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Changes in self-reported sexually transmitted infections and symptoms among married couples in India from 2006 to 2016: a repeated cross-sectional multivariate analysis from nationally representative data

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ABSTRACT

Objective To assess the changes in prevalence of past-year self-reported sexually transmitted infections (STIs) and its symptoms among married couples between 2006 and 2016 in India, overall and by socioeconomic status.

Design This cross-sectional study uses the two most recent waves (2005–2006 vs 2015–2016) of nationally representative health surveys in India. We examined the changes of self-reported STI and symptoms among married couples aged 15–54 by overall and by socioeconomic status. Adjusted logistic regression was used to assess the changes, accounting for covariates and the complex survey design.

Setting Cross-sectional, nationally representative population-based survey in 2005–2006 and 2015–2016 from National Family Health Survey data from Demographic and Health Survey.

Participants 39 257 married couples aged 15–49 years for the 2005–2006 survey wave and 63 696 married couples aged 15–49 years for the 2015–2016 wave.

Outcome measure Self-reported STI was used as a primary outcome measure.

Results In 2016, 2.5% of married women reported having had an STI in the past year, a significant increase from 1.6% in 2006 (p<0.001). The past-year self-reported STI prevalence among married men significantly increased from 0.5% in 2006 to 1.1% in 2016 (p<0.001). Adjusted results showed that the uptrend of couples' self-reported STI was more significant among those whose husbands are currently employed and those families in middle or higher wealth quintiles. Alarmingly, among couples who reported STI or symptoms, they were less likely to seek advice or treatment in 2016 as compared with 2006 (adjusted OR=0.50, p<0.001, 95% CI=0.40 to 0.61).

Conclusion The study identifies a substantial increase in self-reported STI prevalence with a notable treatment seeking gap among married couples in India over the past decade.

Strengths and limitations of this study

- ► Uses a large nationally representative health survey to assess the relationship between self-reported sexually transmitted infection (STI) and various sociodemographic factors in India.
- ► Examines the change of self-reported STI prevalence among married couples with the two most recent data available from 2006 to 2016.
- ► Cross-sectional data limit causal inference.
- ► Survey data may suffer from self-report bias.

INTRODUCTION

The epidemic of sexually transmitted infections (STI) is a growing global concern.[1] A report from WHO estimates 376 million newly diagnosed STI cases each year.[2] STIs come in a bacterial or viral form and can cause symptoms that affect morbidity, mortality, mental health, psychosocial well-being, family relation and the overall quality of life.[3–5] Negative consequences of STI and symptoms present a significant public health challenge, especially in low-income to middle-income countries with limited health system infrastructure.[1 3 6]

Sociodemographic factors and economic conditions are associated with the prevalence of STI to a varying degree. Certain demographic factors are more vulnerable to STI, such as in education, wealth, rurality and other sociodemographic and economic conditions in developing countries.[7–13] Among these countries, India is currently undergoing a profound epidemiological transition amid rapid economic development. Preliminary evidence from regional studies suggests increased STI prevalence in certain vulnerable social groups, like those below primary education level, illiteracy and

unemployment.[14–16] Another study, which used the data from the 1998 wave of the National Family Health Survey (NFHS) and two waves of 1998 and 2002 waves of the District Level Household Survey-Reproductive and Child Health, reported that rural women, Muslim, illiterate and whose marriage occurred at a very young age of less than 18 years old had a higher STI prevalence.[17]

To date, there is a gap in the literature that examines the trends of STI prevalence in recent years in India, particularly among married couples over time. The available literature on STI trends in India tend to focus on high-risk groups, such as female sex workers and men who have sex with men.[18–22] Existing literature that assesses STI prevalence among married couples in India only reports on one time point without time-trend epidemiological analyses.[23–25] Most of the aforementioned studies have been restricted to specific regions of India; thus, the findings are not generalisable to describe the national trend of STI and not adequate to inform whether there have been differential impacts of STI trend on specific subpopulations.

This study analyses two recent waves of India's NFHS spanning over a decade to assess self-reported STI prevalence among married couples and examine whether there are differential trends based on the married couples' sociodemographic factors, such as education, religion, rurality and wealth. This study provides further evidence of differential patterns of self-reported STI across various demographic and socioeconomic conditions through nationally representative samples in the last decade, where there has been profound economic development and epidemiological transition in India.

METHODS

India NFHS is part of the Indian Demographic and Health Survey (DHS), a nationally representative household-based health surveillance system. This study used the nationally representative sample of married couples aged 15–54 from two different waves in 2005–2006 NFHS-3 (N=39 257) and 2015–2016 NFHS-4 (N=63 696). Informed consent for participation in the survey was obtained for all respondents prior to the interview. Interviewers were trained to interview the respondent alone to establish privacy—without other eligible respondents in the household. The reported rates of married couples who do not cohabitate at the time of the survey were less than 1% (female, 2006: 0.62%; female, 2016: 0.37%; male, 2006: 0.26%; male, 2016: 0.14%). The overall response rates were more than 95% for both waves of the survey.[26 27] Both NFHS-3 and NFHS-4 conducted household surveys in states and union territories of India. Both survey samples were systematically stratified in multiple stages using the primary sampling units based on the size of rural villages and urban census blocks, and the randomly selected households within each cluster were chosen for interviews. A detailed sample design is described in the NFHS report.[26 27] As shown in figure 1, the datasets had 39 257 and 63 696 matched couples in a household for NFHS-3, 2006 and NFHS-4, 2016 survey wave, respectively; when both waves were combined, there were 102 953 couples identified. Then, a sample of 102 690 couples from two survey waves was analysed for self-reported STI analyses after excluding couples with unknown and missing self-reported STI status. For the multivariate analyses, a sample of 97 288 couples was analysed after excluding couples with missing covariates. After accounting for unknown and missing variables, among those with at least one self-reported STI or symptoms, we identified 5017 husbands and 10 631 wives to analyse the outcomes for individuals seeking treatment or advice for STI or its symptoms.

In both NFHS waves, respondents were asked if they have ever had sex and were asked whether they heard about other sexually transmitted infections. When they responded yes to those two aforementioned questions, then they were asked: During the last 12 months, have you had a disease which you got through sexual contact? This variable was coded as a primary outcome of self-reported STI for our study. Regardless of whether they have heard about STI, the women respondents were asked to identify STI symptoms through these two questions: (1) During the last 12 months, have you had a bad smelling abnormal genital discharge? (2) During the last 12 months, have you had a genital sore or ulcer? For men, they were asked: (1) During the last 12 months, have you had an abnormal discharge from your penis? (2) During the last 12 months, have you had a sore or ulcer on or near your penis? These two separate STI symptoms variables were combined and coded as a single dichotomous variable to indicate any STI symptom of a bad-smelling, abnormal discharge from the vagina/penis, a genital sore or a genital ulcer. The survey did not specify the diseases of STI diagnoses. For the analyses, the self-reported STI/STI symptom outcomes were categorised as if the respondents had reported STI and/or STI symptoms in the past year. Because STI among any partner in marriage affects the couple's sexual health and family relationship, we followed the prior method[28] and grouped the self-reported STI prevalence of at least one of the married couples as a single dichotomous variable to code as the primary self-reported STI outcome of a couple. Instead of individual prevalence, we used the couple STI prevalence as the primary outcome because the self-reported STI prevalence trend for husband and wife across two waves remained similar in both waves. Among those who reported any STI or symptoms, the survey asked whether they sought advice or treatment when they had STI/discharge/sore/ulcer in the past year. This paper also used married individuals' treatment or seeking advice for STI or its symptoms as a separate outcome. We used self-reported STI status as a primary outcome in our multivariate analysis.

The year variable was coded as follows for each wave: the survey for 2016 was coded as 1, and 0 for 2006. We used covariates that wife and husband individually reported, such as age, education (college or above,

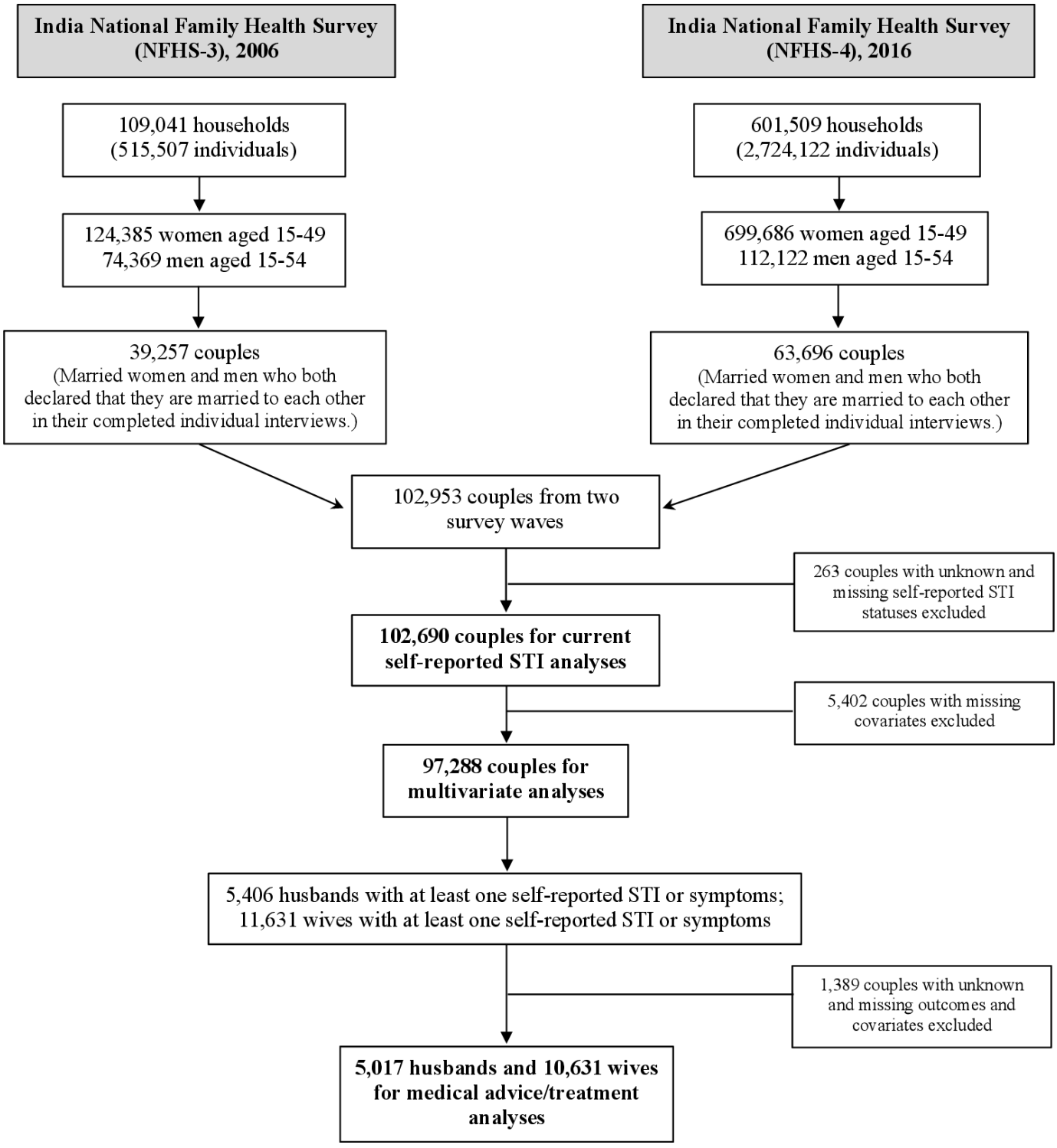

Figure 1 An outline of the process of sample selection from India NFHS datasets. It describes the flow diagram from datasets of two survey waves to the final sample size used for multivariate analyses. STI, sexually transmitted infections.

higher secondary, secondary, primary, illiterate), current employment status, religion (Hindu, Muslim, Christian and other), family wealth (highest, fourth, middle, second, lowest), and family residence (urban, rural). The higher secondary education group is for grades 11 and 12; the secondary education group is for grades 9 and 10; the primary education is for grades 1 to 8. The coding of these covariates was based on prior literature.[29] The caste variable was categorised as scheduled caste, scheduled tribe, other backward class, and others (none of them). The caste system in India is a traditional method of social segregation and adverse socioeconomic and health outcomes disproportionately impact those belonging to disadvantaged caste.[30] For the NFHS couple data set, we used sampling weights of men from both waves representing the respective population and its distribution at

the national level. All statistical analyses were performed using the SAS version 9.3 software.

Prevalence of self-reported STI and symptoms were calculated for husband, wife and couple for 2006 and 2016. Both bivariate and multivariate analyses have been conducted for this study. For this study, we used individualised socioeconomic and demographic factors as the predictor variables to assess their associations with self-reported STI. We estimated associations between individual demographic and socioeconomic characteristics and the couple's self-reported STI status with bivariate analysis. Multiple logistic regressions with complex survey procedures were used to model predictors of a couple's self-reported STI status. Similar approaches were also used for an individual's treatment or seeking advice for STI. To assess the changes over time, we used the year as a categorical variable using 2006 as the reference year to assess the main effect of the time variable from 2006 to 2016. We evaluated the interaction terms of the time variable and these key covariates to determine differential changes by demographics and socioeconomic status (SES). The backward elimination procedure was used to identify significant interaction terms by removing terms from the multivariate logistic regression model with a threshold of p value greater or equal to 0.05. Statistical significance was determined by a p<0.05.

Patient and public involvement

No patients were involved.

RESULTS

The demographics of 102 953 married couples from 2006 and 2016 NFHS waves are provided in table 1. The average age for wives was 31.3 years for 2006 and 32.8 years for 2016; the average age for husbands was 36.7 years for 2006 and 37.7 for 2016. Less than half of wives were employed, whereas more than 90% of the husbands were employed in both waves. With exception to religion, there were significant differences in sociodemographics (mean age, education, employment, caste, family wealth and residence) of married women and men from 2006 to 2016. Compared to, 2006 more women had higher education in 2016; for instance, only 6% of married women reported having a college or higher education in 2006, and for 2016, about 10% of married women reported having an education at college or above (p<0.0001). Wife's employment rate has significantly decreased over 10 years from 38% to 25% (p<0.0001). It should also be noted that similar directionality has been observed among married men: higher education has significantly increased, while employment has also significantly decreased from 97% in 2006 to 92% in 2016 (p<0.0001).

Table 2 summarises the prevalence of past-year self-reported STI and any STI symptom as individually reported by married couples from 2006 and 2016 NFHS waves. Married women reported a significantly greater increase in self-reported STI from 2006 to 2016 when compared with married men. In 2016, 2.5% of married women reported having had an STI in the past year, which significantly increased from 1.6% in 2006 (p<0.001). The national prevalence of past-year self-reported STI among married men increased significantly from 0.5% in 2006 to 1.1% in 2016 (p<0.001). The prevalence of self-reported STI among married couples has significantly increased from 2.06% in 2006 to 3.55% in 2016 (p<0.001). Figure 2 shows an increase in prevalence across self-reported STI and other STI-related symptoms from 2006 to 2016 among married couples in India.

For self-reported STI symptoms (table 2), including genital sore and discharge, there was a significantly higher prevalence among husbands in 2016 compared with 2006. For married men, 6.2% reported having had any STI symptom in 2016 compared with 3.9% in 2006, a substantial increase over the period (p<0.001). Married women also reported a significantly higher prevalence of self-reported STI symptoms for genital sores from 2.3% in 2006 to 3.1% in 2016 (p<0.001). Overall, the prevalence of any self-reported STI or any symptoms in the past year experienced by married couples has significantly increased from 14.7% in 2006 to 17.4% in 2016 (p<0.001).

Table 3 summarises bivariate and multiple logistic regressions with the couple's self-reported STI status as the primary outcome variable. In the adjusted models, married couples in 2016 were approximately 60% more likely to report having STI in the past year (adjusted OR (aOR)=1.61, p<0.001, 95% CI=1.40 to 1.85). Mutually adjusting for the individual-level and couple-level sociodemographic and SES factors, husband's education in college or above (aOR=1.31, p<0.05, 95% CI=1.03 to 1.68), secondary (aOR=1.33, p<0.01, 95% CI=1.09 to 1.62), and primary levels (aOR=1.20, p<0.05, 95% CI=1.01 to 1.43) were significantly positively associated with the couple's self-reported STI status, relative to those who were illiterate. Family wealth at the highest quintile (aOR=1.33, p<0.05, 95% CI=1.05 to 1.69) was significantly associated with the couple's self-reported STI—while other lower quintiles were not significant.

Table 4 demonstrates the time trend by SES interactions in moderating the risk of self-reported STI in married couples. The husband's employment was positively associated with the uptrend of the married couple's report of past-year self-reported STI from 2006 to 2016 (aOR=2.02, p<0.05, 95% CI=1.13 to 3.60). Couples who were in the highest (aOR=2.60, p<0.001, 95% CI=1.72 to 3.92), fourth quintile (aOR=2.52, p<0.001, 95% CI=1.67 to 3.80) and middle quintile (aOR=1.69, p<0.01, 95% CI=1.14 to 2.52) of family wealth were significantly more likely to experience an increase from 2006 to 2016 in reporting past-year STI compared with those in the lowest quintile of family wealth.

We also examined the relationship between the sociodemographic factors and treatment or seeking advice for STI or symptoms in the past 12 months. Using the multivariate analysis, as shown in table 5, husbands with recent

Table 1 Background characteristics of married couples, India National Family Health Survey, 2006–2016

	2006 (N=39 257) % (SE)	2016 (N=63 696) % (SE)	2006 vs 2016 χ^2 (or t-statistic) (p value)	
Wife's age (mean)	31.31 (0.06)	32.76 (0.05)	t=18.61 (t-statistic)	<0.0001
Wife's education			981.59	<0.0001
College or above	6.07 (0.22)	10.28 (0.31)		
Higher secondary	5.09 (0.16)	9.07 (0.19)		
Secondary	13.00 (0.27)	18.07 (0.28)		
Primary	28.90 (0.38)	31.26 (0.31)		
Illiterate	46.96 (0.51)	31.31 (0.32)		
Wife's employment	37.99 (0.50)	25.46 (0.33)	459.01	<0.0001
Wife's religion			0.91	0.8236
Hindu	82.50 (0.60)	82.03 (0.41)		
Muslim	11.98 (0.58)	12.48 (0.37)		
Christian	2.37 (0.15)	2.39 (0.11)		
Other	3.15 (0.19)	3.10 (0.16)		
Wife's caste/tribe			101.22	<0.0001
Scheduled caste	19.55 (0.53)	20.55 (0.40)		
Scheduled tribe	9.36 (0.45)	10.01 (0.25)		
Other backward class	39.97 (0.63)	45.63 (0.45)		
Others (none of them)	31.13 (0.60)	23.82 (0.41)		
Husband's age (mean)	36.68 (0.06)	37.7 (0.05)	12.16 (t-statistic)	<0.0001
Husband's education			353.43	<0.0001
College or above	11.27 (0.31)	14.01 (0.33)		
Higher secondary	8.44 (0.22)	11.55 (0.24)		
Secondary	18.93 (0.30)	22.58 (0.30)		
Primary	36.65 (0.42)	34.19 (0.33)		
Illiterate	24.70 (0.44)	17.67 (0.25)		
Husband's employment	96.65 (0.16)	92.01 (0.19)	301.76	<0.0001
Husband's religion			1.40	0.7049
Hindu	82.58 (0.60)	82.25 (0.41)		
Muslim	12.01 (0.58)	12.55 (0.38)		
Christian	2.25 (0.14)	2.23 (0.12)		
Other	3.16 (0.19)	2.97 (0.15)		
Husband's caste/tribe			79.41	<0.0001
Scheduled caste	19.69 (0.53)	20.80 (0.42)		
Scheduled tribe	9.38 (0.44)	9.85 (0.26)		
Other backward class	40.62 (0.64)	45.53 (0.46)		
Others (none of them)	30.32 (0.60)	23.82 (0.42)		
Family wealth			38.85	<0.0001
Highest	21.48 (0.47)	22.51 (0.42)		
Fourth	20.31 (0.39)	21.86 (0.33)		
Middle	20.24 (0.38)	21.06 (0.28)		
Second	19.52 (0.36)	18.78 (0.26)		
Lowest	18.45 (0.46)	15.78 (0.24)		
Family residence			39.77	<0.01
Urban	32.54 (0.41)	36.01 (0.37)		

Continued

Table 1 Continued

	2006 (N=39 257) % (SE)	2016 (N=63 696) % (SE)	2006 vs 2016 χ^2 (or t-statistic) (p value)
Rural	67.46 (0.41)	63.99 (0.37)	

SE, Standard Error.

self-reported STI or symptoms in 2016 were significantly less likely (aOR=0.50, p<0.001, 95% CI=0.40 to 0.62) to receive treatment or advice compared with those in 2006. Husband's scheduled caste status was associated with less likelihood of receiving treatment or advice (aOR=0.60, p<0.05, 95% CI=0.39 to 0.91). Husbands with family wealth in the second quintile (aOR=1.35, p<0.05, 95% CI=1.05 to 1.73) compared with those in the lowest quintile were more likely to receive treatment or seek advice.

For the next adjusted model, wives in 2016 were significantly less likely to receive treatment or seek advice for STI and symptoms when compared to 2006 (aOR=0.88, p<0.05, 95% CI=0.78 to 0.99). Wives were more likely to receive treatment or seek advice when they had secondary (aOR=1.37, p<0.01, 95% CI=1.13 to 1.66) and primary (aOR=1.35, p<0.001, 95% CI=1.17 to 1.55) education levels compared with those who were illiterate. Wives whose husband had higher secondary (aOR=1.29, p<0.05, 95% CI=1.02 to 1.63), secondary (aOR=1.23, p<0.05, 95% CI=1.01 to 1.48) and primary (aOR=1.24, p<0.05, 95% CI=1.05 to 1.45) education level were also more likely to receive treatment or seek advice. For family wealth, wives in the highest (aOR=1.91, p<0.001, 95% CI=1.51 to 2.41), fourth (aOR=1.65, p<0.001, 95% CI=1.35 to 2.02), and middle (aOR=1.31, p<0.01, 95% CI=1.09 to 1.59) quintiles were significantly more likely to receive treatment or seek advice compared with those in lowest family wealth quintile when adjusted with other sociodemographic variables.

DISCUSSION

The analyses from two waves of NFHS identify a significant increase in self-reported STI prevalence among both married men and women over the past decade in India. In 2016, 2.5% of married women reported having had an STI in the past year, which significantly increased from 1.6% in 2006. Adjusted results showed that the uptrend of couples' self-reported STI was more significant among those whose husbands are currently employed and those in middle or higher wealth quintiles. Alarmingly, among couples who reported STI or symptoms, both husband and wife were less likely to seek advice or treatment in 2016 than in 2006.

Our study uses the two latest datasets from a large nationally representative health survey to assess the relationship between self-reported STI and various sociodemographic factors in India. To the best of

Table 2 Prevalence of past-year self-reported STI and STI symptoms by married couples' self-reports, India National Family Health Survey, 2006–2016

	2006 % (SE)	2016 % (SE)	2006 vs 2016 χ^2 (p value)	
Husband's self-reported STI	0.50 (0.06)	1.07 (0.06)	38.67***	<0.0001
Husband's any STI symptom	3.89 (0.19)	6.22 (0.22)	61.22***	<0.0001
Genital sore	2.14 (0.13)	2.56 (0.11)	5.59*	0.0180
Genital discharge	2.36 (0.14)	4.62 (0.20)	85.35***	<0.0001
Husband's any STI or symptoms	4.07 (0.19)	6.75 (0.22)	78.23***	<0.0001
Wife's self-reported STI	1.58 (0.11)	2.52 (0.11)	32.78***	<0.0001
Wife's any STI symptom	11.02 (0.28)	10.63 (0.22)	1.23	0.2665
Genital sore	2.27 (0.12)	3.14 (0.12)	24.68***	<0.0001
Genital discharge	10.10 (0.26)	9.59 (0.21)	2.26	0.1330
Wife's any STI or symptoms	11.32 (0.28)	11.57 (0.23)	0.45	0.5015
Couple's self-reported STI	2.06 (0.12)	3.55 (0.13)	63.93***	<0.0001
Couple's any STI symptom	14.22 (0.32)	16.05 (0.30)	17.24***	<0.0001
Genital sore	4.29 (0.17)	5.58 (0.16)	28.32***	<0.0001
Genital discharge	12.11 (0.29)	13.65 (0.28)	14.36***	0.0002
Couple's any STI or symptoms	14.72 (0.32)	17.40 (0.30)	36.37***	<0.0001

*p<0.05, **p<0.01, ***p<0.001.
SE, Standard Error; STI, sexually transmitted infection.

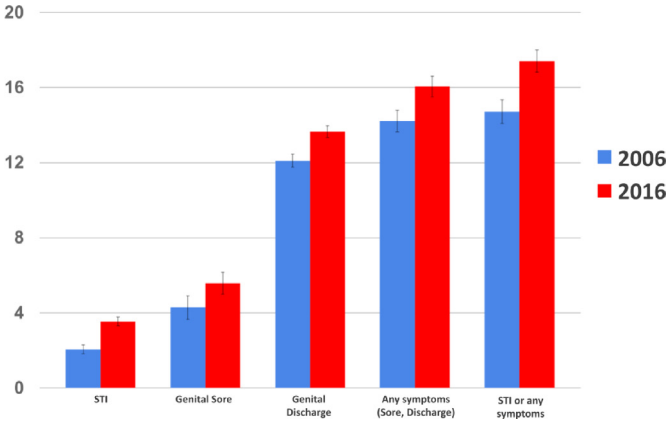

Figure 2 A grouped bar chart of prevalence and 95% CIs of married couple's past-year STI and symptoms in 2006 and 2016. The results are shown in five groups of those who reported having: STI, genital sore, genital discharge, either symptom of soreness and discharge, and having STI or any symptoms. There was an increase in prevalence across the five measures of self-reported STI and other STI-related symptoms from 2006 to 2016. STI, sexually transmitted infections.

our knowledge, this is the first study that describes the changes in self-reported STI prevalence among married couples in India from 2006 to 2016 and assesses whether the changes vary by sociodemographic and economic conditions. Our findings are different from the cross-sectional results of a past similar study based on a single wave of India national survey data of 1998 that showed that the rural women, Muslim and illiterate women had a higher STI prevalence.[17] With the newer datasets from 2006 and 2016, our analysis revealed a new finding that married couples with currently employed husbands and with middle or higher wealth are associated with greater odds of self-reported STI. With rising disposable income due to rapid economic development in India in the past decades,[31] it is possible that the availability of disposable economic resources may have increased the likelihood of risky sexual behaviours. There is evidence that in some epidemiological studies of HIV, wealthier individuals may engage in risky sexual behaviours that increase their vulnerability to infections.[32 33] Other work in Uganda has found that the middle wealth quintile and disposable income posed a higher risk for STI.[34] According to our findings, wives with middle or higher household wealth were more likely to seek advice or treatment for STI compared with those with lower wealth. Combining these two factors may have contributed to the higher rates of self-reported STI among wealthier groups. The imbalance of wealth among husband and wife may contribute to a shift of family dynamics that may further affect sexual health and, broadly, intimate partner relationship.

Since this study used only a limited number of sociodemographic factors in the adjusted multivariate analysis, the contextual background behind these socioeconomic indicators may need to be further examined. For example, statistical differences were observed when comparing sociodemographic factors from 2006 to 2016. While higher education has significantly increased over time for both married women and men, we observed a statistically significant decline in employment. An increase in education level can be attributed to India's growing higher education system. India's education system, the third-largest globally, has been growing particularly with universities, which increased 34 times from 1947 to 2014.[35] Scholars attribute the increase of education level in India to the 'Right to Education Act,' enacted in 2009 to provide free and mandatory education for children aged 6–18.[35 36] As for the statistically significant decline in employment for both married men and women in our study, it may be explained by the overall workforce trend in India during the last few decades. Existing literature shows that employment growth at the national level exploded between 1999 to 2005, but the net employment sharply declined the following years between 2005 to 2010; some scholars note that India saw 'jobless growth' while the national economic development was underway.[37 38]

Compared to 2006, more women had higher education in 2016; for instance, only 6% of married women reported having a college or higher education in 2006, and for 2016, about 10% of married women reported having an education at college or above (p<0.0001). Wife's employment rate has significantly decreased over 10 years from 38% to 25% (p<0.0001). It should also be noted that similar directionality has been observed among married men: higher education has significantly increased, while employment has also significantly decreased from 97% in 2006 to 92% in 2016 (p<0.0001).

Further study is warranted to ascertain associations between couples' self-reported STI and sociodemographics after accounting for another individual, family and state covariates. Also, the decreased prevalence of seeking advice or treatment for STI from 2006 (47.8%) to 2016 (31.9%) suggests that efforts are needed to improve sexual healthcare utilisation in India. Studies in India suggest that stigma, geography, and discrimination are often barriers among high-risk groups to seek healthcare and treatment for STI.[39–41]

There are several limitations to our study. Although the NFHS followed a rigorous and established data collection methodology, there may be self-report bias. According to the interviewer's manual, the survey interviewers administering the NFHS are culturally trained to build rapport, establish safe and private settings, and assure the confidentiality of the respondents.[42] Despite these efforts, survey respondents may have still misreported their STI status due to the sensitive nature, cultural stigma and social undesirability associated with STI. Compared with clinical data gathered from STI laboratory tests, self-reported STI status may have been underreported or misreported. There

Table 3 Associations of married couples' current self-reported STI status with individual demographics and socioeconomic status

			Couple's STI (bivariate)		Couple's STI (multivariate)	
	n	Couple's STI to %	OR	(95% CI)	Adjusted OR	(95% CI)
Year 2016	63 612	3.55	1.75***	(1.52 to 2.01)	1.61***	(1.40 to 1.85)
2006	39 078	2.06	Ref.		Ref.	
Wife's age	102 690	2.96	1.00	(0.99 to 1.01)	1.01	(0.99 to 1.02)
Wife's education						
College or above	9178	4.06	1.56***	(1.22 to 2.00)	1.17	(0.87 to 1.57)
Higher secondary	8304	3.72	1.43***	(1.17 to 1.74)	1.13	(0.88 to 1.44)
Secondary	17 265	3.11	1.19*	(1.01 to 1.40)	0.97	(0.80 to 1.18)
Primary	31 818	2.76	1.05	(0.92 to 1.20)	0.91	(0.79 to 1.06)
Illiterate	36 124	2.64	Ref.		Ref.	
Wife's employment	30 163	2.85	0.95	(0.84 to 1.07)	1.03	(0.91 to 1.17)
Wife's religion						
Hindu	77 388	2.88	0.92	(0.70 to 1.22)	0.97	(0.60 to 1.58)
Muslim	12 905	3.51	1.13	(0.83 to 1.54)	1.05	(0.55 to 2.00)
Christian	7613	2.71	0.87	(0.56 to 1.34)	0.79	(0.33 to 1.86)
Other	4737	3.12	Ref.		Ref.	
Wife caste/tribe						
Scheduled caste	18 090	3.03	1.13	(0.95 to 1.34)	0.93	(0.65 to 1.35)
Scheduled tribe	16 494	2.69	1.00	(0.79 to 1.27)	1.06	(0.67 to 1.67)
Other backward class	38 957	3.08	1.15	(0.98 to 1.34)	1.07	(0.84 to 1.36)
Others (none of them)	25 306	2.70	Ref.		Ref.	
Husband's age	102 690	2.96	1.00	(0.99 to 1.00)	0.99	(0.98 to 1.01)
Husband's education						
College or above	13 860	3.78	1.67***	(1.34 to 2.08)	1.31*	(1.03 to 1.68)
Higher secondary	11 145	2.78	1.21	(1.00 to 1.47)	1.04	(0.82 to 1.31)
Secondary	22 459	3.34	1.47***	(1.23 to 1.75)	1.33**	(1.09 to 1.62)
Primary	36 050	2.85	1.25**	(1.07 to 1.46)	1.20*	(1.01 to 1.43)
Illiterate	19 163	2.30	Ref.		Ref.	
Husband's employment	95 874	2.94	0.90	(0.72 to 1.14)	0.97	(0.76 to 1.24)
Husband's religion						
Hindu	77 594	2.87	0.92	(0.69 to 1.23)	1.01	(0.61 to 1.66)
Muslim	12 901	3.53	1.14	(0.83 to 1.57)	1.31	(0.68 to 2.54)
Christian	7431	2.72	0.87	(0.55 to 1.37)	0.93	(0.38 to 2.25)
Other	4756	3.12	Ref.		Ref.	
Husband caste/tribe						
Scheduled caste	18 160	3.21	1.24*	(1.05 to 1.47)	1.50*	(1.04 to 2.15)
Scheduled tribe	16 489	2.62	1.01	(0.81 to 1.25)	1.17	(0.77 to 1.77)
Other backward class	39 227	3.08	1.19*	(1.02 to 1.38)	1.17	(0.92 to 1.47)
Others (none of them)	24 517	2.61	Ref.		Ref.	
Family wealth						
Highest	23 546	3.51	1.42***	(1.17 to 1.73)	1.33*	(1.05 to 1.69)
Fourth	22 358	3.05	1.23*	(1.02 to 1.48)	1.15	(0.93 to 1.43)
Middle	21 435	2.89	1.17	(0.97 to 1.40)	1.10	(0.90 to 1.32)
Second	19 451	2.70	1.09	(0.91 to 1.30)	1.02	(0.85 to 1.23)

Continued

Table 3 Continued

	n	Couple's STI to %	Couple's STI (bivariate) OR	(95% CI)	Couple's STI (multivariate) Adjusted OR	(95% CI)
Lowest	15 900	2.49	Ref.		Ref.	
Family residence						
Urban	37 261	3.21	1.15	(1.00 to 1.31)	0.94	(0.81 to 1.10)
Rural	65 429	2.82	Ref.		Ref.	

*p<0.05, **p<0.01, ***p<0.001.
OR, Odds Ratio; Ref., Reference group for odds ratio; STI, sexually transmitted infection.

is also a possibility of recall bias due to a longer time interval for the past 12 months for STI incidence. Despite this concern, it is worth noting the large scope of the epidemiological data as it can be useful compared with smaller clinical samples.

Although our analyses use the latest available datasets of two different time points, there is a limitation in assessing change in prevalence between only two time points. Due to the administration interval of DHS, there is a 10-year gap between the two survey

Table 4 Interaction terms between year trend and individual demographics and socioeconomic status in predicting married couples' current self-reported STI status, 2006 and 2016

Interaction terms between year and each of the following predictors	Couple's STI† adjusted OR (95% CI)		Couple's STI‡ adjusted OR (95% CI)	
Wife's education				
College or above	1.29	(0.68 to 2.46)		
Higher secondary	1.12	(0.63 to 1.96)		
Secondary	1.82*	(1.14 to 2.88)		
Primary	1.36	(0.99 to 1.88)		
Illiterate	Ref.			
Wife's employment	1.18	(0.90 to 1.56)		
Husband's education				
College or above	0.95	(0.54 to 1.70)		
Higher secondary	0.87	(0.51 to 1.47)		
Secondary	1.08	(0.70 to 1.66)		
Primary	1.06	(0.74 to 1.52)		
Illiterate	Ref.			
Husband's employment	1.97*	(1.10 to 3.52)	2.02*	(1.13 to 3.60)
Family wealth				
Highest	2.08**	(1.21 to 3.57)	2.60***	(1.72 to 3.92)
Fourth	2.07**	(1.28 to 3.34)	2.52***	(1.67 to 3.80)
Middle	1.49	(0.99 to 2.25)	1.69**	(1.14 to 2.52)
Second	1.27	(0.86 to 1.88)	1.36	(0.93 to 1.99)
Lowest	Ref.		Ref.	
Family residence				
Urban	1.12	(0.79 to 1.59)		
Rural	Ref.			

*p<0.05, **p<0.01, ***p<0.001.
†Adjusted multivariate analysis for all predictors included in the table, including age, religion and caste.
‡Multivariate analysis for SES variables (employment, family wealth) as predictors and adjusted to all predictors included in the table, including age, religion, and caste
STI, sexually transmitted infection.

Table 5 Associations of likelihood of married couples, who reported STI or symptoms, seeking advice or treatment when they had STI/discharge/sore/ulcer and individual demographics and socioeconomic status, 2006 and 2016

	Husband's treatment or seeking advice for STI and symptoms (multivariate) Adjusted OR (95% CI)		Wife's treatment or seeking advice for STI and symptoms (multivariate) Adjusted OR (95% CI)	
Year 2016	0.50***	(0.40 to 0.62)	0.88*	(0.78 to 0.99)
2006	Ref.		Ref.	
Wife's age	1.02	(0.99 to 1.04)	1.00	(0.99 to 1.02)
Wife's education				
College or above	1.33	(0.86 to 2.06)	1.17	(0.86 to 1.59)
Higher secondary	1.31	(0.90 to 1.92)	1.25	(0.98 to 1.61)
Secondary	1.09	(0.81 to 1.47)	1.37**	(1.13 to 1.66)
Primary	0.92	(0.74 to 1.14)	1.35***	(1.17 to 1.55)
Illiterate	Ref.		Ref.	
Wife's employment	0.99	(0.82 to 1.19)	1.12	(1.00 to 1.27)
Wife's religion				
Hindu	1.14	(0.52 to 2.53)	0.92	(0.54 to 1.58)
Muslim	1.50	(0.50 to 4.50)	1.64	(0.79 to 3.43)
Christian	0.42	(0.15 to 1.14)	1.18	(0.59 to 2.38)
Other	Ref.		Ref.	
Wife caste/tribe				
Scheduled caste	1.85**	(1.20 to 2.84)	0.77	(0.54 to 1.09)
Scheduled tribe	1.51	(0.78 to 2.92)	0.85	(0.54 to 1.35)
Other backward class	1.12	(0.79 to 1.58)	0.90	(0.71 to 1.16)
Others (none of them)	Ref.		Ref.	
Husband's age	0.99	(0.97 to 1.01)	1.01	(0.99 to 1.02)
Husband's education				
College or above	1.00	(0.68 to 1.47)	1.28	(1.00 to 1.65)
Higher secondary	0.87	(0.60 to 1.27)	1.29*	(1.02 to 1.63)
Secondary	1.04	(0.77 to 1.40)	1.23*	(1.01 to 1.48)
Primary	1.00	(0.78 to 1.27)	1.24*	(1.05 to 1.45)
Illiterate	Ref.		Ref.	
Husband's employment	1.04	(0.74 to 1.34)	1.09	(0.87 to 1.35)
Husband's religion				
Hindu	0.81	(0.37 to 1.79)	0.75	(0.43 to 1.30)
Muslim	1.12	(0.38 to 3.31)	0.49	(0.23 to 1.05)
Christian	1.38	(0.49 to 3.86)	0.60	(0.29 to 1.25)
Other	Ref.		Ref.	
Husband caste/tribe				
Scheduled caste	0.60*	(0.39 to 0.91)	1.24	(0.87 to 1.76)
Scheduled tribe	0.69	(0.38 to 1.24)	0.97	(0.61 to 1.54)
Other backward class	0.77	(0.54 to 1.11)	1.05	(0.81 to 1.36)
Others (none of them)	Ref.		Ref.	
Family wealth				
Highest	1.22	(0.86 to 1.74)	1.91***	(1.51 to 2.41)
Fourth	1.18	(0.86 to 1.74)	1.65***	(1.35 to 2.02)
Middle	1.20	(0.90 to 1.60)	1.31**	(1.09 to 1.59)
Second	1.35*	(1.05 to 1.73)	1.15	(0.95 to 1.39)

Continued

Table 5 Continued

	Husband's treatment or seeking advice for STI and symptoms (multivariate) Adjusted OR (95% CI)		Wife's treatment or seeking advice for STI and symptoms (multivariate) Adjusted OR (95% CI)	
Lowest	Ref.		Ref.	
Family residence				
Urban	1.15	(0.92 to 1.44)	1.07	(0.93 to 1.22)
Rural	Ref.		Ref.	

Odds ratios adjusted for all variables included in the table.
*p<0.05, **p<0.01, ***p<0.001.
STI, sexually transmitted infection.

waves. The gap between these two survey periods may introduce an additional source of bias that can affect the association. The cross-sectional design is limited to causal inference. Because the current investigation focuses on demographic and socioeconomic conditions, additional residual confounding may be due to unobserved factors.

Evaluating the relationship of sociodemographic determinants and self-reported STI rates among married couples can be valuable for programmatic and policy decisions for community-based clinical care to improve sexual health outcomes for married individuals. The prevention and intervention models for sexual health in communities in India should consider the multitude of social factors that may put certain groups of individuals at greater risk for STI infections than others.

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REFERENCES

1 WHO. *Sexually transmitted infections: implementing the global STI strategy*. Geneva: World Health Organization, 2017.
2 WHO. *Global health sector strategy on sexually transmitted infections 2016-2021: toward ending STIs*. Geneva: World Health Organization, 2016.
3 Mabey D. Epidemiology of STIs: worldwide. *Medicine* 2010;38:216–9.
4 Gottlieb SL, Low N, Newman LM, *et al*. Toward global prevention of sexually transmitted infections (STIs): the need for STI vaccines. *Vaccine* 2014;32:1527–35.
5 Aral SO. Sexually transmitted diseases: magnitude, determinants and consequences. *Int J STD AIDS* 2001;12:211–5.
6 Newman L, Rowley J, Vander Hoorn S, *et al*. Global estimates of the prevalence and incidence of four curable sexually transmitted infections in 2012 based on systematic review and global reporting. *PLoS One* 2015;10:e0143304.
7 Krieger N, Waterman PD, Chen JT, *et al*. Monitoring socioeconomic inequalities in sexually transmitted infections, tuberculosis, and violence: geocoding and choice of area-based socioeconomic measures--the public health disparities geocoding project (US). *Public Health Rep* 2003;118:240–60.
8 Harling G, Subramanian S, Bärnighausen T, *et al*. Socioeconomic disparities in sexually transmitted infections among young adults in the United States: examining the interaction between income and race/ethnicity. *Sex Transm Dis* 2013;40:575–81.
9 Dean HD, Fenton KA. Addressing social determinants of health in the prevention and control of HIV/AIDS, viral hepatitis, sexually transmitted infections, and tuberculosis. *Public Health Rep* 2010;125 Suppl 4:1–5.
10 Hogben M, Leichliter JS. Social determinants and sexually transmitted disease disparities. *Sex Transm Dis* 2008;35:S13–18.
11 Aral SO. Determinants of STD epidemics: implications for phase appropriate intervention strategies. *Sex Transm Infect* 2002;78 Suppl 1:i3–13.
12 Kenyon C, Buyze J, Colebunders R. Classification of incidence and prevalence of certain sexually transmitted infections by world regions. *Int J Infect Dis* 2014;18:73–80.
13 Monteiro EF, Lacey CJN, Merrick D. The interrelation of demographic and geospatial risk factors between four common sexually transmitted diseases. *Sex Transm Infect* 2005;81:41–6.
14 Hawkes S, Santhya KG. Diverse realities: sexually transmitted infections and HIV in India. *Sex Transm Infect* 2002;78 Suppl 1:i31–9.
15 Shendre MC, Tiwari RR. Social risk factors for sexually transmitted diseases. *Indian J Dermatol Venereol Leprol* 2002;68:25.
16 Chaudhary N, Kalyan R, Singh M, *et al*. Prevalence of reproductive tract infections in women attending a tertiary care center in northern India with special focus on associated risk factors. *Indian J Sex Transm Dis AIDS* 2019;40:113–9.
17 Desai GS, Patel R. Incidence of reproductive tract infections and sexually transmitted diseases in India: levels and differentials. *The Journal of Family Welfare* 2011;57:48–60.

18 Reza-Paul S, Steen R, Maiya R, *et al*. Sex worker community-led interventions interrupt sexually transmitted Infection/Human immunodeficiency virus transmission and improve human immunodeficiency virus cascade outcomes: a program review from South India. *Sex Transm Dis* 2019;46:556–62.
19 Beksinska A, Prakash R, Isac S, *et al*. Violence experience by perpetrator and associations with HIV/STI risk and infection: a cross-sectional study among female sex workers in Karnataka, South India. *BMJ Open* 2018;8:e021389.
20 Medhi GK, Mahanta J, Phukan SK, *et al*. Factors associated with Chlamydia trachomatis and Neisseria gonorrhoeae infection among female sex workers in Nagaland, India. *Int J Community Med Public Health* 2017;4:1199.
21 Prakash R, Manthri S, Tayyaba S, *et al*. Effect of physical violence on sexually transmitted infections and treatment seeking behaviour among female sex workers in Thane district, Maharashtra, India. *PLoS One* 2016;11:e0150347.
22 Aggarwal P, Bhattar S, Sahani SK, *et al*. Sexually transmitted infections and HIV in self reporting men who have sex with men: a two-year study from India. *J Infect Public Health* 2016;9:564–70.
23 Rathod ND, Akre CV. An epidemiological cross sectional study to assess the prevalence of reproductive tract infections and sexually transmitted infections among married women in the reproductive age group in urban slum of Mumbai, Maharashtra, India. *Int J Community Med Public Health* 2018;5:4778.
24 Nigam VS, Srivastava VK. Knowledge about sexually transmitted disease (STD) among the women in a rural population of Uttar Pradesh. *International Journal of Medical Science and Clinical Invention* 2018;5:3966–9.
25 Sreelatha CY, Sumana M, Sundar M. Prevalence of symptoms of reproductive tract infections among married reproductive age group women in selected rural areas of Hassan, Karnataka, India. *International Journal of Community Medicine and Public Health* 2017;4:206–10.
26 International Institute for Population Sciences (IIPS). *National family health survey (NFHS-3), 2005-06: India*. Mumbai: International Institute for Population Sciences, 2007.
27 International Institute for Population Sciences (IIPS). *National family health survey (NFHS-4), 2015-16: India*. Mumbai: International Institute for Population Sciences, 2017.
28 Arora P, Nagelkerke N, Sgaier SK, *et al*. Hiv, HSV-2 and syphilis among married couples in India: patterns of discordance and concordance. *Sex Transm Infect* 2011;87:516–20.
29 Subramanian SV, Nandy S, Irving M, *et al*. Role of socioeconomic markers and state prohibition policy in predicting alcohol consumption among men and women in India: a multilevel statistical analysis. *Bull World Health Organ* 2005;83:829–36.
30 Subramanian SV, Nandy S, Irving M, *et al*. The mortality divide in India: the differential contributions of gender, caste, and standard of living across the life course. *Am J Public Health* 2006;96:818–25.
31 Brosius C. *India's middle class: New forms of urban leisure, consumption and prosperity*. New Delhi: Routledge, 2012.
32 Mishra V, Assche SB-V, Greener R, *et al*. HIV infection does not disproportionately affect the poorer in sub-Saharan Africa. *AIDS* 2007;21 Suppl 7:S17–28.
33 Hargreaves JR, Glynn JR. Educational attainment and HIV-1 infection in developing countries: a systematic review. *Trop Med Int Health* 2002;7:489–98.
34 Anguzu G, Flynn A, Musaazi J, *et al*. Relationship between socioeconomic status and risk of sexually transmitted infections in Uganda: multilevel analysis of a nationally representative survey. *Int J STD AIDS* 2019;30:284–91.
35 Sheikh YA. Higher education in India: challenges and opportunities. *Journal of Education and Practice* 2017;8:39–42.
36 Gupta D, Gupta N. Higher education in India: structure, statistics and challenges. *Journal of Education and Practice* 2012;3:17–24.
37 Thomas JJ. The demographic challenge and employment growth in India. *Econ Polit Wkly* 2014;48:15–17.
38 Tejani S. Jobless growth in India: an investigation. *Cambridge J Econ* 2016;40:843–70.
39 Tripathi S. Health seeking behavior: Q-Structures of rural and urban women in India with sexually transmitted diseases and reproductive tract infections. *RTPG* 2000;52:218–32.
40 Shingade PP, Kazi Y, LH M. Treatment seeking behavior for sexually transmitted infections/reproductive tract infections among married women in urban slums of Mumbai, India. *SE Asia J. Pub. Health* 2015;5:65–70.
41 Gour D, Toppo M, Pal DK, *et al*. Rapid Assessment of low utilisation of sexually transmitted infection services amongst high risk groups in designated sexually transmitted infection clinics of Bhopal" - a qualitative study. *Indian J Sex Transm Dis AIDS* 2020;41:58–62.
42 International Institute for Population Sciences (IIPS). *Interviewer's manual: National family health survey 2015-16 (NFHS-4)*. Mumbai: International Institute for Population Sciences, 2014.