

Explaining social group disparities in ever tobacco use among women aged 45 years and older in India: a nonlinear decomposition analysis

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Abstract

Background Social group differences in tobacco use among Indian women are well documented; however, most existing studies remain descriptive, reporting associations without explaining disparities in ever tobacco use between Scheduled Caste/Scheduled Tribe (SC/ST) and non-SC/ST women. This study examines the SC/ST–non-SC/ST gap in ever tobacco use among women aged 45 years and older in India by decomposing it into explained and unexplained components.

Methods Using Longitudinal Ageing Study in India (LASI, 2017–18) data on women aged ≥ 45 years, we analysed ever tobacco use, defined as ever use of any smoked or smokeless tobacco product. A multivariable logistic regression model was fitted to estimate associations between social group (SC/ST vs. non-SC/ST) and ever tobacco use, adjusting for demographic, socioeconomic, and spatial characteristics. Fairlie decomposition was applied to partition the SC/ST–non-SC/ST gap into explained and unexplained components.

Results Ever tobacco use was higher among SC/ST women than among non-SC/ST women (26.4% vs. 16.0%). In adjusted logistic regression models, SC/ST women had significantly higher odds of ever tobacco use compared with non-SC/ST women (adjusted odds ratio [AOR]: 1.30, 95% confidence interval (CI): 1.17–1.43). Fairlie decomposition showed that 75.6% of the SC/ST–non-SC/ST gap in ever tobacco use was explained by differences in observed characteristics. Level of educational attainment (28.8%), occupational history (24.2%), and state/region of residence (40.2%) were the largest contributors to the explained component. Approximately 24.4% of the disparity remained unexplained, indicating that measured socioeconomic and spatial characteristics did not fully account for the SC/ST–non-SC/ST gap.

Conclusion The findings show that the SC/ST–non-SC/ST gap in ever use of tobacco is closely linked to social and geographical disadvantage, especially differences in education, work, rural residence, and state context. Tobacco-control efforts should therefore pay greater attention to women aged 45 years and older from socially disadvantaged groups and high-prevalence settings.

Keywords Social stratification · Caste · Ever tobacco use · Women aged 45 years and older · Life-course inequality · India

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Introduction

Tobacco use remains one of the leading preventable causes of premature mortality globally, causing more than eight million deaths each year, with a disproportionate burden in low- and middle-income countries [1]. India bears a substantial share of this burden. As one of the world's largest producers and consumers of tobacco, the country records more than 1.35 million tobacco-attributable deaths annually [2]. However, the burden of tobacco use in India is not evenly distributed. It is shaped by gender, age, socioeconomic position, and social identity [3]. Women aged 45 years and older from historically marginalised communities sit at the intersection of these disadvantages, yet they remain insufficiently examined in tobacco-control research.

Women aged 45 years and older constitute an important but relatively neglected group in India's tobacco epidemic. Much of the existing research and policy attention has focused on men, young adults, and reproductive-age women, while tobacco use in later life has received less attention [3–10]. This is an important omission because tobacco use in this age group reflects not only present behaviour but also ever tobacco use across the life course. Many women in this age group were socialised into tobacco use before the expansion of India's tobacco-control legislation, programme-based cessation services, and public health messaging [7]. Their tobacco use may therefore reflect long-standing social, cultural, and economic conditions rather than individual choice alone. In later life, such use has particular significance because tobacco-related risks interact with ageing, chronic disease, frailty, and reduced access to timely care [11–13].

Within this already under-studied group, social identity adds another layer of disadvantage. Scheduled Castes (SC) and Scheduled Tribes (ST) are distinct social categories, shaped by different histories of exclusion and marginalisation [14]. SC have been historically disadvantaged through caste-based exclusion and social hierarchy, while ST have faced marginalisation linked to geographical isolation, cultural distinctiveness, displacement, and limited access to mainstream institutions. Despite these differences, both groups are constitutionally recognised as historically disadvantaged communities and continue to experience poorer socioeconomic and health outcomes than non-SC/ST populations [15]. Tobacco use is one such outcome. Existing evidence shows that tobacco use is substantially higher among SC and ST populations than among socially advantaged groups [14, 16, 17], and this pattern is also visible among women aged 45 years and older [6]. This suggests that tobacco use among SC/ST women aged 45 years and older is not simply a behavioural issue but part of a wider structure of social and health inequality.

However, existing studies have not adequately explained why this disparity exists. Most studies identify SC/ST status as a predictor of tobacco use [17–19], but they do not examine how much of the gap is explained by differences in observed characteristics such as education, wealth, place of residence, marital status, work status, and region. Nor do they show how much of the gap remains after accounting for these characteristics. This distinction is important. If the disparity is mainly explained by unequal socioeconomic endowments, then policy needs to address the material and educational disadvantages that increase tobacco use. If a substantial unexplained component remains, it may point to deeper structural processes, including social exclusion, targeted availability of tobacco products, cultural normalisation, weak cessation access, and unmeasured forms of disadvantage.

Decomposition analysis is useful for addressing this gap because it moves beyond documenting association [20]. It allows the observed difference in tobacco use between SC/ST and non-SC/ST women to be separated into components attributable to group differences in measured characteristics and components not explained by those characteristics. Although a recent decomposition work has examined caste-based differences in tobacco use in India, such analysis has generally not focused specifically on women aged 45 years and older [21]. This is a major gap because the determinants of tobacco use in later life may differ from those among younger adults. For women in this age group, tobacco use may be shaped by a number of factors such as widowhood, labour conditions, social isolation, chronic pain, cultural acceptance of smokeless tobacco, and limited interaction with cessation services.

Against this background, the present study examines the SC/ST–non-SC/ST disparity in ever tobacco use among women aged 45 years and older in India. The study estimates the prevalence of ever tobacco use among SC/ST and non-SC/ST women, examines the socio-demographic correlates of ever tobacco use, and applies non-linear decomposition analysis to quantify the contribution of observed characteristics to the social group gap. By focusing on ever tobacco use, the study captures a history of tobacco use that may be missed when only current use is examined, particularly among women in this age group who may have stopped using tobacco because of illness, ageing, widowhood, social pressure, or contact with health services.

This study makes three contributions. First, it brings women aged 45 years and older into the centre of tobacco-control research in India, a group often overlooked in studies focused on men or reproductive-age women. Second, it treats SC/ST identity as a central axis of inequality rather than merely a background covariate. Third, it uses decomposition analysis to identify the observed factors that contribute to the SC/ST–non-SC/ST gap in ever tobacco use. The findings can inform equity-oriented tobacco-control strategies that recognise tobacco use among women in this age group as a product of ever tobacco use, social disadvantage, and unequal access to prevention and cessation support.

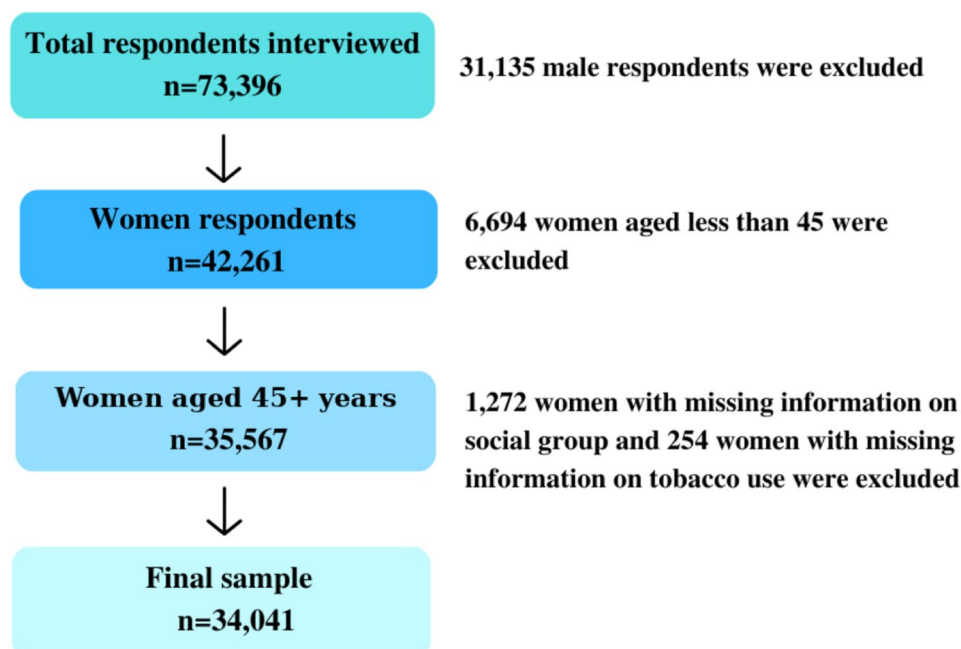
Methods

Data source and study population

This study used data from Wave 1 of the Longitudinal Ageing Study in India (LASI), conducted in 2017–2018. LASI is a nationally representative survey of adults aged 45 years and above and their spouses. It covers all states and union territories of India. The survey collects information on health, economic conditions, family, and social circumstances. LASI used a multistage stratified sampling design to represent rural and urban areas, regions, and socioeconomic groups. More details on the sampling design, survey procedures, and data quality are available in the LASI national report and documentation [22].

The sample selection is shown in Fig. 1. LASI interviewed 73,396 respondents. Of these, 31,135 were men and were excluded from the present analysis. Among 42,261 female respondents, 6,694 women aged below 45 were excluded.

Fig. 1 Detailed sample selection procedure



years were excluded. This left 35,567 women aged 45 years and above. We further excluded 1,272 women with missing information on social group and 254 women with missing information on tobacco use. The final sample included 34,041 women aged 45 years and above. Of the 34,041 women in the descriptive analytical sample, 907 had missing information on childhood residence, 34 on type of work, and 2 on religion. Regression and decomposition analyses therefore used complete cases ($n=33,098$), representing a 2.8% reduction from the descriptive analytical sample.

Outcome variable

The primary outcome was ever tobacco use. It was based on the LASI question: “Have you ever smoked tobacco (cigarette, bidi, cigar, hookah, cheroot) or used smokeless tobacco, such as chewing tobacco, gutka, pan masala, etc.?” Responses were coded as ever used tobacco (1) and never used tobacco (0). This measure identifies whether a respondent has ever used any smoked or smokeless tobacco product. It is useful for studying women aged 45 years and older because some may have stopped using tobacco due to ageing, illness, widowhood, or advice from health workers. However, this measure does not show whether a woman currently uses tobacco, how often she used it, how long she used it, or what type and amount of tobacco she consumed. Throughout this manuscript, the term ‘tobacco use’ refers to ever tobacco use unless otherwise specified.

Social group classification

Social group was the main independent variable in this study. Women were classified into two groups: SC/ST and non-SC/ST. The SC/ST group included women belonging to Scheduled Castes and Scheduled Tribes, while the non-SC/ST group included women from Other Backward Classes and those classified as “Others” in the survey.

We combined Scheduled Castes and Scheduled Tribes because the study aimed to examine broad social disadvantage among constitutionally recognised marginalised groups in India. Both groups have historically faced disadvantages in education, work, living conditions, and access to resources. Combining them also helped us obtain more stable estimates in the decomposition analysis, where smaller subgroup sizes can make the estimates less precise.

We recognise that SC and ST communities are distinct in their histories, social practices, geographical distribution, and tobacco-use norms. Therefore, this combined category should be interpreted as a broad marker of social disadvantage rather than as a homogeneous group.

Covariates and conceptual rationale

Covariates were selected because they represent conditions that may shape tobacco use among women aged 45 years and older. The selection was guided by life-course, intersectional, and fundamental cause perspectives [19, 23–25]. The life-course perspective helps us consider how earlier conditions, such as childhood residence and education, may shape tobacco use in later life. The intersectional perspective helps us examine how social group, gender, work, poverty, and place may operate together rather than separately. The fundamental cause perspective helps us understand education, economic resources, and social position as broader conditions that influence health behaviours.

Based on these perspectives, we included age, religion, educational attainment, consumption quintile, type of work, marital status, current place of residence, childhood place of residence, and geographical location. These variables capture demographic, social, economic, work-related, family, and spatial conditions that may shape tobacco use in this population. Education and consumption reflect access to resources and life opportunities. Type of work reflects women’s labour conditions and daily work settings. Marital status captures differences in family and social support in later life. Current and childhood place of residence capture rural–urban differences across the life course. Geographical location captures broader differences in culture, tobacco use norms, access to

services, and policy implementation. In the descriptive and regression analyses, geographical location was presented as region of residence. In the decomposition analysis, state of residence was used to capture more detailed geographical variation. The coding of each variable is presented in Table 1.

Analytical strategy

Analysis proceeded in three stages. First, weighted descriptive statistics were used to estimate the prevalence of ever tobacco use among SC/ST and non-SC/ST women and to examine differences in covariate distributions across social groups. Second, multivariable logistic regression models were fitted to estimate the association between social group and tobacco use, adjusting for covariates to assess the extent to which observed disparities attenuated after accounting for socioeconomic, demographic, and spatial factors. Analyses incorporated the LASI India-level individual sampling weights (*indiaindividualweight*) and accounted for clustering using the available secondary sampling unit identifier (*ssuid*). Survey-weighted estimates and linearized standard errors were obtained using Stata's survey commands.

Third, Fairlie decomposition was used to quantify the contribution of individual covariates to the observed difference in tobacco use between SC/ST and non-SC/ST women. This method was used because the outcome variable was binary. Unlike linear decomposition methods, the Fairlie approach decomposes differences in predicted probabilities derived from logistic regression models. It partitions the overall gap into an “explained” component

Table 1 Operational definitions and conceptual rationale for variables included in the analysis

Variables	Description
Ever tobacco use (outcome)	Identifies whether the respondent has ever used any smoked or smokeless tobacco product, rather than whether she currently uses tobacco. This is relevant for women aged 45 years and older because some may have stopped using tobacco in later life. Based on the question: “Have you ever smoked tobacco (cigarette, bidi, cigar, hookah, cheroot) or used smokeless tobacco, such as chewing tobacco, gutka, pan masala, etc.?” Coded as ever used tobacco (1) and never used tobacco (0).
Social group (primary exposure)	Represents social stratification in India, reflecting historically produced inequalities in access to education, labour, resources, and social power rather than individual characteristics. Based on self-reported caste/tribe. Coded as binary: Scheduled Caste / Scheduled Tribe (SC/ST) coded as 1, and non-SC/ST (Other Backward Classes and Others) coded as 0.
Religion	The variable is based on the self-reported religion the respondent follows. The variable is binary categorized as Hindu (1), and non-Hindu (0).
Age group	Based on age in completed years. Categorised as 45–54 years (0), 55–64 years (1), 65–74 years (2), and 75 years and above (3). For decomposition analysis, recoded as binary: 45–59 years (0) and 60 years and older (1).
Educational attainment	Captures level of schooling, which may shape health knowledge, work opportunities, autonomy, and access to resources. Highest level of schooling completed. Categorised as no education (0), not completed primary education (1–4) (1), middle (5–7) (2), secondary (8–11) (3), and 12 and above (4). For decomposition, dummy of the categories was used.
Consumption quintile	Captures household economic status and access to resources, which may shape tobacco use and access to health support. Based on monthly per capita consumption expenditure (MPCE), calculated using 11 food and 29 non-food expenditure items standardised to a 30-day reference period. Categorised as poorest (0), poorer (1), middle (2), richer (3), and richest (4). For decomposition, recoded as poor (poorest and poorer) coded as 1 and non-poor (middle, richer and richest) coded as 0.
Type of work	Captures women's work conditions and daily work settings. Tobacco use may become normalised in some labour settings, especially where work involves physical strain. Based on work history/current or last job. Categorised as never worked (0), farm/fishery/forestry own/family work (1), agricultural labourer (2), business owner (3), and wage-salaried worker (4). Dummy variables were used for decomposition analysis
Marital status	Captures women's family and social support situation in later life. Based on current marital status. Categorised as currently married/live-in (0), widowed (1), and others (2). The “others” category included divorced, deserted, separated, and never-married women. These groups were combined because of small sample size. For decomposition analysis, marital status was recoded as married/live-in (1) and others (0).
Current place of residence	Represents spatial structuring of tobacco environments, including access, social norms, healthcare availability, and enforcement contexts. Based on rural/urban residence. Coded as binary: rural (1), urban (0).
Childhood place of residence	Serves as a life-course marker of early social and environmental exposure, capturing origins of inequality not reflected in adult socioeconomic position. Based on place lived during childhood. Reconstructed as binary: rural (1) and urban (0).
Region of residence	Captures geographical differences in tobacco-use norms, access to services, policy implementation, and historical patterns of use. For descriptive and regression analyses, state of residence was grouped into six regions: North (0), Central (1), East (2), West (3), South (4), and Northeast (6). For decomposition analysis, state dummy variables were used to capture more detailed geographical variation.

and an “unexplained” component [25]. In Fairlie decomposition, the explained component refers to the portion of the between-group difference statistically accounted for by differences in the distribution of observed characteristics included in the model. The unexplained component refers to the remaining portion not accounted for by these observed characteristics. These terms are used in their conventional decomposition sense and should not be interpreted as indicating causal explanation or causal mediation. The unexplained component should also be interpreted cautiously, as it may reflect unmeasured characteristics, omitted variables, measurement error, model specification, unobserved heterogeneity, or residual statistical variation.

Because the data are cross-sectional, causal ordering cannot be established. Variables such as education, occupation, and residence may reflect both consequences of social disadvantage and characteristics associated with tobacco use. Their estimated contributions should therefore be interpreted as statistical contributions to the observed SC/ST–non-SC/ST disparity rather than as causal pathways or mediation effects.

To assess the multicollinearity, we have run variance inflation factors (VIFs) (see Table 7 in [Appendix](#)). The mean value of VIF was 1.2. All the individual VIFs were below 1.7, indicating no evidence of problematic multicollinearity. To reduce sensitivity to variable ordering and subsampling, the decomposition used random ordering of covariates and 1,000 replications, with average contributions reported across replications. Standard errors, 95% confidence intervals, and p-values were reported for the contribution of each factor. A detailed description of the method is available in Fairlie’s methodological work [25]. All analyses were carried out in Stata 17 [26]. The study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Results

Socio-demographic profile by social group

The analytical sample comprised 34,041 women aged 45 years and above, of whom 12,155 belonged to SC/ST groups and 21,886 to non-SC/ST groups. The two groups differed across several socio-demographic characteristics. A higher proportion of SC/ST women had no formal education compared with non-SC/ST women (81.9% vs. 58.4%). SC/ST women were also more concentrated in the poorest and poorer consumption quintiles, while non-SC/ST women were more represented in the richer and richest quintiles.

Differences were also observed by work and residence. SC/ST women were more likely than non-SC/ST women to be engaged as agricultural labourers (23.9% vs. 12.0%), while non-SC/ST women were more likely to report never having worked (52.9% vs. 35.7%). Rural residence was also more common among SC/ST women, both in adulthood (81.5% vs. 62.5%) and during childhood (89.9% vs. 76.8%). These patterns show clear social and spatial differences between SC/ST and non-SC/ST women in the sample (Table 2).

Patterns of ever tobacco use

Overall, 19.2% of women aged 45 years and above reported ever tobacco use. The prevalence of ever tobacco-use among SC, ST, OBC, and Others was 25.1%, 29.4%, 15.6%, and 17.0%, respectively (see [Appendix](#), Table 8). The prevalence was substantially higher among SC/ST women (26.4%) than among non-SC/ST women (16.0%). In both groups, reported ever tobacco use was higher in older age groups, with the highest prevalence observed among SC/ST women aged 75 years and above. Clear socioeconomic differences were observed. Prevalence declined with higher levels of education and was generally lower among women in richer consumption groups. Ever tobacco use was higher among women engaged in work, especially agricultural labour and wage-salaried work, and among widowed women. Rural residence, both current and during childhood, was also associated with higher prevalence across social groups. Marked regional variation was observed, with the highest prevalence reported in the northeastern region among both SC/ST and non-SC/ST women (Table 3). State-level patterns

Table 2 Socio-demographic characteristics of women aged 45 years and above by social group, India, 2017–18

Variables	Non-SC/ST		SC/ST		Total	
	<i>n</i>	Weighted %	<i>n</i>	Weighted %	<i>n</i>	Weighted %
Age (in years)						
45–54	8,016	35.4	4,768	36.57	12,784	35.8
55–64	6,941	30.1	3,776	30.19	10,717	30.1
65–74	4,651	23.3	2,482	23.2	7,133	23.3
75+	2,278	11.2	1,129	10.05	3,407	10.8
Religion						
Hindu	17,596	82.2	7,664	85.28	25,260	83.1
Non-Hindu	4,289	17.8	4,490	14.72	8,779	16.9
Level of education						
No education	12,110	58.4	8,724	81.92	20,834	65.2
1–4 years	2,126	9.5	1,167	7.02	3,293	8.8
5–7 years	4,474	18.3	1,601	7.95	6,075	15.3
8–11 years	1,578	6.1	381	1.65	1,959	4.8
12 and above years	1,598	7.7	282	1.46	1,880	5.9
Consumption quintile						
Poorest	3,669	18.6	3,198	27.89	6,867	21.3
Poorer	4,286	19.9	2,606	24.23	6,892	21.2
Middle	4,474	20.8	2,399	19.73	6,873	20.5
Richer	4,691	20.9	2,107	16.09	6,798	19.5
Richest	4,766	19.8	1,845	12.06	6,611	17.6
Type of work						
Never worked	12,049	52.9	4,913	35.69	16,962	47.9
Farm/fishery/forestry (own/family)	4,077	20.1	3,270	23.5	7,347	21.1
Agricultural labourer	2,085	12.0	1,900	23.94	3,985	15.4
Business owner	1,145	4.7	553	4.36	1,698	4.6
Wage-salaried worker	2,510	10.3	1,505	12.51	4,015	10.9
Marital status						
Currently married	13,997	62.6	7,470	59.76	21,467	61.8
Widow	7,187	34.2	4,204	37.6	11,391	35.2
Others	702	3.2	481	2.64	1,183	3.0
Current place of residence						
Urban	8,776	37.5	3,118	18.53	11,894	32.0
Rural	13,110	62.5	9,037	81.47	22,147	68.0
Childhood place of residence						
Rural	16,466	76.8	10,083	89.9	26,549	80.5
Urban	4,903	23.2	1,682	10.1	6,585	19.5
Region of residence						
North	4,389	12.1	1,837	13.72	6,226	12.6
Central	3,089	19.3	1,492	21.9	4,581	20.1
East	3,833	19.9	1,969	27.14	5,802	22.0
West	3,011	17.1	1,458	15.81	4,469	16.7
South	6,146	29.4	2,245	16.41	8,391	25.6
Northeast	1,418	2.2	3,154	5.01	4,572	3.0
India	21,886	100.0	12,155	100.0	34,041	100.0

Values are weighted percentages unless otherwise stated; *n* denotes unweighted sample size. Percentages were calculated using individual survey weights from the Longitudinal Ageing Study in India

SC/ST Scheduled Caste/Scheduled Tribe

Table 3 Weighted prevalence of ever tobacco use among women aged 45 years and above in India by SC/ST status and background characteristics, 2017–18

Variable	SC/ST % (95% CI)	Non-SC/ST % (95% CI)	Total % (95% CI)
Age (in years)	115.2, <0.001	176.2, <0.001	269.6, <0.001
45–54	22.1 (20.0,24.5)	11.9 (10.3,13.6)	15.1 (13.6,16.7)
55–64	26.4 (23.6,29.3)	16.8 (15.2,18.5)	19.7 (18.2,21.3)
65–74	28.8 (25.5,32.3)	19.2 (16.7,21.9)	22.2 (20.1,24.5)
75+	36.6 (31.7,41.9)	20.6 (17.9,23.5)	25.0 (22.5,27.7)
Religion	27.1, 0.005	15.5, 0.057	1.5, 0.572
Non-Hindu	21.4 (18.0,25.2)	18.1 (15.6,21.0)	19.8 (17.6,22.1)
Hindu	27.3 (25.2,29.5)	15.6 (14.1,17.1)	19.1 (17.6,20.6)
Level of education	127.3, <0.001	640.5, <0.001	1033.5, <0.001
No education	28.2 (26.1,30.3)	20.3 (18.7,22.0)	23.4 (21.9,24.9)
1–4 years	25.3 (20.6,30.7)	17.9 (15.3,20.9)	19.7 (17.2,22.4)
5–7 years	15.6 (12.3,19.5)	11.2 (9.3,13.6)	12.2 (10.5,14.3)
8–11 years	12.7 (6.3,24.1)	3.3 (2.0,5.3)	4.4 (2.9,6.6)
12 and above years	7.3 (3.8,13.7)	2.4 (1.4,4.0)	2.7 (1.7,4.2)
Consumption quintile	12.7, 0.497	91.6, <0.001	160.5, <0.001
Poorest	27.3 (24.1,30.9)	16.6 (14.5,18.9)	20.7 (18.7,22.9)
Poorer	27.5 (24.1,31.4)	19.4 (17.2,21.8)	22.3 (20.5,24.4)
Middle	25.8 (22.6,29.4)	16.7 (14.5,19.1)	19.5 (17.6,21.6)
Richer	26.4 (23.2,29.9)	15.5 (13.3,18.0)	18.4 (16.4,20.6)
Richest	23.0 (18.8,27.8)	12.0 (10.2,14.1)	14.2 (12.4,16.4)
Type of work	202.1, <0.001	324.0, <0.001	603.7, <0.001
Never worked	19.5 (16.9,22.2)	12.5 (10.7,14.5)	14.3 (12.6,16.2)
Farm/fishery/forestry (own/family)	27.0 (23.7,30.6)	20.3 (18.3,22.5)	22.8 (20.9,24.8)
Agricultural labourer	31.3 (28.3,34.6)	25.0 (22.2,28.0)	28.0 (25.8,30.2)
Business owner	38.1 (27.9,49.4)	15.7 (12.6,19.4)	21.7 (17.8,26.3)
Wage-salaried worker	31.5 (26.9,36.6)	15.5 (12.1,19.7)	20.7 (17.8,24.0)
Marital status	88.1, <0.001	143.2, <0.001	278.5, <0.001
Currently married	23.6 (21.7,25.6)	13.9 (12.7,15.3)	16.7 (15.5,18.0)
Widow	31.2 (28.0,34.7)	20.1 (17.9,22.6)	23.9 (21.8,26.2)
Others	21.7 (16.0,28.6)	12.5 (8.0,18.8)	15.4 (11.2,20.8)
Current place of residence	78.1, <0.001	391.8, <0.001	660.9, <0.001
Rural	28.1 (26.0,30.3)	19.8 (18.2,21.5)	22.9 (21.5,24.4)
Urban	19.0 (15.2,23.4)	9.7 (7.9,11.7)	11.4 (9.7,13.4)
Childhood place of residence	48.8, 0.002	151.9, <0.001	305.0, <0.001
Rural	27.1 (25.2,29.1)	17.6 (16.2,19.1)	20.9 (19.5,22.2)
Urban	17.7 (13.2,23.3)	10.3 (8.1,13.0)	11.5 (9.5,14.0)
Region of residence	326.7, <0.001	748.4, <0.001	1214.6, <0.001
North	14.2 (10.7,18.5)	11.5 (9.6,13.7)	12.5 (10.6,14.7)
Central	23.7 (20.0,27.7)	17.0 (14.7,19.4)	19.1 (16.8,21.5)
East	35.1 (31.4,39.0)	22.6 (19.1,26.6)	26.7 (23.6,30.1)
West	24.4 (19.8,29.7)	19.6 (16.7,22.8)	20.9 (18.3,23.6)
South	24.0 (19.2,29.5)	8.6 (6.7,11.0)	11.5 (9.3,14.1)
Northeast	39.0 (34.5,43.6)	43.3 (37.8,49.0)	43.3 (39.5,47.2)
India	26.4 (24.5,28.4)	16.0 (14.6,17.5)	19.2 (17.9,20.6)

Values are weighted percentages with 95% confidence intervals. Bold italic values indicate chi-square test statistics and corresponding *p*-values
 SC/ST Scheduled Caste/Scheduled Tribe, CI Confidence interval

were highly heterogeneous. Ever tobacco use was particularly high in several northeastern and eastern states, while the SC/ST–non-SC/ST gap varied considerably across states and was sometimes small or reversed (see [Appendix](#), Table 9 and Fig. 2).

Adjusted associations with ever tobacco use

After accounting for socioeconomic, demographic, and spatial characteristics, women belonging to SC/ST groups exhibited higher odds of ever tobacco use than non-SC/ST women (AOR=1.30; 95% CI: 1.17–1.43). A strong educational gradient was evident, with women having higher secondary education or above showing substantially lower odds of ever tobacco use compared with those with no education (AOR=0.15; 95% CI: 0.10–0.22). Engagement in manual and wage-based work was associated with markedly higher odds of ever tobacco use, particularly among wage or salaried workers (AOR=1.91; 95% CI: 1.57–2.31) and agricultural labourers (AOR=1.84; 95% CI: 1.57–2.14). Spatial context was strongly associated with ever tobacco use; women residing in the northeastern region had more than fivefold higher odds of ever tobacco use compared with those in the northern region (AOR=5.30; 95% CI: 4.50–6.23). Associations with age, widowhood, and rural residence were positive but more modest in magnitude (Table 4).

Fairlie decomposition of the SC/ST–non-SC/ST gap in ever tobacco use

The Fairlie decomposition showed that the predicted probability of ever tobacco use was higher among SC/ST women than among non-SC/ST women. The predicted probability was 0.262 for SC/ST women and 0.160 for non-SC/ST women, giving an absolute difference of 0.102. Of this gap, 0.076, or 75.6%, was statistically accounted for by differences in observed characteristics between the two groups. The remaining 24.4% was not accounted for by the observed characteristics included in the model (Table 5).

State of residence made the largest contribution to the explained gap, accounting for 40.2% of the difference. This was followed by educational attainment (28.8%), type of work (24.2%), and current place of residence (11.3%). These findings show that the SC/ST–non-SC/ST gap in ever tobacco use was mainly associated with differences in geographical location, education, work profile, and rural–urban residence. Marital status made a small positive contribution (1.1%).

Negative contributions indicate that differences in the distribution of these characteristics act to reduce rather than widen the observed SC/ST–non-SC/ST disparity. Age, religion, consumption quintile, and childhood place of residence made small negative contributions, each contributing about –1% to –2%, suggesting that their distribution slightly reduced, rather than increased, the overall gap (Table 6).

Discussion

This study examined social differences in ever tobacco use among women aged 45 years and older in India, focusing on the SC/ST–non-SC/ST gap. By combining descriptive analysis, regression modelling, and Fairlie decomposition, the study moves beyond documenting the presence of a gap and examines the observed factors associated with it. Three findings are important. First, ever tobacco use was higher among SC/ST women than among non-SC/ST women. Second, much of this gap was statistically accounted for by differences in education, type of work, rural residence, and state context. Third, a residual gap remained after accounting for these factors, indicating that measured socioeconomic, occupational, and spatial characteristics did not fully explain the SC/ST–non-SC/ST difference. This residual should be interpreted cautiously because it may reflect unmeasured social processes as well as data and model limitations.

The study also extends the existing literature on social inequalities in tobacco use in India. Previous decomposition research has examined caste-related differences in tobacco use in the broader population [21], while

Table 4 Adjusted associations of social group and socio-demographic characteristics with ever tobacco use among women aged 45 years and above in India, 2017–18

Variable	AOR (95% CI)	<i>p</i> -value
Social group		
Non-SC/ST	1.00	
SC/ST	1.30 (1.17,1.43)	<0.001
Religion		
Non-Hindu	1.00	
Hindu	0.95 (0.81,1.09)	0.479
Age (in years)		
45–54	1.00	
55–64	1.22 (1.08,1.37)	0.001
65–74	1.34 (1.16,1.54)	<0.001
75+	1.41 (1.19,1.67)	<0.001
Level of education		
No education	1.00	
1–4 years	0.85 (0.72,0.98)	0.033
5–7 years	0.61 (0.50,0.73)	<0.001
8–11 years	0.23 (0.15,0.33)	<0.001
12 and above years	0.15 (0.10,0.22)	<0.001
Consumption quintile		
Poorest	1.00	
Poorer	1.20 (1.04,1.38)	0.011
Middle	1.12 (0.97,1.28)	0.105
Richer	1.19 (1.01,1.38)	0.030
Richest	1.06 (0.91,1.24)	0.426
Type of work		
Never worked	1.00	
Farm/fishery/forestry (own/family)	1.44 (1.27,1.62)	<0.001
Agricultural labourer	1.84 (1.57,2.14)	<0.001
Business owner	1.81 (1.42,2.30)	<0.001
Wage-salaried worker	1.91 (1.57,2.31)	<0.001
Marital status		
Currently married	1.00	
Widow	1.28 (1.13,1.43)	<0.001
Others	1.01 (0.76,1.32)	0.960
Current place of residence		
Urban	1.00	
Rural	1.43 (1.23,1.65)	<0.001
Childhood place of residence		
Rural	1.00	
Urban	1.12 (0.91,1.37)	0.290
Region of residence		
North	1.00	
Central	1.62 (1.38,1.88)	<0.001
East	2.58 (2.25,2.96)	<0.001
West	1.79 (1.51,2.11)	<0.001
South	0.97 (0.81,1.15)	0.752
Northeast	5.30 (4.50,6.23)	<0.001

SC/ST Scheduled Caste/Scheduled Tribe, CI confidence interval, AOR Adjusted Odd Ratio

Table 5 Summary of Fairlie decomposition of the SC/ST–non-SC/ST gap in ever tobacco use among women aged 45 years and above in India, 2017–18

Total number of observations	33,098
Total number of observation (SC/ST)	11,750
Total number of observation (non-SC/ST)	21,348
Mean predicted probability for SC/ST	0.262
Mean predicted probability for non-SC/ST	0.160
Difference in mean predicted probability (SC/ST – non-SC/ST)	0.102
Total explained	0.076
Percentage explained	75.64
Percentage unexplained	24.36

SC/ST Scheduled Caste/Scheduled Tribe

Table 6 Contributions of observed factors to the SC/ST–non-SC/ST gap in ever tobacco use among women aged 45 years and above in India, 2017–18

Variable	Coefficient	Contribution %	Standard Error	95% CI	<i>p</i> -value
Age	-0.001	-1.01	0.0003	(-0.001,0.000)	0.008
Religion	-0.001	-1.47	0.0005	(-0.002,0.000)	0.036
Type of work	0.018	24.17	0.0020	(0.014,0.022)	<0.001
Level of education	0.022	28.78	0.0019	(0.017,0.025)	<0.001
Consumption quintile	-0.001	-1.03	0.0011	(-0.002,0.001)	0.477
Marital status	0.001	1.08	0.0003	(0.000,0.001)	0.011
Current place of residence	0.009	11.33	0.0018	(0.005,0.012)	<0.001
Childhood place of residence	-0.002	-2.06	0.0018	(-0.005,0.001)	0.383
State of residence	0.030	40.21	0.0020	(0.026,0.034)	<0.001

Decomposition estimates are based on 1000 replications. Random ordering of covariates was used to reduce sensitivity to variable ordering. Positive values indicate factors that widened the SC/ST–non-SC/ST gap, while negative values indicate factors that reduced the gap

SC/ST Scheduled Caste/Scheduled Tribe, CI Confidence interval

comparatively little attention has been given specifically to women aged 45 years and older. By focusing on this population and incorporating education, work history, marital status, childhood and current residence, and detailed geographical context, the present analysis identifies the observed characteristics that statistically account for substantial portions of the SC/ST–non-SC/ST gap in ever tobacco use. This provides information beyond conventional regression estimates, which identify associations but do not quantify how differences in the distribution of observed characteristics contribute to the between-group disparity.

Social stratification and tobacco use in later life

The higher prevalence of ever tobacco uses among SC/ST women than among non-SC/ST women indicates that ever tobacco use is socially patterned among women aged 45 years and older. The observed differences may reflect accumulated social and economic contexts, including differences in educational opportunities, exposure to manual and agricultural work, and access to health-promoting resources [19, 27]. However, because the data are cross-sectional, the present analysis cannot establish when these differences emerged or the temporal processes through which they developed.

At the same time, tobacco use should not be understood only in relation to structural disadvantage. In difficult living and working conditions, tobacco may form part of everyday practices. Among women involved in agricultural, manual, or informal work, particularly in settings where smokeless tobacco is readily available, tobacco use may be associated with work routines, social interaction, fatigue, stress, or bodily strain [28]. These patterns

are consistent with research suggesting that tobacco use may occur within broader social and economic contexts rather than reflecting individual choice alone [29, 30].

Cohort differences may also be relevant. Women in different age groups experienced different tobacco-control environments, social norms, and levels of access to cessation support, and smokeless tobacco use among women may have been more socially accepted in some regions and periods [31]. Accordingly, the higher prevalence of ever tobacco use observed in older age groups may reflect a combination of age, cohort, survival, and other unmeasured differences rather than an ageing effect itself. The observed age pattern is therefore consistent with a life-course perspective but does not establish specific temporal pathways [32].

These findings suggest that ever tobacco use among women aged 45 years and older is associated with social disadvantage and with the social, occupational, and geographical contexts in which tobacco use occurs. These findings also suggest that individual-level cessation messages alone may be insufficient, particularly for women whose tobacco-use patterns are associated with work, place, cohort, and social position.

Observed factors underlying the SC/ST–non-SC/ST gap in ever tobacco use

The decomposition results provide insight into the observed factors associated with the SC/ST–non-SC/ST gap in ever tobacco use. Approximately three-quarters of the gap was statistically accounted for by differences in the distribution of the observed characteristics included in the decomposition model. Educational attainment emerged as a major contributor, highlighting education's role as a fundamental resource that shapes health knowledge, occupational trajectories, and autonomy across the life course. The strong inverse association between level of education and ever tobacco use observed in the regression analysis strengthens this interpretation [33].

Type of work was another key contributor, reflecting the concentration of SC/ST women in agricultural and manual occupations characterised by physical strain, insecure conditions, and limited regulation. In these settings, tobacco use may be normalised within labour environments, particularly where alternative forms of relief or access to healthcare are constrained [24]. Current place of residence also played a meaningful role, with rural residence contributing to the explained gap, consistent with differential exposure to tobacco markets, weaker enforcement, and reduced access to cessation support [34].

State of residence made the largest contribution to the explained SC/ST–non-SC/ST gap. This suggests that the gap is shaped not only by education or work, but also by where women live. Tobacco use among women is more socially accepted in some parts of India than in others, especially where smokeless tobacco has long been part of everyday social and labour practices. Women aged 45 years and older in eastern, central, and northeastern states may therefore have tobacco-use histories shaped by local norms, product availability, and work conditions. State differences may also reflect uneven implementation of tobacco-control measures, differences in access to cessation support, and the clustering of poverty, rural residence, and manual work in particular regions. Because many SC/ST women live in disadvantaged and high-prevalence settings, state context statistically accounted for a large share of the observed gap. This finding shows that tobacco use among women in this age group is not only associated with an individual behaviour, but also a geographically patterned outcome [19, 35–37].

The apparent socioeconomic gradient observed in the descriptive analysis became less consistent after adjustment for education, occupation, residence, and region. This attenuation suggests that household economic status may influence tobacco use through these correlated socioeconomic characteristics rather than acting as an independent determinant. Among women aged 45 years and older, ever tobacco use may be less sensitive to current household consumption because tobacco-use behaviours were established earlier in life, whereas current consumption reflects present household economic circumstances.

The significance of the unexplained component

Nearly one-quarter of the SC/ST–non-SC/ST gap in ever tobacco use was not accounted for by the observed characteristics included in the decomposition model. This unexplained component should be interpreted cautiously.

It may reflect factors that were not measured in the survey, such as early-life experiences, local tobacco-use norms, discrimination, or differences in access to support and services. However, it may also reflect limitations of the data and model, including omitted variables, measurement error, residual confounding, model specification, unobserved heterogeneity, and statistical variation.

Some unmeasured social processes may also be relevant. For example, education, income, or other resources may be associated with tobacco use differently across social groups, and long-standing local practices surrounding smokeless tobacco use may not be fully captured by the available survey measures. Similarly, experiences of social exclusion or differences in access to services could potentially contribute to the observed disparity. These possibilities are consistent with broader literature on caste, social position, and health inequalities across the life course [38, 39], but they cannot be established from the present decomposition analysis.

The unexplained component should therefore not be interpreted as direct evidence of discrimination or structural inequity. Rather, it indicates that the observed characteristics included in the model do not fully account for the SC/ST–non-SC/ST gap in ever tobacco use. Future studies using richer information on early-life circumstances, local tobacco-use norms, discrimination, and access to cessation support may help identify additional factors associated with the observed disparity.

Implications for tobacco control and healthy ageing

These findings have implications for equity-focused tobacco control and healthy ageing in India. The SC/ST–non-SC/ST gap in ever tobacco use among women aged 45 years and older was partly explained by state context, education, type of work, and rural residence. This means that policy responses should not rely only on general awareness messages. They should also address the social and geographical conditions that contribute to the gap.

India already has a tobacco-control framework through the National Tobacco Control Programme (NTCP) and the Cigarettes and Other Tobacco Products Act (COTPA) [40, 41]. The findings suggest that these efforts need stronger attention to women aged 45 years and older from socially disadvantaged groups, especially in high-prevalence states. District Tobacco Control Cells (DTCCs) and state tobacco-control units can use local data to identify areas where tobacco use among women in this age group is more common [42]. They can also develop messages that are suitable for women with low literacy, women in manual or agricultural work, and women who use smokeless tobacco products. Such messages should be simple, repeated, locally understandable, and sensitive to local norms.

The contribution of work and rural residence suggests that cessation support should be brought closer to women's everyday settings. Ayushman Arogya Mandirs, earlier known as Health and Wellness Centres (HWCs), Accredited Social Health Activists (ASHAs), Auxiliary Nurse Midwives (ANMs), and primary care workers can ask women aged 45 years and older about tobacco use during routine health contacts. They can provide brief advice and refer women who need more support. Existing services such as the National Tobacco Quitline Services (NTQLS) and mCessation services can also be linked with community-level counselling, especially in rural and high-prevalence settings [40, 42, 43].

The large contribution of state context is especially important. It shows that the gap is not distributed evenly across India. A single national message may not work equally well everywhere. High-prevalence states may need more focused strategies for SC/ST women aged 45 years and older, particularly in rural and manual-work communities. In this sense, tobacco control for women aged 45 years and older should be place-sensitive, socially targeted, and linked with healthy-ageing and chronic disease prevention efforts. Women aged 45 years and older should not be treated as a residual group in tobacco-control policy, but as an important population for reducing social inequalities in later-life health.

Strengths and limitations

This study has several strengths. It uses nationally representative data, focuses on an under-examined population group, and applies decomposition methods to highlight the sources of inequality rather than merely describing associations. By incorporating childhood residence, the analysis also brings a life-course dimension that is often absent in studies of tobacco use in India.

Several limitations should be acknowledged. First, the cross-sectional design limits the ability to establish causal relationships between the identified factors and ever tobacco use. The findings should therefore be interpreted as associations rather than causal effects. In addition, the regression and decomposition analyses were based on complete cases; selection bias cannot be ruled out if women excluded because of missing covariate information differed systematically from those retained, although only 2.8% of the descriptive analytical sample was excluded for this reason. Second, tobacco use was self-reported and may be affected by recall and social desirability biases, leading to possible underreporting or misclassification, particularly in settings where tobacco use among women is socially discouraged. Third, the study used ever tobacco use as the outcome. Although this measure identifies women with any history of tobacco use, it does not distinguish current from former users or capture frequency, duration, age at initiation, cessation, or intensity of use. The results should therefore be interpreted as inequalities in ever tobacco use rather than inequalities in current tobacco use, tobacco dependence, cumulative exposure, or tobacco-related disease risk. Fourth, the analysis did not distinguish between smoked and smokeless tobacco, which may have different social, occupational, and cultural correlates among Indian women. Consequently, the present analysis cannot determine whether the observed SC/ST–non-SC/ST disparity is driven primarily by smoked or smokeless tobacco use. Fifth, SC and ST women were analysed together. Although this approach allowed us to examine broad social disadvantage, the two groups differ in their histories, social and cultural practices, geographical distribution, livelihoods, and tobacco-use norms. The combined SC/ST category may therefore mask important heterogeneity, and future studies should examine these groups separately where sample size permits. Sixth, the standard Fairlie decomposition procedure available in Stata does not directly accommodate the full complex survey design, particularly clustering and stratification. Finally, the unexplained component of the Fairlie decomposition should not be interpreted as a direct measure of discrimination or structural inequity. It may reflect unmeasured social or life-course characteristics and structural conditions not captured in the survey, but it may also arise from unobserved confounding, omitted variables, measurement error, model specification, unobserved heterogeneity, or residual statistical variation.

Conclusion

This study shows that ever tobacco use among women aged 45 years and older in India is shaped by both social position and place. Women from SC/ST groups were more likely to report tobacco use than non-SC/ST women. A large part of this gap was explained by differences in education, work, rural residence, and state context. The decomposition analysis therefore adds to existing evidence by showing not only that a social group gap exists, but also which observed factors account for much of it. These findings are important in the context of India's ageing population. Women aged 45 years and older are often less visible in tobacco-control research and programmes, even though ever tobacco use may matter for later-life health and quality of life. The findings suggest that tobacco control for women in this age group should not rely only on general awareness messages. It should pay closer attention to socially disadvantaged women and to high-prevalence states where tobacco use is shaped by local norms, work conditions, and access to cessation support.

Appendix

Table 7 Variance inflation factors (VIFs) for variables included in the multivariable model

Variable	VIF	1/VIF
Current place of residence	1.61	0.62
Childhood place of residence	1.54	0.65
Education	1.36	0.74
Age	1.17	0.85
Marital status	1.16	0.86
Social group	1.13	0.89
Region	1.09	0.92
Religion	1.08	0.92
Consumption quintile	1.06	0.95
Type of work	1.05	0.95
Mean VIF	1.22	

Table 8 Prevalence of ever tobacco use by the social group

Social group	% of ever tobacco use	95% CI
SC	25.1	[23.1,27.2]
ST	29.4	[25.8,33.3]
OBC	15.6	[13.8,17.5]
Others	17.0	[15.4,18.7]
Total	19.2	[17.9,20.6]

SC Scheduled Caste, ST Scheduled Tribe, OBC Other Backward Class, CI Confidence interval

Table 9 State-wise prevalence of ever tobacco use among women aged 45 years and older, by social group

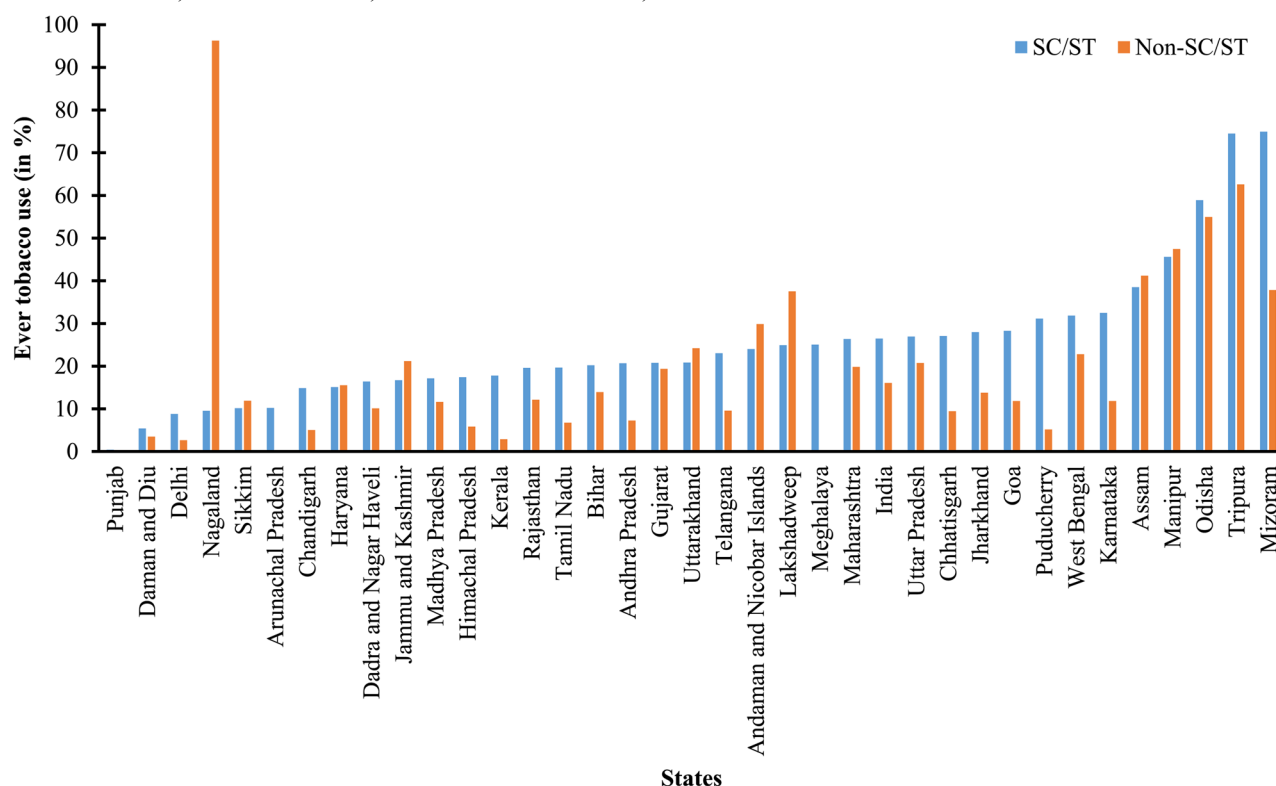
State	SC/ST Prevalence (95% CI)	Non-SC/ST Prevalence (95% CI)
Andaman and Nicobar Islands	24.0 (17.1–32.4)	29.8 (19.2–43.1)
Andhra Pradesh	20.7 (15.4–27.0)	7.2 (4.1–12.3)
Arunachal Pradesh	10.2 (4.4–21.6)	0.0 (-)
Assam	38.5 (31.0–46.4)	41.2 (34.5–48.1)
Bihar	20.2 (16.0–25.1)	13.9 (9.7–19.3)
Chandigarh	14.9 (5.8–33.0)	5.0 (3.1–7.9)
Chhattisgarh	27.1 (21.8–33.0)	9.4 (6.6–13.3)
Dadra and Nagar Haveli	16.4 (12.3–21.3)	10.1 (5.2–18.6)
Daman and Diu	5.4 (2.9–9.7)	3.5 (1.6–6.9)
Delhi	8.8 (4.2–17.4)	2.6 (1.3–4.9)
Goa	28.3 (20.4–37.7)	11.8 (7.8–17.4)
Gujarat	20.8 (13.1–31.2)	19.4 (15.1–24.3)
Haryana	15.1 (10.0–22.0)	15.5 (11.3–20.8)
Himachal Pradesh	17.4 (11.1–26.0)	5.8 (3.8–8.6)
Jammu and Kashmir	16.7 (9.8–26.9)	21.2 (15.4–28.2)
Jharkhand	28.0 (22.8–33.7)	13.8 (10.1–18.4)
Karnataka	32.5 (17.5–52.0)	11.8 (6.7–19.8)
Kerala	17.8 (9.7–30.2)	2.9 (1.5–5.2)
Lakshadweep	24.9 (20.1–30.3)	37.5 (17.1–63.5)
Madhya Pradesh	17.1 (12.5–22.8)	11.6 (9.0–14.8)
Maharashtra	26.4 (20.8–32.7)	19.8 (16.2–23.9)
Manipur	45.6 (34.2–57.4)	47.4 (37.0–58.0)
Meghalaya	25.0 (19.9–30.8)	0.0 (-)
Mizoram	74.9 (68.1–80.6)	37.8 (3.6–90.6)
Nagaland	9.5 (3.0–25.8)	96.2 (61.5–99.7)
Odisha	58.9 (49.2–67.8)	55.0 (48.6–61.0)

Table 9 State-wise prevalence of ever tobacco use among women aged 45 years and older, by social group

State	SC/ST Prevalence (95% CI)	Non-SC/ST Prevalence (95% CI)
Puducherry	31.1 (21.7–42.3)	5.2 (3.2–8.0)
Punjab	0.4 (0.0–1.6)	0.3 (0.0–1.3)
Rajasthan	19.6 (13.2–28.0)	12.1 (8.7–16.5)
Sikkim	10.2 (5.6–17.4)	11.9 (7.7–17.8)
Tamil Nadu	19.7 (12.5–29.3)	6.8 (4.8–9.2)
Telangana	23.0 (17.6–29.4)	9.6 (6.8–13.2)
Tripura	74.5 (66.6–81.0)	62.6 (53.0–71.2)
Uttar Pradesh	26.9 (21.9–32.4)	20.7 (17.6–24.1)
Uttarakhand	20.9 (13.1–31.4)	24.2 (16.9–33.3)
West Bengal	31.8 (27.1–36.9)	22.8 (17.6–28.9)
India	26.4 (24.5–28.4)	16.0 (14.6–17.5)

Values are prevalence percentages with 95% confidence intervals. A dash indicates that the confidence interval was not available in the supplied table

SC Scheduled Caste, ST Scheduled Tribe, OBC Other Backward Class, CI Confidence interval

**Fig. 2** State wise ever tobacco use among SC/ST and Non-SC/ST

Fairlie multivariable decomposition

The Fairlie multivariable decomposition method was used to quantify the contribution of observed characteristics to the difference in ever tobacco use between Scheduled Caste/Scheduled Tribe (SC/ST) and non-SC/ST women aged 45 years and above. The method is appropriate for a binary outcome and extends the logic of the Blinder-Oaxaca decomposition to nonlinear models such as logistic regression. In this study, the disparity was defined as the difference in the mean predicted probability of ever tobacco use between SC/ST and non-SC/ST women (SC/ST minus non-SC/ST).

Let group A denote SC/ST women and group B denote non-SC/ST women. For a binary outcome, the overall difference can be expressed as:

$$Y^{-A} - Y^{-B} = \left[\frac{1}{N_A} \sum_{i=1}^{N_A} F(X_i^A \hat{\beta}^A) - \frac{1}{N_B} \sum_{i=1}^{N_B} F(X_i^B \hat{\beta}^A) \right] + \left[\frac{1}{N_B} \sum_{i=1}^{N_B} F(X_i^B \hat{\beta}^A) - \frac{1}{N_B} \sum_{i=1}^{N_B} F(X_i^B \hat{\beta}^B) \right] \quad (1)$$

Eq. (1). Overall Fairlie decomposition of the group difference.

Here, N_A and N_B are the group-specific sample sizes, X is the vector of observed characteristics, $\hat{\beta}^A$ and $\hat{\beta}^B$ are the estimated logistic-regression coefficients for the two groups, and $F(\cdot)$ denotes the logistic cumulative distribution function. The first bracketed term represents the part of the observed gap associated with group differences in the distribution of measured characteristics (the explained component), whereas the second term represents the remaining unexplained component.

For the detailed decomposition, coefficients from the pooled logistic model can be used to estimate the contribution of individual characteristics. For an explanatory variable X_k , its contribution can be represented generally as:

$$C_k = \frac{1}{N} \sum_{i=1}^N \left[F(X_{ki}^A \hat{\beta}_k^* + X_{-k,i} \hat{\beta}_{-k}^*) - F(X_{ki}^B \hat{\beta}_k^* + X_{-k,i} \hat{\beta}_{-k}^*) \right] \quad (2)$$

Eq. (2). Contribution of an individual explanatory characteristic.

Here, $\hat{\beta}^*$ denotes coefficients from the pooled logistic model and X_{-k} denotes the remaining characteristics held constant. Thus, the contribution of a factor is the change in the average predicted probability obtained when the distribution of that factor is replaced by the corresponding distribution from the comparison group while the other characteristics are held constant.

The percentage contribution of each factor to the explained component was calculated as:

$$Contribution_k (\%) = \frac{C_k}{Total\ explained\ component} \times 100 \quad (3)$$

Eq. (3). Percentage contribution to the explained component.

Positive contributions indicate that differences in the distribution of a characteristic widen the observed SC/ST-non-SC/ST gap, whereas negative contributions indicate that the characteristic reduces the gap.

In this study, the decomposition analysis was conducted among 33,098 women with complete information on all variables included in the model. The mean predicted probability of ever tobacco use was 0.262 among SC/ST women and 0.160 among non-SC/ST women, corresponding to an absolute difference of 0.102 (10.2% points).

The decomposition included age, religion, educational attainment, consumption status, type of work, marital status, current place of residence, childhood place of residence, and state of residence. Age was entered as 45–59 years versus 60 years and above; consumption status as poor versus non-poor; marital status as currently married/live-in versus other marital status; and current and childhood place of residence as rural versus urban. Educational attainment, type of work, and state of residence were represented using indicator variables, with one category omitted as the reference group.

Because the two social groups differed in sample size, the Fairlie procedure used one-to-one matching after drawing a subsample from the larger group. Observations were ranked according to their predicted probabilities and matched across groups. To reduce sensitivity to the particular subsample selected and to the ordering of variables, the decomposition was estimated using random ordering of covariates and 1,000 replications. The

average contribution across replications was reported, together with standard errors, 95% confidence intervals, and p-values.

LASI India-level individual sampling weights were incorporated in the decomposition. However, clustering and stratification were not incorporated because the standard Fairlie decomposition procedure available in Stata does not directly accommodate the full complex survey design. The decomposition results should therefore be interpreted as statistical accounting of the observed SC/ST-non-SC/ST difference rather than as causal mediation estimates. Similarly, the unexplained component should not be interpreted as direct evidence of discrimination or structural inequity, because it may also reflect omitted variables, measurement error, model specification, unobserved heterogeneity, and other characteristics not captured in the analysis.

Abbreviations

SC	Scheduled Caste
ST	Scheduled Tribe
OBC	Other Backward Classes
LASI	Longitudinal Ageing Study in India
VIF	Variance Inflation Factor
AOR	Adjusted Odds Ratio
CI	Confidence Interval
COTPA	Cigarettes and Other Tobacco Products Act
NTCP	National Tobacco Control Programme
DTCCs	District Tobacco Control Cells
HWCs	Health and Wellness Centres
ASHAs	Accredited Social Health Activists
ANMs	Auxiliary Nurse Midwives
and NTQLS	National Tobacco Quitline Services

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Authors' contributions Anshika Singh: Methodology; Data curation; Formal analysis; Visualization; Writing – original draft; Writing – review & editing. Aditya Singh: Conceptualization; Methodology; Formal analysis; Data curation; Investigation; Visualization; Writing – original draft; Writing – review & editing; Supervision; Project administration. Muhammad Hossain: Methodology, Writing – original draft; Writing – review & editing; Supervision; Project administration. Rakesh Chandra: Methodology, Writing – original draft; Writing – review & editing; Supervision; Project administration. Utkarsh Jain: Data curation, Formal analysis, Writing – review & editing.

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Data availability The data used in this study are from the Longitudinal Ageing Study in India, Wave 1, and are available upon registration and approval through the LASI data portal. The dataset can be accessed at <https://www.iipsdata.ac.in/lasi>.

Declarations

Ethics approval and consent to participate This study used de-identified data from Wave 1 of the Longitudinal Ageing Study in India (LASI). The LASI survey received ethical approval from the Indian Council of Medical Research and the institutional review boards of the International Institute for Population Sciences, Harvard T. H. Chan School of Public Health, and the University of Southern California. Written informed consent was obtained from all participants before their participation in the survey. No additional ethical approval was required for the present secondary analysis of de-identified data.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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