

# Tobacco use in currently married pregnant & lactating women in India; key findings from the National Family Health Survey-5



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## Summary

**Background** Tobacco use among pregnant and lactating women carries dangerous repercussions for women and their children. Limited information is available at the national level on the prevalence and determinants of tobacco use in this vulnerable sub-population of women. This study aims to estimate the prevalence of tobacco use among currently married pregnant and lactating women and its association with demographic, behavioural and regional determinants in India.

**Methods** A cross-sectional study was conducted during which secondary data from the fifth National Family Health Survey, 2019–2020, was analysed. The prevalence and associated 95% confidence intervals (CI) for different forms of tobacco use were documented among currently married pregnant and lactating women. Adjusted Odds Ratio and 95% CI were calculated using multivariate logistic regression to identify the independent factors associated with different forms of tobacco use among respondents after applying sampling weights.

**Findings** In India, the prevalence of tobacco use among currently married pregnant and lactating women was 2.5% and 3.2%, respectively, with over 85% of tobacco-using currently married pregnant (85.6%) and lactating (85.6%) women using smokeless tobacco (SLT) only. Age group 30–34 years, working women and the richest wealth quintile were found to be independent predictors of smoked tobacco use among currently married pregnant women. In contrast, among the currently married lactating women, the middle wealth quintile and South Indian region were found to be independent predictors of smoked tobacco use.

**Interpretation** Smokeless tobacco was found to be the most prevalent type of tobacco consumed by pregnant and lactating women in India. There is an urgent need to curb tobacco use in this vulnerable sub-population of women in the country by sensitising them to the harmful consequences of tobacco use by integrating tobacco awareness and cessation services during routine ante-natal examinations.

**Funding** No funding was received for this study.

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**Keywords:** Tobacco; Smokeless tobacco; Pregnant women; Lactating women and health risks

## Introduction

Tobacco use in all its forms is harmful and no known safe level of exposure to tobacco has been documented. A pre-eminent preventable cause of mortality and morbidity in the world today, tobacco use is accountable for over 8 million global deaths annually, including

around 1.2 million deaths from exposure to second-hand smoke (SHS).<sup>1</sup>

Of the 1.3 billion tobacco users worldwide, more than 80% live in low and middle-income countries (LMICs), which bear the heaviest burden of tobacco-related illness and death. Tobacco use is an avoidable

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### Research in context

#### Evidence before this study

Our literature search on tobacco use in women revealed a high prevalence of smokeless tobacco in many Southeast Asian countries including India. Likewise, its use in pregnant and lactating women was found to be high. While these studies provide the prevalence of tobacco use, information on its use in different forms (smoked, smokeless and combined) in pregnant and lactating women has not been explored. Nor has any study been conducted on nationally representative data to identify the determinants and country-wide distribution of tobacco use among this vulnerable sub-section of the population that can have potential adverse effects on future generations.

#### Added value of this study

This study is among the first to report on the prevalence of tobacco smoking and smokeless tobacco use among currently married pregnant and lactating women in India with over 85% of tobacco-using currently married pregnant and lactating women using smokeless tobacco (SLT) only. Tobacco use at any age is known to have harmful effects, more so, during pregnancy and lactation. Monitoring tobacco use is thus an important strategy that can lay the foundation

for preventive actions. This study focuses on generating valuable and timely information about the prevalence, patterns and determinants of tobacco use among currently married pregnant and lactating women in India using a nationally-representative sample.

#### Implications of all the available evidence

The WHO Framework Convention on Tobacco Control (FCTC) advocates preventing and managing tobacco use and exposure to second-hand smoke during pregnancy and calls for continuous monitoring of tobacco use among different sections and sub-sections of society.

Our findings emphasise creating awareness through education and tobacco cessation services during adolescence, the antenatal period and the post-partum period not just among women but also their partners and other members of the family so as to provide support within the family. The postpartum follow-up period can serve as an opportunistic time to accommodate tobacco prevention and cessation programmes within the existing reproductive, maternal, newborn and child healthcare services as an integral component of region-specific health promotion and tobacco control initiatives.

contributor to poverty that diverts household spending from basic essential needs such as food and shelter towards tobacco. Tobacco-related deaths among women aged 20 years and above may rise to 2.5 million by 2030, with 75% of the projected mortality expected to occur in low and middle-income countries (LMICs).<sup>2</sup> The pooled prevalence of tobacco use in pregnant women in LMICs has been reported as 2.6%, with the highest prevalence in the South-East Asian region (5.1%).<sup>3</sup>

In India, nearly 267 million adults (15 years and above) consume tobacco, accounting for about 1.35 million deaths annually. Additionally, tobacco use is a significant risk factor for many chronic diseases, including cancer, lung disease, cardiovascular disease and stroke. The most prevalent form of tobacco use in India is smokeless tobacco (SLT) which includes tobacco products consumed without combustion either by chewing, dipping, snuffing or applying on teeth and gums. Nearly 90% of global SLT users belong to the Indian subcontinent.<sup>4</sup> Most commonly used forms of SLT are *khaini*, *gutkha*, betel quid with tobacco and *zarda* and the forms of smoked tobacco (ST) are *bidi*, cigarette and *hookah*.<sup>5</sup>

Since the year 2005, data from nationally representative surveys in the country consistently documents the increasing trend of tobacco use among women, particularly smokeless tobacco (SLT) that is culturally more acceptable in women than smoked tobacco.<sup>6</sup> Evidence from the National Family Health Survey-4 (NFHS-4) and Global Adult Tobacco survey-2 (GATS-2) indicates

that 4% to 7.4% of pregnant women and about 5% of lactating women in India consume any form of SLT among which *gutka* and *paan with tobacco* are the most commonly consumed.<sup>5,7</sup>

Tobacco use in women can impact their reproductive health and outcomes and also leads to other health risks.<sup>8</sup> Studies have reported that smokeless tobacco consumption during pregnancy adversely affects the gestational age at birth and can lead to low birth weight babies and act as a neuro-teratogen.<sup>9</sup> Women who did not use tobacco during pregnancy but lived with smokers had a two-time higher risk of stillbirth, indicating a strong causal association with second-hand smoke.<sup>10</sup> Furthermore, tobacco use in mothers is known to present a greater risk for children than its use by fathers.<sup>11</sup>

The detrimental effects of tobacco use during pregnancy and lactation to both mother and the foetus are attributed to more than 4000 compounds and 70 carcinogens identified in tobacco smoke, sixteen of which are classified as Group 1-carcinogenic to humans. Ample evidence is available in the literature to substantiate the claim that breastfed infants of tobacco-smoking mothers have a higher incidence of cardiac rhythm disorders, allergies, increased colic sleep disorders, respiratory tract infections, early age leukaemia (EAL) and sudden infant death syndrome (SIDS).<sup>12</sup> As the World Health Organization (WHO) has recommended exclusive breastfeeding for the first six months of life, the number of lactating women who use tobacco

(smoking/smokeless) adds significantly to at-risk women and infants.<sup>13</sup>

Although tobacco consumption has a severely damaging influence on the health of pregnant and lactating women and the foetus, spanning its lifetime; yet limited studies are available at the national level on tobacco use among pregnant and lactating women in India. Vital information specific to pregnant and lactating women on epidemiological statistics and risks can help generate robust evidence. In turn, this evidence can serve as an essential data source at the national and regional levels and guide future decisions for gender-specific tobacco control policies that can concretise public health gain.

This study attempts to estimate the burden and pattern of tobacco use among currently married pregnant and lactating women in India. The aim is to evaluate the association of various demographic, behavioural and regional correlates of tobacco use among this subpopulation of women. Given the fact that WHO has advocated identifying tobacco users as a prerequisite to treating tobacco use and dependence, the findings from this study can help monitor and evaluate existing policies with a particular focus on expanding knowledge of various determinants influencing tobacco use in pregnant and lactating women in India.<sup>13</sup>

## Methods

We conducted a cross-sectional study to analyse data from the Fifth National Family Health Survey (NFHS-5) conducted in India between 2019 and 2021.

The NFHS is a large-scale, multi-round survey conducted in a representative sample of households under the aegis of the Ministry of Health and Family Welfare (MOHFW), Government of India, that has designated the International Institute of Population Sciences (IIPS), Mumbai, as the nodal agency for coordination and providing technical expertise. The NFHS-5 fieldwork was conducted in two phases. Phase-I commenced on 17 June 2019 and continued till 30 January 2020, covering 17 states and 5 Union Territories. Phase II was conducted from 02 January 2020 to 30 April 2021 in 11 states and 3 Union Territories.

### Sample size

The overall sample size required for NFHS-5 was derived by considering different indicators at the district level. The mandate for NFHS-5 was to produce estimates for each of the 707 districts in the country as observed on 01 March 2017.

To track the progress of maternal and child health over the years at the district and state levels, the sample size for NFHS-5 was calculated by considering 3+ Ante Natal Care (ANC) visits among women aged 15–49 years as the critical behavioural indicator, with due care paid to relative precision, statistical power and design effects.

For this purpose, the most recent estimates of NFHS-4 (2015–2016) were considered for different states. As per NFHS-4 estimates, among the major states in India, Bihar had the lowest level of 3+ ANC among women at 27.4 per cent. This level was, hence, taken as the value of 'p' and used in the following formula, where the value of n is given by:

$$n = \frac{1}{\alpha^2} \frac{(1-P)}{P} D$$

where n is the desired sample size. P is the prevalence of the variable under study.  $\alpha$  represents the desired relative standard error, and D is the design effect.

The overall sample size for NFHS-5 was calculated as 609,120 households from 30,456 PSUs, including 724,115 women and 101,839 men.

More details on sample size calculation can be obtained from <http://rchiips.org/nfhs/NFHS-5Reports/National%20Report%20Volume%20II.pdf>.

### Sampling design

NFHS-5 is a nationally representative cross-sectional survey that provides national information on India's population, health and nutrition. The NFHS-5 used a stratified two-stage sampling design that was uniformly adopted in all districts in the country. In each district, samples were selected in two stages. In the first stage, the selection of Primary Sampling Units (PSUs)—which were villages in the rural areas and Census Enumeration Blocks (CEBs) in urban areas was carried out with probability proportional to size (PPS).

The second stage consisted of a random selection of an equal number of households within each PSU. Small PSUs with fewer than 40 households (HHs) were linked to the nearest geographically located PSUs. The PSUs were selected by PPS systematic sampling and the households by systematic sampling. The number of households selected per PSU was 20 in every state.

As NFHS-5 had a stratified sample design, stratification was achieved by separating each district into urban and rural areas. The second stage of stratification in the rural areas was conducted based on the village size (number of HHs) by creating three explicit strata and then six equal size sub-strata within each rural stratum after sorting the sampling frame by the percentage of Scheduled Caste/Scheduled Tribe population. Within each explicit sampling stratum, implicit stratification was achieved by sorting the sampling frame according to the female literacy rate. Within each of the three explicit rural strata created earlier, villages were selected with probability proportional to size (PPS) sampling from the 2011 sampling frame. In urban areas, information related to the CEBs was procured from the Office of the Registrar General and Census Commissioner, New Delhi, India. Within each urban sampling stratum of each district, implicit stratification

was achieved by sorting the sampling frame according to the percentage of the SC/ST population and using the PPS selection procedure for selecting the CEBs.

Households (HHs) were listed in all selected PSUs before the survey. The household listing consisted of visiting each of the selected PSUs and recording all residential HHs in those PSUs. The resulting list of HHs served as the sampling frame for selecting households in the second stage. During the HH listing operation, the selected PSUs with an estimated number of households greater than 300 were divided into segments of about 100–150 HHs. Two segments were chosen for the survey with probability proportional to the segment size. After the HH listing and in the second stage of sample selection, for each selected PSU, a fixed number of 22 households (adjusted for 10% non-response) were chosen with systematic equal selection probability from the household list created during household listing. All women aged 15–49 in the selected households were eligible for interview and all men aged 15–54 in the households selected for the state module were eligible for interview.

#### Study tool

Four survey schedules/questionnaires were used in NFHS-5 (Household, Woman's, Man's and Biomarker Questionnaire). For this study, data from the Woman's Questionnaire that collected information on tobacco use from all eligible women aged 15–49 was analysed ( $n = 724,115$ ). The Woman's questionnaire collected data from all eligible women on various background characteristics, including age, education, occupation, religion, caste/tribe, place of residence, number of children, alcohol consumption and tobacco consumption. Information on current tobacco usage and different forms of tobacco used was also collected from each female respondent.

Tobacco use status among currently married pregnant and lactating women is the outcome variable in this study. A respondent who smokes cigarettes, pipes, cigars, bidis or hookah was considered a tobacco smoker (ST). A respondent who chews tobacco in the form of *Khaini* or *Gutkha/Paan masala with tobacco*, or consumes *Paan with tobacco*, was considered a smokeless tobacco user (SLT). A respondent who used smoked and smokeless tobacco was considered a combined tobacco user (ST + SLT). A respondent is regarded as a current tobacco user if she reports either smoking any tobacco product or using any smokeless tobacco product on a daily or less-than-daily basis at the time of the survey. The regional classification followed in the NFHS-5 report was applied. Household wealth is a composite measure of household items and assets divided into five quintiles (richest, rich, middle, poor, poorest). The NFHS-5 data is in the public domain and available to all registered users from the DHS website, accessible at <https://dhsprogram.com>.<sup>14</sup>

#### Statistical analysis

The study estimated prevalence and associated 95% confidence intervals (CIs) for different forms of tobacco use among currently married pregnant and lactating women. Missing values were excluded from data analysis and survey-weighted analysis was performed.

Categorical data is presented as numbers ( $n$ ) and weighted percentages (%) with a 95% confidence interval. The Chi-square test was performed to estimate the association between various individual factors and different forms of tobacco use (smoked, smokeless and combined tobacco) among currently married pregnant and lactating women. Adjusted Odds Ratio (AOR) and 95% CI were calculated using multivariate logistic regression analyses to estimate the independent factors associated with different forms of tobacco use among currently married pregnant and lactating women after applying sampling weights. Statistical significance was considered at  $p < 0.05$ . All statistical analyses were carried out using SPSS version 27.0 (IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp).

#### Role of funding source

Not applicable.

#### Results

Of 7,24,115 women interviewed in the NFHS-5 survey, 5,12,575 (70.7%) women were currently married. Of these, 28,408 (5.5%) were pregnant and 1,05,482 (20.6%) were lactating at the time of the interview. 719 (2.5%) of the currently married pregnant women and 3426 (3.2%) of the currently married lactating women reported using some form of tobacco ([Supplementary Fig. S1](#)).

Among the pregnant women, 616 (2.2%) used smokeless tobacco, 95 (0.3%) used smoked tobacco, and 08 (0.03%) used both smoked and smokeless tobacco. Among the lactating women, 2934 (2.8%) used smokeless tobacco, 447 (0.4%) used smoked tobacco and 45 (0.04%) used both smoked and smokeless tobacco. Most (85.6%) of respondents who use tobacco use it in a smokeless form.

Among tobacco-using pregnant women, the use of smokeless tobacco in the form of *Gutkha/Paan masala with tobacco* (38.4%), *Paan with tobacco* (23.2%), *khaini* (20.9%) and chewing tobacco (8.7%) were the more popular forms, whereas, among lactating women, *Gutkha/Paan masala with tobacco* (37.6%), *Paan with tobacco* (24.1%) and *Khaini* (21.9%) were the common forms of smokeless tobacco use. In both pregnant and lactating women, the use of *bidi* is the most popular form of smoked tobacco (1.7% & 2.1% respectively) ([Supplementary Table S1](#)).

The weighted socio-demographic and economic characteristics of tobacco-using pregnant and lactating women referred to in the present study as respondents

or married pregnant and lactating women are shown in [Supplementary Table S2](#). The majority of respondents in the present study (pregnant and lactating women) were in the age group 25–29 years (32.5% and 34.4% respectively), had received no education (43.8% and 43.5%), were Hindus (70% and 75.6%), belonged to the poorest household wealth quintile (54.9% and 55.3%), were rural residents (83.7% and 86.1%), were not working (62.4% and 66.4%), did not consume alcohol (93.7% and 93.3%) and were from the North-east regions of India (31% and 27.8%). Among pregnant women, tobacco consumption was highest in women having  $\geq 2$  children (38.1%) and women belonging to the backward class (35.1%) ([Supplementary Table S2](#)).

Prevalence of ST use among pregnant women was found to increase with the age group from 10.5% in the age group 15–19 years to 38.9% in the age group 20–24 years. The prevalence of SLT in tobacco-using pregnant women increased from 9.6% at 15–19 years to 33.4% at 25–29 years of age. The prevalence of combined tobacco use (ST + SLT) was highest in the age group of 25–29 years (50%). The prevalence of SLT use is seen to decrease after 30 years of age. Among tobacco-using lactating women, the prevalence of ST, SLT and combined tobacco use was the highest in the age group of 25–29 years (29.3%, 35.2% and 33.3%, respectively) ([Supplementary Table S2](#)).

Prevalence of ST and SLT use was highest among the respondents (pregnant and lactating women) with no education (41.1% and 44.6% among pregnant women and 41.4% and 43.5% among lactating women, respectively). Among tobacco-using pregnant women, the prevalence of ST and combined tobacco use was highest with less than 2 children (37.9% and 50%, respectively), while the prevalence of SLT was highest with  $\geq 2$  children (38.5%). However, among tobacco-using lactating women, the prevalence of all forms (ST, SLT and combined) of tobacco use was highest in women with  $\geq 2$  children (78.3%, 76.2% and 77.8% respectively) ([Supplementary Table S2](#)).

Among tobacco-using pregnant women, the prevalence of all forms of tobacco use (ST, SLT and combined) was highest among women belonging to the Hindu religion. As regards social class, pregnant women belonging to the backward classes have the highest prevalence of ST and SLT (31.9% and 35.7%); while lactating women belonging to Scheduled Tribes had the highest prevalence of all forms (ST, SLT and combined) of tobacco use (34.5%, 32.6% and 45.4% respectively).

The prevalence of tobacco use is found to steadily decrease with increasing household wealth quintile in married pregnant and lactating women, with the highest tobacco use of all forms seen in the poorest wealth quintile. The only exception was combined tobacco use among pregnant women, wherein the highest use was observed in the middle wealth quintile (50%). The

prevalence of ST and SLT among tobacco-using pregnant women was highest in the poorest wealth quintile (47.4% and 45.1%). Likewise, the prevalence of ST, SLT and combined tobacco use among tobacco-using lactating women is highest among the poorest wealth quintile (55.7%, 54.9% and 73.3%, respectively). Tobacco use of all forms is highest among tobacco-using pregnant and lactating women from the country's Northern region, barring ST use in tobacco-using lactating women, which was seen to be highest in the Eastern region (28.4%) ([Supplementary Table S2](#)).

### Factors associated with tobacco consumption during pregnancy

Factors associated with tobacco use among currently married pregnant and lactating women in India are shown in [Tables 1 and 2](#).

After adjusting for other variables, pregnant women in the age group of 30–34 years were seen to have the lowest odds (AOR = 0.385, 95% CI: 0.160–0.928,  $p = 0.033$ ) of using smoked tobacco compared to those in  $\geq 35$  years age group, while the odds of using smokeless tobacco were highest in the same age group 30–34 years (AOR = 2.319, 95% CI: 1.0–5.378,  $p = 0.049$ ). Similarly, working pregnant women showed higher odds of consuming smoked tobacco (AOR = 4.635, 95% CI: 1.23–17.43,  $p = 0.023$ ) and the odds of SLT were lower among those working (AOR = 0.167, 95% CI: 0.057–0.491,  $p = 0.001$ ). Currently married pregnant women from the richest wealth quintile had three times higher odds of consuming smoked tobacco ( $p = 0.014$ ) as compared to pregnant women in the poorest wealth quintile. However, the odds of smokeless tobacco use among pregnant responders were significantly lower in the richest quintile (AOR = 0.306, 95% CI: 0.110–0.850,  $p = .0023$ ).

The odds of smokeless tobacco (SLT) use among currently married pregnant women in southern India were three times (AOR = 3.192, 95% CI: 0.161–63.433,  $p = 0.4477$ ) that of northern parts ([Table 1](#)).

### Factors associated with tobacco consumption during lactation

Among the currently married lactating women, the odds of combined tobacco use were observed to be significantly less in the 30–34 years age group (AOR = 0.266, 95% CI: 0.097–0.728,  $p = 0.01$ ) and 20–24 years age group (AOR = 0.382, 95% CI: 0.16–0.913,  $p = 0.03$ ) as compared to women 35 years old and above.

Regarding the number of living children, the odds of smokeless tobacco use were higher among women with less than 2 children (AOR = 2.873, 95% CI: 0.916–9.012,  $p = 0.07$ ). The odds of combined tobacco use in currently married women of 'other religions' were three times greater as compared with tobacco-using lactating women of the Hindu religion. Interestingly, currently married lactating women belonging to the Middle

Characteristic	Currently married pregnant women		
	ST	SLT	Combined tobacco use
	AOR (95% CI); p value	AOR (95% CI); p value	AOR (95% CI); p value
Age			
15–19	0.719 (0.284–1.817); 0.485	1.466 (0.585–0.674); 0.415	–
20–24	0.822 (0.403–1.677); 0.590	1.248 (0.620–2.510); 0.535	0.452 (0.023–8.731); 0.599
25–29	0.468 (0.222–0.988); 0.046 <sup>a</sup>	1.807 (0.884–3.695); 0.105	1.668 (0.145–19.164); 0.681
30–34	0.385 (0.160–0.928); 0.033 <sup>a</sup>	2.319 (1.0–5.378); 0.049 <sup>a</sup>	1.360 (0.091–20.258); 0.823
≥35	Reference	Reference	Reference
Education			
No education	Reference	Reference	Reference
Primary	0.883 (0.123–6.336); 0.901	0.442 (0.114–1.716); 0.238	6.363 (0.893–45.319); 0.065
Secondary	0.218 (0.041–1.938); 0.197	0.902 (0.240–3.386); 0.878	2.90 (0.389–21.602); 0.299
Higher	0.413 (0.0–685.0); 0.815	1.20 (0.002–723.135); 0.955	–
Occupation			
Not working	Reference	Reference	Reference
Working	4.635 (1.232–17.438); 0.023 <sup>a</sup>	0.167 (0.057–0.491); 0.001 <sup>a</sup>	4.513 (0.254–80.142); 0.305
No. of living children			
Nullipara	0.815 (0.053–12.613); 0.884	1.106 (0.626–1.957); 0.728	3.952 (0.460–33.925); 0.210
<2	2.808 (0.492–16.026); 0.245	0.939 (0.563–1.565); 0.809	2.752 (0.447–16.940); 0.275
≥2	Reference	Reference	Reference
Religion			
Hindu	Reference	Reference	Reference
Muslim	0.610 (0.332–1.122); 0.112	1.510 (0.752–3.035); 0.247	4.074 (0.560–29.620); 0.165
Christian	0.575 (0.233–1.420); 0.230	0.787 (0.70–4.560); 0.224	1.462 (0.101–21.052); 0.780
Other	0.680 (0.116–3.989); 0.669	1.003 (0.235–4.274); 0.997	7.601 (0.639–90.381); 0.108
Caste			
Scheduled caste	0.758 (0.356–1.615); 0.473	1.330 (0.609–2.905); 0.474	0.659 (0.061–7.095); 0.731
Scheduled Tribe	0.665 (0.320–1.381); 0.274	1.214 (0.560–2.630); 0.624	0.709 (0.058–8.683); 0.788
Backward class	0.643 (0.317–1.302); 0.220	1.437 (0.718–2.877); 0.305	0.330 (0.043–2.546); 0.288
Other/Don't know	Reference	Reference	Reference
Wealth index			
Poorest	Reference	Reference	Reference
Poorer	1.375 (0.779–2.426); 0.272	0.768 (0.440–1.341); 0.353	0.566 (0.032–10.133); 0.699
Middle	1.261 (0.670–2.375); 0.472	0.669 (0.373–1.199); 0.177	3.714 (0.742–18.60); 0.110
Richer	2.312 (1.049–5.092); 0.038	0.397 (0.187–0.841); 0.016	4.483 (0.577–34.833); 0.152
Richest	3.663 (1.298–10.340); 0.014 <sup>a</sup>	0.306 (0.110–0.850); 0.023 <sup>a</sup>	0.454 (0.001–356.976); 0.816
Partner alcohol use			
Yes	1.472 (0.360–6.013); 0.591	0.562 (0.145–2.180); 0.404	2.895 (0.111–75.820); 0.523
No	Reference	Reference	Reference
Alcohol consumption			
Yes	1.349 (0.476–3.819); 0.573	1.182 (0.076–18.276); 0.905	0.086 (0.003–2.671); 0.162
No	Reference	Reference	Reference
Place of residence			
Urban	Reference	Reference	Reference
Rural	1.285 (0.667–2.476); 0.454	0.997 (0.256–3.875); 0.996	0.117 (0.007–2.089); 0.144
Region			
North	Reference	Reference	Reference
South	0.380 (0.019–7.658); 0.528	3.192 (0.161–63.433); 0.447	–
East	1.065 (0.530–2.139); 0.860	1.134 (0.594–2.166); 0.702	0.570 (0.044–7.431); 0.668
West	1.145 (0.589–2.226); 0.691	0.953 (0.515–1.766); 0.879	1.160 (0.158–8.523); 0.884
Central	1.649 (0.821–3.309); 0.160	0.688 (0.377–1.256); 0.224	1.193 (0.152–9.351); 0.866
North-east	0.608 (0.277–1.333); 0.214	1.805 (0.942–3.4585); 0.075	1.062 (0.166–6.809); 0.949

Multivariable logistic regression was performed; values are presented as Odds ratio OR (95% Confidence Interval, CI). <sup>a</sup>p value < 0.05.

**Table 1: Factors associated with tobacco use among currently married pregnant women in India.**

Characteristic	Currently married lactating women		
	ST	SLT	Combined tobacco use
	AOR (95% CI); p value	AOR (95% CI); p value	AOR (95% CI); p value
<b>Age</b>			
15–19	1.142 (0.577–2.260); 0.704	0.473 (0.120–1.860); 0.284	0.934 (0.169–5.169); 0.937
20–24	0.864 (0.618–1.207); 0.391	1.958 (0.765–5.009); 0.161	0.382 (0.160–0.913); 0.030 <sup>a</sup>
25–29	0.729 (0.527–1.009); 0.056	1.146 (0.515–2.552); 0.738	0.482 (0.228–1.020); 0.056
30–34	1.088 (0.781–1.517); 0.617	0.808 (0.369–1.769); 0.594	0.266 (0.097–0.728); 0.010 <sup>a</sup>
≥35	Reference	Reference	Reference
<b>Education</b>			
No education	Reference	Reference	Reference
Primary	1.093 (0.829–1.443); 0.528	1.274 (0.532–3.051); 0.587	0.536 (0.016–17.489); 0.726
Secondary	1.057 (0.831–1.344); 0.653	1.041 (0.461–2.349); 0.923	0.748 (0.037–15.254); 0.850
Higher	0.621 (0.208–1.854); 0.393	0.849 (0.075–9.598); 0.894	–
<b>Occupation</b>			
Not working	Reference	Reference	Reference
Working	0.739 (0.347–1.573); 0.433	1.013 (0.593–1.731); 0.961	0.796 (0.074–8.569); 0.851
<b>No. of living children</b>			
<2	0.337 (0.093–1.223); 0.098	2.873 (0.916–9.012); 0.070	0.796 (0.074–8.569); 0.851
≥2	Reference	Reference	Reference
<b>Religion</b>			
Hindu	Reference	Reference	Reference
Muslim	1.555 (0.502–4.811); 0.444	0.559 (0.215–1.456); 0.234	0.741 (0.296–1.856); 0.522
Christian	3.218 (0.315–32.844); 0.324	0.523 (0.073–3.730); 0.518	1.619 (0.530–4.948); 0.398
Other	0.061 (0.0–101.462); 0.460	4.765 (0.071–319.553); 0.467	3.981 (1.154–13.761); 0.029 <sup>a</sup>
<b>Caste</b>			
Scheduled caste	0.471 (0.137–1.619); 0.232	2.119 (0.691–6.495); 0.189	4.786 (0.673–34.034); 0.118
Scheduled tribe	0.406 (0.118–1.390); 0.151	1.605 (0.535–4.813); 0.398	10.485 (1.513–72.659); 0.017 <sup>a</sup>
Backward class	0.358 (0.119–1.079); 0.068	1.876 (0.730–4.818); 0.191	5.414 (0.796–36.821); 0.084
Other/Don't know	Reference	Reference	Reference
<b>Wealth index</b>			
Poorest	Reference	Reference	Reference
Poorer	0.689 (0.263–1.810); 0.450	1.638 (0.663–4.046); 0.285	0.382 (0.152–0.963); 0.041 <sup>a</sup>
Middle	2.829 (1.020–7.847); 0.046 <sup>a</sup>	0.298 (0.120–0.743); 0.009 <sup>a</sup>	0.212 (0.046–0.986); 0.048 <sup>a</sup>
Richer	1.299 (0.260–6.481); 0.750	0.747 (0.180–3.102); 0.688	0.375 (0.071–1.964); 0.245
Richest	1.065 (0.111–10.218); 0.957	0.176 (0.035–0.899); 0.037 <sup>a</sup>	2.412 (0.682–8.527); 0.172
<b>Partner alcohol use</b>			
Yes	1.119 (0.536–2.336); 0.764	0.885 (0.451–1.737); 0.723	0.299 (0.016–5.706); 0.422
No	Reference	Reference	Reference
<b>Alcohol consumption</b>			
Yes	0.650 (0.184–2.301); 0.504	1.883 (0.622–5.703); 0.263	0.115 (0.003–4.636); 0.251
No	Reference	Reference	Reference
<b>Place of residence</b>			
Urban	Reference	Reference	Reference
Rural	1.179 (0.415–3.347); 0.757	0.806 (0.312–2.078); 0.655	0.608 (0.238–1.551); 0.297
<b>Region</b>			
North	Reference	Reference	Reference
South	3.414 (1.957–5.956); <0.001 <sup>a</sup>	0.041 (0.009–0.177); <0.001 <sup>a</sup>	–
East	1.651 (1.248–2.184); <0.001 <sup>a</sup>	0.417 (0.171–1.017); 0.054	0.152 (0.046–0.497); 0.118
West	2.015 (1.475–2.753); <0.001 <sup>a</sup>	0.436 (0.158–1.206); 0.110	0.112 (0.020–0.638); 0.014 <sup>a</sup>
Central	1.391 (1.600–1.924); 0.046 <sup>a</sup>	0.391 (0.139–1.096); 0.074	0.689 (0.298–1.591); 0.383
North-east	0.499 (0.341–0.730); <0.001 <sup>a</sup>	2.441 (0.516–11.549); 0.261	0.433 (0.170–1.103); 0.079

Multivariable logistic regression was performed; values are presented as Odds ratio OR (95% Confidence Interval, CI). <sup>a</sup>p value < 0.05.

**Table 2: Factors associated with tobacco use among currently married lactating women in India.**

wealth quintile had higher odds (AOR = 2.829) of consuming smoked tobacco and lower odds of smokeless (AOR = 0.298) and combined tobacco use (AOR = 0.048) when compared with the poorest wealth quintile.

The odds of smoked tobacco use in southern India (AOR = 3.414, 95% CI: 1.957–5.956,  $p < 0.001$ ) were significantly higher than in northern parts of the country. On the contrary, the odds of smokeless tobacco use were lower for southern India (AOR = 0.041, 95% CI: 0.009–0.177,  $p < 0.001$ ). Compared to the northern parts of the country, the odds of combined tobacco use were 88.8% less among lactating women from the western parts (Table 2).

The countrywide prevalence of tobacco use in its different forms among currently married pregnant and lactating women is depicted in Figs. 1 and 2.

## Discussion

The tobacco epidemic is impacting the lives of women and children worldwide. Even though tobacco use in women has been reported to decline in India (GATS-2),<sup>5</sup> women continue to shoulder a sizeable burden of its consequences in terms of tobacco-related disease and mortality.

Given that the global prevalence of tobacco smoking has been historically higher in men, there is now an increased uptake of smoking in young women as compared to young men. The tobacco industry is partly responsible for this shift and for fuelling the tobacco epidemic by focusing on women in LMICs as prospective customers in response to the considerable decline in its consumption in the West.<sup>15</sup>

Tobacco use in young women at a young age puts them at a higher risk of continuing to use smoked or smokeless tobacco during pregnancy and lactation. A large body of evidence suggests that smoking in women predisposes them to the risk of gender-specific conditions such as premature menopause, fertility impairment and pregnancy and neonatal complications. Despite these well-known risks, tobacco use during pregnancy and lactation remains one of the leading causes of poor pregnancy outcomes and prenatal death.<sup>16</sup> A recent study by Singh et al. reported a high prevalence of tobacco use among lactating women in South-east Asia, particularly smokeless tobacco, which is double that of smoked tobacco.<sup>17</sup>

This study investigated the prevalence of tobacco use among currently married pregnant and lactating women in India. It found that 2.5% of currently pregnant women and 3.2% of currently married lactating women in India were using tobacco in some form. The results indicate a reduction in tobacco use among pregnant and lactating women since the fourth round of NFHS. NFHS-5 was conducted between 2019 and 2021 and coincided with the emergence of the COVID-19

pandemic. The lockdown measures to contain COVID-19 spread and the resultant restrictions impacted lifestyle changes and addictive behaviours among people and led to mental distress due to fear of the unknown. Albeit, the social isolation and the rising evidence of a direct association between the use of tobacco, mainly smoked tobacco, and COVID-19 severity and mortality may have caused regular tobacco users to quit its use.<sup>18</sup>

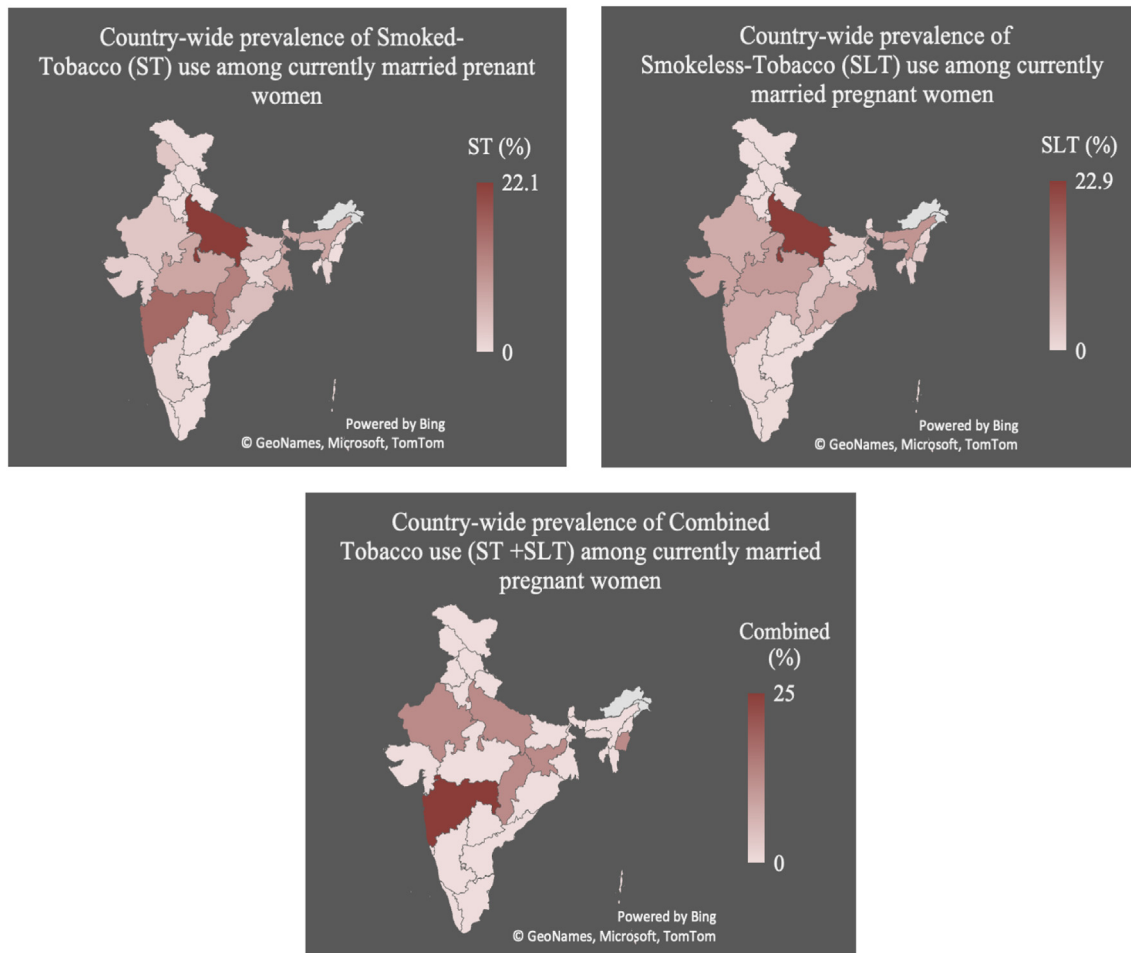
Among pregnant and lactating tobacco-using women, smokeless tobacco use was more prevalent (>85%) than smoked tobacco use. The relative popularity of SLT can be attributed to its cheap cost, easy availability and acceptability.<sup>19</sup> Earlier studies on tobacco use among pregnant women have been reported using NFHS-4 data by Samba S et al., wherein the prevalence of tobacco use during pregnancy was seen to be varied in different countries [Brazil (6.2%) and Pakistan (3%), Nepal (17.2%) and Uruguay (19%)].<sup>20</sup> This varied difference can also be attributed to a higher cultural acceptance of tobacco use among women in certain regions.

WHO has noted that ‘few tobacco users understand the full extent of their health risk’. Likely, knowledge of the risks of tobacco use is especially lacking among poorly educated and illiterate pregnant women.<sup>21</sup> Research conducted in China, India and Indonesia has shown that while people commonly associated smoking with lung cancer, most did not associate smoking with coronary heart disease, peripheral vascular disease, stroke, or tuberculosis.<sup>22</sup>

A decline in the rates of SLT use in pregnant women was seen from 7.17% to 3.95% in the decade since the third round of the National Family Health Survey (NFHS-3) (2005–2006) to NFHS-4 (2015–2016). The present study also shows a steady decline in the rate of SLT use in currently married pregnant women to 2.2% in NFHS-5 (2019–2021).<sup>20</sup>

This study reveals higher SLT use among respondents from the poorest wealth quintile. This finding relates well with a multi-country analysis that reported almost 90% SLT burden among the most impoverished population in LMICs. Region-wise, the likelihood of consuming ST and combined tobacco among tobacco-using pregnant women was highest in central parts of the country (AOR 1.649 and 1.193, respectively), while SLT use was highest in the southern parts (AOR = 3.192). Among tobacco-using lactating women, the north-eastern parts of the country showed the highest odds of SLT use (AOR = 2.441), while ST use was highest in the southern parts. Earlier studies have reported a high prevalence of smoking and smokeless tobacco in the north-eastern and central parts of the country.<sup>18</sup> These regional variations in the prevalence of tobacco use among currently married pregnant women may be attributed to cultural influences, a wider acceptance of tobacco use and differences in the implementation of tobacco control policies across the country.





**Fig. 1:** Country-wide prevalence of all forms of tobacco use among currently married pregnant women in India.

Traditionally, the use of tobacco during pregnancy has often been reported with seeking a change of taste or to obtain relief from nausea, vomiting, constipation, cold and influenza.<sup>19,23,24</sup>

This study reported higher odds of smoked tobacco use among pregnant (AOR = 1.285) and lactating women (AOR = 1.179) in rural areas. The odds of smokeless tobacco use were 19.4% less in rural areas as compared to urban areas among tobacco-using lactating women. Interestingly, lactating and pregnant women consuming alcohol showed higher odds of using tobacco than women not drinking alcohol. The dual use of tobacco and alcohol puts these women at a higher risk for ill effects on general and reproductive health.

The results indicate inequalities concerning social determinants, thereby reflecting the importance of building evidence on social determinants of tobacco use in Indian women to form policies and tailor interventions to address its root cause, considering their vulnerability to tobacco initiation. Thus, there is an

urgent need for innovative health promotion and communication strategies using media to raise awareness regarding the harm of all forms of tobacco use among this vulnerable section of the society.

On the basis of the above discussion, it can safely be concluded that despite the strong presence of adequate evidence to demonstrate the detrimental effects of the use of tobacco in any form among pregnant and lactating women, the situation continues to be worrisome in this particular group as a grave risk is posed to the mother as well as her unborn child. Although tobacco control measures over the years have aided in reducing tobacco use among women in India, there is still a need for more focused gender-based efforts to prevent this vulnerable group of women from falling prey to the perils of tobacco use.

This study has numerous strengths, including its large study sample that focuses on the burden of tobacco use among pregnant and lactating Indian women. As

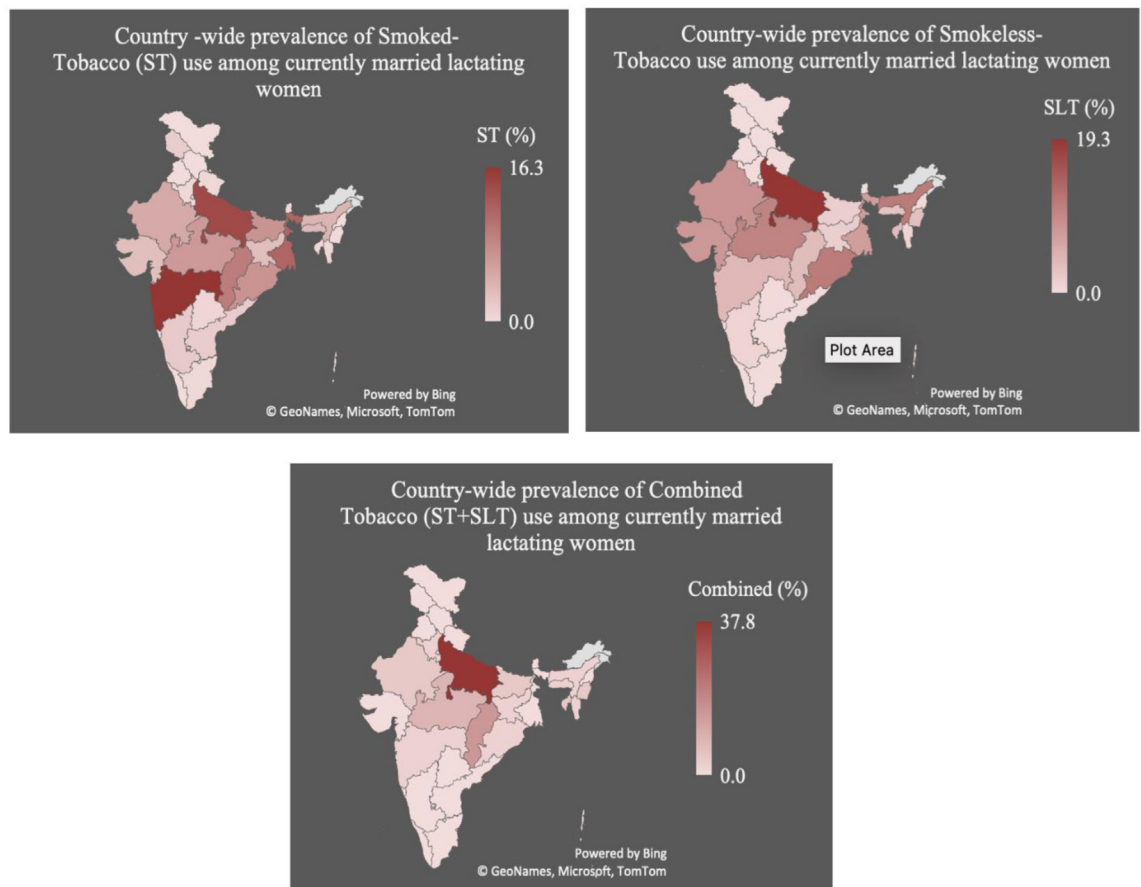


Fig. 2: Country-wide prevalence of all forms of tobacco use among currently married lactating women in India.

per the literature search, this is the first study that considers all potential correlates of tobacco use in pregnant and lactating Indian women. Therefore, the results of this study are expected to be insightful for future research prioritising gender-specific tobacco control policies in India. However, the study is not bereft of a few limitations. Errors due to self-reporting of information cannot be ruled out. Also, the results need a cautious interpretation as the cross-sectional design limits causal inferences from this research study. The findings of the study cannot be generalised for the whole female population because of the geographical variation in tobacco use and the focus on solely the married pregnant and lactating women of India.

The findings of this study provide timely information about the prevalence and patterns of tobacco use among currently married pregnant and lactating women in India. It thus becomes imperative that evidence-based interventions are implemented urgently by enhancing the awareness of the detrimental effects of tobacco use among adolescents and young women. Additionally, tobacco cessation interventions may be included as an

integral part of the antenatal care and health care delivery system to discourage and prevent tobacco use during pregnancy and lactation.

#### Contributors

AV, MK, SG and SS<sup>§</sup>: Conceived and designed the study and interpreted the data, checked the accuracy of findings, and drafted, edited, and revised the manuscript. PS and SK: contributed substantially to the extraction, assembly and analysis of data. SS<sup>‡</sup>: Contributed towards revising the manuscript critically for intellectual content. All authors edited and approved the final version of the manuscript.

#### Data sharing statement

This study uses publicly available data, that can be accessed through The DHS Program, <https://dhsprogram.com/data/>.

#### Editor note

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#### Declaration of interests

None reported.

#### Acknowledgements

We thank the Resource Centre for Tobacco Control (RCTC), PGIMER Chandigarh, for making data from Demographic and Health Surveys

(DHS) available and providing technical support towards completing this manuscript. We would also like to acknowledge Professor Deepti Gupta, Department of English & Cultural Studies, Panjab University, Chandigarh, for her support in the language review of this manuscript.

#### Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.lansea.2023.100274>.

#### References

- World Health Organization. Tobacco. Available from: <https://www.who.int/news-room/fact-sheets/detail/tobacco>; 2022. Accessed August 6, 2022.
- Women and Health, *Today's Evidence Tomorrow's Agendas, Executive summary*. Switzerland: World Health Organization; 2009.
- Asma S. The GATS atlas: global adult tobacco survey. Available from: <https://stacks.cdc.gov/view/cdc/51993>. Accessed March 31, 2023.
- Barakoti R, Ghimire A, Pandey AR, Baral DD, Pokharel PK. Tobacco use during pregnancy and its associated factors in a mountain district of eastern Nepal: a cross-sectional questionnaire survey. *Front Public Health*. 2017;5:129.
- Global adult tobacco survey GATS 2 India 2016-17. Available from: [https://www.who.int/tobacco/surveillance/survey/gats/GATS\\_India\\_2016-17\\_FactSheet.pdf?ua=1](https://www.who.int/tobacco/surveillance/survey/gats/GATS_India_2016-17_FactSheet.pdf?ua=1). Accessed March 1, 2020.
- Goel S, Tripathy JP, Singh RJ, Lal P. Smoking trends among women in India: analysis of nationally representative surveys (1993-2009). *South Asian J Cancer*. 2014;3(4):200-202. <https://doi.org/10.4103/2278-330X.142958>.
- International Institute for Population Sciences (IIPS), ICF. *National family health survey (NFHS-4), 2015-16: India*. Mumbai: IIPS; 2017.
- Hyland A, Piazza K, Hovey KM, et al. Associations between lifetime tobacco exposure with infertility and age at natural menopause: the Women's Health Initiative Observational Study. *Tob Control*. 2016;25(6):706-714. <https://doi.org/10.1136/tobaccocontrol-2015-052510>.
- Gupta PC, Subramoney S. Smokeless tobacco use, birth weight, and gestational age: a population-based prospective cohort study of 1217 women in Mumbai, India. *BMJ*. 2004;328(7455):1538.
- Subramoney S, d'Espaignet ET, Gupta PC. Higher risk of stillbirth among lower and middle-income women who do not use tobacco but live with smokers. *Acta Obstet Gynecol Scand*. 2010;89(4):572-577.
- Secretan B, Straif K, Baan R, et al. A review of human carcinogens—Part E: tobacco, areca nut, alcohol, coal smoke, and salted fish. *Lancet Oncol*. 2009;10(11):1033-1034. [https://doi.org/10.1016/S1470-2045\(09\)70326-2](https://doi.org/10.1016/S1470-2045(09)70326-2).
- Napierala M, Mazela J, Merritt TA, Florek E. Tobacco smoking and breastfeeding: effect on the lactation process, breast milk composition and infant development. A critical review. *Environ Res*. 2016;151:321-338. <https://doi.org/10.1016/j.envres.2016.08.002>. ISSN 0013-9351.
- WHO Recommendations for the prevention and management of tobacco use and second-hand smoke exposure in pregnancy. Geneva: World Health Organization; 2013.
- National Family Health Survey (NFHS-5), 2019-20: India. Available from: [http://rchiips.org/NFHS/NFHS5/manuals/NFHS5%20Interviewer%20Manual\\_Eng.pdf](http://rchiips.org/NFHS/NFHS5/manuals/NFHS5%20Interviewer%20Manual_Eng.pdf).
- Tripathy JP. Socio-demographic correlates of quit attempts and successful quitting among smokers in India: analysis of Global Adult Tobacco Survey 2016-17. *Indian J Cancer*. 2018;58(3):394-401.
- Singh S, Jain P, Singh PK, Reddy KS, Bhargava B. White paper on smokeless tobacco and women's health in India. *Indian J Med Res*. 2020;151:513-552.
- Singh PK, Singh L, Fernando C, et al. Prevalence of smoking and smokeless tobacco use during breastfeeding: a cross-sectional secondary data analysis based on 0.32 million sample women in 78 low-income and middle-income countries. *Lancet*. 2022;53:101660.
- Carreras G, Lugo A, Stival C, et al. Impact of COVID-19 Lockdown on smoking consumption in a large representative sample of Italian Adults. *Tob Control*. 2022;31:615-622.
- Schensul JJ, Nair S, Bilgi S, et al. Availability, accessibility and promotion of smokeless tobacco in a low-income area of Mumbai. *Tob Control*. 2013;22(5):324-330.
- Pasupuleti Samba SR, Mohan Priya, Babu Punuri J. Prevalence and predictors of tobacco use among currently married pregnant women in India. *Popul Med*. 2021;3(April):11.
- WHO report on the global tobacco epidemic, 2008: the MPOWER package. Geneva, Switzerland: World Health Organization; 2008.
- Nichter M, Greaves L, Bloch M, et al. Tobacco use and second-hand smoke exposure during pregnancy in low- and middle-income countries: the need for social and cultural research. *Acta Obstet Gynecol Scand*. 2010;89:465-477.
- Anwar S, Williams SA, Scott-Smith J, et al. A comparison of attitudes and practices of gutka users and non-users in Chitrakoot, India: a pilot. *Prim Dent Care*. 2005;12(1):5-10.
- Verma P, Pandey P, Thakur A. Prevalence and determinants of tobacco consumption among pregnant women of three Central Indian Districts. *Trop J Obstet Gynaecol*. 2017;34(2):99-106. [https://doi.org/10.4103/TJOG.TJOG\\_32\\_17](https://doi.org/10.4103/TJOG.TJOG_32_17).