise for the general population group. The condom use in lat sex with commercial partner has gone down from 79 percent in 2001 to 64 percent in 2006 and consistent condom use with non regular partner is only 53.5 percent. According to NFHS-III, comprehensive knowledge does not show much impact on the HIV prevalence. But condom use shows strong effect on the HIV prevalence. The sexual encounter with non regular partner is showing a small reduction in BSS data and on the same line, men in NFHS-III also reports sexual partner out of wedlock to be very small. Matter of concern here is the increasing positivity of STIs from 4.2 percent in 2001 to 6.1 percent in 2006 as NFHS-III also shows 10 percent more positivity of HIV in general men reporting STIs.

Summary of findings

At every level of the framework there are different set of underlying and behavioural proximate determinant that are operating in both the groups making their issues to be addressed and intervention needs are different.

- *Underlying factors affecting the behavioural proximate determinants the general men and the clients very prominently points one common similarity which is male youth of Maharashtra shows higher indulgence in risky sexual practices in terms of multi partner sexual behaviour, low condom use and reported sex with FSWs and the casual sex is highest in this group. Rural residence is significant for general men putting a question mark on the accessibility of programmes for this group. Sterilisation is affecting the condom use to a great extent for the general men. This gives a scope for BCC that will promote condom as prophylaxis for STIs and not just a contraception mechanism*

- *Proximate determinants that are affecting the epidemiological outcome have a set of commonality for both the groups. As a matter of grave concern, in client the condom use in last sex is dangerously low for all the partners and esp. with regular partner. This can be a serious issue considering the bridge population role of these people. Premarital sex and age at first intercourse less than 16 have emerged as two important factors that are affecting the vulnerability of both the groups for HIV as well for STI, this shows a gap that need to filled through educating people about safe sex. Strangely, the above argument about age at first intercourse is not true for the men of general population as they show higher positivity for later debuts. This issue need to be taken for further research to get a better picture of this issue. It is well documented in literature that migrant men are at higher risk. Our findings revels that general population migrants show high positivity of STI whereas migrant clients show low prevalence. This again opens door to a new potential and interesting area of research.*

- *Factors that are playing the major role at the health outcome level has seen a strong contribution from knowledge of HIV, as a major player operating in reducing the risk of HIV. Marital status is a matter of concern here as married men from both the groups of population studied exhibit higher risk behaviour. Marital status is*

significant variable for both the groups at same (5 percent) level of significance. Along with premarital sex, age at first intercourse is showing significant effect on the health outcome. Use of sterilization is also seen to have a significant effect on health outcome in general men whereas for HRG men it is not significant at all. There is an increasing trend seen in the positivity of STI in both the groups. This is a matter of concern and looking at the bridge role of men its need urgent address.

Conclusions and Policy implications

It is clear from the study that the underlying and proximate determinants operating are different in both the groups under study as the behaviour these men exhibit is different. So the programmes that are required at this stage of epidemic in this country should be tailored to meet the specific need of the population sub group it is aiming to cater. This finding supports the targeted intervention model followed at present, but at same time it also points out that there is a pressing need to educate the general men esp. youth with working knowledge of these issues as there is an increase in risky behaviour exhibited by this group. Also there is an imperative need to strengthen the prevention and early diagnosis of STI by strengthening the syndromic approach treatment model at grass root level to cater the needs of these men. There is an urgent need to address this group and study their behaviour as these are the general men a subset of which is bridge population, the clients of sex worker. Condom should be promoted as an prophylaxis for STI prevention and condom use behaviour of clients with commercial and esp. with regular partner needs to be focused. BCC can be an imperative tool as we see that the knowledge is universal but is not coming in practice.

Limitations of the study

- Unavailability of biological data of HIV transmission and Incidence due to which we could not test the transmission dynamics through this frame wok

- Unavailability of demographic outcome owing to which we could not reach the last stage of our framework that is, the demographic outcome, HIV deaths

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Diagram of proposed causal linkages among a set of concepts believe to be related to a particular public health problem

Proximate determinant conceptual framework for factors affecting the risk of sexual transmission of HIV

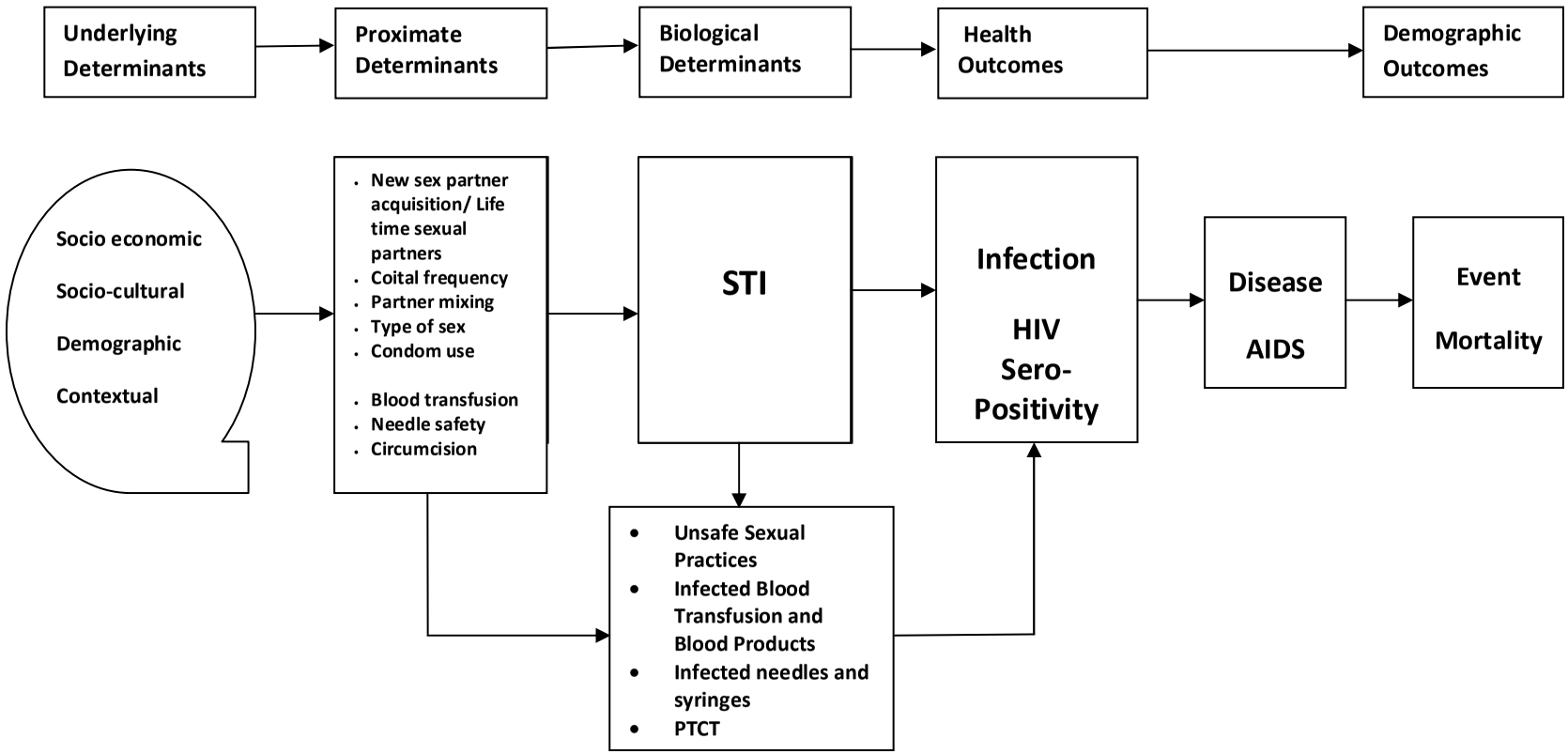

Table 1. Underlying factors operating on Behavioral Proximate determinants of General men												
Underlying factors	Proximate determinants											
	Lifetime sexual partner (%)			Condom use in the last sex (%)			Relationship with last sexual partner (%)					
	One	Two or more	Total	Yes	No	Total	Spouse	Girlfriend/fiancé / live-in partner	Other friends/ relatives	Casual acquaintance/ others	Female sex workers	Total
Age												
<25	75.4	24.6	638	4.0	96.0	3141	69.0	18.6	7.4	1.2	3.7	484
25-34	87.8	12.2	1975	9.1	90.9	2429	97.1	2.1	0.4	0.1	0.3	1862
35 and above	88.0	12.0	3261	6.1	93.9	3298	99.7	0.3	0.0	0.0	0.0	3038
Education												
Uneducated	86.7	13.3	638	2.3	97.7	682	97.2	1.7	0.3	0.3	0.3	576
Educated	86.6	13.4	5237	6.5	93.5	8186	96.0	2.6	0.9	0.1	0.4	4806
Occupation												
Not working	76.6	23.4	107	2.6	97.4	1155	66.7	20.8	5.6	0.0	6.9	72
Professional	91.3	8.7	470	13.5	86.5	657	98.2	1.4	0.5	0.0	0.0	444
Agricultural worker	86.2	13.8	1786	2.7	97.3	2238	97.7	1.4	0.5	0.3	0.1	1657
Other worker	86.5	13.5	3509	7.6	92.4	4818	95.6	2.9	0.9	0.1	0.5	3210
Caste												
SC	81.3	18.7	854	6.2	93.8	1291	94.6	2.9	1.8	0.3	0.4	763
ST	88.2	11.8	662	2.8	97.2	888	97.2	1.5	0.3	0.3	0.7	608
OBC	87.8	12.2	1617	5.5	94.5	2481	96.8	2.4	0.5	0.0	0.3	1480
Others	87.3	12.7	2703	7.2	92.8	4152	96.0	2.6	0.8	0.1	0.5	2495
Place of residence												
Urban	87.1	12.9	2942	8.1	91.9	4753	95.5	3.1	0.8	0.1	0.5	2676
Rural	86.0	14.0	2932	3.9	96.1	4115	96.7	2.0	0.8	0.2	0.4	2706
Religion												
Hindu	87.6	12.4	4728	5.7	94.3	7089	96.5	2.4	0.6	0.2	0.3	4333
Muslim	84.4	15.6	636	8.3	91.7	1021	95.6	3.0	0.7	0.0	0.7	594
Christian	83.0	17.0	47	6.1	93.9	82	93.2	4.5	2.3	0.0	0.0	44
Others	79.2	20.8	461	7.7	92.3	674	92.5	3.4	2.7	0.2	1.2	412
Wealth Index												

Poorest	82.9	17.1	544	1.9	98.1	699	95.5	3.3	0.4	0.4	0.4	510
Poorer	85.0	15.0	829	2.3	97.7	1174	95.9	2.4	0.9	0.4	0.4	765
Middle	86.8	13.2	1076	4.5	95.5	1546	96.1	1.9	1.0	0.3	0.7	971
Richer	84.8	15.2	1504	5.8	94.2	2396	97.0	1.6	0.8	0.0	0.6	1355
Richest	89.5	10.5	1920	9.7	90.3	3052	95.6	3.4	0.8	0.0	0.2	1782
Media exposure												
No exposure	88.5	11.5	416	0.2	99.8	480	98.9	0.5	0.5	0.0	0.0	378
Exposure	86.4	13.6	5458	6.3	93.7	8387	95.9	2.7	0.8	0.2	0.5	5005
Comprehensive knowledge of HIV/AIDS												
No	85.9	14.1	3001	4.1	95.9	4226	97.2	2.2	0.2	0.0	0.3	2723
Yes	87.3	12.7	2872	8.1	91.9	4641	94.9	2.9	1.4	0.3	0.5	2660
Household structure												
Nuclear	87.1	12.9	2813	6.0	94.0	4382	96.4	2.4	0.8	0.2	0.3	2614
Non-nuclear	86.1	13.9	2986	6.4	93.6	4358	95.8	2.7	0.8	0.1	0.6	2702
Not dejure resident	83.8	16.2	74	4.7	95.3	127	100.0	0.0	0.0	0.0	0.0	66
Marital status												
Never married	62.3	37.7	427	4.0	96.0	3402	1.5	62.3	21.1	3.9	11.3	204
Married	88.5	11.5	5446	7.5	92.5	5464	99.8	0.2	0.0	0.0	0.0	5179
Age at marriage												
Less than 18 years	83.6	16.4	397	3.5	96.5	397	99.5	0.5	0.0		0.0	370
18 or more years	88.9	11.1	5050	7.8	92.2	5068	99.9	0.1	0.0		0.0	4809
Duration of marriage												
<10 years	89.9	10.1	2128	11.0	89.0	2138	99.7	0.3	0.0		0.0	2079
10-19 years	87.1	12.9	1878	7.4	92.6	1882	99.8	0.2	0.0		0.0	1818
20 or more years	88.1	11.9	1440	2.4	97.6	1445	100.0	0.0	0.0		0.0	1281
Number of children												
0 child	75.9	24.1	982	4.1	95.9	3962	72.1	17.7	5.9	1.1	3.2	724
2 or less children	90.8	9.2	2596	11.6	88.4	2605	99.8	0.2	0.0	0.0	0.0	2522
More than 2 children	86.3	13.7	2296	3.6	96.4	2300	99.9	0.1	0.0	0.0	0.0	2136
Use sterilization												
No	85.7	14.3	3343	8.1	91.9	6334	93.2	4.4	1.4	0.3	0.8	2994
Yes	87.7	12.3	2530	1.3	98.7	2532	99.8	0.2	0.0	0.0	0.0	2389
Migration status												
Migrants	86.3	13.7	161	3.8	96.2	264	93.3	5.4	1.3	0.0	0.0	149

Non-migrants	86.6	13.4	5657	6.3	93.7	8520	96.1	2.5	0.8	0.2	0.4	5187
Visitors	87.3	12.7	55	3.6	96.4	83	100.0	0.0	0.0	0.0	0.0	47
Smokes cigarettes												
No	89.5	10.5	4503	5.6	94.4	7236	97.2	1.8	0.6	0.1	0.3	4168
Yes	77.1	22.9	1370	8.7	91.3	1627	92.3	4.9	1.6	0.2	1.0	1214
Drinking Alcohol												
No	89.6	10.4	4037	5.5	94.5	6706	97.5	1.6	0.5	0.1	0.2	3726
Yes	79.8	20.2	1837	8.2	91.8	2161	92.9	4.6	1.5	0.2	0.8	1655
age at first intercourse												
<16	69.7	30.3	155	11.6	88.4	155	76.9	14.5	4.3	2.6	1.7	117
16-20	76.3	23.7	1583	8.1	91.9	1587	91.9	5.1	1.6	0.3	1.1	1406
21-52	91.1	8.9	4132	9.6	90.4	4142	98.2	1.2	0.4	0.0	0.2	3856
Prior HIV testing												
Received result	84.5	15.5	490	16.9	83.1	574	95.1	4.0	0.0	0.2	0.7	448
Did not receive results	75.0	25.0	36	6.1	93.9	49	100.0	0.0	0.0	0.0	0.0	35
Never tested	86.8	13.2	5346	5.4	94.6	8242	96.1	2.4	0.9	0.1	0.4	4899
Wife beating justified												
Agree with none of the specified reasons	90.1	9.9	3153	7.5	92.5	4568	97.3	2.0	0.5	0.0	0.2	2924
Agree with any one specified reasons	82.3	17.7	2690	4.8	95.2	4215	94.5	3.2	1.2	0.3	0.7	2437
Agree with all specified reasons	100.0	0.0	31	1.2	98.8	84	100.0	0.0	0.0	0.0	0.0	23
Premarital sex												
No	89.8	10.2	5170	6.1	93.9	8156	95.6	2.8	0.9	0.2	0.5	4696
Yes	62.9	37.1	703	6.5	93.5	711	99.1	0.9	0.0	0.0	0.0	687
Had sexual intercourse in past 12 months												
No	81.3	18.7	493	0.0	100.0	494	96.1	2.5	0.8	0.1	0.4	5382
Yes	87.1	12.9	5376	10.1	89.9	5382						
Total	**86.6**	**13.4**	**5874**	**6.2**	**93.8**	**8868**	**96.1**	**2.5**	**0.8**	**0.1**	**0.4**	**5384**

Table 2. Underlying factors operating on Behavioral Proximate determinants of Clients of FSW

Underlying factors	Proximate determinants												
	Number of partners (%)			Type of partners (%)				Coital frequency (%)			Condom use in last sex with all female partners (%)		
	One	Two or more	Total	female RP & FSW	male and FSW	only FSW	Total	Less than three encounters	three or more encounters	Total	Not used	used	Total
Age													
>25	42.1	57.9	573	34.0	11.0	55.0	573	35.7	64.3	569	99.5	0.5	574
25-34	46.5	53.5	643	46.9	14.2	38.9	646	34.6	65.4	638	99.7	0.3	648
35 and	35.7	64.3	370	49.3	17.1	33.6	375	31.7	68.3	369	100.0	0.0	376
Education													
Uneducated	40.2	59.8	234	29.7	9.6	60.7	239	21.5	78.5	233	100.0	0.0	240
Educated	42.8	57.2	1354	45.2	14.5	40.3	1354	36.5	63.5	1342	99.6	0.4	1359
Occupation													
Not	53.8	46.3	80	36.6	14.6	48.8	82	45.6	54.4	79	100.0	0.0	82
Professional	35.8	64.2	123	56.1	8.9	35.0	123	25.4	74.6	122	100.0	0.0	123
Agricultural	39.7	60.3	1043	38.7	13.6	47.7	1042	32.4	67.6	1032	99.5	0.5	1047
Other	50.1	49.9	339	52.8	15.2	32.1	343	40.1	59.9	339	100.0	0.0	343
Knowledge of HIV/AIDS intervention													
No	29.9	70.1	107	22.0	2.8	75.2	109	10.5	89.5	105	100.0	0.0	109
Yes	43.3	56.7	1481	44.4	14.6	41.1	1483	36.0	64.0	1470	99.7	0.3	1489
Exposure to intervention													
No	29.7	70.3	145	19.2	3.4	77.4	146	12.5	87.5	144	100.0	0.0	147
Yes	43.7	56.3	1443	45.3	14.8	39.9	1447	36.5	63.5	1432	99.7	0.3	1451
Marital status													
Never	46.7	53.3	829	32.5	15.2	52.3	830	36.5	63.5	819	99.6	0.4	831
	37.7	62.3	759	54.1	12.2	33.7	763	31.9	68.1	756	99.7	0.3	768
Mobility													
No	42.1	57.9	1452	41.4	14.7	43.8	1458	34.5	65.5	1439	99.7	0.3	1463
Yes	44.9	55.1	136	58.1	3.7	38.2	136	32.4	67.6	136	100.0	0.0	136
Injected Drug abuse													
No	42.2	57.8	1563	43.2	13.6	43.1	1568	34.7	65.3	1551	99.7	0.3	1574
Yes	42.9	57.1	14	7.1	35.7	57.1	14	14.3	85.7	14	100.0	0.0	14
No answer	70.0	30.0	10	30.0	0.0	70.0	10	0.0	100.0	10	100.0	0.0	10
age at first intercourse													
<16	45.5	54.5	110	37.3	17.3	45.5	110	11.0	89.0	109	100.0	0.0	110
16-20	39.1	60.9	1091	39.0	14.3	46.7	1097	33.8	66.2	1082	99.5	0.5	1100
21-52	50.5	49.5	382	56.0	11.3	32.7	382	41.8	58.2	378	100.0	0.0	384
age at first paid intercourse													
<16	39.5	60.5	38	39.5	5.3	55.3	38	10.5	89.5	38	100.0	0.0	38
16-20	39.2	60.8	956	38.3	15.8	45.8	960	32.2	67.8	946	99.5	0.5	961
21-52	49.6	50.4	560	52.2	11.6	36.2	561	40.2	59.8	557	100.0	0.0	562
Prior HIV													
No	45.0	55.0	1313	43.4	16.1	40.5	1317	38.6	61.4	1305	99.6	0.4	1320
yes	29.3	70.7	167	51.5	3.0	45.6	169	15.2	84.8	165	100.0	0.0	169
Total	**25.0**	**75.0**	**1598**	**43.0**	**14.0**	**43.0**	**1598**	**34.0**	**66.0**	**1598**	**100.0**	**0.0**	**1598**

Table 3. Underlying and Proximate determinates of STI and the underlying, proximate and biological determinant of HIV for general men						
	Any STI (%)			HIV sero-positivity (%)		
	No	Yes	Total	No	Yes	Total
Underlying factors						
Age						
15-24	98.9	1.1	3141	99.7	0.3	2674
25-34	98.1	1.9	2428	99.0	1.0	2089
35 and above	98.0	2.0	3297	99.0	1.0	2866
Education						
Uneducated	98.7	1.3	682	98.7	1.3	599
Educated	98.3	1.7	8186	99.3	0.7	7030
Occupation						
Not working	99.8	0.2	1155	99.8	0.2	982
Professional	99.7	0.3	657	98.8	1.2	519
Agricultural worker	97.6	2.4	2237	99.4	0.6	2122
Other worker	98.2	1.8	4818	99.1	0.9	4006
Caste						
SC	98.0	2.0	1291	99.3	0.7	1165
ST	98.1	1.9	887	98.9	1.1	792
OBC	98.0	2.0	2481	99.1	0.9	2235
Others	98.7	1.3	4153	99.4	0.6	3393
Place of residence						
Urban	98.9	1.1	4753	99.2	0.8	3799
Rural	97.8	2.2	4115	99.3	0.7	3831
Religion						
Hindu	98.4	1.6	7089	99.2	0.8	6211
Muslim	99.0	1.0	1021	99.6	0.4	740
Christian	100.0	0.0	82	100.0	0.0	67
Others	96.6	3.4	674	99.3	0.7	610
Wealth Index						
Poorest	98.3	1.7	699	98.9	1.1	632
Poorer	97.4	2.6	1174	99.4	0.6	1085
Middle	97.6	2.4	1546	99.4	0.6	1388
Richer	98.8	1.2	2396	99.1	0.9	2054
Richest	98.8	1.2	3052	99.3	0.7	2472
Media exposure						
No exposure	97.5	2.5	480	98.8	1.2	408
Exposure	98.4	1.6	8387	99.3	0.7	7221
Comprehensive knowledge of HIV/AIDS						
No	97.7	2.3	4226	99.3	0.7	3682
Yes	99.0	1.0	4641	99.2	0.8	3948
Household structure						
Nuclear	98.7	1.3	4381	99.4	0.6	3773
Non-nuclear	98.1	1.9	4358	99.1	0.9	3750
Not dejure resident	96.1	3.9	127	100.0	0.0	106
Marital status						
Never married	99.2	0.8	3402	99.7	0.3	2871
Married	97.8	2.2	5464	99.0	1.0	4758
Age at marriage						
Less than 18 years	97.5	2.5	397	98.8	1.2	344
18 or more years	97.8	2.2	5068	99.0	1.0	4415
Duration of marriage						
<10 years	97.2	2.8	2138	98.9	1.1	1859
10-19 years	98.2	1.8	1882	98.6	1.4	1614
20 or more years	98.2	1.8	1445	99.5	0.5	1286
Number of children						

0 child	98.7	1.3	3962	99.6	0.4	3353
2 or less children	98.0	2.0	2605	98.8	1.2	2249
More than 2 children	98.2	1.8	2300	99.1	0.9	2029
Use sterilization						
No	98.4	1.6	6334	99.4	0.6	5328
Yes	98.3	1.7	2532	98.9	1.1	2301
Migration status						
Migrants	98.5	1.5	264	98.2	1.8	219
Non-migrants	98.4	1.6	8520	99.3	0.7	7343
Visitors	96.4	3.6	83	100.0	0.0	67
Smokes cigarettes						
No	98.6	1.4	7236	99.3	0.7	6234
Yes	97.5	2.5	1627	98.9	1.1	1393
Drinking Alcohol						
No	98.8	1.2	6705	99.4	0.6	5745
Yes	97.1	2.9	2160	98.9	1.1	1884
age at first intercourse						
<16	95.5	4.5	155	100.0	0.0	135
16-20	96.7	3.3	1586	99.1	0.9	1402
21-52	98.0	2.0	4142	98.8	1.2	3584
Prior HIV testing						
Received result	98.1	1.9	574	98.0	2.0	456
Did not receive results	96.0	4.0	50	95.7	4.3	47
Never tested	98.4	1.6	8242	99.3	0.7	7126
Wife beating justified						
Agree with none of the	98.9	1.1	4568	99.2	0.8	3815
Agree with any one	97.8	2.2	4215	99.3	0.7	3746
Agree with all specified	100.0	0.0	84	100.0	0.0	70
Premarital sex						
No	98.5	1.5	8156	99.3	0.7	7002
Yes	96.5	3.5	711	99.0	1.0	628
Had sexual intercourse						
No	97.7	2.3	5383	96.5	3.5	429
Yes	95.7	4.3	494	99.1	0.9	4687
			Proximate determinants			
Relationship with last sexual partner						
Spouse	97.9	2.1	5172	99.2	0.8	4503
Girlfriend/fiancé/live-in	92.0	8.0	137	98.3	1.7	120
Other friends/relatives	95.3	4.7	43	100.0	0.0	34
Casual	100.0	0.0	8	100.0	0.0	7
Female sex workers	100.0	0.0	23	100.0	0.0	22
Lifetime sexual partner						
One	97.9	2.1	5085	99.0	1.0	4424
Two or more	95.6	4.4	789	98.6	1.4	690
Condom use in the last sex						
No	98.4	1.6	8321	98.9	1.1	454
Yes	97.4	2.6	546	99.3	0.7	7175
Circumcision						
No	98.4	1.6	7644	99.2	0.8	6766
Yes	99.6	1.3	1049	99.6	0.4	772
Ever had a blood transfusion						
No				99.3	0.7	7355
Yes				98.5	1.5	261
			Biological determinants			
Any STI						
No				99.2	0.8	7497
Yes				100.0	0.0	133
Total	**98.4**	**1.6**	**8866**	**99.3**	**0.7**	**7629**

Table 4. Underlying and Proximate determinates of STI and the underlying, proximate and biological determinant and HIV for clients

	Any STI (%)			HIV sero positivity (%)		
	No	Yes	Total	No	Yes	Total
		Underlying factors				
Age						
<25	91.3	8.7	574	92.9	7.1	574
25-34	88.7	11.3	648	91.8	8.2	648
35 and above	81.7	18.3	377	88.6	11.4	376
Education						
Uneducated	88.8	11.2	240	82.0	18.0	239
Educated	87.9	12.1	1359	93.2	6.8	1358
Occupation						
Not working	95.1	4.9	81	91.5	8.5	82
Professional	80.5	19.5	123	91.9	8.1	124
Agricultural worker	89.9	10.1	1046	90.1	9.9	1047
Other worker	84.3	15.7	343	95.6	4.4	342
Knowledge of HIV/AIDS intervention						
No	78.0	22.0	109	90.9	9.1	110
Yes	88.7	11.3	1489	91.5	8.5	1489
Exposure to intervention						
No	81.6	18.4	147	90.5	9.5	148
Yes	88.6	11.4	1451	91.5	8.5	1450
Marital status						
Never married	90.1	9.9	830	94.0	6.0	830
Married	85.7	14.3	768	88.8	11.2	767
Mobility						
No	87.8	12.2	1462	91.2	8.8	1462
Yes	89.7	10.3	136	94.1	5.9	136
Migration status						
Migrants	87.8	12.2	1336	91.1	8.9	1336
Non-migrants	88.9	11.1	262	93.1	6.9	262
Injected Drug abuse						
No	87.9	12.1	1574	91.4	8.6	1573
Yes	85.7	14.3	14	100.0	0.0	14
No answer	100.0	0.0	10	100.0	0.0	10
age at first intercourse						
<16	65.8	34.2	38	84.2	15.8	38
16-20	87.6	12.4	961	92.0	8.0	961
21-52	89.3	10.7	562	91.8	8.2	562
age at first paid intercourse						
<16	84.4	15.6	109	85.5	14.5	110
16-20	88.2	11.8	1099	92.1	7.9	1099
21-52	88.5	11.5	383	91.1	8.9	384

Prior HIV testing						
No	89.3	10.7	1320	92.0	8.0	1320
yes	84.0	16.0	169	87.0	13.0	169
Staying with spouse						
Yes	89.4	10.6	434	96.5	3.5	434
No	89.9	10.1	593	85.5	14.5	593
	Proximate determinants					
no. of partners						
One	87.2	12.8	673	94.3	5.7	672
Two or more	88.7	11.3	915	89.5	10.5	915
type of partners						
female RP and FSW	91.7	8.3	683	90.0	10.0	683
male and FSW	73.5	26.5	219	95.4	4.6	219
only FSW	89.0	11.0	691	91.6	8.4	691
coital frequency						
Less than three	87.8	12.2	540	93.0	7.0	540
Three or more encounters	88.5	11.5	1035	91.0	9.0	1035
condom use in last sex with all female partners						
Not used	88.0	12.0	1594	91.4	8.6	1594
used	100.0	0.0	5	100.0	0.0	5
Type of sex						
No	88.7	11.3	1249	90.2	9.8	1249
Yes	85.3	14.7	348	96.0	4.0	347
no answer	100.0	0.0	1	100.0	0.0	1
Circumcision						
No	87.2	12.8	1084	91.1	8.9	1084
Yes	89.6	10.4	512	92.0	8.0	513
no answer	100.0	0.0	2	100.0	0.0	2
Blood Transfusion						
No				91.0	9.0	1372
Yes				93.3	6.7	210
no answer				100.0	0.0	16
	Biological determinants					
Any STI symptom reported						
No	88.0	12.0	1310	90.6	9.4	1310
Yes	87.8	12.2	288	95.1	4.9	288
Any STI tested						
No				91.7	8.3	1406
Yes				89.1	10.9	192
Total	**88.0**	**12.0**	**1598**	**91.4**	**8.6**	**1598**

Table 5: Logistic Regression for Proximate Determinants of STIs and HIV for General Men and Clients of Female Sex workers of Maharashtra

Binary Logistic Regression for General Males		
Determinants	**Any STI**	**HIV Prevalence**
	Exp(β)	**Exp(β)**
Age		
<25 ®		
25-34	1.237	2.657*
35 and above	1.124	2.001
Place of residence		
Urban®		
Rural	1.652*	0.773
Religion		
Hindu®		
Muslim	1.266	0.716
Christian	0	0.819
Others	2.431***	1.046
Comprehensive knowledge of HIV/AIDS		
No®		
Yes	2.072***	1.061
Marital status		
Never married®		
Married	1.733*	2.601**
Use sterilization		
No®		
Yes	0.568**	0.908
Migration status		
Migrants®		
Non-migrants	1.421	0.476
Visitors	1.945	0
Behavioural characteristics		
Drinking Alcohol		
No®		
Yes	2.125***	1.645**
Premarital sex		
No®		
Yes	1.94*	0.698
Any STI		
No®		
Yes		0
Ever had a blood transfusion		
No®		
Yes	1.415	2.2***
Condom use in the last sex		
No®		
Yes	0.504***	0.619
Treatment seeking behaviour		
No®		
Yes		0.958

Note *** 1 percent **5 percent and *10 percent significance level

Binary Logistic Regression for Male Clients group		
Determinants	**Any STI**	**HIV Prevalence**
	Exp(β)	**Exp(β)**
Age		
<25®		
25-34	0.909	0.993
35 and above	2.213**	0.773
Education		
Uneducated®		
Educated	1.058	3.207***
Occupation		
Not working®		
Professional	1.81	0.73
Agricultural worker	2.304	0.716
Other worker	3.699**	2.03
Exposure to intervention		
No®		
Yes	1.878	1.262
Marital status		
Never married®		
Married	1.101	0.586**
Mobility		
Yes®		
No	1.1	0.443*
Number of sexual partners		
<3®		
3 or more	0.327***	1.44
Age at first intercourse		
<16®		
16-20	0.438*	1.837*
21-52	0.371**	2.163**
Prior HIV testing		
No®		
yes	1.63**	0.581**
Circumcision		
No®		
Yes	0.603**	1.319
Any STI		
No®		
Yes		0.821
Blood transfusion		
No®		
Yes		1.182

Note *** 1 percent **5 percent and *10 percent significance level

Note: All other variables are controlled