

Correlates of HIV Transmission from Husband to Wife among Heterosexual Married Couples in ART-era in West Bengal, India

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Abstract

Objective: To identify factors associated with HIV-transmission from husbands to their wives within the existing HIV prevention and control program environment in West Bengal, India.

Methods: In this cross-sectional study, information was collected from the study participants on socio-demography and various health issues including sexually transmitted diseases (STDs). They were also tested for blood borne and sexually transmitted infections. Women living with HIV were compared for behavioral and biologic markers against women who did not have the virus. Both these groups of women were married to HIV sero-reactive men. To detect recent HIV infection, HIV sero-negative women were tested by Polymerase Chain Reaction.

Results: Of the 234 married couples, 29% (69/234) lived in HIV discordant relationship where wives were not infected with HIV and the rest were concordant for HIV infection. Six of the 165 women living in concordant relationship acquired HIV infection recently. Fifty six percent of the husbands were in advanced stage of HIV disease with CD4 count $\leq 200/\mu\text{l}$ while tested for the first time at ART center. Factors independently associated with HIV concordance were 'wives experiencing any STD-symptom after marriage' (Adjusted Odds Ratio (AOR) 2.05; 95% CI 1.09 - 3.83; $p=0.02$) and 'self-reported male condom use/reduced frequency of sex with spouse' (AOR 2.99; 95% CI 1.29-6.94; $p=0.01$). Although 'HSV-2 concordance' (Odds Ratio (OR) 2.46; 95% CI 1.32-4.59; $p=0.004$) and 'bacterial vaginosis' (OR 2.57; 95% CI 1.18-5.61; $p=0.02$) were associated with HIV infection in wives in uni-variate analyses, the strength of such associations weakened in multi-variate model. ART intake by husbands did not offer any protection against HIV infection in wives.

Conclusions: Early initiation of ART among HIV discordant couples, strengthening of STD prevention and control and limitation of self-reported sexual risk reduction to inform HIV-program in India are underscored.

Keywords: HIV; ART; Herpes Simplex Virus-2; India; Heterosexual-couples

Introduction

During the third round of the National Family Health Survey (NFHS-3 2005-2006) in India, among 27000 married couples undergoing HIV test, 0.11% were in HIV-concordant and 0.39% in HIV-discordant relationship [1]. Extrapolating this finding as well as drawing on other information, a desk review had estimated HIV affected heterosexual couples in reproductive age group in the country to be 1.18 million [2]. It is important to appreciate that the spread of HIV infection in married monogamous Indian women was recognized in the early phase of HIV epidemic. Detection of 14% women attending sexually transmitted disease (STD) clinics (who were not female sex workers) as HIV sero-reactive [3] and 45% HIV prevalence among wives of HIV positive injection drug users (IDUs) who had never injected drugs nor reported sex outside marriage [4] underlined such spread. In addition to these studies from west (Maharashtra) and north-eastern part of the country (Manipur) respectively, the rural and urban settings of the southern State of Tamilnadu witnessed a similar phenomenon [5]. Role of STDs in HIV transmission in stable heterosexual relationship was discussed in these studies. A secondary analysis of couple-linked information collected during NFHS-3, further revealed that 'sexual violence', 'multiple wives' and 'lower educational status' of husbands were associated with HIV infection in married women in India who had been currently living with their husbands [6].

None of the afore-mentioned articles had the opportunity to examine issues of HIV transmission in marriage in the context of anti-retroviral therapy (ART), provided free of cost by the Ministry of

Health and Family welfare, Government of India since 2004 (starting with only eight government hospitals in six States) [7]. Subsequent studies on the topic of HIV transmission in marriage have been scarce. We therefore undertook the current investigation in West Bengal, an eastern Indian State, where spread of HIV is characterized by patronage of female sex workers by men within or outside the State and unsafe injecting practices by drug users in certain districts.

Methodology

Study participants

The National Institute of Cholera and Enteric Diseases (NICED), a premier institute under Indian Council of Medical Research (ICMR), in collaboration with the civil society organization named 'Society for Positive Atmosphere and Related Support to HIV/AIDS' (SPARSHA) conducted this study during 2009 to 2012. SPARSHA is an organization

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constituted of and managed by people living with HIV/AIDS and their friends (PLWHAF) and receives grant from the West Bengal State AIDS Prevention and Control Society (WBSAPandCS) for HIV care and support program. The study received approval from the institutional ethics committee (IEC) of NICED prior to its implementation. Participants were recruited from the three districts of West Bengal namely Kolkata, Paschim Medinipur and Purbo Medinipur.

Recruitment procedures and survey questionnaire

Couples consenting for interviews as well as providing clinical specimens for laboratory tests were recruited (Figure 1). Five of 261 married women could not be included in the study as their husbands did not provide consent for collection of venous blood samples. Questionnaires were administered by same-sex trained interviewers from SPARSHA, some of whom lived openly with HIV. Interviewers obtained informed consent from each of the eligible participants before administering the questionnaire in Bangla - the native language of West Bengal. Data were collected on socio demographic profile, economic status, health issues including ART intake, intimate partner relationship, as well as STD symptoms. All the information and investigation results pertaining to an individual was linked through unique identification code assigned to each participant and no name was recorded on data forms.

Study site

History taking, clinical examination, STD diagnosis and collection of clinical specimens following aseptic procedures were carried out at the dermatology department of the RG Kar Medical College and Hospital (RGKMCH), Kolkata. Treatments for STDs were provided along with counselling services from RGKMCH as per the national STD-syndrome management guideline [8]. The study participants received their test results in due course and were assisted in receiving clinical care, as appropriate.

Laboratory tests and statistical analyses

All laboratory tests and statistical analyses were carried out at

NICED. HIV sero-status of the study participants (self-reported and recorded on ART centre-card) were re-confirmed through rapid diagnostic kit (HIV TRI DOT J Mitra and SD Bioline HIV I and II) as well as enzyme linked immuno-sorbent assay (ELISA; Vironostika HIV Uniform II Ag/Ab). In addition, polymerase chain reaction (PCR) was conducted on all sero-nonreactive samples to identify if any of the participants acquired HIV infection recently and thus helped us avoid misclassification of individuals as HIV non-infected based only on antibody detection. HIV viral load was estimated by in vitro nucleic acid amplification test for quantification of Human Immunodeficiency Virus Type 1 (HIV-1) RNA in human plasma, using the High Pure System Viral Nucleic Acid Kit for manual specimen preparation and the COBAS[®]TaqMan[®] 48 analyzer for automated amplification and detection. The limit below which viral load was read as undetectable by this system was 400 copies/ml.

Antibody to hepatitis C (HCVAb) and hepatitis B core antigen (HBcAb) and presence of hepatitis B surface antigen were detected by ELISA (HCV 3.0 ENH SAVE; Ortho Clinical Diagnostics- Johnson and Johnson, Hepanostika AntiHBc Uniform ELISA and Hepanostika HBsAg Ultra respectively). Tests for syphilis (Immutrep TPHA Brand Pthozyme Omega and Rapid Plasma Reagin Antigen-Tulip for RPR) and antibody to herpes simplex type-2 virus were also carried out (IgG ELISA Euroimmune - Oscar diagnostic). Heat fixed vaginal smears were gram stained and scored as per Nugent's criteria [9] to identify cases of bacterial vaginosis (BV).

We used χ^2 tests for comparing proportions and student's t test or the Mann-Whitney test (as appropriate) for comparing continuous outcome measures. Association between key risk factors (pertaining to husbands or wives) and HIV status in wives were examined by univariate analyses. Biologically plausible variables and variables with statistically significant association ($p < 0.05$ and 95% confidence interval (CI) of Odds Ratio (OR) not capturing null) with the study outcome of HIV infection in wives were entered into multivariate logistic regression model. Epi-Info (version 6.4b, Centers for Disease Control, Atlanta, GA, in collaboration with World Health Organization, Geneva, Switzerland) and SPSS 11.0 (SPSS, Inc., Chicago, IL, USA) were used for data analyses.

Results

Socio-demographic profile

About a third of the study participants included in final analysis (Figure 1) came from each of the three districts of West Bengal; Kolkata (82/234; 35%), Paschim Medinipur (72/234; 31%) and Purbo Medinipur (80/234; 34%). Eighty five percent of the husbands (198/234) and 35% of the wives (82/234) reported being engaged in some income generation activities; median monthly income of husbands was Rs 2500 (US\$ 36; 25th percentile Rs. 1500 and 75th percentile Rs. 3500) and that of wives was Rs 600 (25th percentile Rs 300 and 75th percentile Rs 1275). In only 4% couples both husbands and wives reported being unemployed. A fourth of the wives, irrespective of their involvement in income generating activities, reported lack of control in matters of family expenses. Occupations mostly involved working as daily wage labour or as gold or silver artisan, automobile driving, land cultivation, preparing handicraft items, petty business or working as domestic help. The mean duration of marriage of the recruited couples was 14 years (± 7 sd), median 14 years, range 1-39 years). Other socio-demographic information, self-reported sexual practices, ART related information and descriptive data on sexually transmitted infections (STIs) are presented in Table 1.

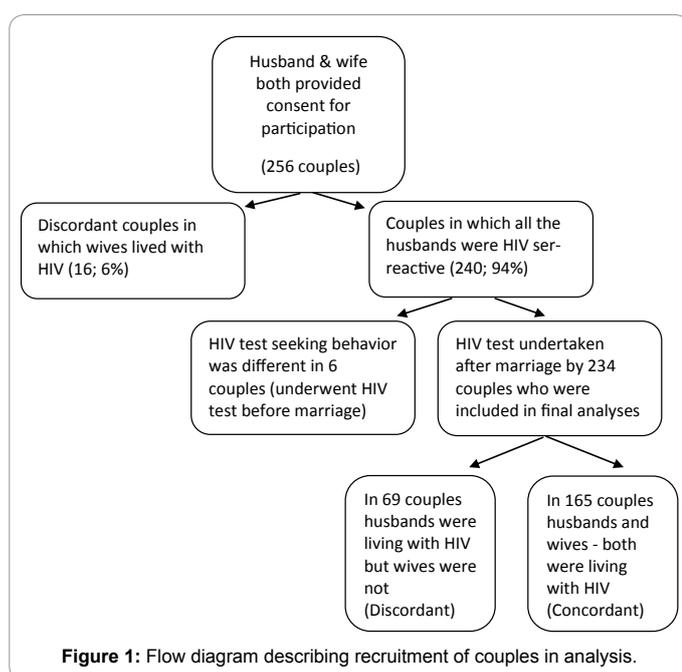


Figure 1: Flow diagram describing recruitment of couples in analysis.

Attributes	Husbands (234) n (%) ^a	Wives (234) n (%)	P
Mean age in year (sd; median)	38 (±7; 38)	31 (± 6; 30)	<0.001
Minimum & Maximum (age in year)	21 - 62	20 - 48	
Never attended school	37 (16)	49 (21)	0.19
<Primary education (IVth standard)	42 (18)	28 (12)	
≥Primary & <secondary (Xth standard) education	130 (55)	135 (58)	
≥ Secondary education	25 (11)	22 (9)	
Physical abuse by husband (reported by wife)	-	80 (34)	NA
Ever had sex under the influence of alcohol (in marriage)	78 (33)	90 (38)	0.28
Did not have sex with a partner other than spouse in lifetime	1 (0.4%)	230 (98%)	<0.001
Had procured sex within the last one year	6 (3%)	0	NA
Reasons for undergoing HIV test			NA
- As wife was pregnant	1 (0.4)	-	
- As respondent was pregnant	-	26 (11)	
- As spouse was detected HIV positive	37 (16)	188 (80)	
- During blood donation	5 (2)	-	
- Advised by physician for physical illness	191 (82)	20 (9)	
On ART	174 (74)	65 (28)	<0.001
HIV Viral Load (copies/ml) during present assessment			0.001
>100000	21 (9)	20 (9)	
>50000 & ≤100000	10 (4)	10 (4)	
>10000 & ≤50000	18 (8)	32 (14)	
≤10000	63 (27)	44 (19)	
Undetectable	122 (52)	59 (25)	
HIV sero-nonreactive	-	69 (29)	
Genital ulcer (ever after marriage)	69 (29)	48 (20)	0.03
Discharge of pus with urine (ever after marriage)	86 (37)	94 (40)	0.5
Warty growth around genitalia/anus (ever after marriage)	110 (47)	104 (44)	0.64
TPHA + RPR (Sero-reactive)	0	1 (0.4)	NA
TPHA sero-reactive	25 (11)	17 (7)	0.25
HSV-2 sero-reactive	126 (54)	111 (47)	0.19

a= column percentage, NA= Not applicable

Table 1: Socio-demographic profile, self-reported sexual practices and STIs in married couples.

Genital examination findings and HSV-2 sero-status

While 5% of the husbands had genital (11/234) and another 2% (4/234) had anal ulcers, other 6% had genital (15/234) warts. Urethral discharge of pus, anal warts and anal molluscum - each was present independently in 1% of the husbands. Considerably greater proportion of husbands had inguinal bubo (20/234; 8%) and 8% had painful scrotal swelling (19/234). Vulvo-vaginal ulcer was present in 4% (9/234) and vaginal discharge in 64% (151/234) of the wives. While warts were observed in 3% (6/234), inguinal bubo and genital molluscum - each was present independently in 1% of the wives. All clinically suspected STD cases were managed as per the national STD-syndrome management guideline.

HSV-2 sero-prevalence in different age groups of husbands and wives (Figure 2), showed an overall increasing trend with increasing age. It was also noticed that the HSV-2 prevalence in husbands in all age groups was almost equal or higher compared to that in wives except in the age group '≤25 year' and '>30 to ≤35 year'.

Exposure to Hepatitis C and Hepatitis B

None of the study participants had reported ever injecting drug for recreation. Two percent of the husbands (5/234) were sero-reactive for hepatitis C antibody. Only one of these husbands had hepatitis C sero-reactive wife. Three more wives were hepatitis C sero-reactive whose husbands were non-reactive for HCVAb. None of the hepatitis C sero-reactive husbands and wives reported ever receiving blood transfusion indicating HCV transmission through unsafe invasive procedures including injecting in therapeutic setting. All four wives who were hepatitis C sero-reactive, tested positive for HIV as well.

Hepatitis B surface antigen (HBsAg) was detected among 6%

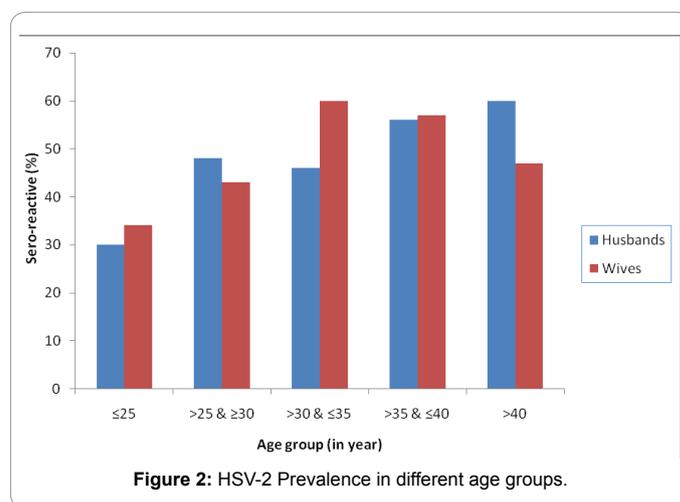


Figure 2: HSV-2 Prevalence in different age groups.

of the husbands (13/234), only 4 of whom reported receiving blood transfusion in the past. The sole HBsAg reactive wife did not have history of blood transfusion. Antibody to hepatitis B core antigen (HBcAb) was detected in 41% of the husbands (97/234) and 17% of the wives (39/234) indicating 'exposure in the past' and possibly through unsafe invasive procedures including injecting in therapeutic setting.

Factors associated with HIV infection in wives - univariate analyses

As all the husbands were living with HIV, wives' HIV status formed the basis of categorizing couples as HIV concordant (165/234; 71%) or discordant (69/234; 29%). Of the 165 wives in concordant relationship,

6 were identified by PCR as acquiring HIV infection recently. Only 3 of the husbands of these 6 wives were on ART and no statistically significant difference was observed between the mean current viral load of this sub-group of husbands and the rest.

In uni-variate analysis, women from Paschim Medinipur had less

chance of being in HIV concordant relationship compared to their counterparts (Table 2). None of the other socio-demographic variables including sexual violence in marriage (as reported by wives) nor migration-status of husbands had any association with HIV status of wives. While behaviours such as 'no reported change in sexual relation with spouse following HIV test' was associated with higher odds of

Exposure variables	Wives living with HIV n=165 (%) ^b	Wives not living with HIV n=69 (%)	OR (95% CI of OR)	p-value
Paschim medinipur (district)	51 (64)	29 (36)	0.49 (0.24 – 0.99)	0.05
Purba Medinipur (district)	50 (69)	22 (31)	0.63 (0.31 – 1.31)	0.23
Kolkata (district)	64 (78)	18 (22)	Reference	
Age (in year) of husband				
≤25	2 (67)	1 (33)	1.25 (0.1 - 14.3)	0.85
>25 to ≤30	23 (79)	6 (21)	2.39 (0.87 - 6.56)	0.08
>30 to ≤35	42 (75)	14 (25)	1.87 (0.87 - 4)	0.1
>35 to ≤40	50 (73)	18 (27)	1.73 (0.85 - 3.51)	0.12
>40	48 (62)	30 (38)	Reference	
Hindu	152 (70)	66 (30)	0.53 (0.14 – 1.92)	0.53
Muslim	13 (81)	3 (19)	Reference	
Husbands never attending school	29 (78)	8 (22)	1.62 (0.70 – 3.76)	0.26
Husbands attended school	136 (69)	61 (31)	Reference	
Wives never attending school	39 (80)	10 (20)	1.82 (0.85 – 3.90)	0.13
Wives attended school	126 (68)	59 (32)	Reference	
Duration of present marriage in years				
<7	33 (83)	7 (17)	2.97 (1.00 – 8.85)	0.05
≥7 to ≤14	63 (72)	24 (28)	1.65 (0.07 – 3.92)	0.25
>14 to ≤22	50 (66)	26 (34)	1.21 (0.51 – 2.88)	0.66
>22	19 (61)	12 (39)	Reference	
No change in sexual relation with spouse after HIV test	28 (78)	8 (22)	3.11 (1.1 – 8.75)	0.03
Used condom/reduced frequency of sex with spouse	119 (73)	45 (27)	2.35 (1.1 – 5)	0.03
Stopped having sex with spouse	18 (53)	16 (47)	Reference	
Husband ever experienced genital ulcer (after marriage)	52 (75)	17 (25)	1.40 (0.74 – 2.66)	0.29
Husband never experienced genital ulcer	113 (68)	52 (32)	Reference	
Wife ever experienced genital ulcer (after marriage)	43 (90)	5 (10)	4.51 (1.7 – 11.95)	0.002
Wife never experienced genital ulcer	122(66)	64 (34)	Reference	
Husband ever had discharge of pus with urine (after marriage)	29 (83)	6 (17)	2.23 (0.88 – 5.66)	0.09
Husband never had discharge of pus with urine	136 (68)	63 (32)	Reference	
Wife ever had discharge of pus with urine (after marriage)	6 (86)	1 (14)	2.56 (0.3 – 21.7)	0.39
Wife never had discharge of pus with urine	159 (70)	68(30)	Reference	
Wife ever experienced white vaginal discharge (after marriage)	128 (74)	46 (26)	1.73 (0.93 – 3.21)	0.08
Wife never experienced vaginal discharge	37 (62)	23(38)	Reference	
Warty growth in husband around genitalia/anus (after marriage)	83 (75)	27 (25)	1.57 (0.88 – 2.78)	0.12
Husband never had warty growth around genitalia/anus	82 (66)	42 (34)	Reference	
Warty growth in wife around genitalia/anus (after marriage)	82 (79)	22 (21)	2.13 (1.18 – 3.86)	0.01
Wife never had warty growth around genitalia/anus	82 (64)	47 (36)	Reference	
Husband experienced any STD symptom (after marriage)	98 (76)	31 (24)	1.79 (1.01 – 3.16)	0.04
Husband did not experience any STD symptom	67 (64)	38 (36)	Reference	
Wife experienced any STD symptom (after marriage)	93 (79)	24 (21)	2.42 (1.35 – 4.33)	0.003
Wife did not experience any STD symptom	72 (52)	45 (38)	Reference	
Couple sero-concordant for HSV-2 antibody	85 (80)	24 (20)	2.46 (1.32 – 4.59)	0.004
Couple sero-discordant for HSV-2 antibody	16 (64)	9 (36)	1.08 (0.43 – 2.68)	0.86
Both members of couple sero-nonreactive for HSV-2 antibody	64 (62)	39(38)	Reference	
Wife diagnosed with bacterial vaginosis	46 (84)	9 (16)	2.57 (1.18 – 5.61)	0.03
Wife not diagnosed with bacterial vaginosis	119 (66)	60 (33)	Reference	
Husband on ART	42 (71)	17 (29)	1.04 (0.54 - 2)	0.89
Husband not on ART	123 (70)	52 (30)	Reference	
Husbands' first CD4 cell count (per µl) at ART centre				
≤200	94 (71)	38 (29)	0.93 (0.42 - 2.06)	0.87
>200 to ≤250	22 (67)	11 (33)	0.75 (0.27 - 2.06)	0.58
>250 to ≤350	20 (69)	9 (31)	0.84 (0.29 - 2.4)	0.75
>350	29 (72)	11 (28)	Reference	
Current viral load of husbands (copies/ml)				
>100000	15 (71)	6 (29)	0.88 (0.31 - 2.48)	0.82
>50000 to ≤100000	6 (60)	4 (40)	0.53 (0.14 - 2.01)	0.35
>10000 to ≤50000	12 (67)	6 (33)	0.71 (0.24 - 2.05)	0.52
<10000	42 (67)	21 (33)	0.71 (0.36 - 1.31)	0.31
Undetectable	90 (74)	32 (26)	Reference	

b= row percentage
OR= Odds Ratio

Table 2: Association of key risk factors with HIV infection in wives.

wives being HIV positive as expected, it was surprising to find such association with 'self-reported condom use / reduced frequency of sex with spouse' indicating challenges associated with recording intimate sexual relationship through self-report.

Diagnosis of bacterial vaginosis (Nugent score ≥ 7) was associated with HIV infection in wives. Any STD symptoms (ulcer/urethral discharge of pus/warty growth) experienced ever after marriage by husbands or wives also had similar association. We computed another variable describing couples as concordant for presence of HSV-2 antibody, discordant HSV-2 couples and couples not harbouring HSV-2 antibody. HSV-2 concordance status in couples was associated with their HIV concordance as well. On the other hand, neither 'ART intake by husbands 'nor', their first CD4 count at ART centre', or 'current viral load' had any association with HIV concordance within the studied unions.

Worth mentioning here is that only 17% (40/234) of the husbands had CD4 count $>350/\mu\text{l}$ while tested at ART centres for the first time (Table 2) and majority (132/234; 56%) were in advanced stage of HIV disease during these encounters (indicated by first CD4 count $\leq 200/\mu\text{l}$). Contrastingly, a greater proportion of HIV sero-reactive wives had CD4 count $\geq 350/\mu\text{l}$ (61%) while tested for the first time at ART centre and very few were with CD4 count $\leq 200/\mu\text{l}$ (16%). Such differences between men and women indicated longer duration of HIV infection in husbands before they sought treatment and contact of wives with ART centre earlier in the course of HIV infection compared to that in husbands. This difference also explained why lesser proportion of wives was on ART compared to husbands as free-ART is initiated at government hospitals at CD4 count 250-300/ μl .

Multivariate analyses

A multivariate model was built adjusting for 'residence-district', 'any STD-symptom ever experienced by husband after marriage', 'any STD-symptom ever experienced by wife after marriage', 'change in sexual practices following HIV test', 'HSV-2 status of couples', and 'bacterial vaginosis in wife'. Factors independently associated with HIV Infection in wives in this model were 'wives ever experiencing any STD-symptom after marriage' and 'self reported male condom use/reduced frequency of sex with spouse'. Although 'HSV-2 concordance' and 'diagnosis of bacterial vaginosis in wife' were indicated as factors associated with HIV infection in wives in uni-variate analyses, the strength of such associations weakened in multi-variate model (Table 3). Women from the district of Paschim Medinipur had lesser chance

of being HIV infected compared to women from the other two districts.

Discussion

The present study analyzed various correlates associated with HIV transmission from husbands to their wives in heterosexual marriage in eastern India. One of the shortcomings of this study was recruitment of couples from a limited number of districts and poor socio-economic backgrounds, which might limit the application of study-findings to other parts of the country. Moreover, the cross-sectional nature of the investigation did not allow generating incidence data, although new HIV infections occurring among women were identified. We also realised that some of the interview-questions were related to very intimate aspects of sexual life, within and outside the marriage. The participants' responses thus could have been tempered, particularly in a population of women experiencing high rates of physical abuse (34%) and who are dependent and submissive to their husbands. Despite such limitations, the current study has raised the following issues of programmatic and scientific importance.

Firstly, ART intake by husbands did not have any protective effect against HIV infection in their wives in our study cohort. Worth noticing in this regard is that 56% of the husbands in our study had CD4 count $\leq 200/\mu\text{l}$ (could be defined as AIDS cases) while tested for the first time at ART centre. Late initiation of ART could therefore be a plausible explanation for high HIV concordance observed in our study cohort. Another study from the School of Tropical Medicine, Kolkata recorded that PLH had even lower level of CD4 count (100/ μl) while reporting for the first time at ART centres [10]. It is important to note in this context that HPTN 052 clinical trial results showing benefits of ART initiated at CD4 level 350-550 cells / μl in preventing HIV transmission in HIV discordant couples [11,12] are yet to be translated in the National AIDS Control Program (NACP) in India.

Secondly, the importance of STD prevention and control in ART-era in West Bengal was indicated by our study as 'any STD symptom experienced by wives after marriage' was independently associated with HIV infection in them. Based on the information volunteered by study participants (Table 1), it seemed that sex outside marriage mostly by husbands paved the path for STDs in couples, which in turn might have facilitated HIV transmission. Studies conducted in other settings [13] and community based intervention trials showing impact of improved STD management in reducing HIV incidence [14] underscore this assertion.

Exposure variables	Wives living with HIV n=165 (%) ^c	Wives not living with HIV n=69 (%)	AOR (95% CI of AOR)	p-value
Paschim Medinipur (district)	51 (64)	29 (36)	0.43 (0.2 - 0.94)	0.03
Purba Medinipur (district)	50 (69)	22 (31)	0.63 (0.28 - 1.39)	0.25
Kolkata (district)	64 (78)	18 (22)	Reference	
Husband experienced any STD symptom (after marriage)	98 (76)	31 (24)	1.52 (0.81 - 2.84)	0.18
Husband did not experience any STD symptom	67 (64)	38 (36)	Reference	
Wife experienced any STD symptom (after marriage)	93 (79)	24 (21)	2.05 (1.09 - 3.83)	0.02
Wife did not experience any STD symptom	72 (52)	45 (38)	Reference	
No change in sexual relation with spouse after HIV test	28 (78)	8 (22)	2.69 (0.87 - 8.24)	0.08
Used condom/reduced frequency of sex with spouse	119 (73)	45 (27)	2.99 (1.29 - 6.94)	0.01
Stopped having sex with spouse	18 (53)	16 (47)	Reference	-
Couple sero-concordant for HSV-2 antibody	85 (80)	24 (20)	1.89 (0.93 - 3.82)	0.07
Couple sero-discordant for HSV-2 antibody	16 (64)	9 (36)	0.98 (0.35 - 2.72)	0.97
Both members of couple sero-nonreactive of HSV-2 antibody	64 (62)	39(38)	Reference	
Wife diagnosed with bacterial vaginosis	46 (84)	9 (16)	2.19 (0.95 - 5.04)	0.06
Wife not diagnosed with bacterial vaginosis	119 (66)	60 (33)	Reference	

c= row percentage

AOR= Adjusted Odds Ratio

Table 3: Factors associated with HIV infection in wives in multivariate analysis.

As self-reported sexual practices are prone to biases [15], we measured HSV-2 sero-reactivity as a marker of sexual lifestyle [16]. Fifty four percent of the husbands were HSV-2 sero-reactive, which was similar to HSV-2 prevalence observed in STD clinic attendees and female sex workers in other Asian country settings [17]. HSV-2 prevalence in wives was less at 47% (Table 1). Given that almost all the husbands reported having sex outside marriage; occurrence of HSV-2 antibody in such high proportion in them was not surprising. Wives, acquiring STDs through their husbands, presented a pattern of HSV-2 prevalence, which had an expected trail (Figure 2) except a little decline in higher age group probably indicating lesser sexual activity.

We identified that couples concordant for HSV-2 infection had greater chance of being concordant for HIV infection as well (Table 2) - a finding similar to the one generated from four sub-Saharan African cities [18]. Keeping intermittent reactivation of latent HSV-2 infection in check however is unlikely to be useful for such populations, as a large trial recruiting 3408 couples at 14 sites failed to show any significant reduction in HIV transmission through administration of daily suppressive dose of acyclovir [19].

Finally, 6 of the 75 wives, who were HIV sero-negative following detection of HIV in their husbands after marriage, had evidence of recent acquisition of HIV infection. This captures the dynamic and evolving nature of HIV epidemic in West Bengal. A study among HIV sero-discordant couples in Pune, Maharashtra in pre-ART era recorded an HIV incidence rate of 1.22 per 100 person-years [20]. On the other hand, HIV incidence rate recorded among heterosexual discordant couples from Chennai, Tamilnadu in ART-era has been 6.52 per 100 person-years [21]. Our study expands this knowledge base by highlighting the issue of new HIV infections occurring in married discordant couples in West Bengal who were in contact with on-going HIV prevention, control and ART program.

In conclusion, we emphasize that enrolling and retaining PLH in ART based intervention since early in the course of HIV disease should be the current priority of NACP in India. This intervention initiative will require adopting HPTN052 trial based recommendations at the earliest. However, the program should simultaneously strengthen STD prevention and control efforts. Another challenge to the on-going HIV/AIDS prevention and control program is to identify appropriate indicators to measure program success as we realise that 'self-reported sexual risk reduction or condom usage' may fail to reflect the actual risks. A study from Papua New Guinea, [22] a country detecting first case of HIV in 1987 (India detected it in 1986) and initiating pilot ART program in 2004, is worth noticing in this regard. Although considerably high proportion of participants had knowledge about the role of condom in HIV prevention in this study, consistent condom use was lowest among married couples and those in sero-discordant relationships.

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