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Trends and determinants of tobacco use initiation in India: Analysis of two rounds of the Global Adult Tobacco Survey

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Trends and determinants of tobacco use initiation in India: Analysis of two rounds of the Global Adult Tobacco Survey

Abstract

Objectives: Early initiation into tobacco use leads to lifelong addiction and increases the burden of future tobacco-related diseases. This study assesses factors associated with tobacco use initiation using disaggregated data from two rounds of the Global Adult Tobacco Survey (GATS 1 (2009-10) and 2 (2016-17)) from India.

Design: Cross-sectional Study

Settings and Participants: We analyzed the mean age of initiation (as recalled by the participants) of smoked and smokeless tobacco (SLT) use (dependent variable) across different socio-demographic variables such as age, gender, education, occupation, gender, residence, region of the country, and knowledge or belief on harms of tobacco use (independent factors) using data from GATS 1 and 2.

Primary and secondary outcome measures: We first depicted the prevalence of current tobacco users and then compared their mean age of initiation of daily tobacco usage and the factors affecting early tobacco use initiation daily.

Results: The analysis finds that the mean age of initiation of using smoked SLT increased with age and among those who were better aware of the adverse effects of tobacco. As per GATS-2, males initiated smoking SLT and dual tobacco use earlier than females. The participants of 25-44 years initiated dual use of tobacco, 45-60 years initiated smoked tobacco, and those> 60 years initiated SLT earlier. The Northeast region initiated smoked and dual tobacco use earlier than other

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geographic regions. Logistic regression depicted significant variables affecting the odds of early initiation of tobacco. Conclusions: Effective strategies to deter early initiation of tobacco use are urgently needed in India. More robust health advocacy campaigns that communicate the harmful effects of tobacco on health can delay tobacco initiation, coupled with reducing the ease of access and affordability among minors and youth. Keywords: Global Adult Tobacco Survey, age of initiation, smoked tobacco, smokeless s of tobacı. tobacco, harmful effects of tobacco

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Strengths and Limitations of the study

- One of the very first comprehensive assessments of the age of daily initiation from the second round of the Global Adult Tobacco Survey India (2016-17)
- We estimated the factors affecting early initiation through a weighted analysis highlighting • feasible, actionable points.
- We have analyzed large and nationally representative data on tobacco use from India.
- Appropriate sampling during the survey makes the results generalizable, and countries with similar Sustainable Development Index can adopt recommendations.
- Recall bias about the exact time of initiation can affect the estimates and be seen as the ation. study's critical limitation.

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Introduction

3 Tobacco use continues to be a leading risk factor for morbidity and mortality, posing a significant 4 threat to global development.[1] Identification of the age of initiation of tobacco use is critical in 5 achieving national tobacco use reductions.[2] It facilitates designing age-appropriate interventions 6 for controlling the tobacco epidemic. Some of the most vital interventions include increasing the 7 age of sale or purchase of any form of tobacco products at the point of sale from the current 8 18 years (under section 6a of The Cigarettes and Other Tobacco Products (Prohibition of 9 Advertisement and Regulation of Trade and Commerce, Production, Supply, and Distribution) 10 Act, 2003) to 21 years which is further supplemented through restricting points of sale through 11 vendor licensing to visualize effective tobacco control.[3] The Global Adult Tobacco Survey-2 12 (GATS 2016-17) has reported that the mean age of initiation of tobacco use (as recalled by the 13 participants) has increased from 17.9 years to 18.9 years for smokers (consuming bidis, cigarettes, 14 hookah, cigars, pipes) and 17.9 years to 18.8 years among smokeless tobacco (SLT) users 15 (consuming betel quid with tobacco, sada/surti, khaini or tobacco lime mixture, gutkha). [4]The 16 mean age of initiation has increased for both male and female tobacco users in GATS 2; male daily 17 tobacco users start earlier (smokers 18.8 years; SLT users 18.7 years) compared to female tobacco 18 users (smokers 21.2 years; SLT users 19.2 years).

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Global evidence suggests that peer pressure, parental tobacco habits, and access to frugal money are the most common reasons for children to start tobacco use.[5] Early initiation into tobacco use critically impacts future physical, psychological, and behavioral health effects, independent of the duration of tobacco consumption. Identifying age-related products for tobacco initiation is

essential when understanding the development of health pathways and guiding future public health efforts.[6] People who begin consuming tobacco during childhood or early adolescence are at a higher risk of continued use, long-term sustained nicotine dependence into adulthood, difficulty quitting, and adverse health outcomes. [7,8] Thus, it is imperative to intervene and protect the younger generation from tobacco addiction. A better understanding of tobacco usage patterns (age of initiation being one of them) is required to develop targeted tobacco use prevention programs for the population. Preventing or delaying the age at which individuals begin using tobacco can reduce the severity of nicotine dependence and increase the likelihood of successful quitting among those who become regular tobacco users. Given the enormous socio-cultural diversity across all states and jurisdictions in India, there is an urgent need for a population-based estimate that informs us regarding the age of initiation of

tobacco use. Within this context, the Global Adult Tobacco Survey (GATS) provides us with an opportunity to study the pattern of tobacco initiation for smoked and SLT products. Therefore, the study's primary objective is to investigate the trends and determinants of tobacco use initiation among tobacco users who participated in the second round of the GATS India (2016-2017). The estimates can be vital in informing policymakers to design more effective prevention policies and allocate resources more efficiently to control the tobacco burden.

Methods

Study design: Repeated Cross-sectional study

Source of data: The current secondary data analysis uses the datasets from the two rounds of the GATS done for India in 2009-10 and 2016-17.[9][4] These were a household survey of persons aged 15 years or older. The study involved 69296 individuals and 76069 households in GATS 1

and 74037 individuals and 77170 households in GATS 2. An overall response rate of 91.8% and 92.9% in GATS 1 and GATS 2, respectively, were found at the household and personal levels. Both rounds have data collected from all 30 states of the country and 3 Union Territories, i.e., Delhi, Chandigarh, and Puducherry, using a multistage, geographically clustered sample design to produce data representative of each state and UT. The three-stage sampling process was adopted for urban areas, while the two-stage method was adopted to get the sample size for rural areas. One individual was randomly chosen from each selected household to participate in the survey. The surveys were designed to produce internationally comparable data on tobacco use and other tobacco control indicators using a standardized questionnaire, sample design, data collection, and management procedures. Both rounds have almost the same questionnaire, with a few questions added in the GATS 2 round. The detail of the methodology of GATS 1 and GATS 2 is explicitly written in the reports for both rounds.[4,9]

13 Study variables

Dependent variable: Age of initiation was the primary dependent variable. For this, we first segregated the participants in both rounds of GATS who were consuming any tobacco products as tobacco users (daily users and less than daily) and non-users (not at all, don't know, refused missing/ not applicable). Then we estimated the current smokers, SLT, and dual users. Current smokers were estimated using the question: Do you currently use smoked tobacco products? (daily, less than daily, not at all, don't know refused missing/ not applicable), current SLT users were estimated from the question: Do you currently use smokeless tobacco? (daily, less than daily, not at all, don't know refused missing/ not applicable), and participants currently consuming both smoked and SLT were categorized as dual users. To calculate dual users, we used the newly constructed outcomes of variables. Do you currently use smoked tobacco products? (daily, less

than daily, not at all, don't know refused missing/ not applicable) and Do you currently use smokeless tobacco? (daily, less than daily, not at all, don't know refused missing/ not applicable) to determine the respondents currently using both forms of tobacco. The response daily and less than daily was clubbed into one category, "yes," and others ("don't know and refused") were categorized into response, "no." From the tobacco users, we estimated the age of initiation using the questions: How old were you when you first started smoking tobacco daily?; How old were you when you first started using smokeless tobacco daily? The recalled age of initiation of tobacco was recoded into four categories: <15 years, 16-18 years, 19-21 years, and >21 years.

Independent variables: The independent variables were included based on a literature review, and the sub-categories were created per the GATS's standard coding protocol.[10,11] We included age (15-24 years, 25-44 years, 45-60 years, and > 60 years); gender (male, female); residence (urban, rural); national region (All States/Union Territories of India were divided into six geographical regions for analysis. The north region contains Jammu and Kashmir, Himachal Pradesh, Punjab, Chandigarh, Uttarakhand, Haryana, and Delhi; the central includes Rajasthan, Uttar Pradesh, Chhattisgarh, and Madhya Pradesh; the east contains West Bengal, Jharkhand, Odisha, and Bihar; northeast includes Sikkim Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, and Assam; west contains Gujarat, Maharashtra, and Goa; south contains Andhra Pradesh (later divided into Andhra Pradesh and Telangana), Karnataka, Kerala, Tamil Nadu, and Puducherry); Education (a. No formal education, b. The primary school completed (Less than primary school completed + Primary school completed), c. The secondary school completed (Less than secondary school completed + Secondary school completed), d. Higher secondary school and above (Higher secondary school completed+ College / University completed + Post-graduate degree completed, e. Don't know (Don't know + Refuse) for both the rounds.);

Occupation (Employee (Government +non-government + daily wagers), b) Self-employed +retired, c) Student + Homemaker, d) Unemployed (able to work + unable to work), e) Don't know + Refused), and Knowledge about the harmful effects of tobacco (*Based on what you know or believe, does smoking tobacco cause serious illness? And Based on what you know or believe, does using smokeless tobacco cause serious illness?* for smoked and SLT products). The values "yes" were labeled as yes, and the values "No, don't know, refused, and missing/ not applicable" were clubbed together as "No" for this study.

Statistical Analysis: The data was analyzed in SPSS v 24 software. All analyses were performed separately for smoked tobacco products, SLT products, and dual-use tobacco products. The mean age $(\pm SD)$ of initiating tobacco products was calculated for all the independent variables. Student's t-test was used to compare the difference in mean age in both rounds of GATS. Logistic regression models were run to estimate the adjusted odds ratio (aOR) and 95% confidence interval (95% CI) of the association of independent variables with early initiation of tobacco usage. For this, early initiators were classified as those who started consuming tobacco before 18 years, per the Cigarette and Other tobacco products Act (COTPA) 2003. Using variance inflation factor (VIF) values, we tested for multicollinearity between the covariates. Sampling weights were applied, and weighted estimates were calculated to account for the complex study design due to Clustering and stratification. All p values were two-sided, and p < 0.05 indicated statistical significance.

20 Ethical clearance:

GATS India survey proposal, protocols, and questionnaires were reviewed and approved by the
Ethics Review Committee and Institutional Review Board (IRB) of Tata Institute of Social
Sciences Mumbai. Ethical approval was not deemed necessary for the present analysis since it was

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a secondary data analysis of completely anonymized national datasets available in the public

Data availability statement

The dataset is available at Global Tobacco Surveillance System (GTSS), Centers for Disease

domain. All methods were performed following the relevant guidelines and regulations.

Control and Prevention (CDC), and Global Adult Tobacco Survey-2(2016-17), India.

- (https://nccd.cdc.gov/GTSSDataSurveyResources/Ancillary/DataReports.aspx?CAID=2)and data
- were retrieved using standard protocols.

Patient and Public Involvement: Patients or the public were not involved in the design, conduct, reporting, or dissemination plans of our research

Results

As per GATS-2, about 10.7% and 21.4% of the participants were daily smokers and SLT users, while 3.4% were dual users (table 1). Tobacco use in any form was more prevalent in older men and those who live in rural settings, particularly those in north-eastern India. Participants with less schooling, employed, self-employed, and retired consumed more smoked and SLT products. Users unaware of the harms caused by tobacco use depicted higher prevalence.

Table 2 depicts the mean age of initiation for smoked and SLT products. As per GATS 2 India, lower age of initiation was reported among males, younger respondents, who received education till primary and secondary school, were employed participants, residing in rural areas, belonged to the North-East region of India, and those who had lesser awareness regarding the harmful effect of Tobacco. We further compared the mean age at which the participants initiated consuming smoked and SLT products using data from GATS1 and GATS2 (Table 2). The mean age increased across all age groups in both genders from GATS1 to GATS 2. As per the GATS2, the mean age of initiating smoking and SLT was lower in rural areas (20.8+11.6 and 19.3+12.0 years) compared

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to urban areas (21.±7.9 and 20.5±11.6 years). There is a relative increase in the mean recalled age of initiation for smoked tobacco throughout the country for smoked and SLT products, except for South India, which depicted a non-significant increase for SLT initiation age. Also, students and homemakers depicted a non-significant increase in the initiation age for smoking tobacco. Respondents who were aware that tobacco causes serious illness reported a higher mean recalled age of initiation among daily tobacco users.

Using logistic regression, **table 3** highlights the factors favoring early initiation of daily tobacco usage. Early initiation of daily smoking depicted higher odds in males, older participants (>60 years), unemployed, living in rural areas, and the North-East region of India. A similar pattern was observed concerning the SLT products, except for the higher odds observed in those who had studied up to primary school and those employed. Likewise, early dual usage was favored in males between 25-44 years and residing in North-East India. Awareness about the harms caused by tobacco affected the odds of SLT and Dual usage initiation, and not smoked tobacco products.

Discussion

Substantial proof informs us that early initiation of tobacco use is critical in deciding the fate of the tobacco epidemic.[3] The present study assesses the age of initiation of tobacco usage as recalled by the participants and compares them using data from the two rounds of a nationally representative survey of Indian adults above 15 years old. There are certain specific findings in the study. First, the average age of initiation has increased for smoked, SLT, and dual tobacco usage from GATS 1 to GATS2 across all socio-demographic strata. Second, smoked tobacco depicted lower age of initiation compared to SLT products. Third, there were significant regional variations concerning the age of initiation. Fourth, certain socio-demographic factors depicted higher odds

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of early initiation of tobacco. Lastly, awareness regarding the harmful effects of tobacco significantly affected the odds of early initiation of SLT and dual usage, but not for smoking. Our findings depict that increased initiation age for smoking, SLT, and dual tobacco usage across all socio-demographic strata between two waves of GATS in India is motivating. Various factors can be attributed to this development, such as increased coverage of MPOWER strategies. Extensive health advocacy in this regard, such as anti-tobacco advertisements through media engagement depicting the tobacco products' use or images, a ban on tobacco vending machines, and substantial prohibitions on the advertisement, promotion, and sponsorship of these tobacco products.[12] There is still scope for the ban on direct and indirect advertising of tobacco products. Compliance with smoke-free policies has improved between 2011 to 2015, with separate, completely enclosed smoking rooms allowed in at least one of the assessed public places if they are separately ventilated to the outside and kept under negative air pressure in the surrounding areas, while the advertising bans remained moderate from 2011 to 2015. There has been a 14% increase in taxes on tobacco products from 2010 to 2014, which is one of the most decisive measures to control tobacco prevalence and initiation. [13][14] Currently, tobacco tax has been reduced to 57.6% compared to 60% in 2014. Also, it is less than the recommended taxation by WHO, which is 75% of the price of tobacco products.[15] However, the taxation on tobacco products has reduced to 57.6% compared to 60% in 2014. Also, it is less than the recommended taxation by WHO, which is 75% of the price of tobacco products. [16,17] Though the affordability of cigarettes has declined since 2010, the bidis, which holds a significant share of smoked tobacco products in India, is still a concern. Studies have found that a substantial increase in taxes on tobacco products at par with increasing income can reverse the affordability of these products.[18,19]

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We observed that people aged 15-24 started tobacco use at an average age of 14 in GATS 1 and 16 years in GATS 2. Early initiation is concerning because it is a proven risk factor for greater severity of nicotine dependence, difficulty quitting, and adverse health consequences. [20] Easy accessibility and affordability are the two parameters responsible for the early initiation of tobacco, worsened by ineffective COTPA implementation. In a recent study by Ali et al., the compliance with policies that protect minors and youth (Section 6a and 6b of COTPA) was 68.57% and 52.85%, respectively, in open spaces in Delhi. [21] There is a pressing need for policies that reduce the accessibility and affordability of tobacco products and advance WHO's Framework Convention on Tobacco Control (FCTC). We also need to explore the intervention that alters various factors that result in Early-onset tobacco, viz. personal, psychological, social, cultural, and environmental factors. A systematic review on predictors of smoking initiation among adolescents aged <18 found 98 potential predictors. [22] In addition, we observed that smoked tobacco depicted lower age of initiation compared to SLT products. This is corroborated by the reports from the Global Youth Tobacco Survey India (GYTS-4) India as per which Age of initiation of tobacco 38% of cigarette, 47% of bidi smokers, and 52% of SLT users initiated the use before their 10th birthday. The median age at initiation of cigarette, bidi smoking, and SLT use were 11.5 years, 10.5 years, and 9.9 years respectively.[23] The marked differences in the consumption of tobacco products leads to different morbidity and mortality patterns.

We observed significant regional variations concerning the age of initiation and northern and northeastern regions dominated in this regard. This is because tobacco consumption is considered a factor that binds them socially and is thought to protect them from the cold climate. In studies from India and Abroad, easy access to local tobacco products deeply embedded in cultural practices normalizes tobacco use. It is sometimes also considered a healthy alternative to

commercial tobacco products that promotes usage. [24,25] This is, in turn, also affected by the awareness regarding the harmful effects of tobacco among the residents of that region.[26] Also, if the females are more into tobacco consumption, then the age of initiation can be even lower, as they tend to consume tobacco within their houses, thus exposing children in early age. [27][28] There were higher odds of early initiation of tobacco per certain socio-demographic factors per our study results. The less educated people don't know about the harmful effects of tobacco and don't even try to look into the statutory warnings as that doesn't make any sense to them.[29] The affordability of tobacco products can be the reason for their higher consumption among employed people. As discussed earlier, rural areas have more access to local tobacco products that bypass the legal restrictions, promoting easy access at earlier ages. A previous geospatial analysis from the united states depicted that more tobacco products are available at a unit cost in rural areas

12 compared to urban settlements as the industry targets disadvantaged populations for their sales.[30]
13 Policies that focus on the retail environment for tobacco are needed to make tobacco less attractive
14 and more costly everywhere, including in rural areas.

Awareness regarding the harmful effects of tobacco significantly affected the odds of early initiation of SLT and dual usage, but not for smoking. Thus intensive and more focussed awareness campaigns about the harmful effects of tobacco consumption among the general population can mitigate new initiations among minors and youth. [26] Further, the odds were higher among those with higher education. Several studies have found a positive impact of education on tobacco use. [3,31,32] There is a need for intersectoral coordination involving the Ministry of Education and the Ministry of Information & Broadcasting to work together. One of the significant drawbacks of tobacco control laws is their partial implication on content available

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on the internet without any statutory warning. The over-the-top (OTT) platform, which delivers
content over the internet, still does not show any statutory warning whenever there is any scene
showing tobacco use or violating tobacco control laws. [33]

There are specific strengths and limitations of this study that should be acknowledged. As a secondary data analysis of nationally representative datasets, the results are generalizable and ensure comparability with other countries participating in GATS. A comprehensive multi-stage sampling design provides robust estimates crucial for planning and management at the national and sub-national levels. However, one of the significant limitations of the secondary analysis is the limited availability of the study variables. Many other factors may affect our study results, like exposure to tobacco through family members, etc. There is a chance of recall bias that may affect our estimates regarding the age of the initiation, and hence we preferred to label it as a recalled age of initiation. The cross-sectional nature of the survey makes it difficult to ascertain temporal associations. The self-reported data in the survey may be affected by social desirability bias.

A few policy implications of this analysis and associated recommendations are emerging from this study. Though the results are motivating concerning the age of initiation, lower age of initiation in the younger age group and geographical disparities are intimidating. We have to ensure a reduced tobacco burden to ensure healthy living, similar to several member states of the European region that have pledged to become tobacco-free and achieve a smoking prevalence of less than equal to 5%.[34] Though tobacco control policies in India have reduced the prevalence of tobacco use from 34.5% to 28.5% between two rounds of the GATS, there is a need to revamp and develop policies targeting disparities. Increasing the permissible age for selling and purchasing tobacco products offers promising outcomes. Secondly, the sale and purchase of tobacco products should be licensed at all points of sale. The sale of single or loose cigarettes and other unpackaged tobacco

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3 4	1	produ	ucts must be brought under a standardized packaging policy. The sale of single cigarettes also
5 6 7	2	circu	mvents the mandatory pack health warnings. [29] Further, the strict implementation of the
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9 10 11	4	can b	be further helpful in realizing a tobacco-free generation.
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17 18 19	8		MV, KR: conceptualised the study, acquisition of data, developed analytical framework,
20 21	9		analysed the data, interpreted the results, wrote the first draft of the manuscript.
22 23	10		GB, PL: interpreted local policy implications of the results, reviewed and approved the early
24 25	11		and advanced drafts of the manuscript.
26 27 28	12		NS: led the data collection, interpreted the results and prepared the draft.
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31 32	14	c.	Funding: This research received no specific grant from any funding agency in the public,
33 34 35	15		commercial or not-for-profit sectors.
36 37	16	d.	Data sharing statement: The dataset is available at Global Tobacco Surveillance System
38 39	17		(GTSS), Centers for Disease Control and Prevention (CDC), Global Adult Tobacco Survey-
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45 46	20		and data were retrieved using standard protocols.
47 48 49	21	e.	Ethical statement: Being a secondary data analysis of an anonymised dataset available in
50 51	22		the public domain, ethical approvals were not deemed necessary.
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	GATS	Current smoker		Cur t	rent Smokeless	Dual user	
Sample Characteristics	Sample distribution	N	Weighted prevalence (95% CI)	N	Weighted prevalence (95% CI)	N N	Weighted prevalence (95% CI)
Dverall	74,037	9499	10.7 (10.2-11.1)	15235	21.4 (20.7-22.3)	2877	3.4 (3.2-3.7)
Gender					ted	<u> </u>	
Male	33772	8434	19.0 (18.2-19.9)	9561	29.6 (28.7-30. 6)	1 2509	6.3 (5.8-6.8)
Female	40265	1065	2.0 (1.7-2.3)	5584	12.8 (12.0-13.g)	368	0.5 (0.4-0.7)
Age-Group					an	<u> </u>	
15-24 Years	12105	576	3.1 (2.6-3.7)	1266	10.5 (9.6-11.5)	231	1.7 (1.3-2.2)
25-44 Years	34841	4440	10.9 (10.3-11.6)	7706	23.3 (22.3-24.2)	1546	4.1 (3.8-4.5)
45 -60 years	16732	2854	16.9 (15.9-17.8)	3959	27.3 (26.0-28.5)	739	4.2 (3.7-4.8)
>60 years	8412	1432	15.8 (14.6-17.1)	1956	28.7 (27.0-30.3)	291	3.6 (3.0-4.3)
Education completed			10.		<u>,</u> 9, ≥		
No formal schooling	18473	2754	14.3 (13.4-15.2)	4889	28.9 (27.7-30. <u>5</u>)	. 764	4.2 (3.8-4.8)
Primary school	16368	2909	15 (14.0-16.0)	4610	28.6 (27.3-29.3)	1022	5.3 (4.7-6.0)
Secondary school	22440	2681	8.8 (8.2-9.4)	4155	18.9 (17.9-19 . 9)	799	3.0 (2.6-3.4)
Higher secondary school and above	16697	1151	5 (4.5-5.6)	1571	9.2 (8.3-10.2)	291	1.4 (1.1-1.8)
Decupation					šim in		
Employed	23363	4571	16.3 (15.5-17.3)	6544	30.5 (29.3-31. x)	1449	5.8 (5.2-6.4)
Self-employed and retired	20089	3322	12.2 (11.3-13.1)	4508	20.3 (19.3-21.7)	1002	4.0 (3.5-4.4)
Students and homemakers	27304	1052	3.2 (2.9-3.6)	3459	13.1 (12.2-13.9)	273	0.7 (0.6-0.9)
Unemployed	3251	551	13.7 (11.9-15.8)	722	23.2 (20.7-26.8)	1 53	3.0 (2.2-4.1)
Residence					gie		
Urban	26488	2519	8.3 (7.7-8.9)	3618	15.2 (14-16.5)°	6 62	2.3 (2.0-2.7)
Rural	47549	6980	11.9 (11.3-12.6)	11617	24.6 (23.8-25.4)	2215	4.0 (3.7-4.4)
Region							
North	17128	2136	14.2 (13.3-15.1)	979	7.4 (6.4-8.4)	297	2.2 (1.8-2.7)
Central	11518	1438	12.2 (11.1-13.5)	3251	26.7 (25.2-28.3)	553	5.5 (4.8-6.2)
East	9834	1044	10.3 (9.5-11.2)	3052	26.8 (25.4-28.2)	<u>444</u>	3.7 (3.2-4.3)

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3	North-East	13574	3044	16.8 (15.6-18.2)	5155	40.5 (38.7-42.3)	4 1286	7.9 (7.1-8.8)
4	West	7901	431	51(44-60)	1443	22 4 (20 4-24 6	ö 111	17(12-22)
6	South	14082	1406	10.3 (9.6-11.1)	1355	10.5 (9.5-11.6	186	1.5 (1.2-1.7)
7 8	Using tobacco cause serious illness					for	22 Sep	
9 10	Yes		8632/ 68182	10.5 (10.1-11.0)	14324/ 70798	21.0(20.3-21.	Ensei 2562/6 6897	3.4(3.1-3.6)
11 12	No		867/ 5855	12.2(11.0-13.6)	911/ 3239	29.5(26.9-32.2)	315/ 7140	4.4(3.7-5.4)
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Table 2: Trends in the mean age of initiation among the daily tobacco users as per the two Rounds of GATS (GATS-1 and GATS-2).

	Daily S	moked tobaco	:0	Daily Smokeless tobacco			
Characteristics	GATS 1 Mean ± SD	GATS-2 Mean ± SD	p- value	GATS 1 Mean ± SD	GATS-2 Mean ± SD	p- value	
Number total	N=9223	N=7647		N=13410	N= 12721		
Gender							
Male	18.4 ± 8.9	20.6 ± 7.4	< 0.01	19.6 ± 10.7	21.7 ± 9.1	< 0.01	
Female	18.8 ± 14.5	23.3 ± 14.2	< 0.01	19.7 ± 13.6	23.2 ± 12.6	< 0.01	
Age-Group							
15-24 Years	14.1 ± 6.3	16.1 ± 3.4	< 0.01	14.1 ± 6.3	15.5 ± 4.2	< 0.01	
25-44 Years	17.6 ± 8.1	19.3 ± 5.8	< 0.01	18.3 ± 9	20.2 ± 6.9	< 0.01	
45 -60 years	19.6 ± 10.5	22.1 ± 9.1	< 0.01	21.9 ± 13.4	24.7 ± 11.5	< 0.01	
>60 years	20.7 ± 13.4	24 ± 12.2	< 0.01	26.9 ± 18.7	28.2 ± 16.5	< 0.01	
Education							
No formal schooling	18.6 ± 11.2	21.2 ± 10.4	< 0.01	20.2 ± 13.6	23.1 ± 12.7	< 0.01	
Primary school	17.9 ± 9.2	20.3 ± 7.5	< 0.01	19.3 ± 11.5	21.8 ± 9.9	< 0.01	
Secondary school	18.6 ± 8.6	20.7 ± 7.5	< 0.01	19.3 ± 10	21.5 ± 8.5	< 0.01	
Higher secondary school and		6	< 0.01			< 0.01	
above	18.9 ± 8.6	21.8 ± 6.9		19.6 ± 10.6	22.4 ± 8.2		
Occupation							
Employed	19.2 ± 8.2	20.4 ± 7.3	< 0.01	19.5 ± 10.2	21.4 ± 9.1	< 0.01	
Self-employed and retired	18.5 ± 13.1	20.7 ± 7.5	< 0.01	19.5 ± 13.7	22.1 ± 9.4	< 0.01	
Students and homemakers	18 ± 9.3	22.8 ± 12.9	0.9	19.7 ± 11.5	23.6 ± 13.3	< 0.01	
Unemployed	18.2 ± 12.4	22.3 ± 10.8	< 0.01	20.4 ± 13.4	23.8 ± 13.1	< 0.01	
Residence							
Urban	19.1± 8.7	21 ± 7.9	< 0.01	20.5 ± 11.6	22.6 ± 10.7	< 0.01	
Rural	18.1±10.1	20.8 ± 8.6	< 0.01	19.3 ± 12	22.1±10.5	< 0.01	
Region							
North	19.2 ± 8.7	21.3± 8.4	< 0.01	20.7 ± 10.6	22.2 ± 9.0	< 0.01	
Central	19.9± 9.1	21.1±9.7	< 0.01	20.6 ± 12.3	21.5 ± 11.2	< 0.01	
East	19.5 ± 9.6	22.1 ± 8.8	< 0.01	20.4 ± 11.1	23 ± 11.1	< 0.01	
North-East	15.8 ± 10.5	19.5 ± 7.3	< 0.01	16.7 ± 11.7	21.5 ± 9	< 0.01	
West	20.5 ± 9.1	22.4 ± 9.4	< 0.01	20.8 ± 11.4	21.9 ± 10.2	< 0.01	
South	20.1 ± 8.9	21.5 ± 8.5	< 0.01	23.2 ± 13.2	25.2 ± 12.8	0.7	
Using tobacco cause serious illness							
No	18.6 ± 9.5	20.9 ± 8.3	< 0.01	19.8 ± 11.7	22.2 ± 10.4	< 0.01	
Yes	17.3 ± 10.6	21.2 ± 9.4	< 0.01	18.7 ± 12.2	22.7 ± 12.5	< 0.01	

	Smo	kers	Smokeless t	obacco users	Dual user		
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Enaglijusted OR	Adjusted OR (95% CI)	
Gender					em Ens		
Female	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	
Male	11.7(10.1-13.7)	14.9(12.4-17.9)	2.8(2.7-3.1)	3.1(2.8-3.4)	1 3 1 (3 .9-17.3)	12(8.8-16.4)	
Age-Group					23. d to		
15-24 Years	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ret Value	Ref. Value	
25-44 Years	3.8(3.2-4.6)	3.5(2.9-4.3)	2.6(2.3-2.8)	2.4(2.1-2.7)	2,45138-3.2)	2.2(1.6-3.1)	
45 -60 years	6.3(5.2-7.6)	5.4(4.5-6.6)	3.2(2.8-3.6)	2.7(2.4-3.1)	257128-3.4)	2.1(1.6-2.9)	
>60 years	5.8(4.8-7.2)	5(4.0-6.3)	3.4(3.0-3.9)	3.2(2.8-3.7)	2日至11至-2.9)	2(1.3-2.8)	
Education		NO.			a fro		
Primary school	Ref. Value	Ref. Value	Ref. Value	Ref. Value	B eff Value	Ref. Value	
No formal schooling	2.2(0.6-7.9)	3.4(0.7-15.1)	1(0.3-2.9)	0.9(0.2-3.0)	16 5(0 2 -10.3)	1.7(0.2-12.6)	
Secondary school	1.3(0.3-4.6)	1.4(0.3-3.3)	0.6(0.2-1.6)	0.5(0.1-1.6)	1≩0.15 7.1)	0.9(0.1-6.3)	
>Higher secondary school	0.7(0.2-2.5)	0.7(0.1-3.3)	0.2(0.1-0.7)	0.2(0.1-0.7)	04(0-1-3.4)	0.4(0.1-2.9)	
Occupation					nin pe		
Unemployed	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	
Employed	1.2(0.2-5.9)	0.7(0.1-6.6)	12.8(1.8-87.7)	22.9 (2.9-179)	(<u>B</u>9 (0:7-1.2)	0.7(0.6-1.0)	
Self-employed and retired	0.8(0.1-4.2)	0.6(0.1-5.6)	7.4(1.1-50.9)	15.4(1.9-120.9)	() () () () () () () () () () () () () (0.7(0.6-0.9)	
Students and home makers	0.2(0.0-1.0)	0.5(0.1-4.7)	4.3(0.6-29.9)	12.4(1.5-97.2)	0,	0.5(0.3-0.6)	
Residence					Lec L		
Urban	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	
Rural	1.5(1.3-1.6)	1.2(1.1-1.4)	1.8(1.6-2.0)	1.2(1.1-1.5)	107(1.4-2.1)	1.2(0.9-1.4)	
Region							
South	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	
North	1.4(1.2-1.6)	1.7(1.5-2.0)	0.7(0.6-0.8)	0.7(0.6-0.9)	1.5(1,1.9)	1.7(1.2-2.2)	
Central	1.2(1.1-1.3)	1.2(1.1-1.4)	3.1(2.7-3.6)	3.5(3.0-4.1)	3.9(390-4.9)	3.8(3.0-4.9)	
East	0.9(0.8-1.1)	0.9(0.7-1.0)	3.1(2.7-3.6)	3.3(2.9-3.9)	2.6(2,0-3.3)	2.4(1.8-3.0)	
North-East	1.7(1.5-2.0)	1.9(1.6-2.2)	5.8(5.0-6.6)	7.1(6.1-8.2)	5.8(4-7.2)	5.7(4.5-7.2)	
West	0.4(0.3-0.5)	0.4(0.3-0.5)	2.4(2.1-2.9)	2.7(2.3-3.3)	1.1(057-1.6)	1.1(0.8-1.7)	

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Using tobacco cause serious					023-07438 9yright, inc		
Yes	Ref. Value	Ref. Value	Ref. Value	Ref. Value	<u> </u>	Ref. Value	
Nc	1.1(1.0-1.3)	1.1(0.9-1.2)	1.5(1.3-1.8)	1.4(1.2-1.7)	19 5 (N 3-1.7)	1.8 (1.6-2.0)	
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Trends of tobacco use initiation in India and factors associated with initiation of tobacco use: analysis of two rounds of the Global Adult Tobacco Survey

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5	2	initiation of tobacco use: analysis of two rounds of the Global Adult
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Abstract

Objectives: Early initiation of tobacco use can lead to lifelong addiction and increases tobacco-attributable morbidity and mortality. This study assesses trends in tobacco use initiation and factors associated with tobacco use initiation using disaggregated data from two rounds of the Global Adult Tobacco Survey-India (GATS; 2009-10 [GATS 1] and 2016-17 [GATS 2]).

Design: Secondary analysis of repeated cross-sectional studies.

Settings and participants: The study involved data from 69,296 individuals and 76,069 households in GATS 1 and 74,037 individuals and 77,170 households in GATS 2, two rounds of a nationally representative survey in India.

Outcome measures: Mean age of initiation (as recalled by the participants) of smoked and smokeless tobacco (SLT) use (dependent variable) was compared and analysed across different sociodemographic variables (independent factors). We assessed change in mean age of initiation of tobacco usage on a daily basis between GATS 1 and GATS 2 and investigated the factors associated with early tobacco use initiation in the GATS 2 dataset (reported using adjusted odds ratio [aORs] with 95% CIs).

Results: The mean age of initiation for smoked and SLT tobacco in GATS 2 were 20.9+8.5 and 22.3+10.6 years, compared with 18.5+9.7 and 19.7 +12.0 years in GATS 1. The mean age of initiation increased with age and among those who were better aware of the adverse effects of tobacco. As per GATS-2, males initiated smoked and SLT use earlier $(20.6 \pm 7.4 \text{ and } 21.7 \pm 9.1)$ than females $(23.3 \pm 14.2 \text{ and } 23.2 \pm 12.6 \text{ years})$. Younger participants (15-24 years) reported earlier initiation of SLT (15.5+ 4.2 years) compared with others. Binary logistic regression depicted variables associated with early initiation of tobacco. Awareness about the harms caused by tobacco affected the odds of SLT (aOR 1.4, 95% CI 1.3-1.7) and dual usage initiation (1.8, 1.6-2.0), but not of initiation of smoked tobacco products (1.1, 0.9-1.2).

1 2 3		
3 4 5	1	Conclusions: More robust health advocacy campaigns that communicate the harmful effects of
5 6 7	2	tobacco on health could be useful to delay tobacco initiation, along with reducing the ease of access
8 9	3	and affordability or tobacco products among vulnerable groups.
10 11 12	4	
13 14	5	Keywords: Global Adult Tobacco Survey, age of initiation, smoked tobacco, smokeless
15 16	6	tobacco, harmful effects of tobacco
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Strengths and limitations of this study

- Large and nationally representative data on tobacco use from India was analysed.
- Factors associated with early initiation were estimated through a weighted analysis highlighting feasible, actionable points.
- Caution should be used when considering the adoption of recommendations in countries with similar sociodemographic indexes.
- The cross-sectional study design of the surveys may lead to recall bias about the exact time of initiation and can be seen as an important limitation.

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1 Introduction

Tobacco use remains a leading risk factor for morbidity and mortality globally. [1,2] According to the Global Burden of Disease 2019 estimates, all tobacco use accounted for at least 8.71 million deaths.[3] Further majority of the smokeless tobacco (SLT) and smoked tobacco users belongs to South East Asia including India. The region alone accounts for 81 and 22 percent of SLT and smoked tobacco users aged 15 years and above.[4] Despite this, tobacco companies continue to market products and target vulnerable populations such as youth and women, particularly those in low- and middle-income countries.[5] Adolescents and young adults are particularly susceptible to developing an addiction to tobacco products.[6] The age of initiation of tobacco use can predict the intensity of dependence and potential quit rates in the future.[7] This is because nicotine induces persistent changes in neural connectivity in several brain areas like the amygdala, which are involved with emotion regulation, and makes them more sensitive to the rewarding effects of nicotine.[8] Young people underestimate the addictive potential of nicotine and overestimate their likelihood of quitting in the future.[9] Early initiation is attributed to a higher risk of chronic diseases, increased psychological disturbances, decreased performance, and increased health costs to the individual and society.[10,11] Regular nicotine consumption at in early age may induce epigenetic modifications that sensitize the brain to other drugs and further increase the risks for future substance abuse.[12] Overall, substantial proof informs us that early initiation of tobacco use is critical in deciding the fate of the tobacco epidemic.[13]

Understanding why and when people start using tobacco can help prevent or delay initiation. Many factors contribute to tobacco initiation at young ages. Still, the two leading contributors are the easy availability of tobacco products and environmental risk factors, including personal attitudes and beliefs about smoking, peer pressure, family dynamics, socioeconomic status, and exposure to advertisements.[7,14] Further, knowledge of the average age of initiation is critical in realizing

national goals concerning tobacco use and related health burden.[15] Previous studies provide evidence that despite more addiction at younger ages, quitting may also be more successful because of the availability of new tools for quitting, such as nicotine gum and patches, and better awareness among the younger generations about the adverse effects of smoking.[16,17] Knowing the age of initiation can help inform policymakers about investments needed for cessation programs and avert tobacco-related disease and death through age-appropriate interventions. For instance, tobacco use by young people is generally more responsive to changes in taxes and prices of tobacco products than older people.[18] Further, when implemented as part of comprehensive tobacco control programs, school-based tobacco education programs improve knowledge, contribute to de-normalizing tobacco use, and deter initiation.[18] Currently, the most vital interventions in this regard from India include increasing the age of sale or purchase of any form of tobacco products at the point of sale from the current 18 years (under section 6a of The Cigarettes and Other Tobacco Products (Prohibition of Advertisement and Regulation of Trade and Commerce, Production, Supply, and Distribution) Act, 2003) to 21 years.[19] Additional policies, such as vendor licensing, restricting marketing and sales, and smoke-free spaces, can supplement tobacco control.[20]

Given the enormous sociocultural diversity across jurisdictions in India, there is an urgent need for a population-based estimate that informs us regarding the age of initiation of tobacco use and the prevailing trends. Within this context, the Global Adult Tobacco Survey (GATS) allows us to study the pattern of tobacco initiation for smoked and SLT products. To date, India has conducted two rounds of GATS which collect data related to the age of initiation across states and different sociodemographic indicators. Therefore, this study aims to investigate and compare the trends in tobacco initiation in India, and to explore the factors associated with early tobacco use initiation

among tobacco users using disaggregated data from two rounds (2009-10 and 2016-17) of the
 Global Adult Tobacco Survey–India (GATS). The estimates will be useful for informing
 policymakers to design effective prevention strategies and efficiently allocate human and financial
 resources.

5 Methods

6 Study design and data source

7 The current secondary data-analysis uses data from repeated cross-sectional studies, specifically 8 from rounds of the GATS done for India in 2009-10 and 2016-17.[21,22] We assessed change in 9 mean age of initiation of tobacco usage on a daily basis between GATS 1 and GATS 2 and 10 investigated the factors associated with early tobacco use initiation using the most recent dataset 11 (GATS 2). BMJ Open: first published as 10.1136/bmjopen-2023-074389 on 22 September 2023. Downloaded from http://bmjopen.bmj.com/ on June 10, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

GATS 1 and 2 were household surveys of persons aged 15 years or older. The studies involved 69,296 individuals and 76,069 households in GATS 1 and 74,037 individuals and 77,170 households in GATS 2. Overall response rates were 91.8% and 92.9% in GATS 1 and GATS 2, respectively. The surveys collected nationally representative data from all 29 States and 2 Union Territories in GATS 1, and all the 30 states of India (1 extra state added due to division of existing state) and two Union Territories (UTs) in GATS-2 using a multistage, geographically clustered sample design to produce data representative of each state and UT. The survey segregated India's states and Union territories into six regions (North, West, East, South, Central, and North-East). The three-stage sampling process was adopted for urban areas, while the two-stage method was adopted to get the sample size for rural areas. The nationally representative probability sample was used to provide national and regional estimates by residence and gender and State estimates by gender. One individual was randomly chosen from each selected household to participate in the

surveys. The surveys were designed to produce internationally comparable data on tobacco use and other tobacco control indicators using a standardized questionnaire, sample design, data collection, and management procedures. Both rounds have almost the same questionnaire, with a few questions added in the GATS 2. The detailed methodology of the GATS 1, 2 is described in the official reports available in the public domain.[21,22]

Study variables

Dependent variable

Age of initiation was the primary dependent variable. For this, we first segregated the GATS participants as tobacco users (daily users and less than daily) and non-users (not at all, don't know, refused missing/ not applicable). Then we estimated the current smokers, SLT, and dual users. Current smokers were estimated using the question: Do you currently use smoked tobacco products? (Daily, less than daily, not at all, don't know refused missing/ not applicable). Current SLT users were estimated from the question: Do you currently use smokeless tobacco? (Daily, less than daily, not at all, don't know refused missing/not applicable). To calculate dual users, we used the newly constructed outcomes of variables. Do you currently use smoked tobacco products? (Daily, less than daily, not at all, don't know refused missing/not applicable) and Do you currently use smokeless tobacco? (Daily, less than daily, not at all, don't know refused missing/ not *applicable*) to identify the respondents currently using both forms of tobacco. The response *daily* and *less than daily* was clubbed into one category, "yes," and others ("don't know and refused") were categorized into response, "no." From the tobacco users, we estimated the age of initiation using the questions: How old were you when you first started smoking tobacco daily? How old were you when you first started using smokeless tobacco daily? The recalled age of initiation of tobacco was recoded into four categories: <15 years, 16-18 years, 19-21 years, and >21 years.

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Independent variables
The independent variable
created per the GATS s
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Statistical analysis
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The in ent variables were included based on a literature review, and the sub-categories were e GATS standard coding protocol. [23,24] We included age (15-24 years, 25-44 years, created 45-60 and > 60 years); gender (male, female); residence (urban, rural); national region (All States/ Territories of India were divided into six geographical regions for analysis. The north region ins Jammu and Kashmir, Himachal Pradesh, Punjab, Chandigarh, Uttarakhand, Delhi; the central include Rajasthan, Uttar Pradesh, Chhattisgarh, and Madhya Haryar Prades ast contains West Bengal, Jharkhand, Odisha, and Bihar; northeast includes Sikkim Aruna desh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, and Assam; west contains Gujara arashtra, and Goa; south contains Andhra Pradesh (later divided into Andhra Pradesh and To a), Karnataka, Kerala, Tamil Nadu, and Puducherry); Education (a. No formal educat The primary school completed (Less than primary school completed + Primary eted), c. The secondary school completed (Less than secondary school completed + school Second hool completed), d. Higher secondary school and above (Higher secondary school comple College / University completed + post-graduate degree completed, e. Don't know + Refuse) for both the rounds.); Occupation (Employee (Government +non-(Don't govern daily wagers), b) Self-employed +retired, c) Student + Homemaker, d) Unemployed (able to + unable to work), e) Don't know + Refused), and Knowledge about the harmful effects acco (Based on what you know or believe, does smoking tobacco cause serious illness Based on what you know or believe, does using smokeless tobacco cause serious illness noked and SLT products). The values "yes" were labeled as yes, and the values "No, don't k efused, and missing/ not applicable" were clubbed together as "No" for this study. Statist alysis

The data was analysed in SPSS v 24 software. All analyses were performed separately for smoked, SLT, and dual-use tobacco products. The mean age (\pm Standard Deviation) of initiating tobacco products was calculated and compared across all the independent variables included in our study. Student's t-test was used to compare the difference in mean age in two rounds of GATS. Logistic regression models were run to estimate the adjusted odds ratio (aOR) and 95% confidence interval (95% CI) of the association of independent variables with early initiation of tobacco usage. For this, early initiators were classified as those who started consuming tobacco before 18 years, per the Cigarette and Other Tobacco Products Act (COTPA) 2003. Using variance inflation factor (VIF) values, we tested for multicollinearity between the covariates. Sampling weights were applied, and weighted estimates were calculated to account for the complex study design due to Clustering and stratification. All p-values were two-sided, and p<0.05 indicated statistical significance.

Ethical clearance

GATS India survey proposal, protocols, and questionnaires were reviewed and approved by the Ethics Review Committee and Institutional Review Board (IRB) of Tata Institute of Social Sciences Mumbai. Ethical approval was not deemed necessary for the present analysis since it was a secondary data analysis of completely anonymized national datasets available in the public domain. All methods were performed following the relevant guidelines and regulations.

- - 20 Patient and public involvement
 - 21 None.
 - **Results**

As per GATS-2, about 10.7% and 21.4% of the participants were daily smokers and SLT users, while 3.4% were dual users (Table 1). Tobacco use in any form was more prevalent in older men and those who live in rural settings. It is particularly high among those who live in northeastern India. Limited schooling, unemployed, self-employed, and retired men consumed more tobacco. Users unaware of the harms caused by tobacco use have a higher prevalence of tobacco use.

Table 2 depicts the mean age of initiation for smoked and SLT products across the two waves of GATS India. Overall, the mean age of initiation for smoked and SLT tobacco in GATS 2 was 20.9+8.5 and 22.3+10.6 years, compared to 18.5+9.7 and 19.7 +12.0 years in GATS 1. The mean age increased across all age groups in both genders from GATS1 to GATS2. As per GATS2, the mean age of initiating smoking and SLT was lower in rural areas (20.8+11.6 and 19.3+12.0 years) compared to urban areas (21.0+7.9 and 20.5+11.6 years). There is a relative increase in the mean recalled age of initiation for smoked tobacco throughout the country for smoked and SLT products, except for South India, which depicted a non-significant increase in SLT initiation age. Also, students and homemakers depicted a non-significant increase in the initiation age for smoking tobacco. Respondents who were aware that tobacco causes serious illness reported a higher mean recalled age of initiation among daily tobacco users.

Using logistic regression, we identified factors associated with early initiation of daily tobacco usage (table 3). Early initiation of daily smoking depicted higher odds among males, older participants (>60 years), unemployed, those who live in rural areas, and the Northeastern region of India. A similar trend occurs for SLT products, except for the higher odds observed in those who had studied up to primary school and those who were employed, self-employed, students and homemakers. Likewise, early dual usage is observed among males between 25-44 years and

residing in North-East India. Awareness about the harms caused by tobacco affected the odds of SLT and dual usage initiation, but not initiation of smoked tobacco products.

Discussion

The study investigates the age of initiation of tobacco use in India based on recall data from two rounds of GATS, a nationally representative survey of adults aged 15 years and above. The findings reveal several significant points. First, the mean age of initiation significantly increased for smoked and SLT tobacco in GATS 2 (20.9+8.5 and 22.3+10.6 years), compared to GATS 1 (18.5+9.7 and 19.7 +12.0 vears) across different sociodemographic variables. Second, smoked tobacco had a lower age of initiation compared to SLT products in all age groups except the voungest. Third, we find regional variations in initiation age, with the northeastern and central India regions showing earlier initiation. Fourth, specific sociodemographic factors were associated with higher odds of early tobacco initiation. Lastly, awareness campaigns about tobacco's harmful effects SLT and dual usage initiation, but not smoking initiation.

The trend of increasing initiation age for various tobacco products across sociodemographic groups is promising and could be attributed to strategies like MPOWER, including anti-tobacco advertisements and bans on vending machines and promotions. [25] However, there's room for stricter advertising bans and higher tobacco taxes. Compliance with smoke-free policies has improved between 2011 to 2015. Although taxes on tobacco products increased by 14% between 2010 and 2014, they remain lower than recommended 75% norm by the WHO and is known to be one of the most decisive measure of tobacco control in India.[26-30] Though the affordability of cigarettes has declined since 2010, accessibility and affordability of bidis, a significant smoked tobacco product in India, remain concerns. Studies have found that a substantial increase in taxes

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on tobacco products at par with increasing income can reverse the affordability of these products.[31,32]

Notably, the study found that people aged 15-24 started tobacco use at an average age of 14 in GATS 1 and 16 in GATS 2. Early initiation increases the risk of severe nicotine dependence, making quitting harder and leading to health issues.[14] Easy accessibility and affordability are the two parameters responsible for the early initiation of tobacco, worsened by ineffective COTPA implementation. In a recent study by Ali et al., the compliance with policies that protect minors and youth (Section 6a and 6b of COTPA) was 68.57% and 52.85%, respectively, in open spaces in Delhi. [33] Therefore, the policies that restrict minors' access to tobacco and align with the WHO's Framework Convention on Tobacco Control (FCTC) are essential. We also need to design and implement interventions that alter various factors that facilitate early tobacco initiation and encompass personal, psychological, social, cultural, and environmental factors. A systematic review on predictors of smoking initiation among adolescents aged <18 found 98 such potential predictors.[34] Furthermore, there's a contrast between the age of initiation for smoked tobacco and SLT products. The mean age of initiating SLT was highest in the youngest age groups, indicating the need for targeted interventions. This is coherent with the findings from the Global Youth Tobacco Survey India (GYTS-4) India, where the majority of the participants (52%) initiated SLT use before their 10th birthday, followed by bidi (47%), and cigarette (38%), with a median age of 9.9, 10.5 and 11.5 years, respectively.[35] However, the influence of different factors affecting tobacco use in the younger age groups makes abstinence difficult, and even with evidence-based cessation interventions, relapse is common due to altered mood, withdrawal symptoms, and cravings. [36] The ultimate aim, however, should be to prolong abstinence that helps mitigate tobacco harm through proven interventions like physical activity, enhanced



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cessation counseling sessions, incentives, behavior change programs, and pharmacotherapy like nicotine gums and patches.[37] But such efforts are scarce in resource-constrained settings, and previous studies suggest that only 3% to 5% of smokers who try to quit unaided achieve prolonged abstinence at 6 to 12 months.[38] Such people with relapse can still be offered help through the Tobacco Harm Reduction approach, where smoked or SLT products are substituted by low-risk nicotine products and is currently being acknowledged widely for benefits not achieved by adopting abstinence.[39,40]

There were higher odds of early initiation of tobacco per certain sociodemographic factors assessed in our study. The less educated people don't know about the harmful effects of tobacco and don't even try to look into the statutory warnings as that doesn't make any sense to them.[41] The affordability of tobacco products can be the reason for higher consumption among employed people. As discussed earlier, rural areas have more access to local tobacco products that bypass the legal restrictions, promoting easy access at earlier ages.[42] Another geospatial analysis from the United States depicted that more tobacco products are available at a unit cost in rural areas compared to urban settlements as the industry targets disadvantaged populations for their sales.[43] Prioritizing the strengthening of retail-focused tobacco control measures could counter easy accessibility, even in rural areas. Regional differences play a role too, with the Northern and Northeastern regions showing earlier initiation. This is possibly due to cultural practices adopted by different communities. Though perceived as an individual habit, tobacco use often acquires a ritualistic character involving group behavior. A commonly cited example of the ritual aspect of tobacco consumption would be the use of the hookah by the rural north Indian men, who usually assembled in caste-based or social-class-based groups to share a hookah in daily gatherings.[44] Further, easy access to local tobacco products deeply embedded in cultural practices normalizes

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tobacco use. It is sometimes also considered a healthy alternative to commercial tobacco products that promotes usage.[45,46] This is, in turn, is also affected by the awareness regarding the harmful effects of tobacco among the residents of that region.[17] Also, if the females are more into tobacco consumption, then the age of initiation can be even lower, as they tend to consume tobacco within their houses, thus exposing children in early age.[47,48] Therefore, multitudes of social and cultural practices also need to be recognized to comprehend tobacco use across social, religious, and ethnic sub-groups.

We observed that the awareness regarding the harmful effects of tobacco significantly affected the odds of early initiation of SLT and dual usage, but not for smoking. Thus intensive and more focussed awareness campaigns about the harmful effects of tobacco consumption among the general population can mitigate new initiations among minors and youth. [17] On similar lines, education also plays a role, with higher education linked to lower odds of early initiation. Several studies have found a positive impact of education on tobacco use. [13,49,50] The collaboration of the Ministries of Education and Information & Broadcasting could enhance awareness efforts, including regulating tobacco-related internet content. One of the significant drawbacks of tobacco control laws is their partial implication on content available on the internet without any statutory warning. It is still uncommon to see any statutory warnings on the media content delivered through over-the-top (OTT) internet-based streaming platforms that exhibit tobacco use or violate tobacco control laws. [51]

20 Strengths of the study include its use of nationally-representative data, offering generalizability 21 and comparability with other countries participating in GATS. A comprehensive multi-stage 22 sampling design provides robust estimates crucial for planning and management at the national 23 and sub-national levels. However, one of the significant limitations of the secondary analysis is

the limited availability of the study variables. Many other factors may affect our study results, like exposure to tobacco through family members, etc. There is a chance of recall bias that may affect our estimates regarding the age of the initiation, and hence we preferred to label it as a recalled age of initiation. The cross-sectional nature of the survey makes it difficult to ascertain temporal associations. The self-reported data in the survey may be affected by social desirability bias.

The study's policy implications suggest a need to address geographical disparities and further reduce the tobacco burden. We have to ensure a reduced tobacco burden to ensure healthy living, similar to several member states of the European region that have pledged to become tobacco-free and achieve a smoking prevalence of less than equal to 5%.[52] Though tobacco control policies in India have reduced the prevalence of tobacco use from 34.5% to 28.5% between two rounds of the GATS, there is a need to revamp and develop policies targeting disparities. Proposals include raising the legal age for buying tobacco products, licensing all points of sale, and standardizing packaging to deter single cigarette sales and ensure prominent health warnings. The sale of single or loose cigarettes and other unpackaged tobacco products must be brought under a standardized packaging policy. The sale of single cigarettes also circumvents the mandatory pack health warnings. [41] Adopting and implementing tobacco-free educational institution guidelines can contribute to a tobacco-free generation.

18 Conclusions

19 This study highlights the increasing age of tobacco initiation in India across different products and 20 demographics. While positive trends are observed, challenges like affordability, accessibility, and 21 awareness persist. The findings underscore the need for comprehensive policies, stricter 22 regulations, and targeted awareness campaigns to reduce tobacco initiation among minors and 23 youth, promoting a healthier society.

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4 5	2	Contributors
6 7	3	MV, KR: conceptualized the study, acquisition of data, developed an analytical framework,
8 9	4	analysed the data, interpreted the results, and wrote the first draft of the manuscript. GB, PL:
10 11 12	5	interpreted local policy implications of the results, reviewed and approved the early and advanced
13		
14 15	6	drafts of the manuscript. NS: led the data collection, interpreted the results, and prepared the draft.
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23 24	10	This research received no specific grant from any funding agency in the public, commercial, or
25 26	11	not-for-profit sectors.
27 28 29	12	Data availability statement
30 31	13	The dataset is available at Global Tobacco Surveillance System (GTSS), Centers for Disease
32 33	14	Control and Prevention (CDC), Global Adult Tobacco Survey-2 (2016–2017), India.
34 35 26	15	(https://nccd.cdc.gov/GTSSDataSurveyResources/Ancillary/DataReports.aspx?CAID=2) and data were
37 38	16	retrieved using standard protocols.[53]
39 40	17	Ethics statement
41 42 42	18	Being a secondary data analysis of an anonymized dataset available in the public domain, ethical
44 45	19	approvals were not deemed necessary.
46 47	20	
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	GATS	Cui	rrent smoker	Current S	user	3 Dual user	
Sample Characteristics	Sample distribution	N	Weighted prevalence (95% CI)	N	Weighted prevalence (95% CI) %	N	Weighted prevalence (95% CI)
Overall	74,037	9499	10.7 (10.2-11.1)	15235	21.4 (20.7-22.3)	2877	3.4 (3.2-3.7)
Gender					ted	Š	
Male	33772	8434	19.0 (18.2-19.9)	9561	29.6 (28.7-30.6)	2509	6.3 (5.8-6.8)
Female	40265	1065	2.0 (1.7-2.3)	5584	12.8 (12.0-13.5)	368	0.5 (0.4-0.7)
Age-Group					t a e		`
15-24 Years	12105	576	3.1 (2.6-3.7)	1266	10.5 (9.6-11.59 6	231	1.7 (1.3-2.2)
25-44 Years	34841	4440	10.9 (10.3-11.6)	7706	23.3 (22.3-24.2)	1546	4.1 (3.8-4.5)
45 -60 years	16732	2854	16.9 (15.9-17.8)	3959	27.3 (26.0-28.5)	739	4.2 (3.7-4.8)
>60 years	8412	1432	15.8 (14.6-17.1)	1956	28.7 (27.0-30.5)	291	3.6 (3.0-4.3)
Education completed			10.		<u>,</u> ,		
No formal schooling	18473	2754	14.3 (13.4-15.2)	4889	28.9 (27.7-30. 5)	. 764	4.2 (3.8-4.8)
Primary school	16368	2909	15.0 (14.0-16.0)	4610	28.6 (27.3-29.3)	1022	5.3 (4.7-6.0)
Secondary school	22440	2681	8.8 (8.2-9.4)	4155	18.9 (17.9-19.9)	799	3.0 (2.6-3.4)
Higher secondary school and above	16697	1151	5.0 (4.5-5.6)	1571	9.2 (8.3-10.2)	291	1.4 (1.1-1.8)
Occupation					Sin Sin		
Employed	23363	4571	16.3 (15.5-17.3)	6544	30.5 (29.3-31.5)	1449	5.8 (5.2-6.4)
Self-employed and retired	20089	3322	12.2 (11.3-13.1)	4508	20.3 (19.3-21.7)	1002	4.0 (3.5-4.4)
Students and homemakers	27304	1052	3.2 (2.9-3.6)	3459	13.1 (12.2-13.9)	273	0.7 (0.6-0.9)
Unemployed	3251	551	13.7 (11.9-15.8)	722	23.2 (20.7-26.8)	1 53	3.0 (2.2-4.1)
Residence					, zc	2	, , , , , , , , , , , , , , , , ,
Urban	26488	2519	8.3 (7.7-8.9)	3618	15.2 (14.0-16.5)	662	2.3 (2.0-2.7)
Rural	47549	6980	11.9 (11.3-12.6)	11617	24.6 (23.8-25.4)	2215	4.0 (3.7-4.4)
Region					, in the second s		
North	17128	2136	14.2 (13.3-15.1)	979	7.4 (6.4-8.4)	297	2.2 (1.8-2.7)
Central	11518	1438	12.2 (11.1-13.5)	3251	26.7 (25.2-28.3)	553	5.5 (4.8-6.2)
	9834	1044	10.3 (9.5-11.2)	3052	26.8 (25.4-28.2)	444	3.7 (3.2-4.3)

BMJ Open **Table 1.** Demographic characteristics of current tobacco users from the second round of Global Adult Tobacco Survey–India (2016-17)

Page 29 of 37				BMJ Open		cted by c	/bmjoper	
1 2						copyrigh	1-2023-0	
3	North-East	13574	3044	16.8 (15.6-18.2)	5155	40.5 (38.7-42.3)	4 1286	7.9 (7.1-8.8)
4 5	West	7901	431	5.1 (4.4-6.0)	1443	22.4 (20.4-24.6)	ä 111	1.7 (1.2-2.2)
6	South	14082	1406	10.3 (9.6-11.1)	1355	10.5 (9.5-11.6	186	1.5 (1.2-1.7)
7	Using tobacco cause serious illness					d f	- 12	
8 9	Yes		8632/ 68182	10.5 (10.1-11.0)	14324/ 70798	21.0(20.3-21.5)	epi 2562/6 6897	3.4(3.1-3.6)
10 11	No		867/ 5855	12.2(11.0-13.6)	911/ 3239	29.5(26.9-32.2)	315/ 7140	4.4(3.7-5.4)
13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47	Fo	r peer review	only - http://b	omjopen_bmj.com/site	e/about/guide	to text and data mining, Al training, and similar technologies.	3. Downloaded from http://bmjopen.bmj.com/ on June 10, 2025 at Agence Bibliographique de l	

Table 2. Comparison of the mean age of tobacco initiation among the daily users as per the two rounds of Global Adult Tobacco Survey–India

Chanastanistics	Daily S	moked tobacc	20	Daily Smokeless tobacco			
Characteristics	GATS 1	GATS-2	p-	GATS 1	GATS-2	p-	
	Mean ± SD	Mean ± SD	value	Mean ± SD	Mean ± SD	value	
Number total	N= 9223	N= 7647		N=13410	N= 12721		
Overall	18.5±9.7	20.9±8.5	< 0.01	19.7±12.0	22.3±10.6	< 0.01	
Gender							
Male	18.4 ± 8.9	20.6 ± 7.4	< 0.01	19.6 ± 10.7	21.7 ± 9.1	< 0.01	
Female	18.8 ± 14.5	23.3 ± 14.2	< 0.01	19.7 ± 13.6	23.2 ± 12.6	< 0.01	
Age-Group							
15-24 Years	14.1 ± 6.3	16.1 ± 3.4	< 0.01	14.1 ± 6.3	15.5 ± 4.2	< 0.01	
25-44 Years	17.6 ± 8.1	19.3 ± 5.8	< 0.01	18.3 ± 9.0	20.2 ± 6.9	< 0.01	
45 -60 years	19.6 ± 10.5	22.1 ± 9.1	< 0.01	21.9 ± 13.4	24.7 ± 11.5	< 0.01	
>60 years	20.7 ± 13.4	24 ± 12.2	< 0.01	26.9 ± 18.7	28.2 ± 16.5	< 0.01	
Education							
No formal schooling	18.6 ± 11.2	21.2 ± 10.4	< 0.01	20.2 ± 13.6	23.1 ± 12.7	< 0.01	
Primary school	17.9 ± 9.2	20.3 ± 7.5	< 0.01	19.3 ± 11.5	21.8 ± 9.9	< 0.01	
Secondary school	18.6 ± 8.6	20.7 ± 7.5	< 0.01	19.3 ± 10	21.5 ± 8.5	< 0.01	
Higher secondary school and			< 0.01			< 0.01	
above	18.9 ± 8.6	21.8 ± 6.9		19.6 ± 10.6	22.4 ± 8.2		
Occupation							
Employed	19.2 ± 8.2	20.4 ± 7.3	< 0.01	19.5 ± 10.2	21.4 ± 9.1	< 0.01	
Self-employed and retired	18.5 ± 13.1	20.7 ± 7.5	< 0.01	19.5 ± 13.7	22.1 ± 9.4	< 0.01	
Students and homemakers	18.0 ± 9.3	22.8 ± 12.9	0.9	19.7 ± 11.5	23.6 ± 13.3	< 0.01	
Unemployed	18.2 ± 12.4	22.3 ± 10.8	< 0.01	20.4 ± 13.4	23.8 ± 13.1	< 0.01	
Residence							
Urban	19.1±8.7	21.0 ± 7.9	< 0.01	20.5 ± 11.6	22.6±10.7	< 0.01	
Rural	18.1±10.1	20.8 ± 8.6	< 0.01	19.3 ± 12.0	22.1±10.5	< 0.01	
Region							
North	19.2 ± 8.7	21.3± 8.4	< 0.01	20.7 ± 10.6	22.2 ± 9.0	< 0.01	
Central	19.9 ± 9.1	21.1 ± 9.7	< 0.01	20.6 ± 12.3	21.5 ± 11.2	< 0.01	
East	19.5 ± 9.6	22.1 ± 8.8	< 0.01	20.4 ± 11.1	23.0 ± 11.1	< 0.01	
North-East	15.8 ± 10.5	19.5± 7.3	<0.01	16.7 ± 11.7	21.5 ± 9.0	< 0.01	
West	20.5 ± 9.1	22.4± 9.4	< 0.01	20.8 ± 11.4	21.9 ± 10.2	< 0.01	
South	20.1 ± 8.9	21.5 ± 8.5	< 0.01	23.2 ± 13.2	25.2 ± 12.8	0.7	
Using tobacco cause serious							
illness							
No	18.6 ± 9.5	20.9 ± 8.3	< 0.01	19.8 ± 11.7	22.2 ± 10.4	<0.01	
Yes	17.3 ± 10.6	21.2 ± 9.4	< 0.01	18.7 ± 12.2	22.7 ± 12.5	< 0.01	

	Smo	kers	Smokeless to	obacco users	 ວັ ຜູ້ Dual users		
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Emagiusted OR	Adjusted OR (95% CI)	
Gender	, , , , , , , , , , , , , , , , , , ,				sign rela		
Female	Ref. Value	Ref. Value	Ref. Value	Ref. Value	I§e∰. Sy alue	Ref. Value	
Male	11.7(10.1-13.7)	14.9(12.4-17.9)	2.8(2.7-3.1)	3.1(2.8-3.4)	1 8 9 (9 .9-17.3)	12.0(8.8-16.4)	
Age-Group					bow : Su		
15-24 Years	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Rue kalue	Ref. Value	
25-44 Years	3.8(3.2-4.6)	3.5(2.9-4.3)	2.6(2.3-2.8)	2.4(2.1-2.7)		2.2(1.6-3.1)	
45 -60 years	6.3(5.2-7.6)	5.4(4.5-6.6)	3.2(2.8-3.6)	2.7(2.4-3.1)	2	2.1(1.6-2.9)	
>60 years	5.8(4.8-7.2)	5.0(4.0-6.3)	3.4(3.0-3.9)	3.2(2.8-3.7)	2.100105-2.9)	2.0(1.3-2.8)	
Education							
Primary school	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	
No formal schooling	2.2(0.6-7.9)	3.4(0.7-15.1)	1.0(0.3-2.9)	0.9(0.2-3.0)	1€5(02-10.3)	1.7(0.2-12.6)	
Secondary school	1.3(0.3-4.6)	1.4(0.3-3.3)	0.6(0.2-1.6)	0.5(0.1-1.6)	190(051-7.1)	0.9(0.1-6.3)	
≥Higher secondary school	0.7(0.2-2.5)	0.7(0.1-3.3)	0.2(0.1-0.7)	0.2(0.1-0.7)	(<u><u></u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u>	0.4(0.1-2.9)	
Occupation					j, b		
Unemployed	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	
Employed	1.2(0.2-5.9)	0.7(0.1-6.6)	12.8(1.8-87.7)	22.9 (2.9-179)	059 (6.7-1.2)	0.7(0.6-1.0)	
Self-employed and retired	0.8(0.1-4.2)	0.6(0.1-5.6)	7.4(1.1-50.9)	15.4(1.9-120.9)	0,6(0,5-0.7)	0.7(0.6-0.9)	
Students and home makers	0.2(0.0-1.0)	0.5(0.1-4.7)	4.3(0.6-29.9)	12.4(1.5-97.2)		0.5(0.3-0.6)	
Residence					no no		
Urban	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	
Rural	1.5(1.3-1.6)	1.2(1.1-1.4)	1.8(1.6-2.0)	1.2(1.1-1.5)	107(104-2.1)	1.2(0.9-1.4)	
Region					at		
South	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. A alue	Ref. Value	
North	1.4(1.2-1.6)	1.7(1.5-2.0)	0.7(0.6-0.8)	0.7(0.6-0.9)	1.5(121-1.9)	1.7(1.2-2.2)	
Central	1.2(1.1-1.3)	1.2(1.1-1.4)	3.1(2.7-3.6)	3.5(3.0-4.1)	3.9(30-4.9)	3.8(3.0-4.9)	
East	0.9(0.8-1.1)	0.9(0.7-1.0)	3.1(2.7-3.6)	3.3(2.9-3.9)	2.6(20)-3.3)	2.4(1.8-3.0)	
	1.7(1.5-2.0)	1.9(1.6-2.2)	5.8(5.0-6.6)	7.1(6.1-8.2)	5.8(426-7.2)	5.7(4.5-7.2)	

BMJ Open **Table 3.** Binary logistic regression to explore factors affecting of early initiation of daily tobacco usage appendix the second round of the Global Adult Tobacco Survey–India Adult Tobacco Survey–India

			BMJ Open		lopen-2023-C I by copyrigh	
West	0.4(0.3-0.5)	0.4(0.3-0.5)	2.4(2.1-2.9)	2.7(2.3-3.3)	nt, in 2743897-1.6)	1.1(0.8-1.7)
illness					1 22 ing t	
Yes	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value	Ref. Value
No	1.1(1.0-1.3)	1.1(0.9-1.2)	1.5(1.3-1.8)	1.4(1.2-1.7)	1655 (£3-1.7)	1.8 (1.6-2.0)
					loaded from http://bmjopen.bmj.com/ on June 10, 2025 at Agence Bibliographique erieur (ABES) . and data mining, Al training, and similar technologies.	
	For pee	r review only - http://b	omjopen ₃ bmj.com/si	te/about/guidelines.x	html <u>e</u>	

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	Item No	Recommendation	Page No
Title and abstract	1	(<i>a</i>) Indicate the study's design with a commonly used term in	3
		the title or the abstract	
		(b) Provide in the abstract an informative and balanced	3
		summary of what was done and what was found	
Introduction			Ι
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	7 line 18-23
Objectives	3	State specific objectives, including any prespecified	Pg 8, line 1-4
Madha Ju		hypotheses	
Niethods Studie design		Present have also and a fate day dealer contrain the gamen	Do 9 line (7
Study design	4	Present key elements of study design early in the paper	Pg 8, line 6-7
Setting	5	periods of recruitment, exposure, follow-up, and data collection	Pg 8, line 8-23
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	Pg 8, line 8-20
Variables	7	Clearly define all outcomes, exposures, predictors, potential	Pg 8, 9
		confounders, and effect modifiers. Give diagnostic criteria, if applicable	
Data sources/	8*	For each variable of interest, give sources of data and details	Page 10,11
measurement		of methods of assessment (measurement). Describe	
		comparability of assessment methods if there is more than one	
		group	
Bias	9	Describe any efforts to address potential sources of bias	Page 11
Study size	10	Explain how the study size was arrived at	Page 8
Ouantitative variables 11		Explain how quantitative variables were handled in the	Page 10 11
		analyses. If applicable, describe which groupings were chosen and why	1 480 10,11
Statistical methods	12	(<i>a</i>) Describe all statistical methods, including those used to control for confounding	Page 10,11
		(b) Describe any methods used to examine subgroups and interactions	Page 10,11
		(c) Explain how missing data were addressed	-
		(<i>d</i>) If applicable, describe analytical methods taking account of sampling strategy	-
		(<u>e</u>) Describe any sensitivity analyses	Not done
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg	Table 1 nage
	-0	numbers potentially eligible examined for eligibility	26
		confirmed eligible included in the study completing follow-	
		un and analysed	
		(b) Give reasons for non-participation at each stage	_
		(c) Consider use of a flow diagram	
		(c) Consider use of a now diagram	-

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic,	Table 1
		clinical, social) and information on exposures and potential	
		confounders	
		(b) Indicate number of participants with missing data for each	-
		variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	Table 2
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-	Page 12
		adjusted estimates and their precision (eg, 95% confidence	
		interval). Make clear which confounders were adjusted for	
		and why they were included	
		(b) Report category boundaries when continuous variables	Table 1
		were categorized	
		(c) If relevant, consider translating estimates of relative risk	-
		into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and	-
		interactions, and sensitivity analyses	
Discussion		6	
Key results	18	Summarise key results with reference to study objectives	
Limitations	19	Discuss limitations of the study, taking into account sources	Page 13
		of potential bias or imprecision. Discuss both direction and	
		magnitude of any potential bias	
Interpretation	20	Give a cautious overall interpretation of results considering	16, 17
		objectives, limitations, multiplicity of analyses, results from	
		similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study	16
		results	
Other information			
Funding	22	Give the source of funding and the role of the funders for the	18
		present study and, if applicable, for the original study on	
		which the present article is based	

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Supplement S. Ci	hecklist	for Reporting Of Survey Studies (CROSS)	, incl	4389
Section/topic	Item	Item description	Reported	on Bage #
Title and abstract			g for	2 Sep
Title and abstract	1a	State the word "survey" along with a commonly used term in title or abstract to introduce the study's design.	1,3 es rela	enseign
	1b	Provide an informative summary in the abstract, covering background, objectives, methods, findings/results, interpretation/discussion, and conclusions.	3 to te	ement S
Introduction			At and	vnloa
Background	2	Provide a background about the rationale of study, what has been previously done, and why this survey is needed.	6-8 data m	eur (ABE
Purpose/aim	3	Identify specific purposes, aims, goals, or objectives of the study.	8 8	S).
Methods	I	· · · · · · · · · · · · · · · · · · ·	, Al t	p://bn
Study design	4	Specify the study design in the methods section with a commonly used term (e.g., cross-sectional or longitudinal).	⁸ ⁸	njopen.b
	5a	Describe the questionnaire (e.g., number of sections, number of questions, number and names of instruments used).	8,9 d simi	mj.com/
	5b	Describe all questionnaire instruments that were used in the survey to measure particular concepts. Report target population, reported validity and reliability information, scoring/classification procedure, and reference links (if any).	ar technolo 8	on June 10
Data collection methods	5c	Provide information on pretesting of the questionnaire, if performed (in the article or in an online supplement). Report the method of pretesting, number of times questionnaire was pre-tested, number and demographics of participants used for pretesting, and the level of similarity of demographics between pre-testing participants and sample population.	NA gies	2025 at Agence
	5d	Questionnaire if possible, should be fully provided (in the article, or as appendices or	NA	Bibli

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		as an online supplement).	2023-0743 pyright, ii	
	6a	Describe the study population (i.e., background, locations, eligibility criteria for participant inclusion in survey, exclusion criteria).	ncluding fo	
ample characteristics	6b	Describe the sampling techniques used (e.g., single stage or multistage sampling, simple random sampling, stratified sampling, cluster sampling, convenience sampling). Specify the locations of sample participants whenever clustered sampling was applied.	eptember 20 Enseigne r uses relate	
	6c	Provide information on sample size, along with details of sample size calculation. Na	23. Downent S and to te	
	6d	Describe how representative the sample is of the study population (or target population if possible), particularly for population-based surveys.	wnloade uperieu xt and d	
	7a	Provide information on modes of questionnaire administration, including the type and number of contacts, the location where the survey was conducted (e.g., outpatient room or by use of online tools, such as SurveyMonkey).	ata mining	
Survey	7b	Provide information of survey's time frame, such as periods of recruitment, exposure, and follow-up days.	Al traini	
Idministration	7c	 Provide information on the entry process: ->For non-web-based surveys, provide approaches to minimize human error in data entry. ->For web-based surveys, provide approaches to prevent "multiple participation" of participants. 	ing, anedainsom/ on June NA (Secoesimilar techn	data analysis)
Study preparation	8	Describe any preparation process before conducting the survey (e.g., interviewers' training process, advertising the survey).	nologies. Na	
thical considerations	9a	Provide information on ethical approval for the survey if obtained, including informed consent, institutional review board [IRB] approval, Helsinki declaration, and good clinical practice [GCP] declaration (as appropriate).	11 at Agence	
	9b	Provide information about survey anonymity and confidentiality and describe what	11, Data ava	ability statement
		For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xh	itml e	

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	mechanisms were used to protect unauthorized access.
	10a Describe statistical methods and analytical approach. Report the statistical software that was used for data analysis.
	10b Report any modification of variables used in the analysis, along with reference (if 9 Signature of the analysis along with reference of the analysis along with reference (if 9 Signature of the analysis along with reference (if 9 Signature of the analysis along with reference (if 9 Signature of the analysis along with reference (if 9 Signature of the analysis along with reference (if 9 Signature of the analysis along with reference (if 9 Signature of the analysis along with reference (if 9 Signature of the analysis along with reference of the analysis along with reference (if 9 Signature of the analysis along with reference of the analysis along with reference (if 9 Signature of the analysis along with reference of the
Statistical	10c Report details about how missing data was handled. Include rate of missing items, missing data mechanism (i.e., missing completely at random [MCAR], missing at random [MAR] or missing not at random [MNAR]) and methods used to deal with missing data (e.g., multiple imputation). - Amount of the second
analysis	10d State how non-response error was addressed.
	10e For longitudinal surveys, state how loss to follow-up was addressed.
	10fIndicate whether any methods such as weighting of items or propensity scores have been used to adjust for non-representativeness of the sample.10,11Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for non-representativeness of the sample.
	10g Describe any sensitivity analysis conducted.
Results	
	11a Report numbers of individuals at each stage of the study. Consider using a flow 12 <td< td=""></td<>
Respondent	11b Provide reasons for non-participation at each stage, if possible.
characteristics	11c Report response rate, present the definition of response rate or the formula used to calculate response rate.
	Provide information to define how unique visitors are determined. Report number of - Q Q
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				-2023-0 opyrigh	
Descriptive results	12	Provide characteristics of study participants, as well as information on potential confounders and assessed outcomes.	Table 1	74389 on t, includi	
	13a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates along with 95% confidence intervals and p-values.	Table 3	22 Septe	
Main findings	13b	For multivariable analysis, provide information on the model building process, model fit statistics, and model assumptions (as appropriate).	Table 3	ember 2023 Inseigneme es related	
	13c	Provide details about any sensitivity analysis performed. If there are considerable amount of missing data, report sensitivity analyses comparing the results of complete cases with that of the imputed dataset (if possible).	-	to text and	
Discussion		80		led fr ur (Al data	
Limitations	14	Discuss the limitations of the study, considering sources of potential biases and imprecisions, such as non-representativeness of sample, study design, important uncontrolled confounders.	16	om http://b BES) . mining, Al	
Interpretations	15	Give a cautious overall interpretation of results, based on potential biases and imprecisions and suggest areas for future research.	16,17	mjopen.l training,	
Generalizability	16	Discuss the external validity of the results.	17	and a	
Other sections	_1	0		om/ o	
Role of funding source	17	State whether any funding organization has had any roles in the survey's design, implementation, and analysis.		on June (
Conflict of interest	18	Declare any potential conflict of interest.	18	10, 20 Nogie	
Acknowledgements	19	Provide names of organizations/persons that are acknowledged along with their contribution to the research.	-))25 at Ag	
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