

RESEARCH ARTICLE

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Tobacco Consumption, Early Initiation, and Determinants Among School-Going Adolescents in Ranchi, Jharkhand: A Cross-Sectional Study

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Abstract

Objective: India faces a rapidly increasing burden of oral cancer. Adolescence is a critical period for risk-taking behaviours, yet state-level, school-based data from high-burden regions such as Jharkhand are limited. To estimate the prevalence and patterns of tobacco use and identify socio-demographic, familial, and awareness-related predictors of ever tobacco use among school-going children in Ranchi, Jharkhand. **Methods:** A cross-sectional survey was conducted among 898 students from government and government-aided schools in Ranchi using a pre-tested, structured, self-administered questionnaire. Data included demographics, awareness, tobacco use, social influences, and attitudes toward tobacco control. Ever tobacco use was defined as lifetime use of smoked or smokeless tobacco; current use was defined as use within the past 30 days among ever users. Prevalence was estimated with 95% confidence intervals (CIs). Chi-square tests assessed associations, and logistic regression identified independent predictors. **Results:** Of 898 students (52.1% girls; mean age 15.6 years), 7.9% (95% CI 6.1–9.7) had ever used tobacco. Among ever users, 22.5% were current users and 50.7% had discontinued. Ever use was higher among boys than girls (12.4% vs 4.1%; OR 3.36, 95% CI 1.95–5.78). However, among ever users, girls were more likely to be current users (OR 5.79, 95% CI 1.74–19.25). Initiation clustered between 10–15 years. In multivariable analysis, male gender (adjusted OR 2.76, 95% CI 1.55–4.93) and family tobacco use (adjusted OR 1.77, 95% CI 1.06–2.95) were independent predictors. **Conclusion:** Tobacco experimentation begins by mid-adolescence in Ranchi. Prevention should start before age 10, emphasize family-centred strategies, and address social modelling beyond awareness programmes.

Keywords: adolescents, tobacco, smokeless tobacco, oral cancer, tobacco control, oral cancer prevention, schools

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Introduction

Tobacco use is a major global public health challenge, and initiation often occurs during adolescence, a crucial developmental stage that shapes lifelong behaviours and future disease risk [1]. Tobacco use is a leading cause of preventable morbidity and mortality worldwide, and early initiation significantly increases the likelihood of long-term use and dependence into adulthood [1–4]. In India, nearly one in ten adolescents aged 13 – 15 years have ever smoked, with almost half of these initiating tobacco use before 10 years of age, underscoring the early age of experimentation and adoption in this population [5]. School-going adolescents are therefore a vulnerable group for early exposure, yet evidence on their tobacco consumption patterns, particularly in district-specific contexts such as Ranchi, Jharkhand, is scarce.

Adolescents in India are exposed to various forms of

tobacco, including both smoked (e.g., bidi and cigarettes) and smokeless products (e.g., khaini, gutkha, paan, and tobacco), with multicultural and socioeconomic factors influencing preferences and patterns of use [6, 7]. Adolescent tobacco initiation is linked to peer and family influence, media exposure, and psychosocial stressors, which help establish habits that persist into adulthood [8, 9]. Moreover, Adolescents often have limited awareness of the harmful health effects of tobacco, including its strong link to oral diseases and cancers.

Findings from the Global Youth Tobacco Survey (GYTS-4) and the Global Adult Tobacco Survey (GATS-2) further demonstrate that a substantial proportion of Indian youth are exposed to tobacco through peers, family members, and pervasive availability of smokeless products, underscoring the need for early, targeted prevention [10, 11]. Jharkhand, and its capital city Ranchi, lie within what has been described as India's "smokeless

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tobacco belt,” where the social acceptability and easy availability of chewing tobacco products are deeply rooted [12]. Yet, despite this recognised risk context, school-based epidemiological data from Jharkhand that explore when and how adolescents initiate tobacco use, and what factors influence continuation or discontinuation, remain limited. In India, smokeless tobacco consumption contributes substantially to the burden of oral cancer, with users of betel quid with tobacco demonstrating a several-fold increased risk of developing malignant lesions compared to non-users [13]. Oral cavity cancer is among the most common cancers in South and Central Asia, with India bearing a disproportionate share of the global burden, largely due to widespread tobacco use behaviour [14]. Despite improvements in surgical techniques, radiotherapy and systemic treatments, outcomes continue to be compromised by late presentation, diagnostic delays and uneven access to care, especially in resource-constrained settings [15].

India has adopted several legislative and policy measures aligned with the WHO Framework Convention on Tobacco Control (WHO-FCTC), including restrictions on advertising, pictorial health warnings, and smoke-free public spaces [16]. However, enforcement gaps and sociocultural acceptance of smokeless tobacco continue to undermine these efforts, particularly in semi-urban and rural regions. Peer behaviour, parental use, and exposure to tobacco marketing remain important determinants of adolescent initiation and continuation [17–19].

Consistent with our outpatient department experience, clinical observations and regional studies from Jharkhand report a concerning number of young patients with oral and head-and-neck cancers who have long histories of smokeless tobacco use beginning during their school years [19–21]. Despite these warning signals, district-level, school-based evidence on prevalence, age at initiation, product patterns, and associated social and familial influences remains scarce in Ranchi. Addressing this gap is essential for designing culturally appropriate, locally relevant prevention strategies. Therefore, this cross-sectional study was conducted to generate district-specific evidence on tobacco consumption among school-going adolescents (Class 9–12) in Ranchi, Jharkhand.

Materials and Methods

Study design and setting

This was a school-based, cross-sectional survey conducted among students in classes 9–12 in selected schools in Ranchi district, Jharkhand, India. Ranchi is an urbanising district with a mix of government, government-aided, and private schools that enrol students from varied socio-economic backgrounds. Data were collected between June and September 2025 across multiple schools.

Sampling and participants

The target population comprised all students enrolled in classes 9–12 in the participating schools at the time of data collection. A school-based sampling frame was constructed using UDISE (Unified District Information

System for Education) codes obtained from the district education office. Schools were purposively selected to capture a range of school types and localities within Ranchi, and within each participating school, all present students in the eligible classes on the survey day were invited to participate. Inclusion criteria were enrolment in classes 9–12 in a participating school and presence in school on the day of the survey. Students who were absent during data collection or who declined to participate were excluded.

Ethical considerations

The study protocol was reviewed and approved by the institutional ethics committee (IRB Reg No: EC/New/INST/2024/4393, Approval Number: ECR/31B), and administrative permission was obtained from the school principals before data collection. The questionnaire was anonymous with no collection of names or roll numbers, and students were informed that they could skip any question or withdraw at any time without academic consequences.

Data collection tool

Data were collected using a structured, self-administered questionnaire that had been developed in English and contextually adapted into simple Hindi language appropriate for school-going adolescents in Ranchi.

The study questionnaire was adapted from standardized instruments used in the Global Adult Tobacco Survey (GATS-2) and the Global Youth Tobacco Survey (GYTS-4). Relevant items were modified to suit the study objectives and local context. The final tool included sections on tobacco use patterns, age of initiation, product types, social influences, awareness of health effects, and attitudes toward tobacco control policies. The instrument covered the following domains:

Socio-demographic information

UDISE school code, date of survey, class, age, and gender.

Awareness of tobacco

Whether the student had heard of “tobacco,” understanding of what it is, and recognition of specific tobacco products (smokeless and smoked forms), including an option “don’t know any.”

Tobacco use behaviour

Ever use of any smokeless or smoked tobacco, age at first use (categorised as <10 years, 10–12, 13–15, >15), and current use status among ever users (past 30-day use).

Social influences and motivations

Sources of influence on understanding or first use (friends, family members, social media/advertisements/films, self-initiated), and main reason for first use (curiosity, peer pressure, stress relief, to look stylish/macho, other/unspecified).

Family tobacco use

presence of any family member using tobacco (yes/no/don't know).

Awareness programmes

Exposure to any tobacco-related awareness sessions in school or neighbourhood, and whether the student had ever attended such a session.

Attitudes and behaviours regarding tobacco control

Whether the student had ever given tobacco to others, and views on banning the sale of tobacco to persons under 18 years (support/oppose/don't know).

Perceived harms and health knowledge

Perception of whether tobacco is harmful (yes/no/don't know), and knowledge of specific health consequences (cancer, respiratory disease, heart disease, all of the above, none of these).

The questionnaire was pilot tested on a small group of students outside the final sample to assess clarity, comprehension, and time required, and minor wording adjustments were made before full implementation.

Definitions and outcome measures

The primary outcome was "ever tobacco use," defined as any self-reported lifetime use of any form of tobacco (smoked or smokeless) at least once. A binary variable was constructed (ever user vs never user) for analysis. "Current tobacco use" among ever users was defined as any use within the past 30 days and was used to classify ever users into current versus non-current users.

Key explanatory variables included gender (male/female), class group (9–10 vs 11–12), family tobacco use (yes/no/don't know), exposure to any awareness programmes (yes/no, based on attending school or neighbourhood sessions), and support for banning sales of tobacco to persons under 18 years (support vs do not support).

Data management and statistical analysis

Data from completed questionnaires were entered into an electronic spreadsheet based on the pre-designed data entry format corresponding to the questionnaire items and coded response options. Data cleaning included range and consistency checks for age, gender, class, and key outcome variables, as well as identification of outliers in age; for descriptive age statistics, 13 students with reported age >20 years were treated as outliers and excluded from the mean and SD calculation.

Descriptive analyses summarised socio-demographic characteristics, awareness, knowledge, exposure to awareness programmes, attitudes, and tobacco use patterns using frequencies and percentages. Prevalence of ever tobacco use and current use among ever users was estimated with 95% CIs. Chi-square tests were used to assess associations between ever tobacco use and key categorical predictors, including gender, family tobacco use, exposure to awareness programmes, and support for banning sales to minors.

To identify independent predictors of ever tobacco use,

univariable logistic regression models were first fitted for each explanatory variable, and crude odds ratios (ORs) with 95% CIs and p values were obtained. Variables with conceptual relevance and/or $p < 0.20$ in univariable analysis were then entered into a multivariable logistic regression model to estimate adjusted odds ratios (aORs) and 95% CIs. The final model included gender (male vs female), class group (11–12 vs 9–10), family tobacco use (yes vs no), exposure to any awareness programme (yes vs no), and support for banning sales to <18 years (yes vs no).

The regression output showed that male gender and family tobacco use were independently associated with higher odds of ever use, while class group, awareness exposure, and support for bans were not statistically significant predictors after adjustment. Model results are presented in Table 10 with both crude and adjusted ORs, CIs, and p-values.

Results

Sample characteristics

A total of 898 students participated in the survey. Of these, 468 (52.1%) were female, 418 (46.5%) were male, and 12 (1.3%) did not report gender. Class distribution was 34.7% in class 9, 31.0% in class 10, 23.2% in class 11, and 10.4% in class 12, with 0.8% missing class data. Table 1 summarises the demographic profile of the surveyed students.

Prevalence of ever and current tobacco use

Overall, 71 of 898 students reported ever using any form of tobacco, yielding an ever-use prevalence of 7.9% (95% CI 6.1–9.7), while 827 students (92.1%; 95% CI 90.3–93.9) reported never using tobacco. Among the 71 ever users, 16 (22.5%; 95% CI 12.8–32.3) reported current use (use within the last 30 days), 36 (50.7%; 95% CI 39.1–62.3) were non-current users (past use but not current), and the remainder did not clearly report current status, as shown in Table 2. These findings suggest that experimentation with tobacco is present, but progression to sustained current use remains relatively limited in this school-based cohort.

Table 1. Baseline Demographic Profile of the Surveyed Students Included in the Study (N = 898)

Demographic Profile		
Characteristic	Category	n (%)
Gender	Female	468 (52.1)
	Male	418 (46.5)
	Missing	12 (1.3)
Class	9 th	312 (34.7)
	10 th	278 (31.0)
	11 th	208 (23.2)
	12 th	93 (10.4)
	Missing	7 (0.8)
Age (years)	Mean $\pm$ SD*	15.6 $\pm$ 1.4
	Range (analytical)	10–20

*Based on 885 students with valid age entries between 10–20 years (outliers >20 years excluded from mean/SD).

Table 2. Prevalence of Ever and Current Tobacco Use among Students (N = 898)

Outcome	n / N	% (95% CI)
Ever used any form of tobacco	71 / 898	7.9 (6.1–9.7)
Never used tobacco	827 / 898	92.1 (90.3–93.9)
Among ever users (n = 71):		
Currently using tobacco	16 / 71	22.5 (12.8–32.3)
Not currently using	36 / 71	50.7 (39.1–62.3)
Current status unclear	19 / 71	26.8 (16.6–36.9)*

*Some ever users did not clearly report current status.

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Gender differences in ever and current use

Supplementary Table 1a showed that, among girls (n = 468), 19 (4.1%) reported ever tobacco use, while 449 (96.0%) were never users. Among boys (n = 418), 52 (12.4%) reported ever use, and 366 (87.6%) were never users. The difference in ever use prevalence between boys and girls was statistically significant ($\chi^2 = 19.91$, $p < 0.001$), with boys having over three times the odds of ever use compared with girls (OR 3.36, 95% CI 1.95–5.78).

In contrast, supplementary Table 1b showed that among ever users only, current use was more frequent among girls than boys. Of 19 females ever users, 9 (47.4%) were current users, whereas among 52 male ever users, 7 (13.5%) were current users. This difference was significant ($\chi^2 = 7.33$, $p = 0.0068$), and the odds of being a current user among ever users were 5.79 times higher in girls than boys (95% CI 1.74–19.25).

These patterns indicate that boys are more likely to experiment with tobacco, whereas the smaller subset of girls who do experiment are more likely to continue as current users.

Age at first tobacco use

Supplementary Table 2 showed that among the 71 ever users, 43 provided their age at first tobacco use, while 28 did not. Of those with valid age information, initiation clustered in early to mid-adolescence: 5 (7.0%) reported starting before age 10 years, 13 (18.3%) at 10–12 years, 14 (19.7%) at 13–15 years, and 11 (15.5%) after age 15. Nearly 40% of ever users did not report age at first use.

Social influences and reasons for first use

Friends were the most commonly reported influence on understanding or first use of tobacco, cited by 35 of 71 ever users (49.3%), followed by family members (19.7%) and social media/advertisements/films (14.1%); 11.3% reported “no influence/self-learned,” and 11.3% marked

“not applicable.” As multiple responses were allowed, totals exceed 100%, as shown in Supplementary Table 3a.

As shown in Supplementary Table 3b, the main reason for first tobacco use, peer pressure, was most frequently reported (28/71; 39.4%), followed by curiosity (23.9%), stress relief (14.1%), and the desire to look “stylish/macho” (9.9%), while 21.1% selected “not applicable.” These findings highlight the primacy of peer dynamics in initiating tobacco use, with curiosity and perceived stress relief also playing notable roles.

Awareness of tobacco products and knowledge of harms

Supplementary Table 4a showed that most students (780/898; 86.9%) reported knowing what tobacco is, while 118 (13.1%) said they did not. Awareness of specific products was highest for smokeless forms (618/898; 68.8%), followed by cigarettes (48.3%), bidis (41.9%), and hookah (31.8); 139 students (15.5%) reported that they did not know any tobacco form, as shown in Supplementary Table 4b.

Perceived harms were high: 805 students (89.6%) agreed that tobacco is harmful, 24 (2.7%) said it is not harmful, and 65 (7.2%) were unsure. When asked about specific health consequences, 652 (72.6%) selected “all of the above” (cancer, respiratory disease, and heart disease), 24.7% selected cancer alone, and 5.3% chose “none of these”, as shown in Supplementary Tables 5a and 5b.

Exposure to tobacco awareness programmes

Less than half of the students reported any exposure to formal awareness activities. A total of 355 (39.5%) had attended a tobacco-related session in school and 59 (6.6%) in the neighbourhood, while 489 (54.5%) reported no exposure, as shown in Supplementary Table 6. Because students could potentially report both school and neighbourhood exposure, these categories are not strictly mutually exclusive.

Table 3. Univariable and Multivariable Logistic Regression Analysis of Predictors of Ever-Tobacco Use (N = 898)

Predictor	Univariable OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Gender (male vs female)	2.76 (1.55–4.93)	0.001	2.76 (1.55–4.93)	0.001
Class (11–12 vs 9–10)	0.72 (0.51–1.03)	0.067	0.83 (0.62–1.10)	0.192
Family tobacco use (yes vs no)	0.52 (0.32–0.85)	0.008	1.77 (1.06–2.95)	0.029
Awareness exposure (yes vs no)	1.40 (0.85–2.30)	0.187	0.92 (0.53–1.61)	0.781
Support ban <18 years (yes vs no)	1.22 (0.74–2.02)	0.437	0.95 (0.55–1.64)	0.858

a, Wald test p-values; OR, Exp(B); 95% CI for adjusted OR

Attitudes toward sale of tobacco to minors

Ninety-seven students (10.8%) reported ever giving tobacco to others, while 791 (88.1%) had never done so; 10 responses (1.1%) were missing. Regarding policy attitudes, only 368 students (41.0%) supported a ban on selling tobacco to persons under 18 years, whereas 517 (57.6%) did not support such a ban and 13 (1.4%) were unsure or did not respond, as shown in Supplementary Table 7.

Bivariate associations with ever tobacco use

Ever use did not differ significantly between students with and without exposure to awareness programmes. Among those with no exposure, 44 of 489 (9.0%) were ever users, compared with 27 of 409 (6.6%) among those with any exposure; $\chi^2 = 1.44$, $p = 0.23$; OR 1.40 (95% CI 0.85–2.30) for no exposure vs exposure.

Family tobacco use showed a significant association with adolescent ever use. Among students reporting no family tobacco use, 18 of 374 (4.8%) were ever users, compared with 36 of 330 (10.9%) among those with at least one family member using tobacco and 17 of 196 (8.7%) among those uncertain of family use ($\chi^2 = 10.28$, $p = 0.0058$). The odds of ever use were more than twice as high in students with family tobacco use vs none (OR 2.41, 95% CI 1.31–4.39).

Attitudes towards banning sales to minors were not significantly associated with ever use. Ever use prevalence was 7.1% among those supporting a ban and 8.5% among those not supporting it ($\chi^2 = 0.46$, $p = 0.50$; OR 1.24, 95% CI 0.74–2.06).

Multivariable predictors of ever tobacco use

In univariable logistic regression analysis, male gender (OR = 2.76, 95% CI: 1.55–4.93, $p < 0.001$) and family tobacco use (OR = 0.52, 95% CI: 0.32–0.85, $p = 0.008$) were significantly associated with ever-tobacco use, while class (11–12 vs. 9–10 years; OR = 0.72, 95% CI: 0.51–1.03, $p = 0.067$), awareness exposure (OR = 1.40, 95% CI: 0.85–2.30, $p = 0.187$), and support for sales ban <18 years (OR = 1.22, 95% CI: 0.75–1.98, $p = 0.430$) were not.

In the multivariable model, male gender (adjusted OR = 2.76, 95% CI: 1.55–4.93, $p = 0.001$) and family tobacco use (adjusted OR = 1.77, 95% CI: 1.06–2.95, $p = 0.029$) remained significant independent predictors of ever-tobacco use. Class group, exposure to awareness programmes, and support for banning sales to minors were not statistically significant after adjustment. Notably, family tobacco use showed a reversal from protective (univariable OR = 0.52) to risk-conferring (adjusted OR = 1.77), indicating confounding by factors such as gender and class in the crude analysis, as shown in Table 3.

Overall, these findings underscore that being a boy and having a family member who uses tobacco are the primary independent drivers of early experimentation in this cohort, whereas school grade, awareness exposure, and stated support for legal restrictions show limited independent influence once gender and family context are taken into account.

Discussion

This study provides district-level evidence on tobacco use among school-going adolescents in Ranchi and highlights an important public health concern: initiation is occurring in early adolescence, often before entry into secondary school. Although the overall prevalence of ever tobacco use (7.9%) appears modest, nearly one quarter of ever users reported current use, indicating progression from experimentation to sustained behaviour in a subset of students. Similar patterns of early initiation and transition to continued use have been documented in Indian and global adolescent populations, where experimentation in early teens frequently preceded long-term dependence [2, 10, 22–24].

The prevalence of ever use tobacco use in this study aligns with GYTS- 4 and other school-based surveys reporting 4 – 10% use among Indian adolescents, with higher rates in regions where smokeless tobacco is culturally entrenched [10, 11]. Jharkhand's position within India's smokeless tobacco belt, where products like khaini and gutkha are widely available and socially accepted, provides important contextual explanation [17]. The higher experimentation among boys reflects patterns observed in Indian studies, where gender norms and greater social exposure increase opportunities for initiation.

A key finding is that initiation clustered between ages 10 and 15 years, with some students reporting first use before age 10. This aligns with national GYTS evidence (38% of cigarette smokers, 47% of bidi smokers, and 52% of smokeless tobacco users aged 13–15 initiated before age 10), showing that many Indian youths experiment with tobacco before mid-adolescence [10, 25]. Early exposure increases the risk of nicotine dependence and longer lifetime consumption, thereby amplifying future risk of tobacco-related disease, including oral cancer [26]. These findings strongly support the need to shift prevention efforts to younger age groups, particularly students in classes 6 – 8, before behavioural patterns are established.

Peer dynamics emerged as the dominant influence on first use, with peer pressure and curiosity cited most frequently. This mirrors established evidence that peer networks and social modelling are among the strongest predictors of adolescent tobacco uptake [25, 27]. The significant association between family tobacco use and adolescent experimentation highlights the home environment as a key determinant, where tobacco use may be normalized. Accordingly, school-based interventions should be complemented by family-centred approaches, including parental counselling and cessation support through community health systems.

Despite 85–92% awareness of tobacco harms among Indian youth aged 13–15 years, this did not protect against experimentation (current use 8.5%, boys 9.6%, girls 7.4%), consistent with studies showing knowledge fails to drive adolescent behaviour change despite high awareness levels [28, 29].

Effective prevention programmes must therefore move beyond information delivery. Multi-component life-skills programs incorporating refusal skills training,

self-efficacy building, and peer-led delivery have demonstrated superior effectiveness, reducing adolescent tobacco uptake by 20-50% compared to information-only approaches [30]. Furthermore, critical media literacy is increasingly important in helping adolescents recognise and resist indirect pro-tobacco influences in films, social media, and online spaces.

Policy awareness was suboptimal, with less than half supporting bans on sales to minors. This suggests limited engagement with tobacco control norms and highlights the need for earlier civic and health education on tobacco regulations [25, 31]. Strengthening enforcement around schools and reducing youth access remain essential components of prevention.

This study's strengths include a large multi-school sample, a pilot-tested tool, and multivariable analysis in a high-burden setting. Limitations include the cross-sectional design, potential underreporting from self-reported data, missing responses, and limited generalisability beyond the surveyed school population.

This study offers district-level evidence from Ranchi, linking adolescent tobacco behaviours with future oral cancer risk, and provides integrated local insights to inform National Tobacco Control Programme planning and strengthen Tobacco-Free Educational Institution (ToFEI) implementation [32].

Longitudinal studies in Jharkhand are needed to examine progression from experimentation to dependence and to assess the effectiveness of integrated school and family-based interventions. Strengthening district-level cancer prevention will require linking adolescent tobacco surveillance with screening for oral potentially malignant disorders and embedding prevention with broader adolescent health programmes.

In Ranchi, tobacco use often begins at a very young age, frequently even before children reach secondary school, and is strongly influenced by peers and family environment. Mere awareness of its harmful effects does not appear sufficient to prevent initiation. Given the strong association between early tobacco exposure and the later development of oral cancer, preventive interventions must begin early in adolescence. These strategies should incorporate life-skills education and be reinforced through family- and community-based approaches to effectively reduce the long-term burden of tobacco-related oral cancer.

Author Contribution Statement

Conceptualization: SPS; Study design: SPS, PM; Data collection: NK; Data analysis: SPS, PM, NK; Manuscript drafting: PM; Manuscript review & editing: SPS, PM; Supervision: SPS.

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General

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access to schools and supporting the conduct of this study.

Approval

Approved by the Institutional Ethics Committee of Ranchi Cancer Hospital & Research Centre (IRB Reg No: EC/New/INST/2024/4393).

Ethical Declaration

The study protocol was reviewed and approved by the Institutional Ethics Committee prior to data collection (IRB Approval Number: EC/New/INST/2024/4393). Permission was obtained from school authorities, and participation was voluntary. The questionnaire was anonymous, and students were informed of their right to decline or withdraw without any academic consequences. Confidentiality and data privacy were strictly maintained throughout the study.

Data Availability

Available upon reasonable request from corresponding author.

Study Registration

Was the study registered in any registration dataset (for clinical trials, guidelines, or meta-analyses): Not applicable

Conflict of Interest

The authors declare no conflict of interest.

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