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Prevalence, Pattern and Correlates of Tobacco Consumption Among Adolescents in a Rural Community of India: A Community-Based Cross-Sectional Study

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ABSTRACT

Background: Tobacco use that begins in adolescence tends to persist, and in India smokeless products dominate; community data on rural adolescents are limited.

Objectives: To estimate the prevalence and pattern of tobacco use among rural adolescents aged 10–19 years and to identify associated factors.

Methods: Community-based cross-sectional study conducted from December 2023 to May 2024 in one randomly selected village; one adolescent per household was interviewed face to face (n = 500). Current use was any smoked or smokeless tobacco in the past 30 days. Prevalence with Wilson 95% confidence intervals and crude odds ratios (OR) were calculated.

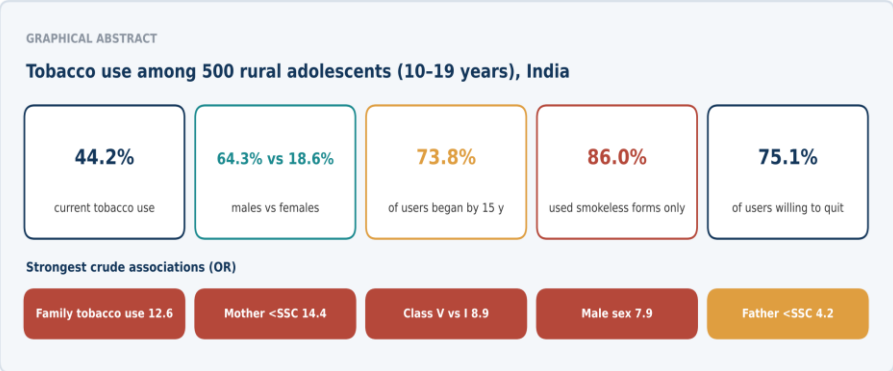
Results: Current use was reported by 221 of 500 adolescents (44.2%; 95% CI 39.9–48.6): 64.3% of males and 18.6% of females. Among users, 73.8% began by age 15 years, 59.7% used daily, 86.0% used only smokeless forms and 75.1% were willing to quit. Gutkha (54.3%), kharra (33.5%) and pan masala (31.7%) were most reported; peer pressure (57.0%) was the commonest reason. Crude odds of use were higher for male sex (OR 7.86; 5.17–11.94), tobacco use in the family (12.62; 8.18–19.46), lower maternal education (14.35; 4.40–46.80) and lower socioeconomic class (class V vs I: 8.93; 4.36–18.26). Because use was common, prevalence ratios were smaller (family tobacco use: 3.54; 2.83–4.42).

Conclusions: Use was highly prevalent, began early, was mainly smokeless and showed strong social gradients. Prevention should target smokeless products, peers and households, and offer cessation support. The data come from a single village and are unadjusted.

Keywords: *adolescent; tobacco use; smokeless tobacco; gutkha; rural health; prevalence; India; cross-sectional study*

KEY POINTS

- Four in ten rural adolescents (44.2%) reported current tobacco use; nearly two-thirds of males and one-fifth of females.
- Use started early (73.8% of users by 15 years) and was mainly smokeless (86.0% of users); gutkha and kharra led.
- Family tobacco use, low parental education and low socioeconomic class showed steep crude gradients.
- Three in four users were willing to quit, an opening for brief advice and cessation support.



1. Introduction

Tobacco use remains among the leading preventable causes of death, killing more than eight million people every year [1]. Global prevalence has fallen, but progress is uneven and smoking continues to be a leading contributor to the global burden of disease [2]. The World Health Organization estimates that 1.2 billion people used tobacco in 2024, down from 1.38 billion in 2000, yet nearly one in five adults still use tobacco and at least 15 million children aged 13–15 years use e-cigarettes [3].

Adolescence, defined by the World Health Organization as ages 10–19 years, is a formative period in which health behaviours and social relationships are established and carried into adulthood [4]. Nicotine exposure during this window has long-lasting effects on the developing brain and increases vulnerability to dependence [5].

In India, the second Global Adult Tobacco Survey (2016–17) found that 28.6% of adults aged 15 years and above used tobacco in some form, with smokeless use more common than smoking [6]. Among students aged 13–15 years, the fourth Global Youth Tobacco Survey (2019) estimated current tobacco use at 8.5% (boys 9.6%, girls 7.4%), a 42% decline from 2009; yet the median age at initiation was 9.9 years for smokeless tobacco and 11.5 years for cigarettes, showing that use begins in childhood [7]. Household survey data indicate higher use in rural than in urban areas [8]. Recent Indian studies report widely varying estimates according to setting and definition: 22.4% current use among adolescents in rural Rajasthan [9], 15.1% any tobacco use among school students in Jhalawar [10], 11% smokeless use among students in Delhi [11] and 2.0% ever smokeless use in grades 6–8 in Karnataka [12], with continuing community surveys from Shivamogga [13]. Analysis of NFHS-5 shows that tobacco use among youths aged 15–24 years has fallen since NFHS-3 (males 40.07% to 22.51%) but remains associated with rural residence and a poor wealth index [14]. The sixth round of the National Family Health Survey (NFHS-6, 2023–24; released 2026), which ran in the same period as the present study, reports tobacco use of 36.3% in men and 8.4% in women aged 15 years and above, slightly below NFHS-5 (38.0% and 8.9%) [15]. Among adolescents aged 15–19 years in aspirational districts, NFHS-5 data show use in 15.9% of males and 1.2% of females [16].

Smokeless products such as gutkha, khaini, kharra (a locally prepared chewing mixture), mishri and betel quid with tobacco are central to this pattern. South Asia carries most of the global smokeless-tobacco burden [17], and use is associated with increased mortality, including from cancer and cardiovascular disease [18]. Areca nut and betel quid are carcinogenic to humans [19], and oral cavity cancer is a major cancer burden in India [20]. Regulation of smokeless products lags behind that of cigarettes in many countries [21].

Trends in smoking in India differ by age, sex and education [22], and smokeless use in South and Southeast Asia is concentrated among rural, less-educated and poorer groups [23]. Exposure to smoking by parents and siblings raises the risk of uptake in childhood and adolescence [24], and smoking is more common in lower socioeconomic groups [25]. Rural studies from Maharashtra reported adolescent tobacco use of roughly 39–47% [26–28], but few community-based studies jointly describe products, age at initiation, frequency, reasons, willingness to quit and family and socioeconomic correlates in one population.

We therefore conducted a community-based survey (1) to estimate the prevalence and describe the pattern of tobacco consumption among adolescents in a rural area and (2) to determine factors associated with current use. Because the data were collected in 2023–2024, they provide a recent benchmark for this community, although they come from a single village and should not be generalised.

2. Materials and Methods

2.1 Design, setting and period

This community-based cross-sectional study followed the STROBE reporting guideline [29]. It was conducted from December 2023 to May 2024 in a rural area near a tertiary-care hospital, in a taluka with 56 Gram Panchayats. The selected village had a population of 5,044, of whom 952 were adolescents aged 10–19 years, in 850 houses.

2.2 Sample size and sampling

The sample size was computed as $n = 4pq/d^2$, taking $p = 45\%$ from a comparable rural adolescent study in Maharashtra [27], $q = 100 - p = 55$, and $d = 4.5$ (10% relative precision at 95% confidence): $n = 4 \times 45 \times 55 / 4.5^2 \approx 489$, rounded up to 500.

Selection was multistage (Figure 1). One Gram Panchayat was selected at random from 56; one of its two villages was then selected at random. Within the village, a house-to-house survey began at a house chosen by spinning a pen at the central square, and then proceeded to the adjacent house on the right until the sample was complete. Locked houses were revisited on two further days and, if still locked, labelled non-contactable and skipped. Houses without an eligible adolescent were skipped. Where several adolescents lived in a household, the eldest eligible adolescent was interviewed. Fieldwork covered 2–3 houses per day on three days a week. Because the within-village route was systematic rather than random, the final stage was not a probability sample.

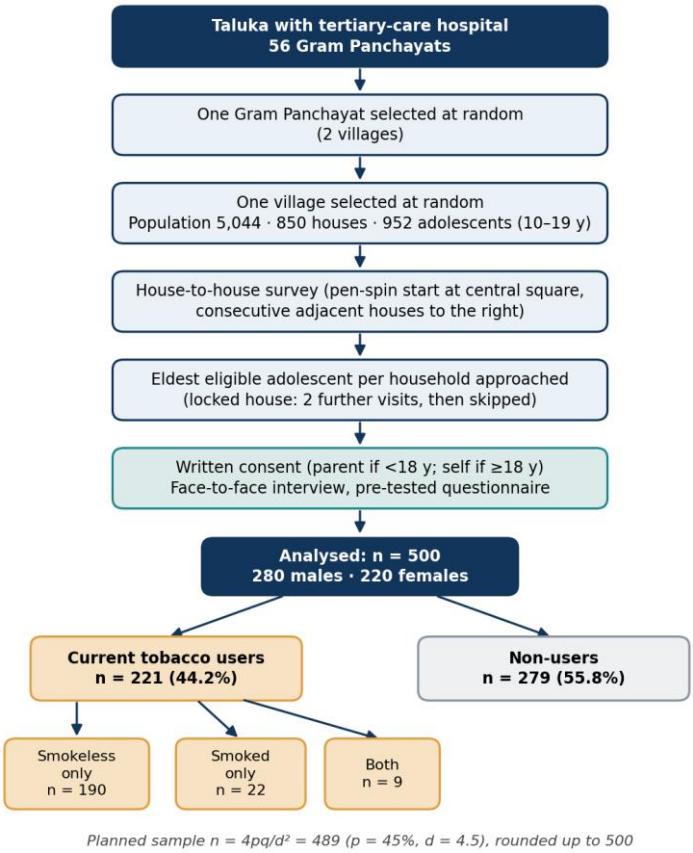


Figure 1. Sampling and participant flow. The final stage of selection (house-to-house, one adolescent per household) was not probability-based.

2.3 Eligibility

Adolescents aged 10–19 years who were present in the study area were eligible. Exclusion criteria were major illness, unwillingness to participate, residence in the area for less than six months, and stated age outside 10–19 years. Age was confirmed from available proof; where none existed, the parent's estimate was used.

2.4 Data collection and variables

Trained interviewers conducted private face-to-face interviews, in the absence of family members, using a pre-designed, pre-tested questionnaire with closed and open-ended items. Domains were age, sex, religion, education, occupation, family type and size, parental education and occupation, socioeconomic status, tobacco use (type, age at initiation, duration, frequency, reasons), tobacco use in the family, and willingness to quit. Socioeconomic status used the modified B.G. Prasad classification, updated to the All India Consumer Price Index (912) of December 2023.

2.5 Operational definitions

- **Current user:** any smoked or smokeless tobacco on one or more days in the 30 days before the survey. **Daily user:** at least once every day;

occasional user: at least once in a week but not daily.

- **Early adolescence:** 10–14 years; **late adolescence:** 15–19 years.
- **Education:** "less than SSC" comprised illiterate, primary, middle and high school; "more than SSC" comprised intermediate and above (SSC = secondary school certificate).
- **Products:** gutkha (manufactured areca nut–tobacco mixture), kharra, mishri, plain tobacco, cigarette, bidi and other smokeless products (khaini, betel quid, dry snuff). Pan masala is an areca-nut mixture that may or may not contain tobacco; it was recorded as a product of use (see Limitations). Multiple responses were allowed.
- **Tobacco use in the family:** use of any tobacco product by one or more family members.

2.6 Ethical considerations

Ethical clearance was obtained from the Institutional Ethics Committee before the study began. Written permission was obtained from the Gram Panchayat. After an information sheet was provided, written informed consent was obtained from a parent for adolescents younger than 18 years and from the participant if aged 18 or more. Confidentiality was assured.

2.7 Statistical analysis

Data were entered in Microsoft Excel and analysed with Epi Info version 7. For this manuscript, all proportions, 95% CIs and test statistics were recalculated independently from the cell counts. Proportions are reported with Wilson score 95% CIs [30]. Associations with current use are reported as crude odds ratios with Woolf logit 95% CIs and, because current use was common (above 10%), also as crude prevalence ratios with Katz log-method 95% CIs, which avoid the overstatement of association that odds ratios produce for common outcomes. Pearson χ^2 tests and, for socioeconomic class, a χ^2 test for linear trend were used. Two-sided $p < 0.05$ was significant. No multivariable model was fitted, and all odds ratios are unadjusted.

3. Results

3.1 Participants

All 500 sampled adolescents were analysed: 280 (56.0%) males and 220 (44.0%) females, 238 (47.6%) aged 10–14 and 262 (52.4%) aged 15–19 years (mean age 14.59 ± 2.24 years). Hindu (49.6%) and Buddhist (36.2%) adolescents predominated, 58.0% lived in nuclear families and 22.0% were working. Most fathers (88.8%) and mothers (90.2%) had education below SSC, and 51.0% of adolescents belonged to socioeconomic classes IV–V (Table 1, Figures 2 and 3).

Table 1. Sociodemographic characteristics of the 500 adolescents.

Characteristic	n (%)
Sex	
Male	280 (56.0)
Female	220 (44.0)
Age group (years)	
10–14 (early adolescence)	238 (47.6)
15–19 (late adolescence)	262 (52.4)
Religion	
Hindu	248 (49.6)

Characteristic	n (%)
Buddhist	181 (36.2)
Muslim	12 (2.4)
Other	59 (11.8)
Type of family	
Nuclear	290 (58.0)
Joint	146 (29.2)
Three-generation	64 (12.8)
Family size	
<4 members	295 (59.0)
4–10 members	143 (28.6)
>10 members	62 (12.4)
Adolescent's education	
Illiterate	31 (6.2)
Primary	20 (4.0)
Middle school	160 (32.0)
High school	187 (37.4)
Intermediate	102 (20.4)
Adolescent's occupation	
Not working	390 (78.0)
Working	110 (22.0)
Father's occupation	
Professional	28 (5.6)
Business	17 (3.4)

Characteristic	n (%)
Skilled worker	217 (43.4)
Semi-skilled worker	50 (10.0)
Unskilled worker	188 (37.6)
Father's education	
Illiterate	40 (8.0)
Primary	89 (17.8)
Middle	185 (37.0)
High school	130 (26.0)
Intermediate	27 (5.4)
Graduate	10 (2.0)
Postgraduate	19 (3.8)
Mother's occupation	
Not working	422 (84.4)
Working	78 (15.6)
Mother's education	
Illiterate	84 (16.8)
Primary	100 (20.0)
Middle	182 (36.4)
High school	85 (17.0)
Intermediate	18 (3.6)
Graduate	28 (5.6)
Postgraduate	3 (0.6)
Socioeconomic class (modified B.G. Prasad)	

Characteristic	n (%)
I	76 (15.2)
II	79 (15.8)
III	90 (18.0)
IV	147 (29.4)
V	108 (21.6)

Percentages are of 500. SSC = secondary school certificate; B.G. Prasad scale updated to the December 2023 consumer price index.

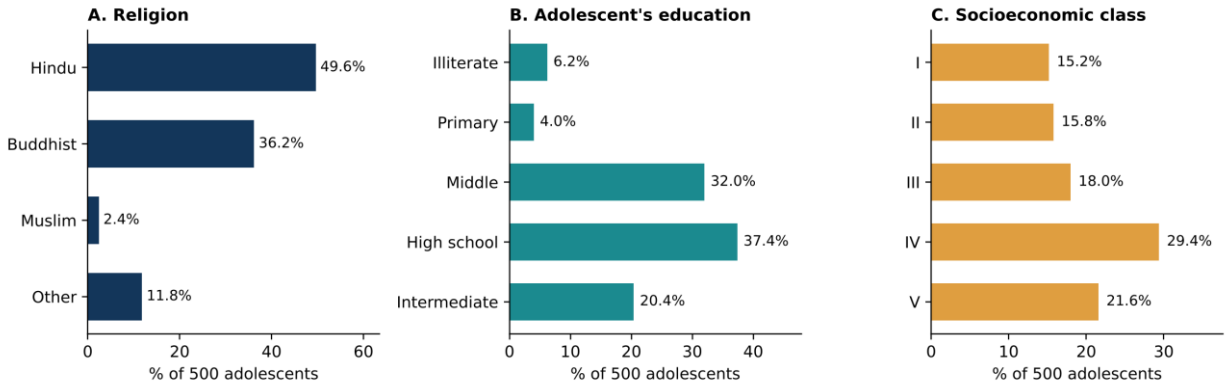


Figure 2. Sociodemographic profile of the 500 adolescents: (A) religion, (B) adolescent's education and (C) socioeconomic class (modified B.G. Prasad).

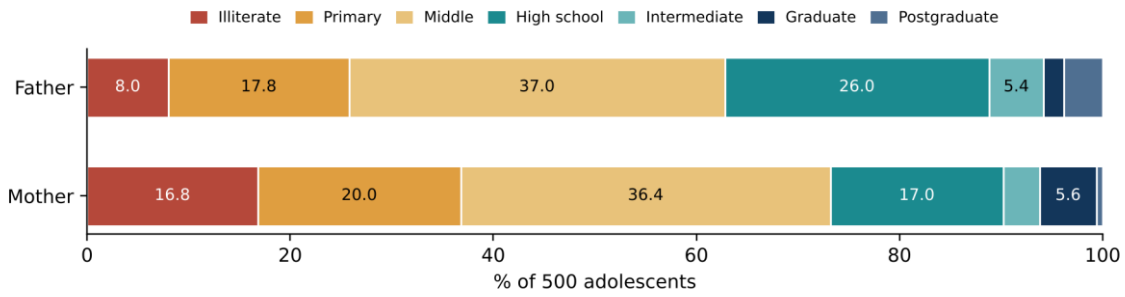


Figure 3. Parental education of the 500 adolescents (percentage of adolescents; labels shown for segments of 5% or more).

3.2 Prevalence of current tobacco use

Current tobacco use was reported by 221 of 500 adolescents: **44.2%** (95% CI 39.9–48.6). Prevalence was **64.3%** (180/280; 95% CI 58.5–69.7) in males and **18.6%** (41/220; 95% CI 14.0–24.3) in females (Figure 4A). Males made up 81.4% of all current users. Of the 221 users, 146 (66.1%) were late and 75 (33.9%) early adolescents.

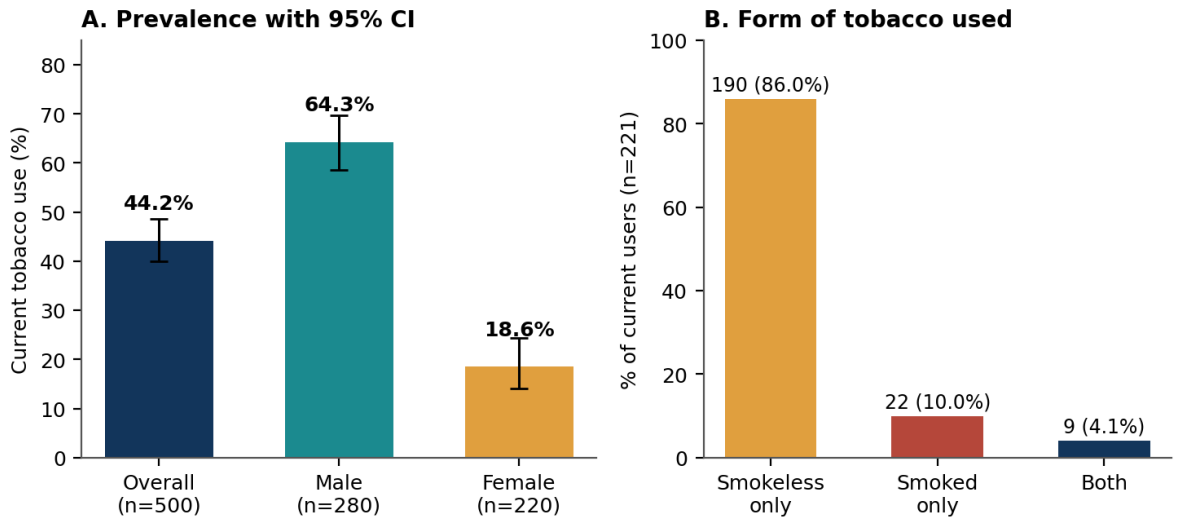


Figure 4. (A) Prevalence of current tobacco use overall and by sex with 95% Wilson confidence intervals. (B) Form of tobacco used among current users.

3.3 Pattern of tobacco use

Among users, 86.0% (190) used smokeless tobacco only, 10.0% (22) smoked only and 4.1% (9) used both; all 41 female users and 149 of 180 male users were smokeless-only users, and every smoker was male (Figure 4B, Table 2). Initiation was at 10 years or younger in 15.4%, at 11–15 years in 58.4% and at 16–19 years in 26.2% (Figure 5A). Duration of use was under one year in 29.4%, 1–5 years in 48.4% and over 5 years in 22.2% (Figure 5B). Daily use was reported by 59.7%, and was more frequent in males than females (65.0% vs 36.6%; $\chi^2 = 11.21$, $p < 0.001$). Willingness to quit was expressed by 75.1% (Figure 5D).

Table 2. Pattern of tobacco use among the 221 current users.

Characteristic	Males (n)	Females (n)	Total, n (% of users)
Age at initiation (years)			
≤10	26	8	34 (15.4)
11–15	103	26	129 (58.4)
16–19	51	7	58 (26.2)
Duration of use (years)			
<1	–	–	65 (29.4)
1–5	–	–	107 (48.4)
>5	–	–	49 (22.2)
Frequency of use			
Daily	117	15	132 (59.7)
Occasional	63	26	89 (40.3)

Characteristic	Males (n)	Females (n)	Total, n (% of users)
Form of tobacco			
Smokeless only	149	41	190 (86.0)
Smoked only	22	0	22 (10.0)
Smoked and smokeless	9	0	9 (4.1)
Willingness to quit			
Willing	–	–	166 (75.1)
Not willing	–	–	55 (24.9)
Tobacco use in family members			
Present	–	–	154 (69.7)
Absent	–	–	67 (30.3)
All current users	**180**	**41**	**221 (100)**

"–" = sex-specific counts not available. Duration, quit intention and family use are shown for all users.

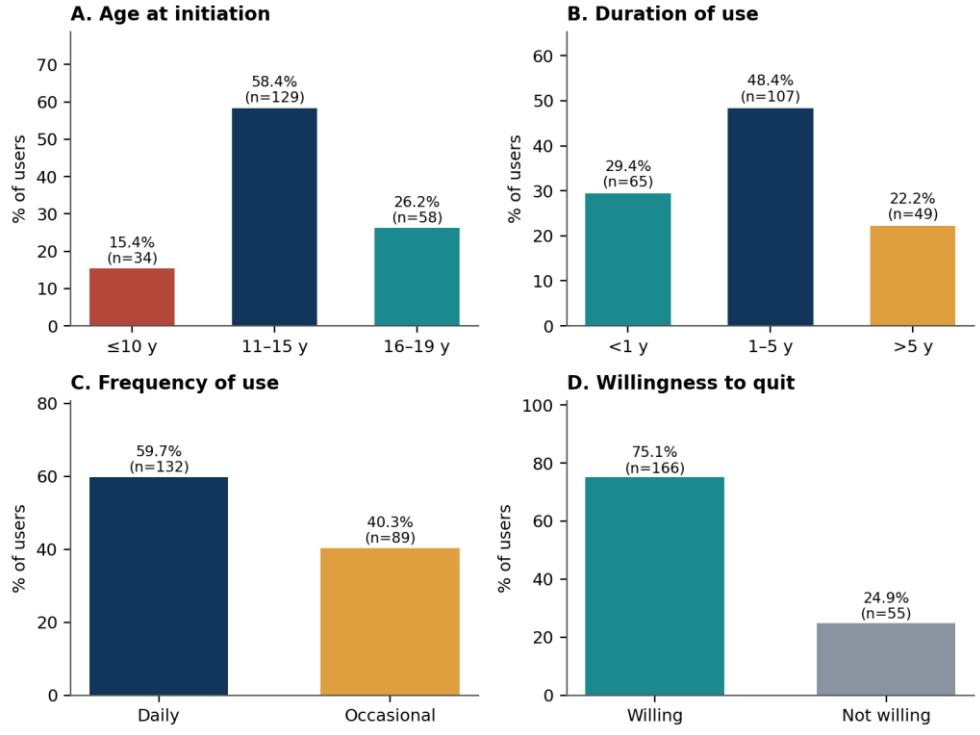


Figure 5. Profile of current users (n = 221): (A) age at initiation; (B) duration of use; (C) frequency of use; (D) willingness to quit.

3.4 Products and reported reasons

The most frequently reported products were gutkha (54.3%), kharra (33.5%) and pan masala (31.7%), followed by other smokeless products (24.4%), plain tobacco (14.9%), mishri (10.9%), cigarettes (4.1%) and bidis (0.9%); responses overlapped (Table 3, Figure 6). Gutkha was reported by 90.2% of female and 46.1% of male users. Peer pressure (57.0%) and "feels better" (54.8%) were the leading reasons, followed by stress relief (27.1%), fun (13.6%), other reasons (8.6%) and concentration on work (4.5%) (Figure 7).

Table 3. Tobacco products reported by current users (multiple responses allowed).

Product	Male (n)	Female (n)	Total, n (% of 221)	% of male users (n=180)	% of female users (n=41)
Gutkha	83	37	120 (54.3)	46.1	90.2
Kharra	61	13	74 (33.5)	33.9	31.7
Pan masala	53	17	70 (31.7)	29.4	41.5
Other smokeless	41	13	54 (24.4)	22.8	31.7
Plain tobacco	17	16	33 (14.9)	9.4	39.0
Mishri	13	11	24 (10.9)	7.2	26.8
Cigarette	9	0	9 (4.1)	5.0	0
Bidi	2	0	2 (0.9)	1.1	0

Percentages do not sum to 100 because users could report more than one product.

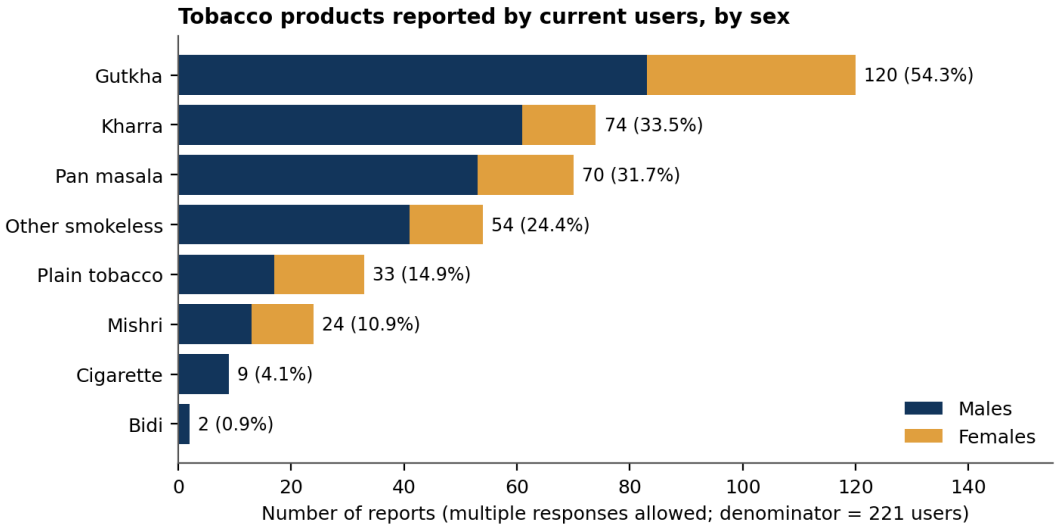


Figure 6. Products reported by current users, by sex (multiple responses allowed).

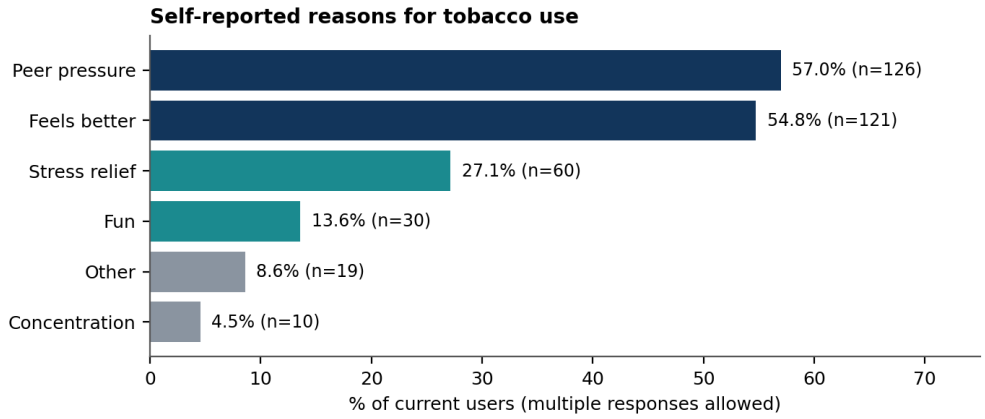


Figure 7. Self-reported reasons for tobacco use among current users (multiple responses allowed).

3.5 Factors associated with current use

In crude analyses (Table 4, Figure 9; odds ratios and prevalence ratios), current use was significantly more common among males, adolescents with education below SSC, working adolescents, and those whose parents had education below SSC. Tobacco use in the family showed the strongest association among the adolescent-level exposures: 78.2% of adolescents with a tobacco-using family member were current users versus 22.1% of those without (OR 12.62; 95% CI 8.18–19.46). The odds associated with maternal education below SSC were large but imprecise (OR 14.35; 95% CI 4.40–46.80), because only three of 49 adolescents with better-educated mothers used tobacco. Because use was common, prevalence ratios were more modest than odds ratios (family tobacco use 3.54, 95% CI 2.83–4.42; male sex 3.45, 2.58–4.61; class V vs I 3.79, 2.27–6.34), but the direction and significance of all associations were unchanged. Family type was not associated with use. Prevalence rose steadily from 17.1% in class I to 64.8% in class V (χ^2 for trend = 63.7, $p < 0.001$; Table 5, Figure 8A).

Table 4. Crude associations between selected factors and current tobacco use (n = 500).

Factor (exposed vs reference)	Users/total (%) exposed	Users/total (%) reference	Crude OR (95% CI)	Crude PR (95% CI)	χ^2	p
Sex: male vs female	180/280 (64.3)	41/220 (18.6)	7.86 (5.17–11.94)	3.45 (2.58–4.61)	104.09	<0.001
Tobacco use in family: yes vs no	154/197 (78.2)	67/303 (22.1)	12.62 (8.18–19.46)	3.54 (2.83–4.42)	152.12	<0.001
Mother's education: <SSC vs >SSC	218/451 (48.3)	3/49 (6.1)	14.35 (4.40–46.80)	7.90 (2.63–23.73)	31.94	<0.001
Father's education: <SSC vs >SSC	211/444 (47.5)	10/56 (17.9)	4.17 (2.05–8.46)	2.66 (1.50–4.71)	17.74	<0.001
Adolescent's education: <SSC vs >SSC	186/398 (46.7)	35/102 (34.3)	1.68 (1.07–2.64)	1.36 (1.02–1.82)	5.08	0.024
Work status: working vs not working	59/110 (53.6)	162/390 (41.5)	1.63 (1.06–2.49)	1.29 (1.05–1.59)	5.09	0.024
Family type: nuclear vs joint/three-generation	131/290 (45.2)	90/210 (42.9)	1.10 (0.77–1.57)	1.05 (0.86–1.29)	0.26	0.61

All estimates are unadjusted (no multivariable model). OR = odds ratio; PR = prevalence ratio. SSC = secondary school certificate. An age-group comparison is not reported because denominators could not be reconciled with Table 1 (see Limitations).

Table 5. Current tobacco use by socioeconomic class (modified B.G. Prasad).

Class	Users/total	Prevalence (%)	Crude OR vs class I (95% CI)	Crude PR vs class I (95% CI)
I	13/76	17.1	1 (reference)	1 (reference)
II	16/79	20.3	1.23 (0.55–2.77)	1.18 (0.61–2.29)
III	41/90	45.6	4.05 (1.96–8.39)	2.66 (1.55–4.59)
IV	81/147	55.1	5.95 (3.01–11.74)	3.22 (1.92–5.40)
V	70/108	64.8	8.93 (4.36–18.26)	3.79 (2.27–6.34)

χ^2 for linear trend = 63.7, $p < 0.001$.

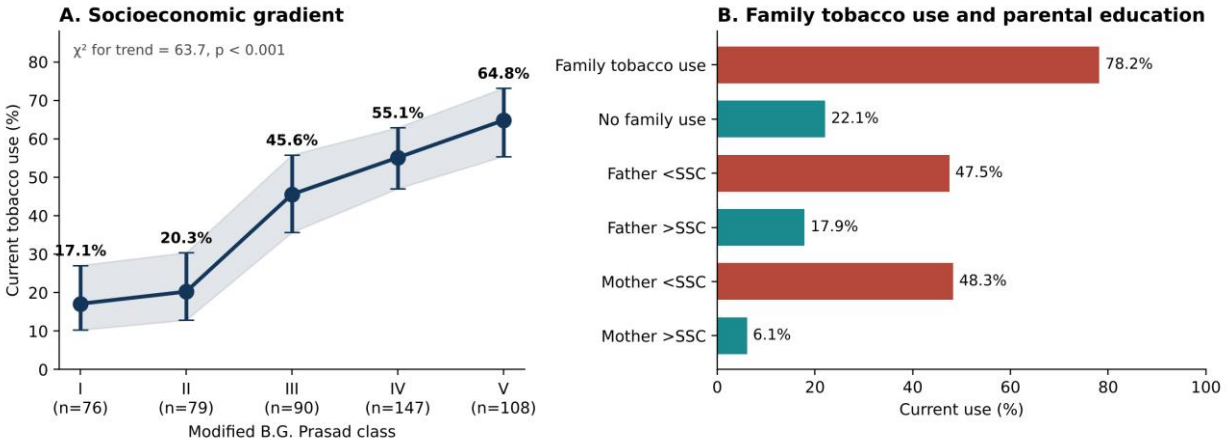


Figure 8. (A) Prevalence of current use by socioeconomic class with Wilson 95% CI (shaded band). (B) Prevalence by family tobacco use and parental education.

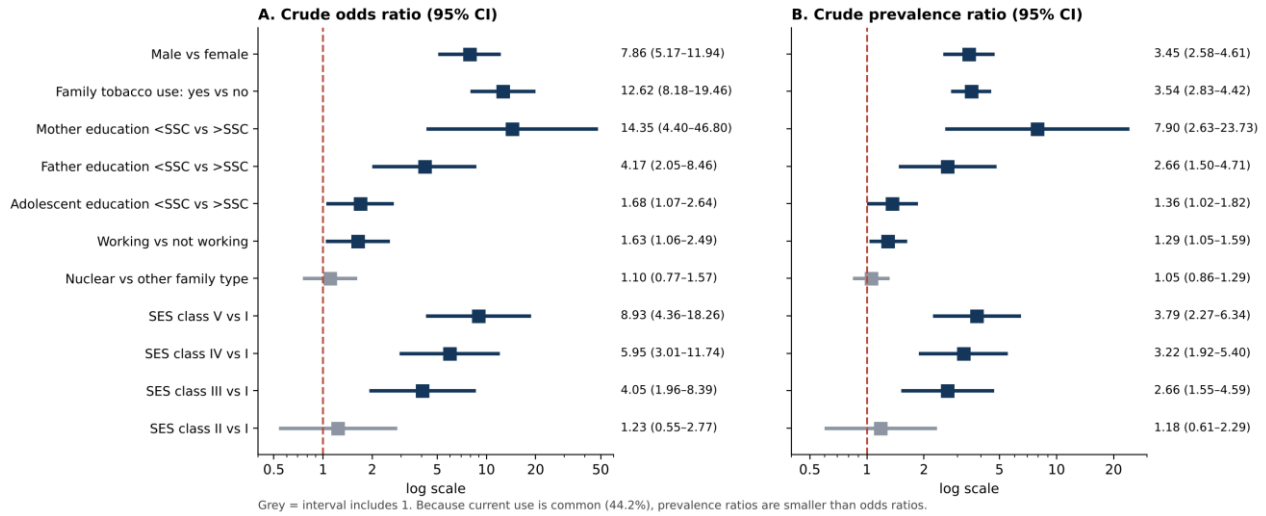


Figure 9. Forest plots of crude (A) odds ratios and (B) prevalence ratios with 95% CIs (logarithmic scale). Grey markers indicate intervals including 1.

4. Discussion

4.1 Principal findings

In this rural community, 44.2% of adolescents reported current tobacco use, with a striking sex difference (64.3% vs 18.6%). Use began early, was daily for six in ten users, and was overwhelmingly smokeless. Social context mattered: use clustered in households where family members used tobacco, in families with less educated parents, and in lower socioeconomic classes.

4.2 Comparison with other studies

The overall prevalence is close to that of earlier rural adolescent surveys in Maharashtra, which reported 39–47% [26–28]. It is far higher than the 8.5% current use estimated for school students aged 13–15 years in the 2019 national survey [7]. Estimates from recent Indian community and school surveys are also lower (Figure 10) [9–12]. The figures are not directly comparable: our sample was community-based, covered ages 10–19 years, counted any smoked or smokeless product including pan masala, and was collected several years after the 2019 national survey [7]; school-based samples exclude out-of-school adolescents, and definitions (current, any or ever use; smokeless only) differ across studies. The male excess is consistent with earlier regional reports [26,27]. National and district estimates are lower still: among adolescents aged 15–19 years in aspirational districts, NFHS-5 recorded use in 15.9% of males and 1.2% of females [16], and NFHS-6 shows only a slight national decline in tobacco use between 2019–21 and 2023–24 [15]. Our much higher community figures, particularly among girls, probably reflect differences in age range, product definitions (smokeless products and pan masala included) and survey method, and suggest that household surveys may under-capture smokeless use; they also indicate that national declines may not yet have reached rural adolescents, a hypothesis that needs repeated community surveys. Local practices, such as the use of tobacco preparations as dentifrice by rural girls, have been described [26] and may help explain why women and girls in our sample used gutkha, plain tobacco and mishri proportionally more often than boys did (Table 3), although we did not collect data on that use.

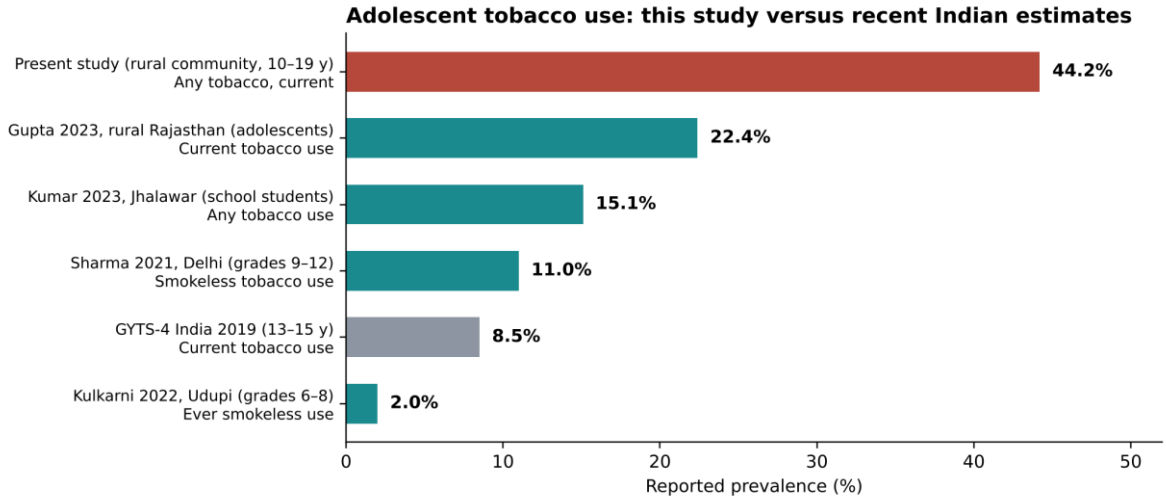


Figure 10. Reported prevalence of tobacco use in the present study and in recent Indian estimates. Definitions, age groups and settings differ between studies; bars are for orientation and not for direct statistical comparison.

That 73.8% of users started by age 15 and 15.4% by age 10 is in line with national data showing smokeless initiation in early childhood [7] and with reports of a downward shift in age at initiation [31]. Adult survey data show that the mean age of smokeless initiation has risen across GATS rounds, but remains earliest, at about 15.5 years, among those aged 15–24 years [32]; most of our users began even earlier. A late-adolescent concentration of use has also been reported elsewhere [33], and 66.1% of our users were aged 15–19 years.

4.3 Smokeless tobacco and product awareness

Nine in ten users used smokeless products (190 smokeless-only plus 9 dual users), so programmes built around cigarettes would miss most adolescent use. Smokeless tobacco carries substantial risks of mortality and oral cancer [18–20], yet regulation lags behind that for smoking [21]. During fieldwork, many adolescents said they did not know whether gutkha and pan masala contained tobacco and regarded them as mouth fresheners (informal observation, not systematically recorded). Evidence on awareness is mixed: in Karnataka, students with the least awareness of harms had about 3.7 times the odds of ever using smokeless tobacco [12], whereas in national adult data awareness of harms did not protect against smokeless initiation (adjusted OR 1.4) [32]. Exposure to tobacco use by teachers at school and to promotion on social media has also been linked to smokeless use among Delhi students [11]. Clear labelling, vendor-level enforcement of the Cigarettes and Other Tobacco Products Act, which prohibits sale to persons under 18 [34], and community education that names these products explicitly are therefore warranted.

4.4 Family, education and socioeconomic gradients

The association of use with tobacco use in the family (OR 12.62) agrees with evidence that exposure to parents' and siblings' smoking increases the risk of uptake [24], and the gradient across socioeconomic classes agrees with the broader literature on smoking and social disadvantage [23,25]. Taken at face value and assuming a causal relationship, the crude prevalence ratio of 3.54 and the 69.7% of users with a tobacco-using family member imply a population attributable fraction of about 50%, that is, roughly half of current use in this community was associated with household tobacco use. Similar correlates were reported in rural Rajasthan, where family tobacco use, maternal education, pocket money and household income predicted adolescent use [9], and in Karnataka, where family or friend use, low socioeconomic status and male sex were associated with smokeless use [12]. In NFHS-5, rural residence and a poor wealth index were likewise associated with youth tobacco use [14]. The very wide interval for maternal education reflects sparse data in the reference group and should not be over-interpreted. Working adolescents had higher crude odds of use, possibly through disposable income; a Nepalese study similarly linked pocket money to use [33], and a national survey has linked occupational context to smokeless use in adults [35]. These are crude, mutually overlapping indicators of disadvantage: without adjustment, we cannot separate the independent contribution of family use, parental education, class and work, and the cross-sectional design cannot establish temporality.

4.5 Peers, reasons and implications for prevention

Peer pressure (57.0%) and perceived benefit ("feels better", 54.8%) were the main reasons given, with stress relief for 27.1%. Peer influence was also the commonest reason among school adolescents in Jhalawar, although only 31.4% of those users wished to quit [10], far below the 75.1% in our community. These findings argue for approaches that build refusal and coping skills and address peer norms. Evidence for school-based smoking prevention programmes is mixed, with stronger support for social-competence and combined approaches than for information alone [36], and family-based programmes show promise [37]. Indian school-based awareness interventions have reported quitting at two weeks in Puducherry [38] and after sensitisation of field workers in rural Gujarat [39], but samples were small and follow-up short, so durability is unproven. Because 75.1% of users were willing to quit, cessation support is needed, but evidence for effective cessation interventions in young people remains limited [40], so services should be evaluated as they are scaled. The nicotine product landscape continues to change: initial e-cigarette use is associated with later cigarette smoking [41], WHO now estimates that at least 15 million adolescents aged 13–15 years use e-cigarettes worldwide [3], and India prohibited electronic cigarettes in 2019 [42]. Figure 11 integrates our findings into a socio-ecological framework with matching intervention entry points.

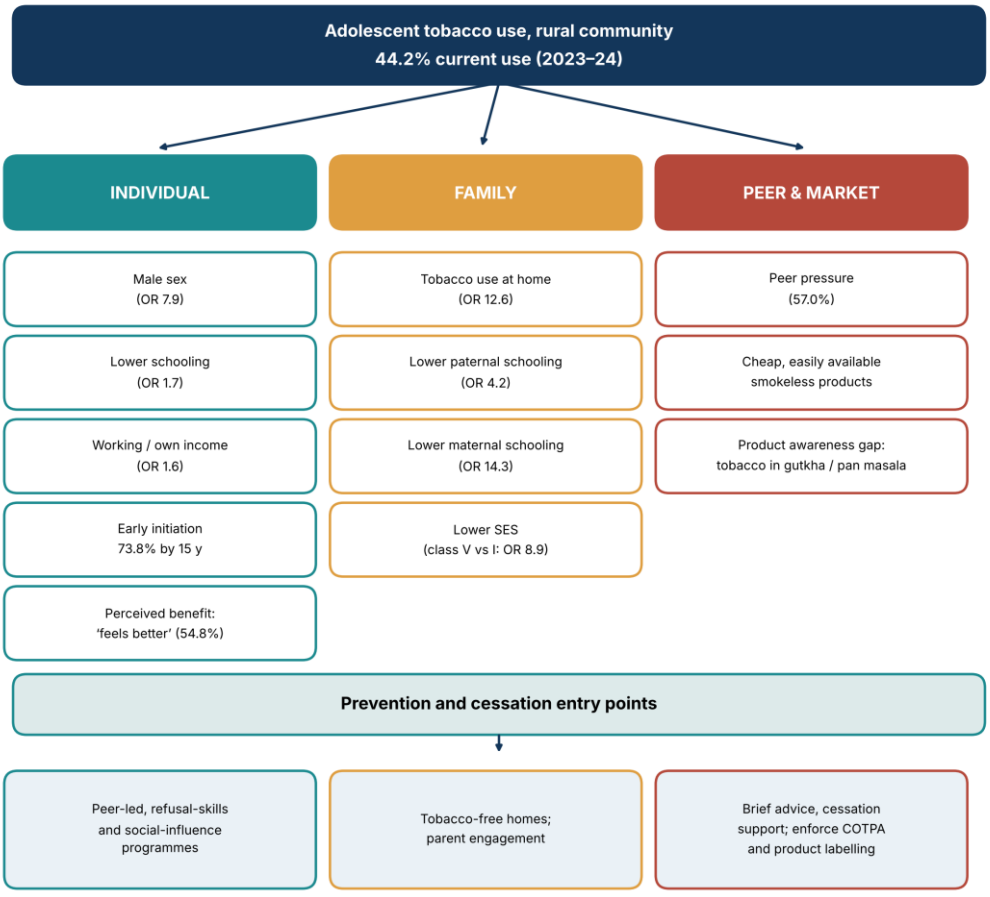


Figure 11. Conceptual framework: correlates of adolescent tobacco use in this rural community (crude odds ratios) and corresponding prevention and cessation entry points.

4.6 Strengths and limitations

Strengths include a community (not school) sampling frame that reaches out-of-school adolescents, both sexes, a standard 30-day definition of current use, private interviews, and a detailed profile of products, initiation and quit intention. Several limitations apply. (1) Tobacco use was self-reported and may be under-reported because of social desirability, or misreported because of recall error. (2) A single village was studied and the within-village route was not probability-based; selecting the eldest eligible adolescent per household may bias the age distribution, and non-response counts were not recorded. (3) All associations are crude; confounding between family use, parental education, class and work is likely. (4) Pan masala may not contain tobacco, so its inclusion may overstate use; users reporting only pan masala cannot be separated from the data. (5) Product-level counts for smoked forms (cigarette 9, bidi 2) do not fully account for the 31 users classified as smoking, suggesting other smoked forms were not itemised. (6) Age-specific prevalence is not reported because the age-group denominators in the analysis tables could not be reconciled with the demographic table.

5. Conclusions

Tobacco use was common among adolescents in this rural community during 2023–2024, began early, and was predominantly smokeless. Use was concentrated among males and in households and strata marked by tobacco use, low parental education and low socioeconomic position. Prevention should therefore address smokeless products explicitly, work through peers and families, and offer accessible cessation support to the three in four users who wish to quit. Multi-village community surveys with adjusted analyses are needed to confirm whether these patterns hold more widely.

Recommendations

1. Include smokeless products (gutkha, kharra, mishri, plain tobacco, khaini) explicitly in school and community prevention curricula, starting before age 10–11 years.
2. Use peer-led, refusal-skills and stress-coping components rather than information-only messages.
3. Engage parents and household members: promote tobacco-free homes and counsel adult users as role models.
4. Offer confidential brief advice and cessation referral to adolescents who use tobacco and wish to quit, and evaluate outcomes.
5. Enforce the prohibition of sales to minors, strengthen vendor monitoring, and require clear labelling of tobacco-containing products.
6. Prioritise outreach to low-income, low-literacy households and to working adolescents.

Declarations

Ethics approval and consent to participate: Approved by the Institutional Ethics Committee. Written informed consent was obtained from parents of participants younger than 18 years and from participants aged 18 years or older. Permission was obtained from the Gram Panchayat.

Conflict of interest: None.

Availability of data: The de-identified dataset is available from the corresponding author on reasonable request.

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Author contributions: Both authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work. Concept and design: Atul Gopal Agrawal. Acquisition, analysis, or interpretation of data: Atul Gopal Agrawal. Drafting of the manuscript: Atul Gopal Agrawal, Ankita Agrawal. Critical review of the manuscript for important intellectual content: Atul Gopal Agrawal, Ankita Agrawal.

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