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Socio-economic patterning of tobacco use in Indian states

S. Agrawal,* A. Karan,†‡ S. Selvaraj,† N. Bhan,§ S. V. Subramanian,§ C. Millett*¶

*South Asia Network for Chronic Disease, Public Health Foundation of India, New Delhi, †Public Health Foundation of India, New Delhi, India; ‡Department of Public Health, University of Oxford, Oxford, UK; §Department of Society, Human Development and Health, Harvard School of Public Health, Boston, Massachusetts, USA; ¶Department of Primary Care and Public Health, School of Public Health, Imperial College London, London, UK

SUMMARY

BACKGROUND: Studies in India have identified marked variations in overall tobacco use between socio-economic groups. We examined whether associations between socio-economic status (SES) and tobacco use varied across individual Indian states by tobacco type.

METHODS: Cross-sectional survey of 100 855 households in 24 Indian states and Union Territories conducted in 2009–2010. Outcome measures were household tobacco consumption by type. Logistic and linear regression models were used to examine associations at the household level between education, income and use and volume of tobacco consumed.

RESULTS: Overall, 52% of households used any form of tobacco product; the predominant form was smokeless tobacco (22%), followed by *bidi* (17%) and cigarettes (4%). Increasing household income and higher education level were associated with a higher likelihood of cigarette use but a lower likelihood of *bidi* and smokeless tobacco use in some Indian states. Increasing household income was associated with higher volumes of cigarette and *bidi* use among consuming households; however, association between educational level and volume of tobacco consumption was inconsistent.

CONCLUSION: SES has a varying impact on different types of tobacco use in Indian states. Policy makers should consider socio-economic patterning of tobacco use when designing, implementing and evaluating tobacco control interventions in different states of India.

KEY WORDS: tobacco; cigarettes; *bidi*; smokeless tobacco; National Sample Survey; India

TOBACCO USE is of growing public health concern in India. Recent survey data indicate that the country has some 275 million tobacco users,[1] with a higher number of smokeless tobacco users than smokers (cigarettes and *bidis* combined). *Bidis*, a slim, handrolled, unfiltered inexpensive locally produced product, are more commonly smoked than cigarettes in rural areas and among groups of lower socio-economic status (SES).[1] Smoking is estimated to have caused one million deaths in India in 2010, with 70% occurring in middle-aged groups.[2] Overall, 52% (n = 36 000 per annum) of oral cancers in India are due to smokeless tobacco use.[3] The total cost of tobacco use to the Indian economy in 2004 was $1.7 billion.[4]

There is considerable heterogeneity in the prevalence, type and volume of tobacco use between states in India.[1] The prevalence of tobacco use ranged from 9% in Goa to 67% in Mizoram in 2009–2010.[1] This likely reflects different historical and cultural factors that have encouraged or discouraged tobacco consumption in different parts of the country. For example, tobacco is an integral part of the socio-cultural milieu of various socio-economic groups in parts of eastern and northern India in particular, and is frequently offered to guests at family and social gatherings. State-level variations in tobacco use also reflect variations in the implementation of tobacco control strategies, such as increases in taxation and the creation of smoke-free workplaces, and the relative success of promotional activities by the tobacco industry.[5] Less is known about the impact of these drivers on the socio-economic patterns of tobacco use in Indian states.

Previous studies have identified marked variations in tobacco use between socio-economic groups in India.[5,6] However, it is unclear whether the associations identified in national-level studies are consistently present in individual Indian states. Furthermore, as previous studies have provided little information on the type and volume of tobacco consumed in India, they have been unable to adequately guide the development and evaluation of tobacco control interventions. Moreover, smokeless tobacco, which is the most dominant form of tobacco consumption in India, has been inadequately addressed in Indian literature. This study seeks to address this important

Correspondence to: Sutapa Agrawal, South Asia Network of Chronic Disease Public Health Foundation of India, First Floor, C-1/52, Safdarjung Development Area, New Delhi 110 016, India. Tel: (+11) 2651 3082, (+11) 2651 3099. Fax: (+11) 2653 4593. e-mail: sutapaiips@rediffmail.com or sutapa.agrawal@phfi.org

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knowledge gap by examining state-level variations in household use and consumption by tobacco type, and the extent to which tobacco use in India is patterned by income and educational levels.

METHODS

Study setting, design and data

Data for this study come from the Consumer Expenditure Survey (CES) of the 66th round of the National Sample Survey (NSS) conducted by the National Sample Survey Organization (New Delhi, India) between 1 July 2009 and 30 June 2010. The NSS is a continuing integrated multi-subject survey being conducted in successive rounds. The CES of the 66th round of the NSS (66th NSS) collected data from 100 855 households in 7428 villages and 5263 urban blocks throughout the entire country via stratified multi-stage sampling covering all the States and Union Territories in India, making the survey representative at national as well as state levels. Full details on the 66th NSS are presented in the basic survey report for all India.[7]

In addition to collecting detailed socio-economic and demographic information from sampled households, the CES also collected data on quantity of and expenditure on the consumption of more than 350 food and non-food items. Information on tobacco product consumption is collected under eight product classifications: 1) *bidi*, 2) cigarette, 3) leaf tobacco, 4) snuff, 5) hookah tobacco, 6) cheroot, 7) *zarda* (flavoured tobacco, prepared by blending tobacco leaves, perfumes, sweeteners and other compounds, primarily used in betel leaves), *kimam* (chewing tobacco used in betel leaves), *surti* (dried tobacco leaves consumed with lime) taken together, and 8) other tobacco products. Data on tobacco consumption are available based on a 30-day recall period in the Type 1 schedule and 7-day recall period in the Type 2 schedule of the 66th NSS. For the present analysis, we used the information on tobacco consumption from the Type 1 schedule, i.e., the 30-day recall-based data.

Prior informed consent was obtained from each respondent. The analysis presented in this study is based on secondary analysis of existing survey data with all identifying information removed.

All data on consumption in the 66th NSS are collected at the household level; data from individual members of the household are therefore not available in the database. Detailed information in the prescribed schedules is obtained by interviewing the heads of households or any knowledgeable member of the household by face-to-face interview. We defined tobacco-consuming households as all those households that responded positively regarding the purchase of any tobacco products in the last 30 days. We used information on the quantity of each tobacco product purchase by households given in the database. The units are given as 'number of sticks' (for cigarettes, *bidis*, *cheroot*, etc.) or 'grams' (for leaf tobacco, *surti*, etc). We used the volume in the same units as reported in the database.

Variables

Our main outcome measures are household tobacco use (household reporting purchase of any tobacco product) and volume (quantity purchased) by type of tobacco products. We conducted analyses on three main tobacco products; cigarettes, *bidis* and smokeless tobacco (combining tobacco leaf, *zarda, kimam* and *surti*). These three together constitute approximately 97% of all the tobacco-consuming households, with approximately 10% of consuming households using multiple tobacco products. These tobacco products are used variously by different kinds of households in India, and analysing them separately may yield results that are useful for public policy. We therefore analysed 'exclusively cigarette', 'exclusively *bidi*', 'exclusively smokeless' and 'multiple tobacco use' households separately to avoid overestimation.

Our main predictor variables are total household expenditure (proxy for household income) and average educational level of adult household members. Educational level was computed as mean completed years of education, excluding children who were still in school. Both monthly per capita consumption expenditure and mean years of education of households were used in the analyses as tertiles, based on rankings of the households from the surveys at the state level. These tertiles were created after applying household-level sample weights, which represent the proportional probability of a sample household in the country (i.e., the total number of households in the country at the time of the survey). Other covariates in our analysis include household size, number and mean age of adults in household, male/female ratio, employment status, caste/tribe status, religion and rural/urban location. Distribution of households in the sample by these categories is shown in Table 1.

Statistical analysis

As approximately 50% of the households in the sample did not report any tobacco consumption, we used two-part models (TPMs) to correct for skewness in the overall distribution of households. The TPM produced estimates on 1) the probability of households consuming a tobacco product and 2) given the positive consumption of a tobacco product, the intensity (in terms of quantity consumed) of use of the tobacco products. Symbolically, the TPM can be written as:

$$\text{Part I: } \text{Prob}(\text{consumption} > 0) = \chi\beta + \epsilon \quad (1)$$

$$\text{Part II: } \text{Log}(\text{volume}|\text{consumption} > 0) = \chi\gamma + \mu \quad (2)$$

where χ represents a vector of predictors and other covariates that are hypothesised to affect tobacco consumption by households, β and γ are vectors of

Table 1 Percentage distribution of sample households by selected characteristics, and percentage of households reporting consumption of different tobacco products, National Sample Survey, 2009–2010

Selected characteristic	Households *n* (%)	Cigarette-consuming households %	*Bidi*-consuming households %	Smokeless tobacco-consuming households %	Multiple tobacco-consuming households* %	Any tobacco-consuming households† %
Caste/tribe‡						
Scheduled Tribe	13 150 (13.0)	1.7	18.5	32.7	14.1	67.0
Scheduled Caste	16 388 (16.3)	3.0	21.9	23.1	11.7	59.7
Other Backward Classes	37 881 (37.6)	3.5	15.5	22.4	8.2	49.7
General	33 436 (33.2)	4.4	13.7	16.6	7.1	41.9
Religion						
Hindu	76 823 (76.2)	3.4	16.4	22.6	9.0	51.4
Muslim	12 445 (12.3)	3.8	21.6	18.4	11.1	55.0
Christian	6 968 (6.9)	9.6	11.2	11.0	8.3	40.2
Others§	4 619 (4.6)	1.0	5.1	17.6	4.5	28.1
Income tertiles¶						
Poorest	29 868 (29.6)	1.6	18.7	29.7	10.6	59.6
Middle	31 620 (31.4)	3.3	18.1	22.9	9.4	2.7
Richest	39 367 (39.0)	5.6	12.8	14.5	7.4	40.3
Education tertiles#						
Lowest	23 429 (23.2)	1.4	22.5	25.4	11.3	60.6
Middle	32 678 (32.4)	2.9	20.2	23.5	11.4	58.0
Highest	44 748 (44.4)	6.3	6.8	16.1	4.6	33.8
Employment category**						
Self-employed	46 772 (46.4)	3.2	17.3	23.8	10.4	54.8
Regular wage	15 769 (15.6)	7.1	6.2	14.3	3.8	31.3
Casual/agricultural labour	22 386 (22.2)	2.6	22.5	24.6	11.1	60.8
Others	15 928 (15.8)	3.6	6.4	12.6	3.9	26.5
Household size						
<5 members	72 179 (71.6)	3.9	15.3	19.2	7.4	45.7
>5 members	28 676 (28.4)	2.6	20.0	28.6	13.8	64.9
Place of residence						
Rural	59 119 (58.6)	2.4	19.6	24.7	10.9	57.7
Urban	41 736 (41.4)	6.2	9.1	14.6	4.8	34.7

*Includes use of at least two of the three main tobacco products (cigarette, *bidi* and smokeless tobacco).
†Includes at least one or more of the three main tobacco products.
‡Scheduled Castes and Scheduled Tribes are historically marginalised and identified by the Government of India as socially and economically backward and needing protection from social injustice and exploitation. Scheduled Castes are a constitutionally declared group of castes, who suffered from the practice of untouchability, whereas Scheduled Tribes constitute the tribal population in India, who may be also referred to as the indigenous groups. Other Backward Classes is a diverse collection of intermediate castes that were considered low in the traditional caste hierarchy, but are clearly above Scheduled Castes. General is thus a default residual group that enjoys higher status in the caste hierarchy.
§Includes Sikh, Buddhist, Jain, Jewish, Zoroastrian.
¶Income tertiles has been calculated from per capita monthly consumption expenditure of households. As both income and education tertiles were calculated after applying weights to the sample, the sample distribution in each tertile is not equal across groups.
#Computed from mean completed years of education, excluded for children who are still in school.
**Based on the concept of main employment of the household, which is estimated on the basis of the main source of livelihood of the households in urban and in rural areas separately.

parameters estimates of the respective models, and € and μ are stochastic error terms. We report odds ratios (ORs) from Part I and coefficient estimates from Part II of the model. The estimations were conducted separately at two levels: 1) all-India level and 2) the 24 major Indian states. As estimates at the all-India level are also corrected for the state-level fixed effects, more specifically the two equations of the TPM can be written as:

$$\text{log}it(C_{ij}) = \alpha + \beta_1\text{income} + \beta_2\text{education} + \beta_3 X_{ij} + \varepsilon_i + \eta_j \quad (3)$$

$$\text{Log}(V_{ij}) = \alpha + \beta_1\text{income} + \beta_2\text{education} + \beta_3 X_{ij} + \varepsilon_i + \eta_j \quad (4)$$

where C_{ij} and V_{ij} are dummy for consumption and volume of consumption respectively, and X_{ij} is a vector of covariates for household i living in state j, income and education are main predictors and α and β are parameter estimates. ε_i and η_j are two error terms generated at the household and state levels, respectively. For the state level results, the second error term does not exist, as the logistic and linear regression models were used separately for each state. Based on these equations, we present our results separately for the three tobacco products—cigarette, *bidi* and smokeless tobacco—and for dual and any tobacco use.

We report the results separately for all-India and 24 major states (with north-eastern states and Union Territories combined in two separate groups).

RESULTS

The total number of households covered in the 2009–2010 NSS was 100 855 (59 119 rural and 41 736

urban), representing a response rate of 98%. Nationally, 52% of the households reported some type of tobacco use and one in 11 households reported multiple tobacco use, the dominant form being smokeless tobacco (22%), followed by *bidi* (17%) and cigarettes (4%; Appendix Table A.1*). The state-level range for households reporting any tobacco use was 19–77%, and multiple tobacco use ranged from 1% (Delhi) to 27% (Assam). There was considerable state-level variation in the proportion of households reporting exclusive cigarette use (0.7–14.8%), *bidi* use (3.2–41%) and smokeless tobacco use (1.7–57.5%).

The mean monthly volume of tobacco consumption in consuming households was 192 g of smokeless tobacco, 375 *bidis* and 77 cigarettes nationally (Appendix Table A.2). The state-level range in mean monthly usage in consuming households was 25–133 cigarettes, 89–672 *bidis* and 100–365 g of smokeless tobacco.

Socio-economic patterning of tobacco use at the national level

Variations in tobacco use by household characteristics are presented in Table 1. The proportion of households reporting exclusive cigarette use (OR 3.45, 95% confidence interval [CI] 3.13 to 3.81) and multiple tobacco use (OR 1.53, 95%CI 1.43 to 1.70) was higher with *bidi* (OR 0.74, 95%CI 0.70 to 0.79) and smokeless tobacco use was lower (OR 0.72, 95%CI 0.68 to 0.76) in the highest income tertile (Table 2). The proportion of households reporting exclusive cigarette use (OR 2.22, 95%CI 1.98 to 2.49) was higher with multiple tobacco use (OR 0.55, 95%CI 0.51 to 0.59), *bidi* (OR 0.31, 95%CI 0.29 to 0.33) and smokeless tobacco use was lower (OR 0.86, 95%CI 0.81 to 0.90) in the highest education tertile (Table 2). A similar result was found for coefficient of tobacco consumption in volume with income and education categories.

Social patterning of tobacco use at the state level

Income

The proportion of households reporting exclusive cigarette use was significantly greater in the highest income tertile in 18 of the 24 states and territories studied (Table 3), while the proportion of households reporting exclusive *bidi* was significantly lower in the highest income tertile in 14/24 states and territories studied. The odds of households reporting exclusive smokeless tobacco use was significantly lower in the highest income tertile in 9/24 states and territories studied. The proportion of households reporting multiple tobacco use was significantly greater in the

Table 2 Adjusted ORs and coefficient (with 95%CIs) showing the association between income, education and tobacco consumption including monthly volume of tobacco consumption at the all-India level, 2009–2010*

	Probability of tobacco consumption					Coefficient of tobacco consumption in volume		
Predictor	Cigarette OR (95%CI)	*Bidi* OR (95%CI)	Smokeless tobacco OR (95%CI)	Multiple tobacco use OR (95%CI)	Any tobacco use OR (95%CI)	Cigarette coefficient (95%CI)	*Bidi* coefficient (95%CI)	Smokeless tobacco coefficient (95%CI)
Income tertile								
High	3.45 (3.13 to 3.81)	0.74 (0.70 to 0.79)	0.72 (0.68 to 0.76)	1.53 (1.43 to 1.70)	1.10 (1.06 to 1.15)	0.76 (0.69 to 0.83)	0.25 (0.22 to 0.28)	0.20 (0.16 to 0.24)
Medium	1.99 (1.81 to 2.19)	0.91 (0.86 to 0.96)	0.88 (0.84 to 0.92)	1.25 (1.17 to 1.32)	1.08 (1.04 to 1.12)	0.35 (0.28 to 0.42)	0.15 (0.12 to 0.17)	0.10 (0.06 to 0.13)
Low[reference]	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)	0 (reference)	0 (reference)	0 (reference)
Education tertile								
High	2.22 (1.98 to 2.49)	0.31 (0.29 to 0.33)	0.86 (0.81 to 0.90)	0.55 (0.51 to 0.59)	0.46 (0.44 to 0.48)	0.31 (0.23 to 0.39)	−0.21 (−0.24 to −0.17)	−0.11 (−0.16 to −0.08)
Medium	1.51 (1.35 to 1.70)	0.74 (0.71 to 0.78)	1.11 (1.06 to 1.17)	0.87 (0.82 to 0.92)	0.84 (0.80 to 0.87)	0.09 (0.02 to 0.17)	−0.06 (−0.09 to −0.03)	−0.03 (−0.07 to 0.00)
Low[reference]	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)	0 (reference)	0 (reference)	0 (reference)

* Adjusted ORs and coefficients potentially controlled for mean age of adults in household, number of adults in household, male/female ratio, household size, education, employment, caste/tribe, religion, rural/urban location and state.
OR = odds ratio; CI = confidence interval.

* The Appendix is available in the online version of this article at http://www.ingentaconnect.com/content/iuatld/ijtld/2013/00000017/00000008/art00021

Table 3 Adjusted ORs (with 95%CIs) showing the association between household income and type of tobacco use in states of India, 2009–2010*

State	Cigarette OR (95%CI)	*Bidi* OR (95%CI)	Smokeless tobacco OR (95%CI)	Multiple tobacco use OR (95%CI)	Any tobacco use OR (95%CI)
Delhi	6.08 (1.87 to 19.74)	0.46 (0.22 to 0.96)	0.73 (0.34 to 1.58)	1.10 (0.23 to 5.33)	1.02 (0.63 to 1.63)
Haryana	19.86 (2.46 to 160.34)	0.92 (0.71 to 1.20)	1.55 (0.80 to 2.99)	1.13 (1.02 to 4.43)	1.25 (0.96 to 1.61)
Himachal Pradesh	7.96 (2.11 to 30.06)	0.55 (0.40 to 0.74)	1.42 (0.56 to 3.60)	1.25 (0.77 to 2.05)	0.79 (0.60 to 1.05)
Jammu & Kashmir	2.30 (1.72 to 3.09)	0.59 (0.37 to 0.95)	0.55 (0.27 to 1.13)	5.25 (2.48 to 11.09)	1.52 (1.20 to 1.93)
Punjab	2.55 (0.79 to 6.89)	0.50 (0.32 to 0.78)	0.86 (0.52 to 1.41)	0.93 (0.41 to 2.11)	0.71 (0.52 to 0.97)
Rajasthan	4.00 (1.25 to 12.76)	1.16 (0.94 to 1.43)	0.56 (0.44 to 0.72)	1.06 (0.80 to 1.42)	0.90 (0.74 to 1.09)
Uttaranchal	2.97 (0.82 to 10.79)	0.49 (0.33 to 0.72)	1.58 (0.87 to 2.87)	1.25 (0.69 to 2.29)	0.95 (0.67 to 1.34)
Assam	15.81 (4.82 to 51.92)	0.44 (0.32 to 0.60)	0.74 (0.60 to 0.93)	2.05 (1.60 to 2.61)	1.20 (0.95 to 1.53)
Other north-eastern states†	3.84 (3.02 to 4.88)	0.58 (0.49 to 0.69)	0.74 (0.65 to 0.85)	1.35 (1.18 to 1.56)	1.24 (1.10 to 1.40)
Chhattisgarh	2.56 (0.54 to 12.09)	1.06 (0.60 to 1.86)	0.79 (0.61 to 1.03)	1.30 (0.89 to 1.88)	0.93 (0.69 to 1.26)
Madhya Pradesh	7.68 (2.24 to 26.24)	1.04 (0.83 to 1.31)	0.70 (0.57 to 0.84)	1.68 (1.32 to 2.14)	1.18 (0.97 to 1.42)
Uttar Pradesh	5.92 (2.40 to 14.60)	1.16 (0.99 to 1.37)	0.63 (0.54 to 0.72)	0.99 (0.82 to 1.19)	0.80 (0.70 to 0.91)
Bihar	3.32 (1.64 to 6.68)	1.43 (0.88 to 2.30)	0.72 (0.60 to 0.86)	2.13 (1.53 to 2.99)	1.06 (0.87 to 1.29)
Jharkhand	3.23 (0.45 to 2.16)	1.01 (0.51 to 1.99)	0.68 (0.54 to 0.86)	1.84 (1.20 to 2.82)	0.95 (0.75 to 1.21)
West Bengal	11.12 (5.77 to 21.40)	0.55 (0.47 to 0.65)	1.04 (0.79 to 1.36)	2.39 (1.93 to 2.94)	1.64 (1.39 to 1.94)
Orissa	—‡	0.60 (0.40 to 0.90)	0.53 (0.43 to 0.65)	1.98 (1.51 to 2.60)	0.75 (0.61 to 0.92)
Maharashtra	4.15 (2.25 to 7.66)	0.65 (0.44 to 0.96)	0.93 (0.80 to 1.09)	1.37 (0.89 to 2.10)	1.07 (0.92 to 1.24)
Goa	1.97 (0.73 to 5.29)	0.24 (0.05 to 1.20)	0.25 (0.03 to 2.11)	1.25 (0.29 to 5.40)	0.93 (0.46 to 1.84)
Gujarat	21.97 (4.58 to 105.37)	0.78 (0.57 to 1.06)	0.83 (0.63 to 1.10)	1.10 (0.73 to 1.68)	0.98 (0.78 to 1.23)
Andhra Pradesh	3.12 (2.43 to 4.00)	0.47 (0.36 to 0.60)	1.10 (0.81 to 1.49)	2.12 (1.40 to 3.22)	1.40 (1.19 to 1.64)
Karnataka	9.84 (4.36 to 22.20)	1.18 (0.88 to 1.58)	0.34 (0.22 to 0.53)	2.75 (1.45 to 5.22)	1.29 (1.03 to 1.63)
Kerala	2.22 (1.67 to 2.94)	0.55 (0.38 to 0.78)	1.65 (0.84 to 3.24)	1.46 (0.89 to 2.37)	1.48 (1.19 to 1.83)
Tamil Nadu	3.49 (2.56 to 4.76)	0.75 (0.57 to 0.97)	1.06 (0.66 to 1.71)	2.29 (1.37 to 3.85)	1.58 (1.32 to 1.89)
Union Territories§	1.86 (1.00 to 3.47)	0.39 (0.19 to 0.81)	0.80 (0.49 to 1.29)	1.08 (0.41 to 2.89)	0.83 (0.59 to 1.18)

*ORs are for the highest income tertile with the lowest income tertile as the reference category. Adjusted ORs potentially controlled for mean age of adults in household, number of adults in household, male/female ratio, household size, education, employment, caste/tribe, religion and rural/urban location.
†Includes Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura.
‡Analysis could not be performed due to the low sample size of the outcome in the base category.
§Daman and Diu, Lakshadweep, Pondicherry (Puduchery), and Andaman and Nicobar Islands.
OR = odds ratio; CI = confidence interval.

highest income tertile in 12/24 states studied. The proportion of households reporting any tobacco use was significantly lower in the highest income tertile in three states and significantly greater in the highest income tertile in seven states. There was no significant relationship between household income and any tobacco use in 14 states.

The mean monthly volume of cigarettes consumed in households exclusively using cigarettes was significantly higher in the highest income tertile in 5/24 states and territories studied (Table 4). The mean monthly volume of *bidis* consumed in households exclusively using *bidis* was significantly greater in the highest income tertile household in 13 states. The mean monthly volume of smokeless tobacco consumed in households exclusively using smokeless tobacco increased in the highest income tertile category in seven states.

Education

The proportion of households reporting exclusive cigarette use was significantly higher in the highest education tertile in nine of the 24 states and Union Territories studied (Table 5). The proportion of households reporting exclusive *bidi* use was significantly lower in the high education tertile group in 23/24 states and Union Territories studied. The proportion of households reporting exclusive smokeless tobacco use was significantly lower in the highest education tertile in 13/24 states and Union Territories studied. The proportion of households reporting multiple tobacco use was significantly lower in the highest education tertile in 20/24 states studied. The proportion of households reporting any tobacco use was also significantly lower in the highest education tertile in 21/24 states and territories studied.

The mean monthly volume of cigarettes consumed in households exclusively using cigarettes was significantly greater in the highest education tertile in only 5/24 states and territories studied (Table 4). The mean monthly volume of *bidis* consumed in households exclusively using *bidis* decreased in eight states and there was no association in 17 states. The mean monthly volume of smokeless tobacco consumed in households exclusively using smokeless tobacco decreased in seven states, and there was no association in 15 states.

DISCUSSION

Main findings

We found varied associations between household income and tobacco use by type in Indian states. Increasing household income was associated with a higher likelihood of cigarette use in most states, but associations between income and *bidi* as well as income and smokeless tobacco were more variable.

Table 4 Adjusted coefficient (with 95%CI) showing the association between household income, education and monthly volume of tobacco use in states of India, 2009–2010*

State	Income			Education		
	Cigarette coefficient (95%CI)	*Bidi* coefficient (95%CI)	Smokeless tobacco coefficient (95%CI)	Cigarette coefficient (95%CI)	*Bidi* coefficient (95%CI)	Smokeless tobacco coefficient (95%CI)
Delhi	1.20 (0.14 to 2.26)	0.15 (−0.30 to 0.60)	0.46 (−0.35 to 1.28)	0.00 (−0.79 to 0.80)	−0.28 (−0.82 to 0.26)	0.23 (−0.86 to 1.33)
Haryana	−0.34 (−2.02 to 1.33)	0.24 (0.11 to 0.37)	0.55 (0.00 to 1.11)	0.33 (−0.51 to 1.17)	−0.10 (−0.24 to 0.03)	−0.14 (−0.74 to 0.46)
Himachal Pradesh	1.35 (0.90 to 1.79)	0.10 (−0.03 to 0.23)	0.93 (0.20 to 1.66)	0.20 (−0.22 to 0.61)	0.02 (−0.11 to 0.15)	−1.08 (−2.15 to −0.01)
Jammu and Kashmir	0.13 (−0.09 to 0.35)	−0.21 (−0.51 to 0.09)	−1.30 (−2.09 to −0.50)	0.14 (−0.09 to 0.35)	0.16 (−0.14 to 0.46)	−0.42 (−1.25 to 0.41)
Punjab	−0.09 (−1.23 to 1.05)	−0.09 (−0.45 to 0.27)	−0.16 (−0.62 to 0.30)	0.15 (−1.20 to 1.50)	−0.63 (−1.02 to −0.23)	−0.35 (−0.87 to 0.17)
Rajasthan	1.21 (0.62 to 1.80)	0.06 (−0.04 to 0.16)	0.04 (−0.17 to 0.25)	0.21 (−0.39 to 0.81)	−0.25 (−0.36 to −0.15)	0.07 (−0.15 to 0.29)
Uttaranchal	0.09 (−1.01 to 1.20)	0.19 (0.02 to 0.35)	0.54 (−0.07 to 1.15)	1.16 (0.20 to 2.13)	−0.03 (−0.21 to 0.15)	−0.11 (−0.80 to 0.57)
Assam	0.89 (0.44 to 1.33)	0.27 (0.11 to 0.42)	0.21 (0.09 to 0.34)	0.10 (−0.25 to 0.46)	−0.50 (−0.68 to −0.32)	−0.24 (−0.37 to −0.11)
Other north-eastern states†	0.74 (0.59 to 0.89)	0.17 (0.08 to 0.27)	0.00 (−0.14 to 0.15)	0.51 (0.36 to 0.66)	−0.26 (−0.36 to −0.16)	−0.10 (−0.25 to 0.04)
Chhattisgarh	1.53 (0.70 to 2.37)	0.22 (−0.01 to 0.46)	0.03 (−0.16 to 0.22)	−0.58 (−1.40 to 0.25)	−0.22 (−0.49 to 0.04)	0.15 (−0.05 to 0.35)
Madhya Pradesh	0.22 (−0.38 to 0.81)	0.42 (0.28 to 0.55)	0.23 (0.09 to 0.37)	0.54 (0.11 to 0.97)	−0.43 (−0.56 to −0.29)	−0.10 (−0.25 to 0.06)
Uttar Pradesh	0.30 (−0.15 to 0.74)	0.30 (0.21 to 0.38)	0.26 (0.16 to 0.36)	0.38 (−0.11 to 0.86)	−0.08 (−0.08 to 0.06)	−0.11 (−0.22 to −0.01)
Bihar	0.73 (0.31 to 1.15)	0.16 (−0.14 to 0.45)	0.10 (0.03 to 0.18)	0.04 (−0.39 to 0.47)	−0.13 (−0.45 to 0.19)	−0.13 (−0.21 to −0.06)
Jharkhand	0.12 (−0.34 to 0.58)	0.39 (0.10 to 0.67)	0.13 (0.02 to 0.23)	0.44 (−0.05 to 0.92)	−0.04 (−0.33 to 0.24)	−0.10 (−0.20 to 0.00)
West Bengal	0.62 (0.37 to 0.88)	0.08 (−0.00 to 0.15)	−0.04 (−0.28 to 0.21)	0.50 (0.29 to 0.70)	−0.10 (−0.17 to −0.02)	0.11 (−0.14 to 0.36)
Orissa	0.97 (0.05 to 1.88)	0.54 (0.38 to 0.71)	0.26 (0.04 to 0.47)	0.51 (−0.11 to 1.14)	0.16 (−0.03 to 0.35)	−0.50 (−0.72 to −0.30)
Maharashtra	0.40 (−0.07 to 0.86)	0.60 (0.29 to 0.90)	0.39 (0.28 to 0.50)	0.32 (−0.04 to 0.68)	−0.51 (−0.90 to −0.13)	−0.27 (−0.38 to −0.15)
Goa	0.67 (−0.02 to 1.36)	−0.50 (−2.14 to 1.15)	—	0.29 (−0.40 to 0.99)	0.69 (−1.03 to 2.41)	—
Gujarat	0.89 (0.13 to 1.65)	0.48 (0.28 to 0.68)	0.39 (−0.12 to 0.89)	0.71 (0.18 to 1.25)	−0.37 (−0.58 to −0.16)	−0.48 (−0.98 to 0.01)
Andhra Pradesh	0.67 (0.49 to 0.85)	0.27 (0.12 to 0.42)	0.09 (−0.23 to 0.40)	0.21 (0.02 to 0.39)	0.03 (−0.14 to 0.20)	−0.38 (−0.79 to 0.03)
Karnataka	0.96 (0.47 to 1.45)	0.33 (0.14 to 0.52)	0.31 (−0.06 to 0.69)	−0.08 (−0.50 to 0.33)	0.07 (−0.15 to 0.28)	0.13 (−0.25 to 0.51)
Kerala	0.72 (0.50 to 0.93)	0.12 (−0.09 to 0.34)	0.25 (−0.20 to 0.69)	−0.15 (−0.37 to 0.07)	−0.12 (−0.31 to 0.13)	−0.82 (−1.40 to −0.24)
Tamil Nadu	0.49 (0.25 to 0.73)	0.26 (0.08 to 0.44)	−0.03 (−0.48 to 0.42)	0.32 (0.09 to 0.54)	−0.05 (−0.24 to 0.16)	−0.48 (−1.16 to 0.20)
Union Territories‡	0.57 (0.06 to 1.08)	0.37 (−0.28 to 1.03)	0.31 (−0.04 to 0.66)	0.27 (−0.22 to 0.77)	−0.22 (−1.44 to 1.00)	−0.13 (−0.50 to 0.24)

*Coefficients potentially controlled for the mean age of adults in household, number of adults in household, male/female ratio, household size, household income, employment, caste/tribe, religion and rural/urban location.
†Includes Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura.
‡Daman and Diu, Lakshadweep, Pondicherry (Puduchery), and Andaman and Nicobar Islands.
OR = odds ratio; CI = confidence interval.

Table 5 Adjusted ORs (with 95%CIs) showing the association between education and type of tobacco use in states of India, 2009–2010*

State	Cigarette OR (95%CI)	*Bidi* OR (95%CI)	Smokeless tobacco OR (95%CI)	Multiple tobacco use OR (95%CI)	Any tobacco use OR (95%CI)
Delhi	1.11 (0.45 to 2.72)	0.22 (0.10 to 0.50)	0.10 (0.03 to 0.35)	—	0.30 (0.18 to 0.50)
Haryana	5.01 (1.37 to 18.36)	0.28 (0.22 to 0.36)	0.44 (0.23 to 0.86)	0.29 (0.15 to 0.57)	0.26 (0.44 to 0.69)
Himachal Pradesh	1.62 (0.68 to 3.84)	0.54 (0.40 to 0.73)	0.29 (0.11 to 0.76)	0.83 (0.51 to 1.35)	0.54 (0.41 to 0.71)
Jammu and Kashmir	1.19 (0.89 to 1.59)	0.28 (0.17 to 0.44)	0.48 (0.24 to 0.95)	0.38 (0.17 to 0.84)	0.67 (0.53 to 0.85)
Punjab	1.74 (0.54 to 5.64)	0.18 (0.11 to 0.29)	0.20 (0.11 to 0.35)	0.36 (0.14 to 0.92)	0.21 (0.15 to 0.29)
Rajasthan	1.93 (0.65 to 5.70)	0.35 (0.28 to 0.45)	1.33 (1.03 to 1.72)	0.46 (0.34 to 0.64)	0.40 (0.33 to 0.49)
Uttaranchal	2.62 (0.79 to 8.73)	0.31 (0.20 to 0.47)	1.34 (0.74 to 2.43)	0.39 (0.20 to 0.75)	0.38 (0.27 to 0.54)
Assam	2.73 (1.30 to 5.74)	0.28 (0.20 to 0.39)	0.97 (0.78 to 1.22)	0.84 (0.66 to 1.08)	0.48 (0.37 to 0.61)
Other north-eastern states†	3.36 (2.65 to 4.27)	0.31 (0.26 to 0.37)	0.80 (0.70 to 0.92)	0.69 (0.60 to 0.79)	0.57 (0.50 to 0.64)
Chhattisgarh	5.15 (1.05 to 25.25)	0.16 (0.08 to 0.32)	1.46 (1.11 to 1.91)	0.55 (0.37 to 0.82)	0.87 (0.64 to 1.18)
Madhya Pradesh	3.35 (1.34 to 8.42)	0.32 (0.25 to 0.40)	1.46 (1.19 to 1.79)	0.46 (0.36 to 0.59)	0.44 (0.36 to 0.54)
Uttar Pradesh	2.39 (1.10 to 5.19)	0.39 (0.33 to 0.47)	1.10 (0.95 to 1.28)	0.49 (0.40 to 0.60)	0.47 (0.41 to 0.53)
Bihar	1.42 (0.72 to 2.80)	0.42 (0.26 to 0.68)	1.19 (0.98 to 1.43)	0.69 (0.48 to 0.97)	0.94 (0.77 to 1.15)
Jharkhand	1.37 (0.67 to 2.80)	0.74 (0.37 to 1.50)	0.85 (0.68 to 1.07)	0.68 (0.45 to 1.03)	0.75 (0.59 to 0.95)
West Bengal	6.43 (3.70 to 11.15)	0.56 (0.47 to 0.67)	0.62 (0.46 to 0.82)	0.75 (0.61 to 0.93)	0.65 (0.55 to 0.77)
Orissa	—‡	0.56 (0.36 to 0.88)	0.84 (0.67 to 1.04)	0.57 (0.42 to 0.76)	0.58 (0.46 to 0.72)
Maharashtra	2.08 (1.24 to 3.49)	0.14 (0.09 to 0.23)	0.44 (0.38 to 0.51)	0.24 (0.15 to 0.37)	0.34 (0.30 to 0.40)
Goa	1.51 (0.62 to 3.67)	0.17 (0.03 to 0.91)	6.32 (0.59 to 67.89)	0.13 (0.03 to 0.64)	0.64 (0.34 to 1.20)
Gujarat	0.82 (0.31 to 2.13)	0.32 (0.23 to 0.44)	0.83 (0.62 to 1.10)	0.55 (0.36 to 0.84)	0.38 (0.31 to 0.48)
Andhra Pradesh	1.11 (0.86 to 1.42)	0.26 (0.20 to 0.34)	0.27 (0.19 to 0.38)	0.24 (0.15 to 0.38)	0.35 (0.30 to 0.42)
Karnataka	1.18 (0.60 to 2.32)	0.21 (0.15 to 0.29)	0.60 (0.40 to 0.89)	0.12 (0.05 to 0.29)	0.27 (0.21 to 0.34)
Kerala	0.84 (0.62 to 1.13)	0.30 (0.20 to 0.44)	0.20 (0.09 to 0.47)	0.28 (0.16 to 0.51)	0.40 (0.32 to 0.50)
Tamil Nadu	1.55 (1.14 to 2.11)	0.23 (0.17 to 0.30)	0.24 (0.13 to 0.42)	0.29 (0.16 to 0.54)	0.43 (0.66 to 0.89)
Union Territories§	1.58 (0.87 to 2.88)	0.04 (0.01 to 0.18)	0.21 (0.13 to 0.36)	0.12 (0.03 to 0.53)	0.24 (0.17 to 0.33)

*ORs are for the highest income tertile, with the lowest income tertile as the reference category. Adjusted ORs potentially controlled for mean age of adults in household, number of adults in household, male/female ratio, household size, education, employment, caste/tribe, religion and rural/urban location.
†Includes Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura.
‡Analysis could not be performed due to the low sample size of the outcome in the base category.
§Daman and Diu, Lakshadweep, Pondicherry (Puduchery), and Andaman and Nicobar Islands.
OR = odds ratio; CI = confidence interval.

Increasing household income was associated with higher volume of cigarette and *bidi* use, but not smokeless tobacco use, among consuming households in most Indian states. Increasing educational level was associated with lower *bidi* and smokeless tobacco use, but not cigarette use, in most Indian states. There was no consistent association between educational level and volume of cigarette, *bidi* or smokeless tobacco use among consuming households.

Strengths and limitations of the study

The NSS is a large, well-established survey that includes a representative sample of households in all Indian states and Union Territories. While data in the NSS are cross-sectional, the 2009–2010 data (66th round) provides the most recent snapshot of tobacco use in India. Further analysis is needed to discern whether the relationship between SES and tobacco use in Indian states has changed over time and how this relationship has been influenced by state- and national-level tobacco control policies. A limitation of using the NSS is the fact that it provides information at the household level instead of the individual level. Further work is required to confirm whether the relationships between SES and tobacco use identified in this study exist at the individual level. Previous studies have only examined the overall prevalence of tobacco consumption, with little exploration of volume and type of tobacco associated with the prevalence data.[5,6]

Previous studies

Lower SES has consistently been associated with higher smoking prevalence in industrialised country settings.[8] However, the relationship between SES and tobacco use in developing countries appears to be more mixed,[9,10] possibly reflecting the fact that many low- and middle-income countries are at an earlier stage of the tobacco epidemic, i.e., the SES gradient becomes most evident in the later stages of the epidemic, when net consumption declines.[11] There are limited data on the relationship between SES and the volume of tobacco consumed in developing countries.[8] We identified higher levels of cigarette and *bidi* consumption in higher income, tobacco-using households, but varied associations between household educational level and consumption.

Information on the relationship between SES and tobacco use at the state level in India is sparse. National-level studies in India have found higher smoking and chewing tobacco rates among lower SES groups.[5,6] However, these studies have used data from the National Family Health Study, which oversamples women of childbearing age, examines overall

tobacco consumption and does not distinguish between cigarettes and *bidi* use by volume among smokers. We found that *bidis* were smoked more commonly in India compared to cigarettes, possibly due to lower costs, with important differences being seen in the socio-economic patterning of their use. The recently published Global Adult Tobacco Survey for India has reported separate prevalence estimates for cigarette and *bidi* use;[1] however, detailed state-level information about the socio-economic patterning in the use of these tobacco products is not yet available.

Policy implications

Our findings highlight the importance of ongoing and timely surveillance of state-level tobacco use by SES in India with potential benefits for the chronic disease burden in India.[12] While tobacco control policies in India have largely been determined at the national level through the Cigarettes and Other Tobacco Products Act 2003,[13] states have a critical role to play in implementing the various sections of the Act. This may be seen through differences in state resources for tobacco control as well as state-specific policies on taxation of tobacco products. Moreover, the penetration of tobacco industry marketing and promotion has been shown to vary considerably between Indian states,[14] and its relative impact on socio-economic disparities in tobacco use at the state level needs to be better understood and addressed. State- and national-level policies may need to target specific tobacco products (*bidi* and smokeless tobacco) consumed predominantly by poorer households to address existing disparities in use. Recent efforts by some states to increase the tax on *bidis* and ban the sale of smokeless tobacco represent a promising step forward.

CONCLUSION

SES appears to have a varying impact on different types of tobacco use in Indian states. While associations between income and cigarette use and between education and *bidi* use varied considerably in the different states, our other findings suggest a more complex relationship between SES and tobacco use. Policy makers should consider socio-economic patterning of tobacco use when designing, implementing and evaluating tobacco control interventions in different states of India.

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APPENDIX

Table A.1 Percentage of households in India and states consuming tobacco by type of tobacco use, 2009–2010

State	Households *n* (%)	Cigarette-consuming households %	*Bidi*-consuming households %	Smokeless tobacco-consuming household %	Multiple tobacco-consuming households %*	Any tobacco-consuming households %†
India	100855 (100)	3.5	16.5	21.7	9.1	51.9
Northern states						
Delhi	901 (0.9)	4.6	14.0	9.2	0.9	28.6
Haryana	2620 (2.6)	0.8	41.0	5.0	3.1	50.0
Himachal Pradesh	2041 (2.0)	1.7	34.2	1.7	8.1	45.7
Jammu and Kashmir	2713 (2.7)	14.8	13.0	3.1	3.4	34.3
Punjab	3115 (3.1)	0.7	9.3	7.0	2.4	19.4
Rajasthan	4136 (4.1)	0.7	29.0	17.6	11.4	58.7
Uttaranchal	1779 (1.8)	5.9	29.6	9.6	8.8	54.0
North-eastern states						
Assam	3448 (3.4)	2.9	14.6	32.8	27.0	77.3
Other north-eastern states*	10647 (10.6)	7.7	20.6	18.8	23.4	70.4
Central states						
Chhattisgarh	2232 (2.2)	1.1	7.4	50.7	13.0	72.1
Madhya Pradesh	4697 (4.7)	1.4	21.8	26.9	17.4	67.5
Uttar Pradesh	8993 (8.9)	0.7	20.5	27.0	13.6	61.9
Eastern states						
Bihar	4571 (4.5)	2.3	4.4	57.5	7.8	71.9
Jharkhand	2747 (2.7)	2.6	3.2	49.2	7.3	62.2
West Bengal	6326 (6.2)	5.4	37.0	7.0	16.6	66.1
Orissa	4030 (4.0)	1.0	6.1	36.4	16.5	60.0
Western states						
Maharashtra	7995 (7.9)	2.2	3.9	37.3	3.1	46.5
Goa	444 (0.4)	6.9	6.5	3.3	5.8	22.5
Gujarat	3424 (3.4)	0.9	18.4	21.0	9.7	50.0
Southern states						
Andhra Pradesh	6892 (6.8)	8.9	13.7	5.6	2.7	31.0
Karnataka	4070 (4.0)	2.6	17.4	7.2	2.9	30.0
Kerala	4452 (4.4)	10.8	10.3	2.0	4.1	27.2
Tamil Nadu	6638 (6.6)	7.3	12.1	2.9	2.2	24.3
Union Territories†	1944 (1.9)	5.2	8.2	10.2	2.6	26.2

*Includes Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura.
†Daman and Diu, Lakshadweep, Pondicherry (Puduchery), and Andaman and Nicobar Islands.

Table A.2 Mean monthly volume of tobacco use in consuming households in India and states by type of tobacco use, 2009–2010

State	Cigarette sticks	*Bidis* sticks	Smokeless tobacco g
India	77.2	374.7	191.9
Delhi	111.3	421.5	141.4
Haryana	133.1	489.4	194.3
Himachal Pradesh	76.3	424.1	111.7
Jammu & Kashmir	108.6	509.0	320.2
Punjab	80.8	335.5	248.9
Rajasthan	52.4	671.9	301.0
Uttaranchal	75.7	495.3	171.3
Assam	45.9	142.0	208.5
Other north-eastern states*	87.5	372.5	159.4
Chhattisgarh	38.9	171.8	166.4
Madhya Pradesh	52.3	354.4	186.9
Uttar Pradesh	71.8	409.0	189.5
Bihar	25.0	105.5	149.5
Jharkhand	33.9	88.6	175.1
West Bengal	64.1	313.9	136.2
Orissa	57.5	124.0	134.9
Maharashtra	85.3	328.9	236.2
Goa	58.7	115.1	100.0
Gujarat	33.5	533.1	135.4
Andhra Pradesh	100.4	352.3	364.6
Karnataka	91.2	453.0	107.1
Kerala	114.4	292.8	242.2
Tamil Nadu	79.0	285.9	314.5
Union Territories†	123.3	385.2	182.0

*Includes Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura.
†Daman and Diu, Lakshadweep, Pondicherry (Puduchery), and Andaman and Nicobar Islands.

RÉSUMÉ

CONTEXTE : Les études menées en Inde ont identifié d'importantes variations dans la consommation globale de tabac entre les différents groupes socio-économiques.
OBJECTIF : Examiner dans quelle mesure les associations entre le statut socio-économique et l'utilisation de tabac variaient d'un Etat indien à l'autre en fonction du type de tabac.
MÉTHODES : Il s'agit d'une enquête transversale portant sur 108 855 ménages dans 24 états de l'Inde et Territoires de l'Union menée en 2009–2010. Les mesures de résultats ont été la consommation par type de tabac. On a utilisé des modèles de régression logistique et linéaire pour examiner les associations au niveau du ménage entre l'éducation, le revenu, l'utilisation et le volume de tabac consommé.
RÉSULTATS : Une forme quelconque de produit de tabac a été utilisée dans 52% des ménages, la forme principale étant le tabac non fumé (22%), suivi par le *bidi* (17%) et la cigarette (4%). Un revenu supérieur du ménage est en association avec une probabilité plus élevée de l'utilisation des cigarettes, mais une probabilité plus faible d'emploi du *bidi* ou du tabac non fumé, de même qu'avec les niveaux d'éducation croissants atteints dans certains états de l'Inde. Un revenu plus élevé du ménage est en association avec des volumes plus élevés d'utilisation de cigarettes et de *bidis* dans les ménages consommateurs, mais l'association entre le niveau d'éducation atteint et le volume de consommation de tabac n'est pas régulier.
CONCLUSION : Les statuts socio-économiques ont un impact varié sur les différents types d'utilisation du tabac dans les états de l'Inde. Les décideurs politiques devraient prendre en considération la répartition du type d'utilisation du tabac lorsqu'ils élaborent, mettent en œuvre et évaluent les interventions de lutte contre le tabagisme dans différents états de l'Inde.

RESUMEN

MARCO DE REFERENCIA: Algunos estudios en la India han encontrado variaciones considerables en el consumo general de tabaco entre los diferentes grupos socioeconómicos.
OBJETIVO: Investigar si las asociaciones entre la situación socioeconómica y el consumo de tabaco presentaban divergencias en los estados de la India según los tipos de tabaco.
MÉTODOS: Se llevó a cabo una encuesta transversal de 100 855 hogares en 24 estados de la India y Territorios de la Unión en el 2009 y el 2010. Los criterios de evaluación fueron el consumo de tabaco en el hogar, según el tipo de tabaco. Se aplicaron modelos de regresión logística y lineal con el fin de examinar el grado de asociación entre el nivel de instrucción, los ingresos y el volumen de tabaco consumido.
RESULTADOS: En el 52% de los hogares se consumía algún tipo de producto de tabaco y la forma predominante fue el tabaco sin humo (22%), seguida por el *bidi* (17%) y el cigarrillo (4%). El incremento del ingreso de los hogares se asoció con una mayor probabilidad de consumo de cigarrillos y una menor probabilidad de consumo de *bidis* y de tabaco sin humo, se observó el mismo efecto con un mayor grado de instrucción en algunos estados de la India. El aumento del ingreso de los hogares se asoció con un mayor volumen de consumo de cigarrillos y *bidis* en los hogares donde se consume, pero la asociación entre el grado de instrucción alcanzado y el volumen de consumo fue discordante.
CONCLUSIÓN: La situación socioeconómica tiene una repercusión variable en los diferentes tipos de consumo de tabaco en los estados de la India. Las personas encargadas de formular las políticas deben tener en cuenta las modalidades de consumo cuando se diseñan, se ejecutan y se evalúan las intervenciones encaminadas a controlar el consumo de tabaco en los diferentes estados de la India.