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Abstract

Background: Quitting tobacco smoking has numerous benefits. However, it takes varying quit attempts to quit smoking completely and awareness about the intention to quit could assist policy makers to establish tailor-made strategies to offer support. **Objective:** In the current study, we analyzed the determinants of cessation among 9499 current smokers of India recorded during the second Global Adult Tobacco Survey (GATS, 2016-2017). **Methods:** Bivariate analysis, multivariate analysis (binary logistic regression was performed for past quit attempts and intention to quit smoking in future; multinomial logistic regression to understand predictors of various stages of change determining cessation behavior of current smokers) was undertaken. **Results:** Majority of the smokers were men (91.0%), in 25-44 years age group, (42.3%), daily wagers (37.4%), and resided in rural area (70%) with bidi being the most commonly smoked product (72%). Nearly 72% tried to quit without any assistance with 36.6% (pre contemplation), 27% (contemplation), 28% (preparation (or action)) and 8.1% in (relapse) stage. Men [(1.049); CI 1.047-1.051], primary [1.192; CI 1.190-1.193] as well as higher education, being married [1.231; CI 1.229-1.234] and urban residence [1.167; CI 1.1.65-1.168] were found to be associated with higher prevalence of previous quit attempts. The regression modeling found out that intent to quit reduced with increasing age and was similarly prevalent with any level of education. **Conclusion:** Understanding stages of behavior change could assist the stakeholders to develop interventions that cater to individual stages and support designing of appropriate cessation programs at individual and population levels along with development of intensive cessation protocols in clinical settings.

Keywords: Global Adult Tobacco Survey, Smoking, Quit attempts, Intention to quit, Stage of Change, India

Strengths and limitations of this study

- This secondary data analysis of Global Adult Tobacco Survey, India provides an understanding about the stage of behavior change among current smokers, highlighting that 36.6% current smokers were in pre-contemplation stage, a similar proportion (27-28%) in contemplation and preparation (or action) stage.
- It addresses the key determinants of quit attempts and intention to quit in the future that would support design of appropriate tobacco cessation programs in as India at individual as well as population levels.
- Based on the analysis of a nationwide representative data the article provides certain recommendations for policy & practice such as aggressive campaigns for rural population, strengthened checks to manage promotions and surrogate advertisements of tobacco products and introduction of integrated capacity building programmes for increasing cessation services at various points of patient contact.
- The study design being a cross sectional one, it limits us from establishing temporal relationship and the responses collected during the survey are susceptible to recall bias.

Background

Smoking cessation has the ability to maximize the efforts of tobacco control. The evidence of health benefits and economic benefits of cessation at any age is well demonstrated at individual level as well as at population level.[1][2] Cessation of tobacco smoking at the earliest is crucial but discontinuing tobacco use at any age adds substantial life extensions.[3] The British Doctor study estimated that major greatest gains in terms of cessation happens at around 30–40 yrs of age whereas individuals who continue to smoke lifelong end to lose an average of 10 yrs of life.[4]

Since tobacco dependence is a chronic disease, therefore, cessation is a continuous process and requires the smoker to make multiple quit attempts to finally quit.[5] A study done among a longitudinal cohort of smokers reported that it may take 30 or more quit attempts before quitting permanently.[6] Apart from this various agencies suggest varied number of quit attempts ranging from 8–10 (The American Cancer Society)[7], 12–14 (Australian Cancer Council)[8], 8-11 (The Centers for Disease Control and Prevention)[9] before quitting forever.

Furthermore, quitting tobacco smoking is a complex process and the trans-theoretical behavioral change model (TTM) describes the process of change that smokers experience in order to be able to stop smoking. As per the TTM, the smoker evolves through pre-contemplation, contemplation, preparation, action and maintenance stages in the smoking cessation.[10] A key element in achieving these stages of behavioral change is the intention of the smoker to quit smoking.[11] This element before cessation has been stated as a determinant as to whether the smoker would then engage in cessation program, attempt to quit smoking and succeed in quitting.

However, it is not easy for smokers at the preparatory stage of behavioral change to demonstrate behavioral change despite having a higher degree of intent than for smokers at the contemplative stage.[12,13] Thus it is crucial to analyze the factors influencing the intention to quit smoking in order to evaluate the diverse underlying contextual factors determinants that influence a smoker's intention to quit smoking.

The round two of the Global Adult Tobacco Survey in India 2017 recorded that almost two in five (38.5%) adult smokers had attempted to quit smoking tobacco (38.8% male; 35.5% female) in the last 12 months prior to the survey. However, the proportion of smokers who made a quit attempt has not been encouraging between GATS - 1(2010) and GATS -2(2017) as the figures have remained almost the same (38.4% vs 38.5%). Nearly half of the cigarette smokers (47.4%) and bidi smokers (48.7%) who made a quit attempt in the past 12 months, were able to maintain a quit status for less than a month.[14] In contrast, majority (55.4%) of the current smokers (55.4%) are interested or planning to quit smoking and the proportion between GATS-1(2010) and GATS-2 (2017) has increased (46.6% vs 55.4%).[14]

Understanding the socio demographic variables and other factors in facilitating or restraining quit behavior of tobacco user is essential for focused tobacco control interventions and optimal utilization of health care resources. Socio demographic variables have been an important determinant of quit attempt among tobacco smokers. A study conducted among Italian adults reported an association of successful quit attempts with higher education level and young age.[15] A secondary data analysis of GATS-1, India (2010), demonstrated significant association of quit attempt with socio-demographic characteristics and placed an evidence for re examining effects of socio-demographic factors on cessation.[16]

Being aware of the intention of the tobacco smoker to quit and the related factors can assist policy makers and interventionists to establish tailor-made strategies and change-based cessation services. Furthermore, awareness of these factors may also encourage stakeholders in other national programs & initiatives to establish a need-based and staged transition for specific smoking cessation services in order to promote tobacco cessation.

In the current study, we primarily aim to analyze the determinants of cessation among current tobacco smokers of India recorded during the second GATS survey with respect to past cessation attempts and intent to quit smoking in the near future.

Methods

Study Settings

The national wide representative survey of GATS (round 2) was carried out in the Indian sub continent during years 2016-2017[17] covering a population of 1029 million[18] (Census 2011). India is a signatory to World Health Organization's – Framework Convention on Tobacco Control and has been implementing Article 14 of WHO FCTC concerning tobacco dependence and cessation.[19] Further, the Government of India launched National Tobacco Control Programme in 2007-2008 with one of the key objective of helping people quit tobacco use in conformance to Article 14 of WHO-FCTC[20].

Study design

This study is secondary data analysis of Global Adult Tobacco Survey, India, 2016-2017. The study design of the survey was cross sectional.

Data sources

This secondary data analysis included data generated from the GATS-II (2016–17) survey.[14] The Global Adult Tobacco Survey is conducted under the Global Tobacco Surveillance System (GTSS).This nationwide representative household survey is a standard instrument for monitoring tobacco use as well as tracking changes in key measures of tobacco control among adults aged

15 or above. The second round was carried out in 2016-2017 using a standardized methodology. Survey was a project of the Ministry of Health & Family Welfare (MoH&FW), Government of India and it designated Tata Institute of Social Sciences (TISS), Mumbai as the nodal implementing agency for the survey. The data collection fieldwork was conducted was carried out in all 30 states including Union Territories (Chandigarh and Puducherry) between August 2016 and February 2017 with a sample of 84,047 households (30,821 from urban areas and 53,226 from rural areas) The survey used probability proportional to size (PPS) sampling technique, with adoption of three stage sampling design for rural areas *(Villages-Households-Respondent)* and a four stage was for urban areas *(Wards- Census Enumeration Block-Households- Respondent)*[17].

Ethics statement

This manuscript is a secondary data analysis of a nationwide representative Global Adult Tobacco Survey, 2017, India.

Data sharing statement

The data sheets of Global Adult Tobacco Survey, 2017, India are available at Global Tobacco Surveillance System Data (GTSSD), Centres For Disease Control and Prevention (CDC) in public domain.[21]

Operational definitions used:

- A quit attempt in the survey was defined as current tobacco smokers who tried to quit during the past 12 months and former tobacco smokers and smokeless tobacco users who have been abstinent for < 12 months.
- Intention in quitting smoking in future was defined as current tobacco smokers who are planning or thinking about quitting smoking within the next month, 12 months, or someday.[14]

Utilization of existing information to classify current tobacco smokers in various stages of change:

Based on the tobacco smoking cessation behavior, the current tobacco smokers were classified into following stages of change:

Pre-contemplation: the current tobacco smokers who did not attempted to quit tobacco smoking neither in past nor do they intend to quit in future.

Contemplation: The current tobacco smokers who did not attempt to quit tobacco smoking in past but intend to quit it in future.

Preparation (or action!): The current tobacco smokers who attempted to quit tobacco smoking in past and also intend to quit in future (apparently because their past quit attempt could not yield success, that's why they were still using tobacco).

Relapse: The current tobacco smokers who made unsuccessful quit attempt in past, and do not intend to quit in future.

Study variables

Outcome variables included past quit attempts and intention to quit tobacco smoking in future. The explanatory variables included socio-demographic characteristics, smoking history and pattern, exposure to media advertisements for and against tobacco smoking as well as knowledge about health effects of tobacco smoking. The analyses performed were frequency distribution, bi-variate analysis (chi-square), multivariate analysis (binary logistic regression for outcome variables mentioned above; and; multinomial logistic regression to understand predictors of various stages of change determining cessation behavior of current tobacco smokers; measure of association: Prevalence ratio). Further, the graphs represent frequency distribution of multiple response variables in the form of percent distribution of responses. The analysis was performed in SPSS software, version 16.

Results:

There were 9499 participants reported as current tobacco smokers in the GATS II survey. Maximum proportion of smokers were in the age group of 25-44 years (42.3%), daily wagers (37.4%), belonged to other backward class caste category (42.3%), resided in rural area (70%) and 60.4% had initiated the regular tobacco smoking at the age of 15-25 years. Bidi was the most commonly used tobacco product (72%). Around 63% of the current smokers had made a quit attempt within past 12 months from the survey and around 44% participants had no intention to quit tobacco smoking in the near future. More than 90% were aware about the serious illnesses that tobacco smoking can cause and 11% reported to have witnessed one or other type of promotion of bidi smoking. Based on the cessation behavior of current tobacco users, they were classified into four groups by applying the principles of Stages of Change Model.[22] It was found that 36.6% current tobacco smokers were in pre contemplation stage. A similar proportion (27-28%) of participants belonged to contemplation and preparation (or action) stage. (Table 1)

Table 1: Distribution of socio-demographic & tobacco smoking related attributes among current tobacco smokers in India, GATS 2016-17

Nearly 72% current tobacco smokers tried to quit without any assistance, whereas counseling was sought by 8.4% of tobacco smokers. Further, 4.2% switched to smokeless tobacco as well. Nicotine replacement was sought by an even lesser proportion (1.7%). (Figure 1)

Figure 1: Cessation method used by the current smokers who attempted to quit tobacco in last 12 months, GATS 2016-17

Maximum promotion was noticed for bidi products in the form of coupons for purchasing (7.8%) followed by sale at low price (3.4%) or as free gifts (3.2%) in comparison to cigarette promotion. However, the surrogate advertisement promotion was more for cigarettes (2.2%) as compared to bidis (2%). (Figure 2)

Figure 2: Distribution of promotional strategies noticed by the current tobacco smokers encouraging tobacco smoking in past 30 days, GATS 2016-17

The age related distribution of various tobacco smoking products was assessed for current tobacco smokers based on smoking frequency. It was found that in, less than daily use of cigarette was prevalent in 60% of the smokers aged 15 to 24 years. Around 65% of tobacco smokers aged 45 years and above smoked bidi on daily basis. In the younger most age group, i.e. 15-24 years, prevalence of daily use of bidi was the highest (50%), followed by cigarettes (40%) as compared to other products. (Figure3)

Figure 3: Age-wise distribution of smoking tobacco product use among current daily and non-daily tobacco smokers, GATS 2016-17

In order to test the effect of socio-demographics and tobacco use related attributes on past quit attempts and intention to quit tobacco in future, bivariate analyses were performed, including chi-square test of association as well as binomial regression analyses. The analysis revealed that all the socio-demographic variables and tobacco smoking related attributes were statistically significantly associated with the outcome variables, i.e. past quit attempts and future intention to quit.

Factors affecting quit attempts among current tobacco smokers:

The male sex, primary as well as higher education (graduation and above), being employed (or retired), married, higher caste and urban residence were found to be associated with higher prevalence of previous quit attempts among current smokers. Further, exposure to regular smoking during early adulthood, perception of having experienced ill effects of smoking on body, awareness about serious ill-effects of smoking on body, and smoking able to cause a multitude of health effects was associated with increased prevalence of attempts to quit tobacco smoking.

Table 2: Factors affecting tobacco quitting attempts within past 12 months among the current tobacco users, GATS 2016-17

Factors affecting intent to quit tobacco in near future:

The regression modeling found out that intent to quit reduced with increasing age and was similarly prevalent with any level of education. Having an occupation with monetary outcomes (i.e. except being student), being married, smoking initiation after the age of 25 years, experience of ill health effect due smoking, perception about smoking able to cause serious and multitude of illnesses was associated with higher odds/ prevalence of intent to quit in future. The prevalence of intent to quit was lower among single individuals and those who recently noticed more than two advertisements about tobacco products. (Table 3)

Table 3: Factors affecting intention to quit tobacco in future among the current tobacco users, GATS 2016-17

The socio-demographic profile of current smokers and their smoking related attributes were tested to find out predictors of being in any of the stages of Transtheoretical model.[10] Younger age, female sex, non-exposure to advertisements promoting smoking, experience of ill health effects, and perception about tobacco being able to cause serious health effects were predictors of being in contemplation stage.

Younger age, female sex, education up to primary level, daily wager, OBC caste, being married, non-exposure to advertisements promoting smoking and experience of ill health effects because of smoking were predictors of being in preparation stage.

Lack of formal education, self-employment, any caste other than general, initiation of tobacco use at age less than 25 years, noticing information encouraging tobacco use as well as quitting, experience of ill health effects because of smoking, and perception about tobacco not being able to cause serious health effects were predictors of relapse among current tobacco smokers. (Table 4)

Table 4: Multinomial logistic regression model to assess predictors of stages of change determining current tobacco smokers' cessation behavior, GATS 2016-17

Discussion

Majority of the current tobacco smokers were males (91%), in 25-44 years age group (42.3%), daily wagers (37.4%), residing in rural area with bidi being the most commonly smoked tobacco product (72%). This could be attributable to bidi being a cheaper tobacco product[23,24] and available in great quantities at rural areas[25], it seems that majority of the current tobacco users get exposed to using bidi before any other kind of smoking tobacco product.[26,27] Our findings are consistent with other large studies from India that have highlighted similar findings with respect to tobacco smoking.[28–31]

The focus of this paper was to look for determinants of two major aspects of tobacco smoking cessation-quit attempts and intent to quit. The former relates to their history of thinking about quitting once and was practiced by 36.3% of the current tobacco smokers. The latter includes their intention to do so in near future and was claimed by 55.3% of the current tobacco smokers.

These two aspects can help us in understanding smokers' attitude and behavior towards smoking cessation by utilizing the Transtheoretical model. The model, including stages marking a particular behavior, is a cyclic representation, which signifies that behavior change is not a unidirectional phenomenon but can be influenced positively or negatively by a variety of factors.[22,32] This can be adequately illustrated by findings of this study.

Out of the current tobacco smokers who made a quit attempt in past, majority reported (72%) to have attempted to quit without any assistance. This could be due to various reasons such as lack of awareness among users about the treatment options available for nicotine addiction, availability of pharmacotherapy & nicotine replacement therapy free of cost in tobacco cessation centers, availability of quitlines & mCessation programmes being run by the Government of India, perceptions about safety of these medications, and perceiving that unassisted is a better choice.[33,34] The ratio of old-age smokers to younger age smokers was lesser about quit attempts.[35] The older age people often smoke habitually and usually forget to stop when it is the thing keeping them stress-free, personally and professionally.[36] Only after they contract some illness due to smoking, do they think and perhaps attempt to quit (or reduce) smoking.[37] Also indicated in this paper, the odds of quit attempt were 2.322 times higher among those who experienced tobacco related harm to their body. The odds of quitting were higher among those who perceived that tobacco smoking can cause serious illness (PR: 2.121). It is possible that the majority of them were those who already had an episode of smoking-related illness. The previous research suggests that such events of ill health could also lead to quit attempts.[38,39]

The current tobacco smokers who were either self-employed or employed with government/ non-government organizations had bit higher odds of making quit attempts (PR: 1.09 and 1.02, respectively). It is possible that the current tobacco smokers had same belief and attempted to quit when their concern for financial security was alleviated. It is also possible that their attempts were a result of the organization policy or a measure of customer engagement.[40]

Those who started smoking regularly after the age of 25 years had higher odds of quit attempts as compared to those who started at the age of less than 15 years. Similar findings have been reported by previous studies as well.[41,42] It is possible that a young adult, who started late, had comparatively more information on ill-effects of tobacco smoking.

Looking at the factors that might influence the intention to quit tobacco smoking in future, interestingly it was found that males had less odds of intent to quit (PR=0.789). The odds of intent to quit increased with increase any level of education (PR ~ 1.3). Further, any kind of occupation was associated with increased odds of intent to quit (PR=1.1 for students to 1.359 for

govt./non-govt. employees) as compared to the financially non-productive individuals, the odds were higher for urban residents also. The observations point towards the fact that the social scale to measure the betterment in life; be it being educated, earning money, or belonging to a higher caste shapes a person's decision to choose pro health options. Daily smokers had lesser intent to quit, just as they had lesser odds of quit attempts.[43] This could be because they were either unaware about ill effects of tobacco smoking or had no interest in quitting.

Role of tobacco related advertisements was also assessed in this study. The inclination of those who noticed advertisements encouraging quitting was more likely to have intent to quit. The odds increased with increase in number of advertisement the person was exposed to in the past 30 days. On the contrary, those who witnessed ads promoting tobacco smoking were less likely to quit in future. It implies that the advertisements do impact general public in making a decision or opinion about something.

Having perception, experience or belief about definite ill-effects of tobacco smoking on one's health can be a major factor in deciding to quit. It was reflected from the results of this study where the odds of quit attempts and intent to quit were higher among those who had experience of ill health due to tobacco smoking, or believed that tobacco smoking can cause serious illness. This may include witnessing someone with declining health due to tobacco smoking. Similar was also reported by Fagan et al.[43]

This study has certain limitations. Firstly, the study design being a cross sectional one, it therefore it limits us from establishing temporal relationship and the responses collected during the survey are susceptible to recall bias. Further, as indicated in this paper, the odds of quit attempt were higher among those who experienced tobacco related harm to their body. It is possible that the majority of them were those who already had an episode of smoking-related illness. This theory wasn't, however, tested by the authors in the present paper.

Conclusion

Majority of the tobacco smokers were men, in 25-44 years age group, daily wagers, belonged to other backward class caste category, resided in rural area and had initiated the regular tobacco smoking at the age of 15-25 years with bidi being the most commonly used tobacco product. More than half of the current smokers had made a quit attempt and majority of these tried to quit without any assistance. Maximum promotion was noticed for bidi products in the form of coupons for purchasing in comparison to cigarette promotion. The regression modeling found out that intent to quit reduced with increasing age and was similarly prevalent with any level of education. Younger age, female sex, non-exposure to advertisements promoting smoking, experience of ill health effects, and perception about tobacco being able to cause serious health effects were predictors of being in contemplation stage. Availability and review of information from a nationwide representative data on such determinants of quit attempts and intention to quit in the future would support design of appropriate tobacco cessation programs in as India at

individual as well as population level along with development of intensive cessation treatment protocols in clinical settings.

Recommendations

Concrete media campaigns with wider coverage, and more aggressive campaigns for rural population are required in order to motivate the tobacco smokers to attempt quitting. Strengthened checks are required to be implemented to manage surrogate advertisements of tobacco products. Further, taxation on bidis needs to increase in order to impact the affordability of the product. Qualitative research must be conducted to understand the reasons of preferring to not make another quit attempt, so that the causes of relapse can be addressed via individual counseling programs. Besides, integrated capacity building programmes for increasing cessation services may be introduced at various points of patient contact in order to increase the outreach of cessation services followed by advertisement of availability of existing cessation services to encourage smokers to quit. Understanding of stage of behavior change among these smokers could assist the stakeholders to develop such intervention that cater to the individual stages and facilitating the desired outcome. Dedicated cessation programs addressing women and younger age groups could help the smoker's progress from contemplation to preparation and action stages.

Contributor ship statement

SG conceptualized the idea. GB did the review of literature. SG and SK designed the study. GB and RK performed the data curation. Data analysis was performed by RK. GB drafted the paper. The draft was critically revised for important intellectual content by all authors and thereafter approved the final version. All authors have read and approved the manuscript. SG is the guarantor for all aspects of the study ensuring those questions related to the accuracy or integrity of any part of the work that are investigated.

Patient and public involvement statement

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Tables and Figures

Table 1: Distribution of socio-demographic & tobacco smoking related attributes among current tobacco smokers in India, GATS 2016-17

Characteristic	Category	n (%)
Total		9499
Age in years	15-24	661 (8.4)
	25-44	4552 (42.3)
	45-64	3304 (37.0)
	65 and above	982 (12.2)
Sex	Male	8434 (91.0)
	Female	1065 (9.0)
Education (n= 9495)*	No formal schooling	2754 (35.3)
	Up to primary	2909 (28.8)
	Up to secondary	3314 (31.1)
	Graduation and above	518 (4.8)
Occupation (n= 9496)*	Daily wager	3220 (37.4)
	Self employed	3148 (34.1)
	Retired /Unemployed/ Homemaker	1603 (14.9)
	Govt. and Non-govt. employee	1351 (12)
	Student	174 (1.5)
Marital status	Married	8133 (84.2)
	Single	882 (10.2)

	Separated/ divorced/widowed	484 (5.6)
Caste (n-9437)*	Scheduled caste/ Scheduled tribe	4235 (33.6)
	Other backward class	2895 (42.3)
	General (none of above)	2307 (24.2)
Area of residence	Rural	6980 (73.3)
	Urban	2519 (26.7)
Age of initiation of tobacco smoking (n=8128)**	< 15 years	707 (8.1)
	15-25 years	5130 (60.4)
	> 25 years	2291 (31.5)
Smoking frequency	Daily	7647 (80.5)
	Less than daily	1852 (19.4)
Type of smoking tobacco used (n=11936)#	Bidi	6070 (72.3)
	Cigarette	3338 (32.6)
	Rolled tobacco	1297 (7.9)
	Hukkah	699 (6.6)
	Cheroot	329 (2.9)
	Others	203 (1.3)
Quit attempt within past 12 months	No	6296 (63.7)
	Yes	3203 (36.3)
Intent to quit tobacco in future	Interested in quitting	5382 (55.3)
	Not interested in quitting	4117 (44.7)
Source of information about harms or quitting tobacco smoking	Haven't noticed	2331 (25.0)
	≤ 3 sources	4201 (42.5)
	> 3 sources	2967 (32.5)
Noticed advertisements or signs promoting tobacco smoking	None	7495 (76.4)
	≤ 2 sources	1080 (11.4)
	< 2 sources	924 (12.2)
Noticed any type of cigarette promotion	No	8736 (91.9)
	Yes	763 (8.1)
Noticed any type of bidi promotion	No	8580 (89.0)
	Yes	919 (11.0)
Has smoking already done harm to your body (n=9488)*	No	4133 (47.9)
	Yes	4933 (49.3)
	Don't know	422 (2.8)
Whether smoking tobacco causes serious illness (n=9494)*	Yes	8632 (91.3)
	No	684 (6.9)
	Don't know	178 (1.8)
Whether smoking tobacco causes no, one or multiple illnesses	No illness	361 (3.7)
	Up to 3 illnesses	3400 (38.0)
	> 3 illnesses	5738 (58.3)
Cessation behavior based on Stages of Change model	Pre-contemplation	3446 (36.6)
	Contemplation	2850 (27.0)
	Preparation / Action!	2532 (28.2)
	Relapse	671 (8.1)

*some participants refused to answer to that particular question, reflecting as changed denominator for analysis

**information not available for all current less than daily tobacco smokers

#Multiple responses per participant (n=frequency of responses and not respondents)

(All percentage is weighted)

Table 2: Factors affecting tobacco quitting attempts within past 12 months among the current tobacco users, GATS 2016-17

Factor	Quit attempt		
	% (n=3203)	Unadjusted PR (95% CI)	Adjusted PR (95% CI)
Age in years			
15-24	34.4	1.033 (1.031-1.035)	1.391 (1.387-1.395)
25-44	37.9	1.202 (1.200-1.203)	1.082 (1.080-1.083)
45-64	35.9	1.106 (1.104-1.107)	0.941 (0.939-0.942)
65 and above	33.7	Ref	
Sex			
Male	36.9	1.297(1.295-1.299)	1.049 (1.047-1.051)
Female	31.0	Ref	
Education (n-9495)*			
Up to primary	39.8	1.377(1.375-1.378)	1.192 (1.190-1.193)
Graduation & above	37.7	1.260(1.258-1.263)	1.115 (1.112-1.118)
Up to secondary	37.3	1.239(1.238-1.241)	0.993 (0.992-0.994)
No formal schooling	32.5	Ref	
Occupation (n= 9496)*			
Govt. and Non-govt. employee	41.0	2.076 (2.068-2.084)	1.269 (1.262-1.276)
Self employed	38.7	1.885 (1.878-1.892)	1.292 (1.285-1.299)
Daily wager	34.7	1.511 (1.586-1.597)	1.097 (1.091-1.104)
Retired /Unemployed/ Homemaker	32.7	1.450 (1.445-1.456)	1.113 (1.107-1.119)
Student	25.1	Ref	
Marital status			
Married	37.2	1.335 (1.332-1.337)	1.231 (1.229-1.234)
Single	32.0	1.059 (1.056-1.061)	0.789 (0.787-0.791)
Separated/ divorced/widowed	30.8	Ref	
Caste (n-9437)*			
Other backward class	41.0	1.461 (1.460-1.462)	1.461 (1.460-1.462)
General	33.5	1.062 (1.061-1.063)	1.062 (1.061-1.063)
Scheduled caste/ Scheduled tribe	32.2	Ref	
Area of residence			
Urban	39.3	1.187(1.186-1.188)	1.167 (1.165-1.168)
Rural	35.3	Ref	
Smoking frequency			
Less than daily smoking	41.4	1.303 (1.301-1.304)	1.303 (1.301-1.304)
Daily smoking	35.1	Ref	
Age of initiation of regular smoking			
< 15 years	37.3	1.090 (1.089-1.092)	1.095 (1.093-1.097)
> 25 years	36.9	1.069 (1.068-1.070)	1.109 (1.108-1.110)
15-25 years	35.3	Ref	
Has smoking already done harm to your body			
Yes	39.8	2.428(2.421-2.435)	2.322 (2.314-2.330)

No	33.7	1.867(1.862-1.873)	1.808 (1.802-1.815)
Don't know	21.4	Ref	
Whether smoking tobacco causes serious illness			
Yes	37.1	3.155(3.142-3.168)	2.121 (2.111-2.131)
No	31.2	2.424(2.413-2.434)	1.947 (1.937-1.957)
Don't know	15.8	Ref	
Whether smoking tobacco causes no, one or multiple illnesses			
> 3 illnesses	38.4	1.830(1.826-1.834)	1.435 (1.431-1.439)
Up to 3 illnesses	34.3	1.530(1.527-1.534)	1.244 (1.240-1.248)
No illness	25.4	Ref	

Table 3: Factors affecting intention to quit tobacco in future among the current tobacco users, GATS 2016-17

Factor	Intention to quit in future		
	% (n=5382)	Unadjusted PR (95% CI)	Adjusted PR (95% CI)
Age group			
15-24	58.3	1.796 (1.793-1.799)	1.478 (1.474-1.482)
25-44	59.1	1.855 (1.852-1.857)	1.457 (1.455-1.459)
45-64	54.0	1.506 (1.504-1.508)	1.225 (1.224-1.227)
65 and above	43.8	Ref	
Sex			
Male	56.1	1.478(1.476-1.480)	0.789 (0.787-0.790)
Female	46.4	Ref	
Education			
Graduation & above	64.8	2.129(2.124-2.133)	1.378 (1.374-1.381)
Up to secondary	61.1	1.822(1.820-1.823)	1.307 (1.305-1.309)
Up to primary	58.3	1.617(1.615-1.619)	1.304 (1.302-1.305)
No formal schooling	46.3	Ref	
Occupation			
Govt. and Non-govt. employee	65.0	2.206(2.202-2.209)	1.359 (1.356-1.362)
Student	59.6	1.749(1.744-1.755)	1.079 (1.073-1.084)
Daily wager	55.8	1.498(1.496-1.500)	1.276 (1.274-1.278)
Self employed	55.3	1.469(1.467-1.471)	1.225 (1.223-1.227)
Retired /Unemployed/ Homemaker	45.7	Ref	
Caste			
General	58.5	1.328 (1.326-1.329)	1.146 (1.145-1.148)
Other backward class	56.3	1.212 (1.211-1.213)	1.184 (1.182-1.185)
Scheduled caste/ Scheduled tribe	51.5	Ref	
Marital status			
Married	56.1	1.800 (1.797-1.803)	1.227 (1.225-1.230)
Single	55.5	1.751 (1.747-1.755)	0.901 (0.898-0.904)

Separated/ divorced/widowed	41.6	Ref	
Residence			
Urban	61.0	1.379 (1.378-1.380)	1.146 (1.144-1.147)
Rural	53.2	Ref	
Smoking frequency			
Less than daily smoking	64.7	1.623 (1.622-1.625)	1.917 (1.913-1.921)
Daily smoking	53.0	Ref	
Age of initiation of regular smoking tobacco use			
> 25 years	55.1	1.152(1.150-1.154)	1.159 (1.157-1.161)
15-25 years	53.3	1.073(1.071-1.075)	0.982 (0.981-0.984)
< 15 years	51.6	Ref	
Noticed information about the dangers of smoking tobacco or that encourages quitting			
More than three sources	63.0	2.193(2.190-2.195)	1.562 (1.560-1.564)
Up to three sources	56.2	1.656(1.655-1.658)	1.380 (1.379-1.382)
Haven't noticed	43.7	Ref	
Noticed any advertisements or signs promoting smoking tobacco products			
Haven't seen any such promotion	55.5	1.067 (1.065-1.068)	1.309 (1.307-1.311)
More than 2 sources promoted tobacco smoking	54.7	1.033 (1.031-1.034)	0.873 (0.871-0.874)
Up to 2 sources promoted tobacco smoking	54.0	Ref	
Whether noticed any type of cigarette promotion			
One or other type of promotion seen	61.5	1.321(1.319-1.323)	1.051 (1.049-1.053)
No promotion seen	54.7	Ref	
Whether noticed any type of bidi promotion			
One or other type of promotion seen	57.5	1.107(1.105-1.108)	1.144 (1.142-1.146)
No promotion seen	55.0	Ref	
Has smoking already done harm to your body			
Yes	58.7	1.977(1.972-1.982)	2.242 (2.235-2.249)
No	52.5	1.535(1.531-1.539)	1.863 (1.858-1.869)
Don't know	41.8	Ref	
Whether smoking tobacco causes serious illness			
Yes	56.5	4.378(4.362-4.393)	2.924 (2.911-2.936)
No	46.8	2.957(2.946-2.968)	2.468 (2.457-2.479)
Don't know	41.8	Ref	
Whether smoking tobacco causes no, one or multiple illnesses			
> 3 illnesses	59.0	1.938(1.934-1.942)	1.259 (1.256-1.263)
Up to 3 illnesses	50.8	1.389(1.386-1.392)	1.041 (1.038-1.043)

No illness	42.6	Ref	

Table 4: Multinomial logistic regression model to assess predictors of stages of change determining current tobacco smokers' cessation behavior, GATS 2016-17

Predictor	Category		Stage[a]	
		Contemplation (n=2850)	Preparation (n=2532)	Relapse (n=671)
		PR (95% CI)[c]	PR (95% CI) [c]	PR (95% CI) [c]
Age group	15-24	1.172(1.168-1.176)	1.737(1.731-1.743)	0.800(0.796-0.804)
	25-44	1.449(1.446-1.452)	1.373(1.371-1.376)	0.843(0.841-0.845)
	45-64	1.376(1.373-1.378)	1.078(1.076-1.080)	0.958(0.956-0.961)
	65 and above[b]			
Sex	Female	1.338(1.335-1.341)	1.178(1.175-1.181)	0.971(0.968-0.974)
Education	No formal schooling	0.733(0.731-0.736)	0.742(0.740-0.745)	1.112(1.106-1.118)
	Up to primary	0.892(0.889-0.895)	1.008(1.005-1.011)	1.046(1.040-1.051)
	Up to secondary	1.065(1.062-1.068)	0.866(0.863-0.868)	1.095(1.089-1.101)
	Graduation &above[b]			
Occupation	Retired /Unemployed/ Homemaker	0.724(0.722-0.725)	0.740(0.738-0.741)	0.974(0.970-0.978)
	Student	0.686(0.682-0.691)	0.735(0.730-0.740)	0.331(0.325-0.336)
	Daily wager	1.021(1.019-1.023)	0.856(0.855-0.858)	0.992(0.988-0.995)
	Self employed	0.907(0.906-0.909)	0.941(0.939-0.943)	1.149(1.146-1.153)
	Govt. and Non-govt. employee[b]			
Caste	SCST	0.812(0.811-0.814)	0.909(0.907-0.910)	1.097(1.095-1.100)
	OBC	0.840(0.839-0.841)	1.315(1.313-1.316)	1.577(1.573-1.581)
	General [b]			
Marital status	Single	0.953(0.949-0.956)	0.790(0.787-0.793)	0.823(0.819-0.828)
	Married	1.043(1.040-1.046)	1.441(1.437-1.445)	0.926(0.923-0.929)
	Separated/ divorced/widowed[b]			
Residence	Urban residence	1.037(1.036-1.038)	1.230(1.228-1.232)	0.942(0.940-0.944)
Frequency of smoking	Daily smokers	0.574(0.573-0.576)	0.409(0.408-0.410)	0.646(0.643-0.648)
Initiation of regular tobacco smoking	< 15 years	0.978(0.976-0.980)	0.862(0.860-0.864)	1.361(1.356-1.365)
	15-25 years	0.973(0.971-0.974)	0.797(0.796-0.798)	1.228(1.225-1.230)
	> 25 years[b]			
Noticed information about the dangers of smoking tobacco or that encourages quitting	Haven't noticed	0.625(0.624-0.627)	0.621(0.620-0.622)	0.868(0.865-0.870)
	Up to three sources	0.885(0.884-0.886)	0.952(0.950-0.953)	1.219(1.216-1.221)
	More than three sources[b]			
Noticed any advertisements or signs	Haven't seen any such promotion	2.114(2.109-2.118)	1.357(1.354-1.359)	1.738(1.733-1.743)

promoting smoking tobacco products	Up to 2 sources promoted tobacco smoking	1.660(1.656-1.664)	1.038(1.036-1.041)	1.814(1.807-1.820)
	more than 2 sources promoted tobacco smoking[b]			
Whether noticed any type of cigarette promotion	No promotion of cigarette seen	0.943(0.940-0.945)	0.854(0.852-0.856)	0.714(0.712-0.717)
Whether noticed any type of bidi promotion	No promotion of bidi seen	0.876(0.875-0.878)	0.717(0.716-0.719)	0.608(0.607-0.610)
Has smoking already done harm to your body	No	1.698(1.692-1.704)	2.453(2.442-2.463)	1.548(1.539-1.557)
	Yes	2.034(2.027-2.042)	3.345(3.330-3.359)	2.148(2.136-2.160)
	Don't know[b]			
Whether smoking tobacco causes serious illness	Yes	2.773(2.759-2.787)	3.775(3.751-3.800)	1.746(1.735-1.757)
	No	2.708(2.693-2.723)	3.014(2.994-3.035)	2.277(2.261-2.292)
	Don't know[b]			
Whether smoking tobacco causes no, one or multiple illnesses	No illness	1.022(1.019-1.025)	0.578(0.575-0.580)	1.098(1.093-1.102)
	Up to 3 illnesses	0.836(0.835-0.837)	0.790(0.789-0.791)	0.926(0.925-0.928)
	> 3 illnesses[b]			

[a] Reference category: Pre-contemplation stage

[b] Redundant parameter

[c] Adjusted

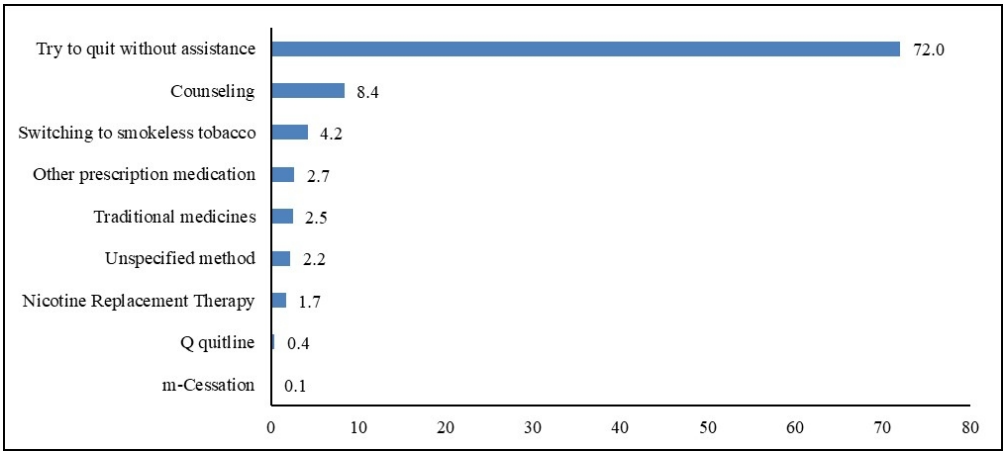

Figure 1: Cessation method used by the current smokers who attempted to quit tobacco in last 12 months, GATS 2016-17

171x76mm (150 x 150 DPI)

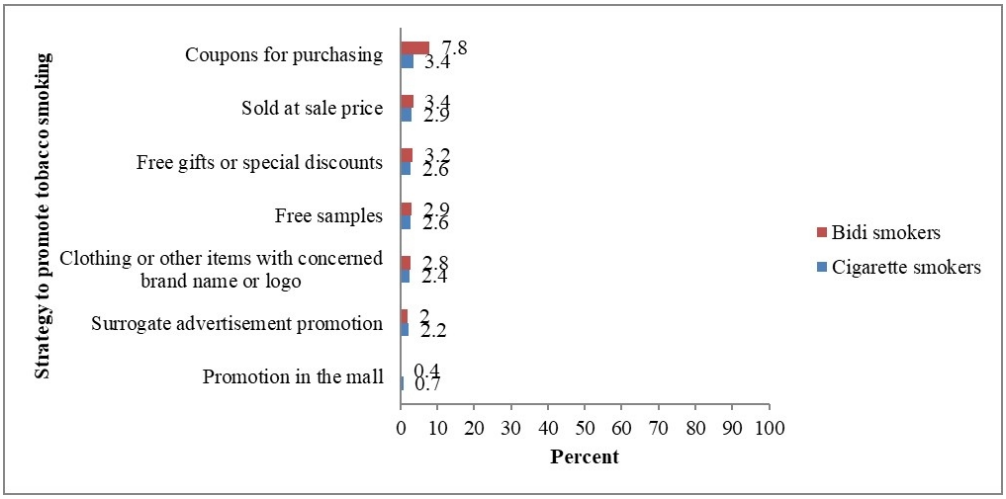

Figure 2: Distribution of promotional strategies noticed by the current tobacco smokers encouraging tobacco smoking in past 30 days, GATS 2016-17

171x84mm (150 x 150 DPI)

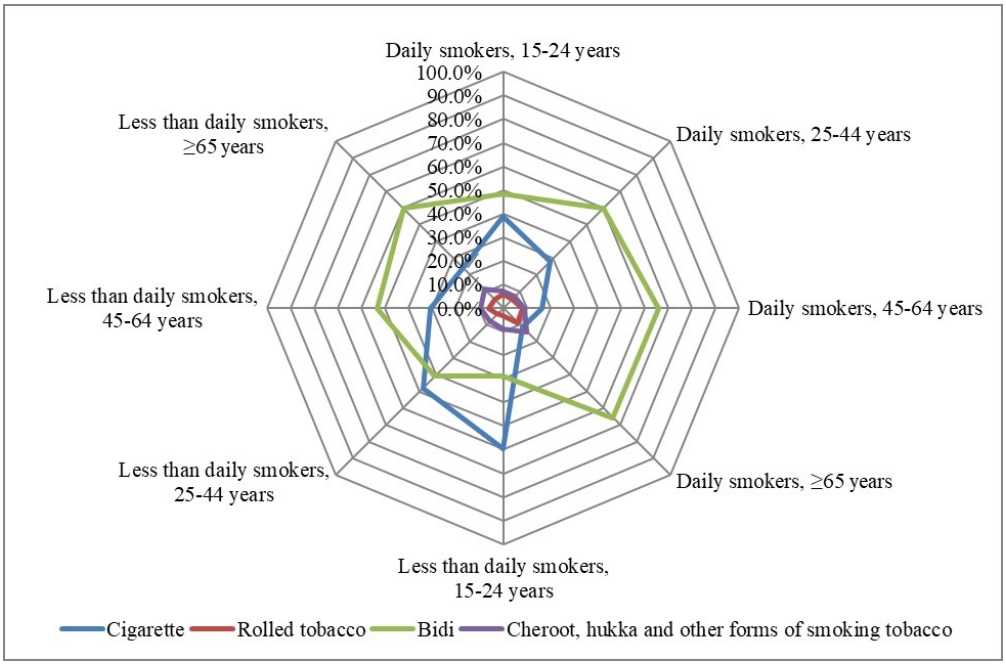

Figure 3: Age-wise distribution of smoking tobacco product use among current daily and non-daily tobacco smokers, GATS 2016-17

165x108mm (150 x 150 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	3,4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4,5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4
Bias	9	Describe any efforts to address potential sources of bias	*2*
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	5
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6,7
		(b) Give reasons for non-participation at each stage	6,7
		(c) Consider use of a flow diagram	6,7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6
		(b) Indicate number of participants with missing data for each variable of interest	5
Outcome data	15*	Report numbers of outcome events or summary measures	5
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6,7
		(*b*) Report category boundaries when continuous variables were categorized	6,7
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	6,7
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	10

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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.

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Tobacco smoking cessation determinants among current adult smokers in India: Findings from GATS-2, India (2016-17)

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Title Page

Title of manuscript: Tobacco smoking cessation determinants among current adult smokers in India: Findings from GATS-2, India (2016-17)

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Manuscript

Tobacco smoking cessation determinants among current adult smokers in India: Findings from GATS-2, India (2016-17)

Abstract

Background: Quitting tobacco smoking is a complex process, and the transtheoretical model (TTM) describes the various stages of behavior change that smokers experience to stop smoking. Predictors of intention to quit and stage of behavior change could assist policymakers in establishing tailor-made strategies to offer support. **Objective:** In the current study, we analyzed the determinants of cessation among 9499 current smokers of India recorded during the second Global Adult Tobacco Survey (GATS, 2016-2017). **Methods:** Bivariate analysis, multivariate analysis (binary logistic regression was performed for past quit attempts and intention to quit smoking in the future; multinomial logistic regression to understand predictors of various stages of change determining cessation behavior of current smokers) was undertaken. **Results:** The majority of the smokers was men (91.0%), in 25-44 years age group, (42.3%), daily wagers (37.4%), and resided in the rural area (70%), with bidi being the most commonly smoked product (72%). Nearly 72% tried to quit without any assistance with 36.6% (pre-contemplation), 27% (contemplation), 28% (preparation (or action)) and 8.1% in (relapse) stage. Men [(1.049); CI 1.047-1.051], the primary [1.192; CI 1.190-1.193] as well as higher education, being married [1.231; CI 1.229-1.234] and urban residence [1.167; CI 1.1.65-1.168] were found to be associated with higher prevalence of previous quit attempts. The regression modeling found out that intent to quit reduced with increasing age and was similarly prevalent with any level of education. **Conclusion:** Understanding stages of behavior change could assist the stakeholders in developing individualized interventions along with the development of intensive cessation protocols in clinical & public health settings.

Keywords: Global Adult Tobacco Survey, smoking, quit attempts, intention to quit, stage of change, India

Strengths and limitations of this study

- This analysis provides an understanding of the stage of behavior change among current smokers of India.
- It addresses the key determinants of quit attempts and intention to quit that would support the design of individual and population-based tobacco cessation programs in India.
- The article provides specific recommendations for policy & practice for increasing awareness about cessation services at various points of patient contact.
- The study design does not permit us to establish a temporal relationship, and the responses collected during the survey are susceptible to recall bias.
- The predictors of quit attempt and intention to quit may vary for various forms of tobacco consumption which was not included in this analysis.

Background

Smoking cessation at any age is associated with substantial health and economic benefits[1]along with the addition of considerable longevity.[2] In comparison to non-smokers, smokers who start smoking early in adulthood lose a decade of life expectancy. Smoking cessation, especially before the age of 40, leads to a substantial decrease in mortality risk.[3] Due to nicotine dependence, the smoker is required to make multiple quit attempts to quit finally.[4]A prospective cohort study of smokers estimated that it might take 30 or more quit attempts before quitting permanently.[5] Apart from this, evidence suggests a varied number of quit attempts ranging from 8–10 (The American Cancer Society)[6],12–14 (Australian Cancer Council)[7],8-11 (The Centers for Disease Control and Prevention)[8] before quitting forever.

Quitting tobacco smoking is a complex process.[9] The trans-theoretical behavioral change model (TTM) describes the process of change that smokers experience to be able to stop smoking. As per the TTM, the smoker evolves through pre-contemplation, contemplation, preparation, action, maintenance, and termination stages in the smoking cessation.[10]A key element in achieving 'quit status' is the intention to quit smoking.[11]This element before cessation has been stated as a determinant of whether the smoker would engage in a cessation program, attempt to quit smoking,and succeed in quitting. During the preparatory stage, the intent to quit may be higher than the latter, but it is not easy to demonstrate behavior change.[12, 13] Thus, it is crucial to analyze the factors influencing the intention to quit smoking in order to evaluate the diverse underlying contextual factors that influence a smoker's intention to quit smoking.

Global Adult Tobacco Survey, round-2 conducted in India in the year 2016-2017 recorded that almost two in five (38.5%) adult smokers had attempted to quit smoking tobacco in the last 12 months prior to the survey. However, the proportion of smokers who made a quit attempt during Global Adult Tobacco Survey (GATS) -1(2010) and GATS -2(2017) remained similar (38.4% vs 38.5%). Further, nearly half of the cigarette (47.4%) and bidi smokers (48.7%) who made a quit attempt in the past 12 months were able to maintain a quit status for less than a month.[14] However, the proportion of current smokers interested or planning to quit smoking increased from 46.6% (GATS-1) to 55.4% (GATS-2).[14]

India is a signatory to World Health Organization's – Framework Convention on Tobacco Control (WHO-FCTC)and has been implementing Article 14 of WHO-FCTC concerning tobacco dependence and cessation.[15]Further, the Government of India (GoI) launched National Tobacco Control Programme in 2007-2008 with one of the key objective of helping people quit tobacco use in conformance to Article 14 of WHO-FCTC.[16]The GoI established Tobacco Cessation Centers (in 2002) at district hospitals.[17] Further, m-cessation (December, 2015) and national tobacco quitline services were launched in 2016 and further expanded to satellite centres in 2018[18, 19] to support tobacco users for quitting.

Understanding the socio-demographic variables and other factors in facilitating or restraining quit behavior of tobacco users is essential for designing & implementing a focused tobacco control intervention. Furthermore, awareness of these factors may also promote tobacco cessation initiatives to establish a staged progression of smoking cessation. A data analysis of GATS-1 (2010),from India, demonstrated significant association of socio-demographic

characteristics with quit attempts indicating the need to re-examine their effect on cessation.[20] Another study conducted among Italian adults reported an association of successful quit attempts with higher education level and young age.[21] Further, it is important to understand the factors that may influence different tobacco smokers by their personal characteristics (gender, age, caste, education and occupation) in order to optimize and strategize effective cessation campaigns. This understanding is solicited for tailoring the content of the message as per aforementioned classification so as to increase the message's relevance and ability to persuade.[22]

Evidence states that lower SES is predictive of a lower probability of quit intention, quit attempts, and successful quitting. A study conducted among Italian smokers found an association of successful recent quit attempts with higher educational level, absence of economic difficulties, and younger age.[21]An analysis of data from a population-based prospective study from Switzerland concluded that the determinants of behavior change vary according to the smoking status.[23] Besides, relapse often occurs even after multiple quitting attempts. Therefore, cessation interventions that support abstinence during this phase are important.[24]There is a limited evidence from LMICs regarding the association between smoking cessation behavior and SES.[25]

Determining the factors that influence quit intentions opens the door to developing effective policies and programmes to help Indian smokers quit. In smoking addiction, TTM measurement tools have a potential for evaluation of smoking cessation and planning quit-behavior. TTM is a significant tool for smoking cessation with its ability to use different models of behavior changes.[26]Further, literature suggeststhat research on the predictors of the transition from preparation to action stage is warranted, which is largely missing in Indian populationdespite leading the tobacco use statistics globally[27]Therefore, in the current study, we undertook the secondary data analysis of GATS-2 to analyze the determinants of smoking cessation and intent to quit smoking among current tobacco smokers of India.

Methods

Study Settings

The nationwide representative survey of GATS (round 2) was carried out in the Indian sub continent during years 2016-2017[14]covering a population of 1029 million(Census 2011).[28]

Study design and data sources

This study is secondary data analysis of GATS-2, India, 2016-17which is being conducted under the Global Tobacco Surveillance System (GTSS).[29]GATS is a nationwide cross- sectional household survey, which uses standardized methodology for monitoring tobacco use as well as tracking changes in key measures of tobacco control among adults aged 15 or above.[30] The GATS-2 out in 2016-17 using a standardized methodology. Survey was a project of the Ministry of Health & Family Welfare (MoH&FW), Government of India and it designated Tata Institute of Social Sciences (TISS), Mumbai as the nodal implementing agency for the survey. The data collection fieldwork was conducted was carried out in all 30 states including Union Territories (Chandigarh and Puducherry) between August 2016 and February 2017 with a sample of 84,047 households (30,821 from urban areas and 53,226 from rural areas) The survey used probability proportional to size (PPS) sampling technique, with adoption of three stage sampling design for rural areas *(Villages-Households-Respondent)* and a four stage was for urban areas *(Wards-Census Enumeration Block- Households- Respondent)*[14]

Sample size:

Out of the total sample, we extracted the sample of 9499 respondents who were current tobacco smokers (daily and less than daily)

Patient and Public Involvement: No patient involved

Operational Definitions

The following operational definitions were used in GATS for variables under the study:

- Current tobacco smoker: An individual who currently smokes any tobacco product, either daily or occasionally.
- A quit attempt in the survey was defined as current tobacco smokers who tried to quit during the past 12 months and former tobacco smokers and smokeless tobacco users who have been abstinent for < 12 months. In this analysis, we included the former one.
- Intention in quitting smoking in the future was defined as current tobacco smokers planning or thinking about quitting smoking within the next month, 12 months, or someday.[14]
- Stage of Change- Based on the tobacco smoking cessation behavior, the current tobacco smokers were classified into following stages of change:

Pre-contemplation: The current tobacco smokers who neither made a quit attempt in the past nor intend to quit in the future.

Contemplation: The current tobacco smokers who did not make a quit attempt in past but intend to do so in future.

Preparation (or action!): The current tobacco smokers who made a quit attempt in the past and intend to quit in the future (apparently because their past quit attempt could not yield success).

Relapse: The current tobacco smokers who made an unsuccessful quit attempt in the past do not intend to quit in the future.

Study variables

Outcome variables included past quit attempts and intention to quit tobacco smoking in future. The exposure variables included socio-demographic characteristics, smoking history and pattern, exposure to media advertisements for and against tobacco smoking, and knowledge about the health effects of tobacco smoking. The questions used for analysis along with codes are added to supplementary file-1.

Data analysis

We performed univariate analysis (frequency distribution), bivariate analysis (chi-square), and multivariate analysis (binary logistic regression for outcome variables mentioned above; and; multinomial logistic regression to understand predictors of various stages of change determining cessation behavior of current tobacco smokers. The analysis was performed in SPSS software, version 16 [SPSS Inc. released 2007. SPSS for Windows, Version 16.0. Chicago, SPSS Inc.] (with p-value <0.05 was considered significant).

Ethics statement

The ethical clearance was not sought as this work is on secondary data.

Data sharing statement

The data of GATS-2 India is available at Global Tobacco Surveillance System Data (GTSSD), Centres For Disease Control and Prevention (CDC) in the public domain.[29]

Results:

A total of 9499 current tobacco smokers were identified. The socio-demographic distribution of currents smokers is presented in Table-1. 63% of the current smokers had made a quit attempt within past 12 months from the survey. Around 44% of participants had no intention to quit tobacco smoking in the near future. More than 90% tobacco smokers were aware about serious illnesses caused by smoking tobacco. Further, 11% reported to have witnessed one or other type of promotion of bidi smoking. Based on the cessation behavior of current smokers, they were classified into four groups using the Stages of Change Model.[10]The analysis revealed that 36.6% of current tobacco smokers were in the pre-contemplation stage. (Table 1)

Table 1: Distribution of socio-demographic & tobacco smoking-related attributes among current tobacco smokers in India, GATS 2016-17

Nearly 72% of current tobacco smokers tried to quit without any assistance, whereas counseling was sought by 8.4% of tobacco smokers. Further, 4.2% switched to smokeless tobacco as well. Nicotine replacement was sought by an even lesser proportion (1.7%). (Figure 1)

Figure 1: Cessation methods used by the current smokers who attempted to quit smoking in last 12 months, GATS 2016-17 (multiple responses)

Maximum promotion was noticed for bidi products in the form of coupons for purchasing (7.8%) followed by sale at low price (3.4%) or as free gifts (3.2%) in comparison to cigarette promotion. However, the surrogate advertisement promotion was more for cigarettes (2.2%) than bidis (2%). (Figure 2)

Figure 2: Distribution of promotional strategies encouraging smoking noticed by the current tobacco smokers in past 30 days, GATS 2016-17

The age-related distribution of various tobacco smoking products was assessed for current tobacco smokers based on smoking frequency. Daily bidi smoking was practiced by 45 years and above age group. This was represented using spider diagram to highlight the age wise difference in daily and non-daily use of smoking tobacco in various forms. (Figure3)

Figure 3: Age-wise distribution of smoking tobacco product use among current daily and less than daily tobacco smokers, GATS 2016-17

The males, primary as well as higher education (graduation and above), being employed (or retired), married, higher caste and urban residence were found to be associated with higher prevalence of previous quit attempts among current smokers. Further, exposure to regular smoking during early adulthood, perception & awareness about ill effects of smoking on body, and smoking being able to cause a multitude of health effects was also associated with increased quit attempts.(Table-2)

Table 2: Factors affecting quitting attempts within past 12 months among the current smokers, GATS 2016-17

Factors affecting intent to quit tobacco in near future:

The regression modeling revealed that intent to quit reduced with increasing age and was similarly prevalent with any level of education. Having an occupation with monetary outcomes (i.e. except being student), being married, initiation after the age of 25 years, experience of ill health effect due to smoking, perception about smoking being able to cause serious and multitude of illnesses and those who recently noticed more than two advertisements about tobacco products was associated with higher odds of intention to quit in future. (Table 3)

Table 3: Factors affecting intention to quit tobacco in future among the current smokers, GATS 2016-17

The socio-demographic profile of current smokers and their smoking related attributes were tested to find out predictors of being in any of the stages of Transtheoretical model.[10]Younger age, female sex, non-exposure to advertisements promoting smoking,werecommon predictors of being in contemplation and preparation stage. Further, experience of ill health effects because of smoking was a common predictor to contemplation, preparation and relapse stage.

The perception about tobacco being able to cause serious health effects (contemplation);education up to primary level, daily wager, OBC caste, being married (preparation); lack of formal education, self-employment, any caste other than general, initiation of tobacco use at age less than 25 years, noticing information encouraging tobacco use as well as quitting, perception about tobacco not being able to cause serious health effects (relapse) were additional predictors. (Table 4)

Table 4: Multinomial logistic regression model to assess predictors of stages of change determining current tobacco smokers'cessation behavior, GATS 2016-17

Discussion

The focus of this paper was to look for the determinants of two major aspects of tobacco smoking cessation-quit attempts and intent to quit as they can help us in understanding smokers' attitude and behavior towards smoking cessation. We utilized the Transtheoretical model (TTM) for a cyclic representation of factors influencing behavior change of a smoker which will facilitate tailored heath promotion strategies that are individualized and easily adapted. The purpose of TTM is to delineate smoker's behavior under the five stages and describe how smokers move dynamically through them. The TTM model used in the study has aptly proved that smokers not only perceive more benefits as they move in later stages but are also being influenced by a different set of determinants for smoking cessation. This view has been supported by other studies on physical activity[31], sedentary behavior[32], nutritional interventions[33] etc. The TTM's ability to customize its constructs to an individual's readiness to initiate cessation behavior is a major strength, making individually-based interventions applicable at the population level. The TTM is flexible enough to be employed by almost any sort of practitioner or researcher, which adds to the possibility of a population-based intervention strategy. The TTM can combine clinical and public health strategies to increase the likelihood of successful health behavior change.[34]

Out of the current tobacco smokers who made a quit attempt in past, majority reported (72%) to have attempted to quit without any assistance. This could be due to various reasons such as lack of awareness among users about the available treatment options (pharmacotherapy & nicotine replacement therapy, quitlines & mCessation), concerns about their safety and perceiving that unassisted is a better choice.[35, 36] The lower odds of quit attempt among the older age groups in the study may be attributed to higher nicotine addiction level[37], beliefs about quitting, believing that 'the damage had been done' so they see no point in attempting to quit later in life[38], beliefs of health care providers reluctance to give cessation advice or to provide medication, type, location and visibility of smoking cessation services[39, 40], reluctance to use telephone or online support such as m-cessation.[41]Only after they contract some illness due to smoking, they think and perhaps attempt to quit (or reduce) smoking,[42] as indicated in this paper as well. Prevalence of quit attempt was higher (PR 2.32) among those who experienced tobacco-related harm to their body or perceived that tobacco smoking can cause serious illness (PR: 2.121).Those who started smoking regularly after the age of 25 years had higher odds of quit attempts than those who started at the age of less than 15 years. Similar findings have been reported by previous studies as well.[43, 44]It is possible that a young adult, who started late, had comparatively more information on the ill-effects of tobacco smoking. We found that the odds of quit attempts and intent to quit were higher among those who had experience of ill health due to tobacco smoking, or believed that tobacco smoking can cause serious illness. This may include witnessing someone with declining health due to tobacco smoking.

Younger age, female sex, and non-exposure to advertisements promoting smoking were common predictors of being in contemplation and preparation stages, as explained further. The possibility that societal norms against smoking are significantly stronger among these younger adult smokers, as seen by their high level of desire to quit.[45]Women may have a higher risk of smoking-related morbidity and mortality, and face different barriers to smoking cessation that

warrant intervention.[46] Women smokers are more likely to believe that society disapproves of smoking,perceive that the risk of dying from smoking significantly greater among them, and have more concerns regarding health than men.[47-49]Further, experience of ill health effects because of smoking was a common predictor to contemplation, preparation and relapse stage. The advancement to later stages in TTM model may be attributed to having experienced an illness due to smoking resulting in compromised health status, increased treatment costs and implied financial burden.[50, 51]

This study has certain limitations. First, it is difficult to establish a temporal relationship between quit attempt/intention to quit with other variables as it was secondary analysis of cross-sectional household survey. Second, the responses are also susceptible to recall bias. Further, as indicated in this paper, the odds of quit attempt were higher among those who experienced tobacco related harm to their body. It is possible that the majority of them were those who already had an episode of smoking-related illness. This theory wasn't however, tested by the authors in the present paper due to lack of required information. The predictors of quit attempt and intention to quit may vary for various forms of tobacco consumption which was not included in this analysis. The age of first exposure to tobacco smoking, reasons for doing so and reasons for continuously indulging in tobacco smoking were not asked in GATS survey. Also, reasons for making quit attempts, if asked, could shed some light on potential motivational factors.

We propose the following recommendations for policymakers, implementers, health care providers (HCPs), researchers, academia and civil society advocates enhancing the quit attempts and promoting cessation among current smokers. Understanding the stage of behavior change among these smokers could assist the stakeholders in developing such interventions that cater to the individual stages and facilitate the desired outcome. Dedicated cessation programs addressing women and younger age groups could help the smoker's progress from contemplation to preparation and action stages. Checks on surrogate advertisements of tobacco products need to be strengthened along with steering of increased taxes on bidis to impact the affordability of the product. Further, concrete & aggressive mass media campaigns along with advertising mcessation and quitline services with wider coverage, especially for motivating smokers residing in rural areas, need to be implemented. Integrated capacity building initiatives on cessation for HCPs providing services under various national health programmes (NCD control, oral health, maternal & child health, tuberculosis control, mental health etc.) may be introduced.
Further, building the motivation of HCPs to uptake and deliver cessation support (identification of smokers, sharing benefits, addressing barriers, coping strategies) is of paramount importance. Qualitative research must be conducted to understand the reasons for preferring not to make another quit attempt so that the causes of relapse can be addressed via individual counseling programs. Also, research is necessary to understand the difference in cessation practices across different cross-cultural settings.Inclusion of smoking cessation as part of the medical curriculum that prioritizes the need to ask about smoking habits and offer support to each user could be helpful. Civil society could mobilize community support for the uptake of cessation services and facilitate the exchange of good practices in cessation.

Conclusion

The present study encapsulates and demonstrates that TTM approach is highly applicable in the current context. The factors influencing different stages of TTM were younger age, female sex, non-exposure to advertisements promoting smoking, for contemplation and preparation both. In

addition, experience of ill health effects because of smoking was a common predictor to contemplation, preparation and relapse stage. This indicates that there is a need for designing stage-based cessation interventions at individual and population levels that caters and focuses on aforementioned groups and hard to engage groups such as older age groups. Given that experience of ill health effects because of smoking emerged to be a key predictor in later stages, it's essential to develop and implement intensive cessation treatment protocols in clinical settings utilizing the flexibility of TTM model. Besides, India being an LMIC and a resource-constrained economy, it is vital to integrate cessation services into all possible national health programs and policies to expand the outreach and the accessibility of cessation services. This could provide 'one stop solution' to many diseases, whether communicable or non-communicable, strengthening the health systems to support and achieve Sustainable Development Goals.

Tables and Figures

Table 1: Distribution of socio-demographic & tobacco smoking-related attributes among current tobacco smokers in India, GATS 2016-17

Characteristic	Category	n (%)
Total		9499
Age in years	15-24	661 (8.4)
	25-44	4552 (42.3)
	45-64	3304 (37.0)
	65 and above	982 (12.2)
Sex	Male	8434 (91.0)
	Female	1065 (9.0)
Education (n= 9495)*	No formal schooling	2754 (35.3)
	Up to primary	2909 (28.8)
	Up to secondary	3314 (31.1)
	Graduation and above	518 (4.8)
Occupation (n= 9496)*	Daily wager	3220 (37.4)
	Self employed	3148 (34.1)
	Retired /Unemployed/ Homemaker	1603 (14.9)
	Govt. and Non-govt. employee	1351 (12)
	Student	174 (1.5)
Marital status	Married	8133 (84.2)
	Single	882 (10.2)
	Separated/ divorced/widowed	484 (5.6)
Caste (n-9437)*	Scheduled caste/ Scheduled tribe	4235 (33.6)
	Other backward class	2895 (42.3)
	General (none of above)	2307 (24.2)
Area of residence	Rural	6980 (73.3)
	Urban	2519 (26.7)
Age of initiation of tobacco smoking (n=8128)**	< 15 years	707 (8.1)
	15-25 years	5130 (60.4)
	> 25 years	2291 (31.5)
Smoking frequency	Daily	7647 (80.5)
	Less than daily	1852 (19.4)
Type of smoking tobacco used (n=11936)#	Bidi	6070 (72.3)
	Cigarette	3338 (32.6)
	Rolled tobacco	1297 (7.9)
	Hukkah	699 (6.6)
	Cheroot	329 (2.9)
	Others	203 (1.3)
Quit attempt within past 12 months	No	6296 (63.7)
	Yes	3203 (36.3)
Intent to quit tobacco in future	Interested in quitting	5382 (55.3)
	Not interested in quitting	4117 (44.7)
Source of information about harms or quitting tobacco smoking	Haven't noticed	2331 (25.0)
	≤ 3 sources	4201 (42.5)
	> 3 sources	2967 (32.5)
Noticed advertisements or signs promoting tobacco smoking	None	7495 (76.4)
	≤ 2 sources	1080 (11.4)
	< 2 sources	924 (12.2)

Noticed any type of cigarette promotion	No	8736 (91.9)
	Yes	763 (8.1)
Noticed any type of bidi promotion	No	8580 (89.0)
	Yes	919 (11.0)
Has smoking already done harm to your body (n=9488)*	No	4133 (47.9)
	Yes	4933 (49.3)
	Don't know	422 (2.8)
Whether smoking tobacco causes serious illness (n=9494)*	Yes	8632 (91.3)
	No	684 (6.9)
	Don't know	178 (1.8)
Whether smoking tobacco causes no, one or multiple illnesses	No illness	361 (3.7)
	Up to 3 illnesses	3400 (38.0)
	> 3 illnesses	5738 (58.3)
Cessation behavior based on Stages of Change model	Pre-contemplation	3446 (36.6)
	Contemplation	2850 (27.0)
	Preparation / Action!	2532 (28.2)
	Relapse	671 (8.1)

*some participants refused to answer to that particular question, reflecting as changed denominator for analysis
**information not available for all current less than daily tobacco smokers
#Multiple responses per participant (n=frequency of responses and not respondents)
(All percentage is weighted)

Table 2: Factors affecting tobacco quitting attempts within past 12 months among the current smokerss, GATS 2016-17

Factor	**Quit attempt**		
	% (n=3203)	**Unadjusted PR (95% CI)**	**Adjusted PR (95% CI)**
Age in years			
15-24	34.4	1.033 (1.031-1.035)	1.391 (1.387-1.395)
25-44	37.9	1.202 (1.200-1.203)	1.082 (1.080-1.083)
45-64	35.9	1.106 (1.104-1.107)	0.941 (0.939-0.942)
65 and above	33.7	Ref	
Sex			
Male	36.9	1.297(1.295-1.299)	1.049 (1.047-1.051)
Female	31.0	Ref	
Education (n-9495)*			
Up to primary	39.8	1.377(1.375-1.378)	1.192 (1.190-1.193)
Graduation & above	37.7	1.260(1.258-1.263)	1.115 (1.112-1.118)
Up to secondary	37.3	1.239(1.238-1.241)	0.993 (0.992-0.994)
No formal schooling	32.5	Ref	
Occupation (n= 9496)*			
Govt. and Non-govt. employee	41.0	2.076 (2.068-2.084)	1.269 (1.262-1.276)
Self employed	38.7	1.885 (1.878-1.892)	1.292 (1.285-1.299)
Daily wager	34.7	1.511 (1.586-1.597)	1.097 (1.091-1.104)
Retired /Unemployed/ Homemaker	32.7	1.450 (1.445-1.456)	1.113 (1.107-1.119)
Student	25.1	Ref	
Marital status			
Married	37.2	1.335 (1.332-1.337)	1.231 (1.229-1.234)
Single	32.0	1.059 (1.056-1.061)	0.789 (0.787-0.791)
Separated/ divorced/widowed	30.8	Ref	
Caste (n-9437)*			
Other backward class	41.0	1.461 (1.460-1.462)	1.461 (1.460-1.462)
General	33.5	1.062 (1.061-1.063)	1.062 (1.061-1.063)
Scheduled caste/ Scheduled tribe	32.2	Ref	
Area of residence			
Urban	39.3	1.187(1.186-1.188)	1.167 (1.165-1.168)
Rural	35.3	Ref	
Smoking frequency			
Less than daily smoking	41.4	1.303 (1.301-1.304)	1.303 (1.301-1.304)
Daily smoking	35.1	Ref	
Age of initiation of regular smoking			
< 15 years	37.3	1.090 (1.089-1.092)	1.095 (1.093-1.097)
> 25 years	36.9	1.069 (1.068-1.070)	1.109 (1.108-1.110)
15-25 years	35.3	Ref	
Has smoking already done harm to your body			

Yes	39.8	2.428(2.421-2.435)	2.322 (2.314-2.330)
No	33.7	1.867(1.862-1.873)	1.808 (1.802-1.815)
Don't know	21.4	Ref	
Whether smoking tobacco causes serious illness			
Yes	37.1	3.155(3.142-3.168)	2.121 (2.111-2.131)
No	31.2	2.424(2.413-2.434)	1.947 (1.937-1.957)
Don't know	15.8	Ref	
Whether smoking tobacco causes no, one or multiple illnesses			
> 3 illnesses	38.4	1.830(1.826-1.834)	1.435 (1.431-1.439)
Up to 3 illnesses	34.3	1.530(1.527-1.534)	1.244 (1.240-1.248)
No illness	25.4	Ref	

*some participants refused to answer to that particular question, reflecting as changed denominator for analysis
**information not available for all current less than daily tobacco smokers
#Multiple responses per participant (n=frequency of responses and not respondents)
(All percentage is weighted)

Table 3: Factors affecting intention to quit tobacco in future among the currentsmokers , GATS 2016-17

Factor	Intention to quit in future		
	% (n=5382)	Unadjusted PR (95% CI)	Adjusted PR (95% CI)
Age group			
15-24	58.3	1.796 (1.793-1.799)	1.478 (1.474-1.482)
25-44	59.1	1.855 (1.852-1.857)	1.457 (1.455-1.459)
45-64	54.0	1.506 (1.504-1.508)	1.225 (1.224-1.227)
65 and above	43.8	Ref	
Sex			
Male	56.1	1.478(1.476-1.480)	0.789 (0.787-0.790)
Female	46.4	Ref	
Education			
Graduation & above	64.8	2.129(2.124-2.133)	1.378 (1.374-1.381)
Up to secondary	61.1	1.822(1.820-1.823)	1.307 (1.305-1.309)
Up to primary	58.3	1.617(1.615-1.619)	1.304 (1.302-1.305)
No formal schooling	46.3	Ref	
Occupation			
Govt. and Non-govt. employee	65.0	2.206(2.202-2.209)	1.359 (1.356-1.362)
Student	59.6	1.749(1.744-1.755)	1.079 (1.073-1.084)
Daily wager	55.8	1.498(1.496-1.500)	1.276 (1.274-1.278)
Self employed	55.3	1.469(1.467-1.471)	1.225 (1.223-1.227)
Retired /Unemployed/ Homemaker	45.7	Ref	
Caste			
General	58.5	1.328 (1.326-1.329)	1.146 (1.145-1.148)
Other backward class	56.3	1.212 (1.211-1.213)	1.184 (1.182-1.185)
Scheduled caste/ Scheduled tribe	51.5	Ref	
Marital status			
Married	56.1	1.800 (1.797-1.803)	1.227 (1.225-1.230)
Single	55.5	1.751 (1.747-1.755)	0.901 (0.898-0.904)
Separated/ divorced/widowed	41.6	Ref	
Residence			
Urban	61.0	1.379 (1.378-1.380)	1.146 (1.144-1.147)
Rural	53.2	Ref	
Smoking frequency			
Less than daily smoking	64.7	1.623 (1.622-1.625)	1.917 (1.913-1.921)
Daily smoking	53.0	Ref	
Age of initiation of regular smoking tobacco use			
> 25 years	55.1	1.152(1.150-1.154)	1.159 (1.157-1.161)
15-25 years	53.3	1.073(1.071-1.075)	0.982 (0.981-0.984)
< 15 years	51.6	Ref	
Noticed information about the dangers of smoking tobacco or that encourages quitting			
More than three sources	63.0	2.193(2.190-2.195)	1.562 (1.560-1.564)
Up to three sources	56.2	1.656(1.655-1.658)	1.380 (1.379-1.382)
Haven't noticed	43.7	Ref	

Noticed any advertisements or signs promoting smoking tobacco products			
Haven't seen any such promotion	55.5	1.067 (1.065-1.068)	1.309 (1.307-1.311)
More than 2 sources promoted tobacco smoking	54.7	1.033 (1.031-1.034)	0.873 (0.871-0.874)
Up to 2 sources promoted tobacco smoking	54.0	Ref	
Whether noticed any type of cigarette promotion			
One or other type of promotion seen	61.5	1.321(1.319-1.323)	1.051 (1.049-1.053)
No promotion seen	54.7	Ref	
Whether noticed any type of bidi promotion			
One or other type of promotion seen	57.5	1.107(1.105-1.108)	1.144 (1.142-1.146)
No promotion seen	55.0	Ref	
Has smoking already done harm to your body			
Yes	58.7	1.977(1.972-1.982)	2.242 (2.235-2.249)
No	52.5	1.535(1.531-1.539)	1.863 (1.858-1.869)
Don't know	41.8	Ref	
Whether smoking tobacco causes serious illness			
Yes	56.5	4.378(4.362-4.393)	2.924 (2.911-2.936)
No	46.8	2.957(2.946-2.968)	2.468 (2.457-2.479)
Don't know	41.8	Ref	
Whether smoking tobacco causes no, one or multiple illnesses			
> 3 illnesses	59.0	1.938(1.934-1.942)	1.259 (1.256-1.263)
Up to 3 illnesses	50.8	1.389(1.386-1.392)	1.041 (1.038-1.043)
No illness	42.6	Ref	

Table 4: Multinomial logistic regression model to assess predictors of stages of change determining current tobacco smokers'cessation behavior, GATS 2016-17

Predictor	**Category**	**Stage[a]**		
		Contemplation (n=2850)	**Preparation (n=2532)**	**Relapse (n=671)**
		PR (95% CI)[c]	**PR (95% CI) [c]**	**PR (95% CI) [c]**
Age group	15-24	1.172(1.168-1.176)	1.737(1.731-1.743)	0.800(0.796-0.804)
	25-44	1.449(1.446-1.452)	1.373(1.371-1.376)	0.843(0.841-0.845)
	45-64	1.376(1.373-1.378)	1.078(1.076-1.080)	0.958(0.956-0.961)
	65 and above[b]			
Sex	Female	1.338(1.335-1.341)	1.178(1.175-1.181)	0.971(0.968-0.974)
Education	No formal schooling	0.733(0.731-0.736)	0.742(0.740-0.745)	1.112(1.106-1.118)
	Up to primary	0.892(0.889-0.895)	1.008(1.005-1.011)	1.046(1.040-1.051)
	Up to secondary	1.065(1.062-1.068)	0.866(0.863-0.868)	1.095(1.089-1.101)
	Graduation &above[b]			
Occupation	Retired /Unemployed/ Homemaker	0.724(0.722-0.725)	0.740(0.738-0.741)	0.974(0.970-0.978)
	Student	0.686(0.682-0.691)	0.735(0.730-0.740)	0.331(0.325-0.336)
	Daily wager	1.021(1.019-1.023)	0.856(0.855-0.858)	0.992(0.988-0.995)
	Self employed	0.907(0.906-0.909)	0.941(0.939-0.943)	1.149(1.146-1.153)
	Govt. and Non-govt. employee[b]			
Caste	SCST	0.812(0.811-0.814)	0.909(0.907-0.910)	1.097(1.095-1.100)
	OBC	0.840(0.839-0.841)	1.315(1.313-1.316)	1.577(1.573-1.581)
	General [b]			
Marital status	Single	0.953(0.949-0.956)	0.790(0.787-0.793)	0.823(0.819-0.828)
	Married	1.043(1.040-1.046)	1.441(1.437-1.445)	0.926(0.923-0.929)
	Separated/ divorced/widowed[b]			
Residence	Urban residence	1.037(1.036-1.038)	1.230(1.228-1.232)	0.942(0.940-0.944)
Frequency of smoking	Daily smokers	0.574(0.573-0.576)	0.409(0.408-0.410)	0.646(0.643-0.648)
Initiation of regular tobacco smoking	< 15 years	0.978(0.976-0.980)	0.862(0.860-0.864)	1.361(1.356-1.365)
	15-25 years	0.973(0.971-0.974)	0.797(0.796-0.798)	1.228(1.225-1.230)
	> 25 years[b]			

Noticed information about the dangers of smoking tobacco or that encourages quitting	Haven't noticed	0.625(0.624-0.627)	0.621(0.620-0.622)	0.868(0.865-0.870)
	Up to three sources	0.885(0.884-0.886)	0.952(0.950-0.953)	1.219(1.216-1.221)
	More than three sources[b]			
Noticed any advertisements or signs promoting smoking tobacco products	Haven't seen any such promotion	2.114(2.109-2.118)	1.357(1.354-1.359)	1.738(1.733-1.743)
	Up to 2 sources promoted tobacco smoking	1.660(1.656-1.664)	1.038(1.036-1.041)	1.814(1.807-1.820)
	more than 2 sources promoted tobacco smoking[b]			
Whether noticed any type of cigarette promotion	No promotion of cigarette seen	0.943(0.940-0.945)	0.854(0.852-0.856)	0.714(0.712-0.717)
Whether noticed any type of bidi promotion	No promotion of bidi seen	0.876(0.875-0.878)	0.717(0.716-0.719)	0.608(0.607-0.610)
Has smoking already done harm to your body	No	1.698(1.692-1.704)	2.453(2.442-2.463)	1.548(1.539-1.557)
	Yes	2.034(2.027-2.042)	3.345(3.330-3.359)	2.148(2.136-2.160)
	Don't know[b]			
Whether smoking tobacco causes serious illness	Yes	2.773(2.759-2.787)	3.775(3.751-3.800)	1.746(1.735-1.757)
	No	2.708(2.693-2.723)	3.014(2.994-3.035)	2.277(2.261-2.292)
	Don't know[b]			
Whether smoking tobacco causes no, one or multiple illnesses	No illness	1.022(1.019-1.025)	0.578(0.575-0.580)	1.098(1.093-1.102)
	Up to 3 illnesses	0.836(0.835-0.837)	0.790(0.789-0.791)	0.926(0.925-0.928)
	> 3 illnesses[b]			

[a] Reference category: Pre-contemplation stage
[b] Redundant parameter
[c] Adjusted

Figure-1 Cessation methods used by the current smokers who attempted to quit smoking in last 12 months, GATS 2016-17

Figure 2: Distribution of promotional strategies encouraging smoking noticed by the current tobacco smokers in past 30 days, GATS 2016-17

Figure 3: Age-wise distribution of smoking tobacco product use among current daily and less than daily tobacco smokers, GATS 2016-17

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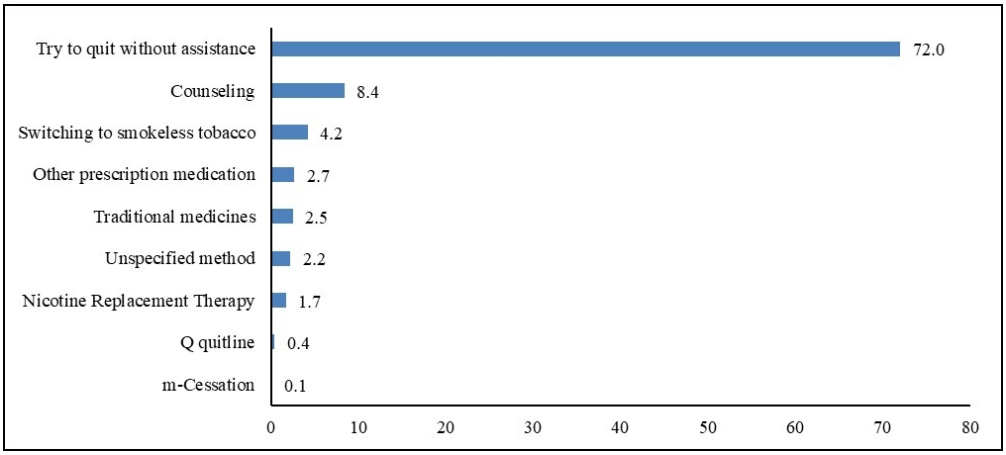
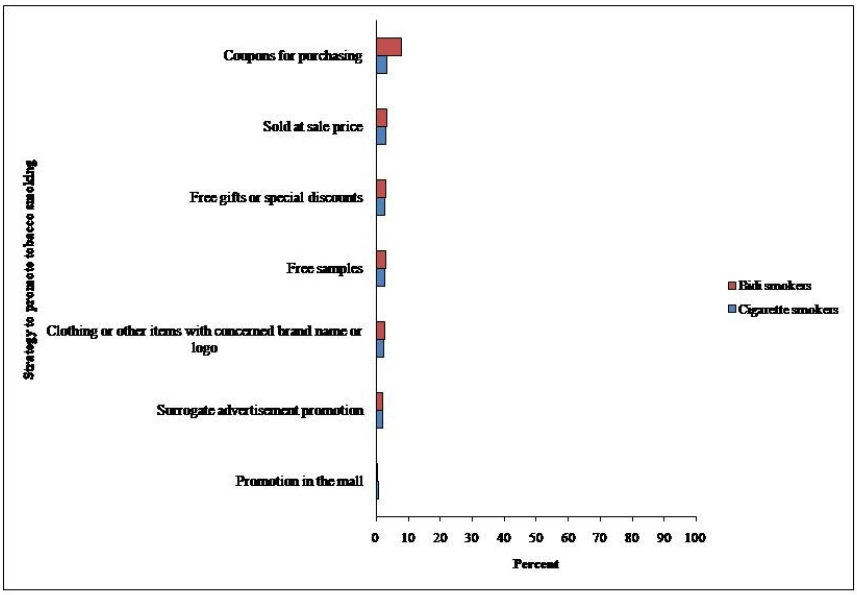


Figure 1: Cessation method used by the current smokers who attempted to quit tobacco in last 12 months, GATS 2016-17

171x76mm (150 x 150 DPI)



Distribution of promotional strategies encouraging smoking noticed by the current tobacco smokers in past 30 days, GATS 2016-17

254x190mm (96 x 96 DPI)

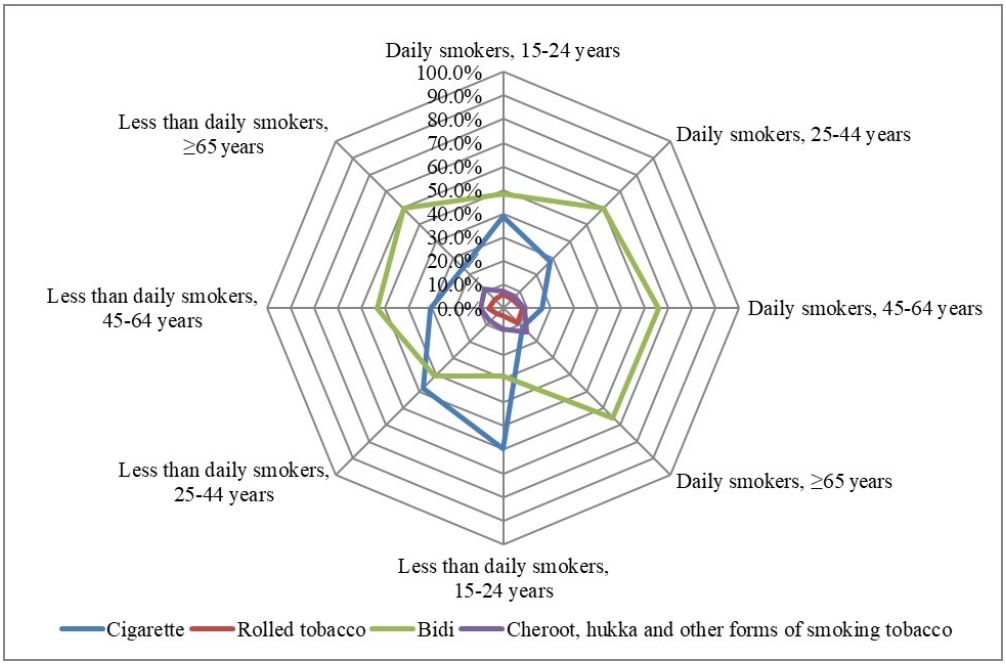


Figure 3: Age-wise distribution of smoking tobacco product use among current daily and non-daily tobacco smokers, GATS 2016-17

165x108mm (150 x 150 DPI)

The following questions were used to conduct the analysis:

Code	Question
A03	How old are you?
A04	What is the highest level of education you have completed?
A05	Which of the following best describes your main work status over the past 12 months?
A09	Do you belong to a scheduled caste, scheduled tribe, other backward caste, or none of these groups?
A11	What is your marital status? Would you say single, married, separated, divorced, or widowed?
B01	Do you currently smoke tobacco on a daily basis, less than daily, or not at all?
B04, B05, B08, B09	(daily smokers) How old were you when you first started smoking tobacco daily?How many years ago did you first start smoking tobacco daily? (less than daily)how old were you when you first started smoking tobacco daily? How many years ago did you first start smoking tobacco daily?
B07	How soon after you wake up do you usually have your first smoke?
D01	The next questions ask about any attempts to stop smoking that you might have made during the past 12 months. Please think about tobacco smoking. During the past 12 months, have you tried to stop smoking?
D03 (D03A to D03E)	During the past 12 months, did you use any of the following to try to stop smoking tobacco?
D08	Which of the following best describes your thinking about quitting smoking?
G01 (G01A to G01I)	In the last 30 days, have you noticed information about the dangers of smoking tobacco or that encourages quitting in any of the following places?
G04 (G04A to G04K)	In the last 30 days, have you noticed any advertisements or signs promoting smoking tobacco products in the following places?
G06 (G06A to G06G)	In the last 30 days, have you noticed any of the following types of cigarette promotions?
G206 (G206A to G206G)	In the last 30 days, have you noticed any of the following types of Bidi promotions?
H01	Based on what you know or believe, does smoking tobacco cause serious illness?
HH07	Based on what you know or believe, has smoking already done any harm to your body? Would you say definitely no, probably no, probably yes, or definitely yes?

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	3,4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4,5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4
Bias	9	Describe any efforts to address potential sources of bias	*2*
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	5
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6,7
		(b) Give reasons for non-participation at each stage	6,7
		(c) Consider use of a flow diagram	6,7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6
		(b) Indicate number of participants with missing data for each variable of interest	5
Outcome data	15*	Report numbers of outcome events or summary measures	5
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6,7
		(*b*) Report category boundaries when continuous variables were categorized	6,7
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	6,7
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	10

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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.

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Theoretical Constructs of Smoking Cessation among Current Tobacco Smokers in India: A Secondary analysis of Global Adult Tobacco Survey-2 (2016-17)

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Title Page

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Manuscript

Theoretical Constructs of Smoking Cessation among Current Tobacco Smokers in India: A Secondary analysis of Global Adult Tobacco Survey-2 (2016-17)

Abstract

Background: Quitting tobacco smoking is a complex process, and the transtheoretical model (TTM) describes the various stages of behavior change that smokers experience to stop smoking. Predictors of intention to quit and stage of behavior change could assist policymakers in establishing tailor-made strategies to offer support. **Objective:** In the current study, we analyzed the determinants of cessation among 9499 current smokers of India recorded during the second Global Adult Tobacco Survey (GATS, 2016-2017). **Methods:** Bivariate analysis, multivariate analysis (binary logistic regression was performed for past quit attempts and intention to quit smoking in the future; multinomial logistic regression to understand predictors of various stages of change determining cessation behavior of current smokers) was undertaken. **Results:** The majority of the smokers was men (91.0%), in 25-44 years age group, (42.3%), daily wagers (37.4%), and resided in the rural area (70%), with bidi being the most commonly smoked product (72%). Nearly 72% tried to quit without any assistance with 36.6% (pre-contemplation), 27% (contemplation), 28% (preparation (or action)) and 8.1% in (relapse) stage. Men [(1.049); CI 1.047-1.051], the primary [1.192; CI 1.190-1.193] as well as higher education, being married [1.231; CI 1.229-1.234] and urban residence [1.167; CI 1.1.65-1.168] were found to be associated with higher prevalence of previous quit attempts. The regression modeling found out that intent to quit reduced with increasing age and was similarly prevalent with any level of education. **Conclusion:** Understanding stages of behavior change could assist the stakeholders in developing individualized interventions along with the development of intensive cessation protocols in clinical & public health settings.

Keywords: Global Adult Tobacco Survey, smoking, quit attempts, intention to quit, stage of change, India

Strengths and limitations of this study

- This analysis provides an understanding of the stage of behavior change among current smokers of India.
- It addresses the key determinants of quit attempts and intention to quit that would support the design of individual and population-based tobacco cessation programs in India.
- The article provides specific recommendations for policy & practice for increasing awareness about cessation services at various points of patient contact.
- The study design does not permit us to establish a temporal relationship, and the responses collected during the survey are susceptible to recall bias.
- The predictors of quit attempt and intention to quit may vary for various forms of tobacco consumption which was not included in this analysis.

Background

Smoking cessation at any age is associated with substantial health and economic benefits[1]along with the addition of considerable longevity.[2] In comparison to non-smokers, smokers who start smoking early in adulthood lose a decade of life expectancy. Smoking cessation, especially before the age of 40, leads to a substantial decrease in mortality risk.[3] Due to nicotine dependence, the smoker is required to make multiple quit attempts to quit finally.[4]A prospective cohort study of smokers estimated that it might take 30 or more quit attempts before quitting permanently.[5] Apart from this, evidence suggests a varied number of quit attempts ranging from 8–10 (The American Cancer Society)[6],12–14 (Australian Cancer Council)[7],8-11 (The Centers for Disease Control and Prevention)[8] before quitting forever.

Quitting tobacco smoking is a complex process.[9] The trans-theoretical behavioral change model (TTM) describes the process of change that smokers experience to be able to stop smoking. As per the TTM, the smoker evolves through pre-contemplation, contemplation, preparation, action, maintenance, and termination stages in the smoking cessation.[10]A key element in achieving 'quit status' is the intention to quit smoking.[11]This element before cessation has been stated as a determinant of whether the smoker would engage in a cessation program, attempt to quit smoking,and succeed in quitting. During the preparatory stage, the intent to quit may be higher than the latter, but it is not easy to demonstrate behavior change.[12, 13] Thus, it is crucial to analyze the factors influencing the intention to quit smoking in order to evaluate the diverse underlying contextual factors that influence a smoker's intention to quit smoking.

Global Adult Tobacco Survey, round-2 conducted in India in the year 2016-2017 recorded that almost two in five (38.5%) adult smokers had attempted to quit smoking tobacco in the last 12 months prior to the survey. However, the proportion of smokers who made a quit attempt during Global Adult Tobacco Survey (GATS) -1(2010) and GATS -2(2017) remained similar (38.4% vs 38.5%). Further, nearly half of the cigarette (47.4%) and bidi smokers (48.7%) who made a quit attempt in the past 12 months were able to maintain a quit status for less than a month.[14] However, the proportion of current smokers interested or planning to quit smoking increased from 46.6% (GATS-1) to 55.4% (GATS-2).[14]

India is a signatory to World Health Organization's – Framework Convention on Tobacco Control (WHO-FCTC)and has been implementing Article 14 of WHO-FCTC concerning tobacco dependence and cessation.[15]Further, the Government of India (GoI) launched National Tobacco Control Programme in 2007-2008 with one of the key objective of helping people quit tobacco use in conformance to Article 14 of WHO-FCTC.[16]The GoI established Tobacco Cessation Centers (in 2002) at district hospitals.[17] Further, m-cessation (December, 2015) and national tobacco quitline services were launched in 2016 and further expanded to satellite centres in 2018[18, 19] to support tobacco users for quitting.

Understanding the socio-demographic variables and other factors in facilitating or restraining quit behavior of tobacco users is essential for designing & implementing a focused tobacco control intervention. Furthermore, awareness of these factors may also promote tobacco cessation initiatives to establish a staged progression of smoking cessation. A data analysis of GATS-1 (2010),from India, demonstrated significant association of socio-demographic

characteristics with quit attempts indicating the need to re-examine their effect on cessation.[20] Another study conducted among Italian adults reported an association of successful quit attempts with higher education level and young age.[21] Further, it is important to understand the factors that may influence different tobacco smokers by their personal characteristics (gender, age, caste, education and occupation) in order to optimize and strategize effective cessation campaigns. This understanding is solicited for tailoring the content of the message as per aforementioned classification so as to increase the message's relevance and ability to persuade.[22]

Evidence states that lower SES is predictive of a lower probability of quit intention, quit attempts, and successful quitting. A study conducted among Italian smokers found an association of successful recent quit attempts with higher educational level, absence of economic difficulties, and younger age.[21]An analysis of data from a population-based prospective study from Switzerland concluded that the determinants of behavior change vary according to the smoking status.[23] Besides, relapse often occurs even after multiple quitting attempts. Therefore, cessation interventions that support abstinence during this phase are important.[24]There is a limited evidence from LMICs regarding the association between smoking cessation behavior and SES.[25]

Determining the factors that influence quit intentions opens the door to developing effective policies and programmes to help Indian smokers quit. In smoking addiction, TTM measurement tools have a potential for evaluation of smoking cessation and planning quit-behavior. TTM is a significant tool for smoking cessation with its ability to use different models of behavior changes.[26]Further, literature suggeststhat research on the predictors of the transition from preparation to action stage is warranted, which is largely missing in Indian populationdespite leading the tobacco use statistics globally[27]Therefore, in the current study, we undertook the secondary data analysis of GATS-2 to analyze the determinants of smoking cessation and intent to quit smoking among current tobacco smokers of India.

Methods

Study Settings

The nationwide representative survey of GATS (round 2) was carried out in the Indian sub continent during years 2016-2017[14]covering a population of 1029 million(Census 2011).[28]

Study design and data sources

This study is secondary data analysis of GATS-2, India, 2016-17which is being conducted under the Global Tobacco Surveillance System (GTSS).[29]GATS is a nationwide cross- sectional household survey, which uses standardized methodology for monitoring tobacco use as well as tracking changes in key measures of tobacco control among adults aged 15 or above.[30] The GATS-2 out in 2016-17 using a standardized methodology. Survey was a project of the Ministry of Health & Family Welfare (MoH&FW), Government of India and it designated Tata Institute of Social Sciences (TISS), Mumbai as the nodal implementing agency for the survey. The data collection fieldwork was conducted was carried out in all 30 states including Union Territories (Chandigarh and Puducherry) between August 2016 and February 2017 with a sample of 84,047 households (30,821 from urban areas and 53,226 from rural areas) The survey used probability proportional to size (PPS) sampling technique, with adoption of three stage sampling design for rural areas *(Villages-Households-Respondent)* and a four stage was for urban areas *(Wards-Census Enumeration Block- Households- Respondent)*[14]

Sample size:

Out of the total sample, we extracted the sample of 9499 respondents who were current tobacco smokers (daily and less than daily)

Patient and Public Involvement: No patient involved

Operational Definitions

The following operational definitions were used in GATS for variables under the study:

- Current tobacco smoker: An individual who currently smokes any tobacco product, either daily or occasionally.
- A quit attempt in the survey was defined as current tobacco smokers who tried to quit during the past 12 months and former tobacco smokers and smokeless tobacco users who have been abstinent for < 12 months. In this analysis, we included the former one.
- Intention in quitting smoking in the future was defined as current tobacco smokers planning or thinking about quitting smoking within the next month, 12 months, or someday.[14]
- Stage of Change- Based on the tobacco smoking cessation behavior, the current tobacco smokers were classified into following stages of change:

Pre-contemplation: The current tobacco smokers who neither made a quit attempt in the past nor intend to quit in the future.

Contemplation: The current tobacco smokers who did not make a quit attempt in past but intend to do so in future.

Preparation (or action!): The current tobacco smokers who made a quit attempt in the past and intend to quit in the future (apparently because their past quit attempt could not yield success).

Relapse: The current tobacco smokers who made an unsuccessful quit attempt in the past do not intend to quit in the future.

Study variables

Outcome variables included past quit attempts and intention to quit tobacco smoking in future. The exposure variables included socio-demographic characteristics, smoking history and pattern, exposure to media advertisements for and against tobacco smoking, and knowledge about the health effects of tobacco smoking. The questions used for analysis along with codes are added to supplementary file-1.

Data analysis

We performed univariate analysis (frequency distribution), bivariate analysis (chi-square), and multivariate analysis (binary logistic regression for outcome variables mentioned above; and; multinomial logistic regression to understand predictors of various stages of change determining cessation behavior of current tobacco smokers. The analysis was performed in SPSS software, version 16 [SPSS Inc. released 2007. SPSS for Windows, Version 16.0. Chicago, SPSS Inc.] (with p-value <0.05).

Ethics statement

The ethical clearance was not sought as this work is on secondary data.

Data sharing statement

The data of GATS-2 India is available at Global Tobacco Surveillance System Data (GTSSD), Centres For Disease Control and Prevention (CDC) in the public domain.[29]

Results:

A total of 9499 current tobacco smokers were identified. The socio-demographic distribution of currents smokers is presented in Table-1. 63% of the current smokers had made a quit attempt within past 12 months from the survey. Around 44% of participants had no intention to quit tobacco smoking in the near future. More than 90% tobacco smokers were aware about serious illnesses caused by smoking tobacco. Further, 11% reported to have witnessed one or other type of promotion of bidi smoking. Based on the cessation behavior of current smokers, they were classified into four groups using the Stages of Change Model.[10]The analysis revealed that 36.6% of current tobacco smokers were in the pre-contemplation stage. (Table 1)

Table 1: Distribution of socio-demographic & tobacco smoking-related attributes among current tobacco smokers in India, GATS 2016-17

Nearly 72% of current tobacco smokers tried to quit without any assistance, whereas counseling was sought by 8.4% of tobacco smokers. Further, 4.2% switched to smokeless tobacco as well. Nicotine replacement was sought by an even lesser proportion (1.7%). (Figure 1)

Figure 1: Cessation methods used by the current smokers who attempted to quit smoking in last 12 months, GATS 2016-17 (multiple responses)

Maximum promotion was noticed for bidi products in the form of coupons for purchasing (7.8%) followed by sale at low price (3.4%) or as free gifts (3.2%) in comparison to cigarette promotion. However, the surrogate advertisement promotion was more for cigarettes (2.2%) than bidis (2%). (Figure 2)

Figure 2: Distribution of promotional strategies encouraging smoking noticed by the current tobacco smokers in past 30 days, GATS 2016-17

The age-related distribution of various tobacco smoking products was assessed for current tobacco smokers based on smoking frequency. Daily bidi smoking was practiced by 45 years and above age group. This was represented using spider diagram to highlight the age wise difference in daily and non-daily use of smoking tobacco in various forms. (Figure3)

Figure 3: Age-wise distribution of smoking tobacco product use among current daily and less than daily tobacco smokers, GATS 2016-17

The males, primary as well as higher education (graduation and above), being employed (or retired), married, higher caste and urban residence were found to be associated with higher prevalence of previous quit attempts among current smokers. Further, exposure to regular smoking during early adulthood, perception & awareness about ill effects of smoking on body, and smoking being able to cause a multitude of health effects was also associated with increased quit attempts.(Table-2)

Table 2: Factors affecting quitting attempts within past 12 months among the current smokers, GATS 2016-17

Factors affecting intent to quit tobacco in near future:

The regression modeling revealed that intent to quit reduced with increasing age and was similarly prevalent with any level of education. Having an occupation with monetary outcomes (i.e. except being student), being married, initiation after the age of 25 years, experience of ill health effect due to smoking, perception about smoking being able to cause serious and multitude of illnesses and those who recently noticed more than two advertisements about tobacco products was associated with higher odds of intention to quit in future. (Table 3)

Table 3: Factors affecting intention to quit tobacco in future among the current smokers, GATS 2016-17

The socio-demographic profile of current smokers and their smoking related attributes were tested to find out predictors of being in any of the stages of Transtheoretical model.[10]Younger age, female sex, non-exposure to advertisements promoting smoking,werecommon predictors of being in contemplation and preparation stage. Further, experience of ill health effects because of smoking was a common predictor to contemplation, preparation and relapse stage.

The perception about tobacco being able to cause serious health effects (contemplation);education up to primary level, daily wager, OBC caste, being married (preparation); lack of formal education, self-employment, any caste other than general, initiation of tobacco use at age less than 25 years, noticing information encouraging tobacco use as well as quitting, perception about tobacco not being able to cause serious health effects (relapse) were additional predictors. (Table 4)

Table 4: Multinomial logistic regression model to assess predictors of stages of change determining current tobacco smokers'cessation behavior, GATS 2016-17

Discussion

The focus of this paper was to look for the determinants of two major aspects of tobacco smoking cessation-quit attempts and intent to quit as they can help us in understanding smokers' attitude and behavior towards smoking cessation. We utilized the Transtheoretical model (TTM) for a cyclic representation of factors influencing behavior change of a smoker which will facilitate tailored heath promotion strategies that are individualized and easily adapted. The purpose of TTM is to delineate smoker's behavior under the five stages and describe how smokers move dynamically through them. The TTM model used in the study has aptly proved that smokers not only perceive more benefits as they move in later stages but are also being influenced by a different set of determinants for smoking cessation. This view has been supported by other studies on physical activity[31], sedentary behavior[32], nutritional interventions[33] etc. The TTM's ability to customize its constructs to an individual's readiness to initiate cessation behavior is a major strength, making individually-based interventions applicable at the population level. The TTM is flexible enough to be employed by almost any sort of practitioner or researcher, which adds to the possibility of a population-based intervention strategy. The TTM can combine clinical and public health strategies to increase the likelihood of successful health behavior change.[34]

Out of the current tobacco smokers who made a quit attempt in past, majority reported (72%) to have attempted to quit without any assistance. This could be due to various reasons such as lack of awareness among users about the available treatment options (pharmacotherapy & nicotine replacement therapy, quitlines & mCessation), concerns about their safety and perceiving that unassisted is a better choice.[35, 36] The lower odds of quit attempt among the older age groups in the study may be attributed to higher nicotine addiction level[37], beliefs about quitting, believing that 'the damage had been done' so they see no point in attempting to quit later in life[38], beliefs of health care providers reluctance to give cessation advice or to provide medication, type, location and visibility of smoking cessation services[39, 40], reluctance to use telephone or online support such as m-cessation.[41]Only after they contract some illness due to smoking, they think and perhaps attempt to quit (or reduce) smoking,[42] as indicated in this paper as well. Prevalence of quit attempt was higher (PR 2.32) among those who experienced tobacco-related harm to their body or perceived that tobacco smoking can cause serious illness (PR: 2.121).Those who started smoking regularly after the age of 25 years had higher odds of quit attempts than those who started at the age of less than 15 years. Similar findings have been reported by previous studies as well.[43, 44]It is possible that a young adult, who started late, had comparatively more information on the ill-effects of tobacco smoking. We found that the odds of quit attempts and intent to quit were higher among those who had experience of ill health due to tobacco smoking, or believed that tobacco smoking can cause serious illness. This may include witnessing someone with declining health due to tobacco smoking.

Younger age, female sex, and non-exposure to advertisements promoting smoking were common predictors of being in contemplation and preparation stages, as explained further. The possibility that societal norms against smoking are significantly stronger among these younger adult smokers, as seen by their high level of desire to quit.[45]Women may have a higher risk of smoking-related morbidity and mortality, and face different barriers to smoking cessation that

warrant intervention.[46] Women smokers are more likely to believe that society disapproves of smoking,perceive that the risk of dying from smoking significantly greater among them, and have more concerns regarding health than men.[47-49]Further, experience of ill health effects because of smoking was a common predictor to contemplation, preparation and relapse stage. The advancement to later stages in TTM model may be attributed to having experienced an illness due to smoking resulting in compromised health status, increased treatment costs and implied financial burden.[50, 51]

This study has certain limitations. First, it is difficult to establish a temporal relationship between quit attempt/intention to quit with other variables as it was secondary analysis of cross-sectional household survey. Second, the responses are also susceptible to recall bias. Further, as indicated in this paper, the odds of quit attempt were higher among those who experienced tobacco related harm to their body. It is possible that the majority of them were those who already had an episode of smoking-related illness. This theory wasn't however, tested by the authors in the present paper due to lack of required information. The predictors of quit attempt and intention to quit may vary for various forms of tobacco consumption which was not included in this analysis. The age of first exposure to tobacco smoking, reasons for doing so and reasons for continuously indulging in tobacco smoking were not asked in GATS survey. Also, reasons for making quit attempts, if asked, could shed some light on potential motivational factors.

We propose the following recommendations for policymakers, implementers, health care providers (HCPs), researchers, academia and civil society advocates enhancing the quit attempts and promoting cessation among current smokers. Understanding the stage of behavior change among these smokers could assist the stakeholders in developing such interventions that cater to the individual stages and facilitate the desired outcome. Dedicated cessation programs addressing women and younger age groups could help the smoker's progress from contemplation to preparation and action stages. Checks on surrogate advertisements of tobacco products need to be strengthened along with steering of increased taxes on bidis to impact the affordability of the product. Further, concrete & aggressive mass media campaigns along with advertising mcessation and quitline services with wider coverage, especially for motivating smokers residing in rural areas, need to be implemented. Integrated capacity building initiatives on cessation for HCPs providing services under various national health programmes (NCD control, oral health, maternal & child health, tuberculosis control, mental health etc.) may be introduced.
Further, building the motivation of HCPs to uptake and deliver cessation support (identification of smokers, sharing benefits, addressing barriers, coping strategies) is of paramount importance. Qualitative research must be conducted to understand the reasons for preferring not to make another quit attempt so that the causes of relapse can be addressed via individual counseling programs. Also, research is necessary to understand the difference in cessation practices across different cross-cultural settings.Inclusion of smoking cessation as part of the medical curriculum that prioritizes the need to ask about smoking habits and offer support to each user could be helpful. Civil society could mobilize community support for the uptake of cessation services and facilitate the exchange of good practices in cessation.

Conclusion

The present study encapsulates and demonstrates that TTM approach is highly applicable in the current context. The factors influencing different stages of TTM were younger age, female sex, non-exposure to advertisements promoting smoking, for contemplation and preparation both. In

addition, experience of ill health effects because of smoking was a common predictor to contemplation, preparation and relapse stage. This indicates that there is a need for designing stage-based cessation interventions at individual and population levels that caters and focuses on aforementioned groups and hard to engage groups such as older age groups. Given that experience of ill health effects because of smoking emerged to be a key predictor in later stages, it's essential to develop and implement intensive cessation treatment protocols in clinical settings utilizing the flexibility of TTM model. Besides, India being an LMIC and a resource-constrained economy, it is vital to integrate cessation services into all possible national health programs and policies to expand the outreach and the accessibility of cessation services. This could provide 'one stop solution' to many diseases, whether communicable or non-communicable, strengthening the health systems to support and achieve Sustainable Development Goals.

Tables and Figures

Table 1: Distribution of socio-demographic & tobacco smoking-related attributes among current tobacco smokers in India, GATS 2016-17

Characteristic	Category	n (%)
Total		9499
Age in years	15-24	661 (8.4)
	25-44	4552 (42.3)
	45-64	3304 (37.0)
	65 and above	982 (12.2)
Sex	Male	8434 (91.0)
	Female	1065 (9.0)
Education (n= 9495)*	No formal schooling	2754 (35.3)
	Up to primary	2909 (28.8)
	Up to secondary	3314 (31.1)
	Graduation and above	518 (4.8)
Occupation (n= 9496)*	Daily wager	3220 (37.4)
	Self employed	3148 (34.1)
	Retired /Unemployed/ Homemaker	1603 (14.9)
	Govt. and Non-govt. employee	1351 (12)
	Student	174 (1.5)
Marital status	Married	8133 (84.2)
	Single	882 (10.2)
	Separated/ divorced/widowed	484 (5.6)
Caste (n-9437)*	Scheduled caste/ Scheduled tribe	4235 (33.6)
	Other backward class	2895 (42.3)
	General (none of above)	2307 (24.2)
Area of residence	Rural	6980 (73.3)
	Urban	2519 (26.7)
Age of initiation of tobacco smoking (n=8128)**	< 15 years	707 (8.1)
	15-25 years	5130 (60.4)
	> 25 years	2291 (31.5)
Smoking frequency	Daily	7647 (80.5)
	Less than daily	1852 (19.4)
Type of smoking tobacco used (n=11936)#	Bidi	6070 (72.3)
	Cigarette	3338 (32.6)
	Rolled tobacco	1297 (7.9)
	Hukkah	699 (6.6)
	Cheroot	329 (2.9)
	Others	203 (1.3)
Quit attempt within past 12 months	No	6296 (63.7)
	Yes	3203 (36.3)
Intent to quit tobacco in future	Interested in quitting	5382 (55.3)
	Not interested in quitting	4117 (44.7)
Source of information about harms or quitting tobacco smoking	Haven't noticed	2331 (25.0)
	≤ 3 sources	4201 (42.5)
	> 3 sources	2967 (32.5)
Noticed advertisements or signs promoting tobacco smoking	None	7495 (76.4)
	≤ 2 sources	1080 (11.4)
	< 2 sources	924 (12.2)

Noticed any type of cigarette promotion	No	8736 (91.9)
	Yes	763 (8.1)
Noticed any type of bidi promotion	No	8580 (89.0)
	Yes	919 (11.0)
Has smoking already done harm to your body (n=9488)*	No	4133 (47.9)
	Yes	4933 (49.3)
	Don't know	422 (2.8)
Whether smoking tobacco causes serious illness (n=9494)*	Yes	8632 (91.3)
	No	684 (6.9)
	Don't know	178 (1.8)
Whether smoking tobacco causes no, one or multiple illnesses	No illness	361 (3.7)
	Up to 3 illnesses	3400 (38.0)
	> 3 illnesses	5738 (58.3)
Cessation behavior based on Stages of Change model	Pre-contemplation	3446 (36.6)
	Contemplation	2850 (27.0)
	Preparation / Action!	2532 (28.2)
	Relapse	671 (8.1)

*some participants refused to answer to that particular question, reflecting as changed denominator for analysis
**information not available for all current less than daily tobacco smokers
#Multiple responses per participant (n=frequency of responses and not respondents)
(All percentage is weighted)

Table 2: Factors affecting tobacco quitting attempts within past 12 months among the current smokerss, GATS 2016-17

Factor	**Quit attempt**		
	% (n=3203)	**Unadjusted PR (95% CI)**	**Adjusted PR (95% CI)**
Age in years			
15-24	34.4	1.033 (1.031-1.035)	1.391 (1.387-1.395)
25-44	37.9	1.202 (1.200-1.203)	1.082 (1.080-1.083)
45-64	35.9	1.106 (1.104-1.107)	0.941 (0.939-0.942)
65 and above	33.7	Ref	
Sex			
Male	36.9	1.297(1.295-1.299)	1.049 (1.047-1.051)
Female	31.0	Ref	
Education (n-9495)*			
Up to primary	39.8	1.377(1.375-1.378)	1.192 (1.190-1.193)
Graduation & above	37.7	1.260(1.258-1.263)	1.115 (1.112-1.118)
Up to secondary	37.3	1.239(1.238-1.241)	0.993 (0.992-0.994)
No formal schooling	32.5	Ref	
Occupation (n= 9496)*			
Govt. and Non-govt. employee	41.0	2.076 (2.068-2.084)	1.269 (1.262-1.276)
Self employed	38.7	1.885 (1.878-1.892)	1.292 (1.285-1.299)
Daily wager	34.7	1.511 (1.586-1.597)	1.097 (1.091-1.104)
Retired /Unemployed/ Homemaker	32.7	1.450 (1.445-1.456)	1.113 (1.107-1.119)
Student	25.1	Ref	
Marital status			
Married	37.2	1.335 (1.332-1.337)	1.231 (1.229-1.234)
Single	32.0	1.059 (1.056-1.061)	0.789 (0.787-0.791)
Separated/ divorced/widowed	30.8	Ref	
Caste (n-9437)*			
Other backward class	41.0	1.461 (1.460-1.462)	1.461 (1.460-1.462)
General	33.5	1.062 (1.061-1.063)	1.062 (1.061-1.063)
Scheduled caste/ Scheduled tribe	32.2	Ref	
Area of residence			
Urban	39.3	1.187(1.186-1.188)	1.167 (1.165-1.168)
Rural	35.3	Ref	
Smoking frequency			
Less than daily smoking	41.4	1.303 (1.301-1.304)	1.303 (1.301-1.304)
Daily smoking	35.1	Ref	
Age of initiation of regular smoking			
< 15 years	37.3	1.090 (1.089-1.092)	1.095 (1.093-1.097)
> 25 years	36.9	1.069 (1.068-1.070)	1.109 (1.108-1.110)
15-25 years	35.3	Ref	
Has smoking already done harm to your body			

Yes	39.8	2.428(2.421-2.435)	2.322 (2.314-2.330)
No	33.7	1.867(1.862-1.873)	1.808 (1.802-1.815)
Don't know	21.4	Ref	
Whether smoking tobacco causes serious illness			
Yes	37.1	3.155(3.142-3.168)	2.121 (2.111-2.131)
No	31.2	2.424(2.413-2.434)	1.947 (1.937-1.957)
Don't know	15.8	Ref	
Whether smoking tobacco causes no, one or multiple illnesses			
> 3 illnesses	38.4	1.830(1.826-1.834)	1.435 (1.431-1.439)
Up to 3 illnesses	34.3	1.530(1.527-1.534)	1.244 (1.240-1.248)
No illness	25.4	Ref	

*some participants refused to answer to that particular question, reflecting as changed denominator for analysis
**information not available for all current less than daily tobacco smokers
#Multiple responses per participant (n=frequency of responses and not respondents)
(All percentage is weighted)

Table 3: Factors affecting intention to quit tobacco in future among the currentsmokers , GATS 2016-17

Factor	Intention to quit in future		
	% (n=5382)	Unadjusted PR (95% CI)	Adjusted PR (95% CI)
Age group			
15-24	58.3	1.796 (1.793-1.799)	1.478 (1.474-1.482)
25-44	59.1	1.855 (1.852-1.857)	1.457 (1.455-1.459)
45-64	54.0	1.506 (1.504-1.508)	1.225 (1.224-1.227)
65 and above	43.8	Ref	
Sex			
Male	56.1	1.478(1.476-1.480)	0.789 (0.787-0.790)
Female	46.4	Ref	
Education			
Graduation & above	64.8	2.129(2.124-2.133)	1.378 (1.374-1.381)
Up to secondary	61.1	1.822(1.820-1.823)	1.307 (1.305-1.309)
Up to primary	58.3	1.617(1.615-1.619)	1.304 (1.302-1.305)
No formal schooling	46.3	Ref	
Occupation			
Govt. and Non-govt. employee	65.0	2.206(2.202-2.209)	1.359 (1.356-1.362)
Student	59.6	1.749(1.744-1.755)	1.079 (1.073-1.084)
Daily wager	55.8	1.498(1.496-1.500)	1.276 (1.274-1.278)
Self employed	55.3	1.469(1.467-1.471)	1.225 (1.223-1.227)
Retired /Unemployed/ Homemaker	45.7	Ref	
Caste			
General	58.5	1.328 (1.326-1.329)	1.146 (1.145-1.148)
Other backward class	56.3	1.212 (1.211-1.213)	1.184 (1.182-1.185)
Scheduled caste/ Scheduled tribe	51.5	Ref	
Marital status			
Married	56.1	1.800 (1.797-1.803)	1.227 (1.225-1.230)
Single	55.5	1.751 (1.747-1.755)	0.901 (0.898-0.904)
Separated/ divorced/widowed	41.6	Ref	
Residence			
Urban	61.0	1.379 (1.378-1.380)	1.146 (1.144-1.147)
Rural	53.2	Ref	
Smoking frequency			
Less than daily smoking	64.7	1.623 (1.622-1.625)	1.917 (1.913-1.921)
Daily smoking	53.0	Ref	
Age of initiation of regular smoking tobacco use			
> 25 years	55.1	1.152(1.150-1.154)	1.159 (1.157-1.161)
15-25 years	53.3	1.073(1.071-1.075)	0.982 (0.981-0.984)
< 15 years	51.6	Ref	
Noticed information about the dangers of smoking tobacco or that encourages quitting			
More than three sources	63.0	2.193(2.190-2.195)	1.562 (1.560-1.564)
Up to three sources	56.2	1.656(1.655-1.658)	1.380 (1.379-1.382)
Haven't noticed	43.7	Ref	

Noticed any advertisements or signs promoting smoking tobacco products			
Haven't seen any such promotion	55.5	1.067 (1.065-1.068)	1.309 (1.307-1.311)
More than 2 sources promoted tobacco smoking	54.7	1.033 (1.031-1.034)	0.873 (0.871-0.874)
Up to 2 sources promoted tobacco smoking	54.0	Ref	
Whether noticed any type of cigarette promotion			
One or other type of promotion seen	61.5	1.321(1.319-1.323)	1.051 (1.049-1.053)
No promotion seen	54.7	Ref	
Whether noticed any type of bidi promotion			
One or other type of promotion seen	57.5	1.107(1.105-1.108)	1.144 (1.142-1.146)
No promotion seen	55.0	Ref	
Has smoking already done harm to your body			
Yes	58.7	1.977(1.972-1.982)	2.242 (2.235-2.249)
No	52.5	1.535(1.531-1.539)	1.863 (1.858-1.869)
Don't know	41.8	Ref	
Whether smoking tobacco causes serious illness			
Yes	56.5	4.378(4.362-4.393)	2.924 (2.911-2.936)
No	46.8	2.957(2.946-2.968)	2.468 (2.457-2.479)
Don't know	41.8	Ref	
Whether smoking tobacco causes no, one or multiple illnesses			
> 3 illnesses	59.0	1.938(1.934-1.942)	1.259 (1.256-1.263)
Up to 3 illnesses	50.8	1.389(1.386-1.392)	1.041 (1.038-1.043)
No illness	42.6	Ref	

Table 4: Multinomial logistic regression model to assess predictors of stages of change determining current tobacco smokers'cessation behavior, GATS 2016-17

Predictor	**Category**	**Stage[a]**		
		Contemplation (n=2850)	**Preparation (n=2532)**	**Relapse (n=671)**
		PR (95% CI)[c]	**PR (95% CI) [c]**	**PR (95% CI) [c]**
Age group	15-24	1.172(1.168-1.176)	1.737(1.731-1.743)	0.800(0.796-0.804)
	25-44	1.449(1.446-1.452)	1.373(1.371-1.376)	0.843(0.841-0.845)
	45-64	1.376(1.373-1.378)	1.078(1.076-1.080)	0.958(0.956-0.961)
	65 and above[b]			
Sex	Female	1.338(1.335-1.341)	1.178(1.175-1.181)	0.971(0.968-0.974)
Education	No formal schooling	0.733(0.731-0.736)	0.742(0.740-0.745)	1.112(1.106-1.118)
	Up to primary	0.892(0.889-0.895)	1.008(1.005-1.011)	1.046(1.040-1.051)
	Up to secondary	1.065(1.062-1.068)	0.866(0.863-0.868)	1.095(1.089-1.101)
	Graduation &above[b]			
Occupation	Retired /Unemployed/ Homemaker	0.724(0.722-0.725)	0.740(0.738-0.741)	0.974(0.970-0.978)
	Student	0.686(0.682-0.691)	0.735(0.730-0.740)	0.331(0.325-0.336)
	Daily wager	1.021(1.019-1.023)	0.856(0.855-0.858)	0.992(0.988-0.995)
	Self employed	0.907(0.906-0.909)	0.941(0.939-0.943)	1.149(1.146-1.153)
	Govt. and Non-govt. employee[b]			
Caste	SCST	0.812(0.811-0.814)	0.909(0.907-0.910)	1.097(1.095-1.100)
	OBC	0.840(0.839-0.841)	1.315(1.313-1.316)	1.577(1.573-1.581)
	General [b]			
Marital status	Single	0.953(0.949-0.956)	0.790(0.787-0.793)	0.823(0.819-0.828)
	Married	1.043(1.040-1.046)	1.441(1.437-1.445)	0.926(0.923-0.929)
	Separated/ divorced/widowed[b]			
Residence	Urban residence	1.037(1.036-1.038)	1.230(1.228-1.232)	0.942(0.940-0.944)
Frequency of smoking	Daily smokers	0.574(0.573-0.576)	0.409(0.408-0.410)	0.646(0.643-0.648)
Initiation of regular tobacco smoking	< 15 years	0.978(0.976-0.980)	0.862(0.860-0.864)	1.361(1.356-1.365)
	15-25 years	0.973(0.971-0.974)	0.797(0.796-0.798)	1.228(1.225-1.230)
	> 25 years[b]			

Noticed information about the dangers of smoking tobacco or that encourages quitting	Haven't noticed	0.625(0.624-0.627)	0.621(0.620-0.622)	0.868(0.865-0.870)
	Up to three sources	0.885(0.884-0.886)	0.952(0.950-0.953)	1.219(1.216-1.221)
	More than three sources[b]			
Noticed any advertisements or signs promoting smoking tobacco products	Haven't seen any such promotion	2.114(2.109-2.118)	1.357(1.354-1.359)	1.738(1.733-1.743)
	Up to 2 sources promoted tobacco smoking	1.660(1.656-1.664)	1.038(1.036-1.041)	1.814(1.807-1.820)
	more than 2 sources promoted tobacco smoking[b]			
Whether noticed any type of cigarette promotion	No promotion of cigarette seen	0.943(0.940-0.945)	0.854(0.852-0.856)	0.714(0.712-0.717)
Whether noticed any type of bidi promotion	No promotion of bidi seen	0.876(0.875-0.878)	0.717(0.716-0.719)	0.608(0.607-0.610)
Has smoking already done harm to your body	No	1.698(1.692-1.704)	2.453(2.442-2.463)	1.548(1.539-1.557)
	Yes	2.034(2.027-2.042)	3.345(3.330-3.359)	2.148(2.136-2.160)
	Don't know[b]			
Whether smoking tobacco causes serious illness	Yes	2.773(2.759-2.787)	3.775(3.751-3.800)	1.746(1.735-1.757)
	No	2.708(2.693-2.723)	3.014(2.994-3.035)	2.277(2.261-2.292)
	Don't know[b]			
Whether smoking tobacco causes no, one or multiple illnesses	No illness	1.022(1.019-1.025)	0.578(0.575-0.580)	1.098(1.093-1.102)
	Up to 3 illnesses	0.836(0.835-0.837)	0.790(0.789-0.791)	0.926(0.925-0.928)
	> 3 illnesses[b]			

[a] Reference category: Pre-contemplation stage
[b] Redundant parameter
[c] Adjusted

Figure-1 Cessation methods used by the current smokers who attempted to quit smoking in last 12 months, GATS 2016-17

Figure 2: Distribution of promotional strategies encouraging smoking noticed by the current tobacco smokers in past 30 days, GATS 2016-17

Figure 3: Age-wise distribution of smoking tobacco product use among current daily and less than daily tobacco smokers, GATS 2016-17

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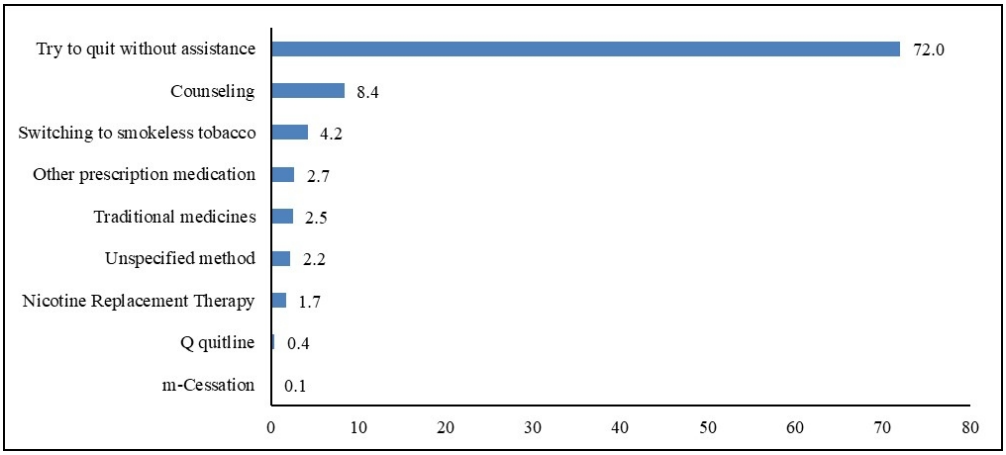
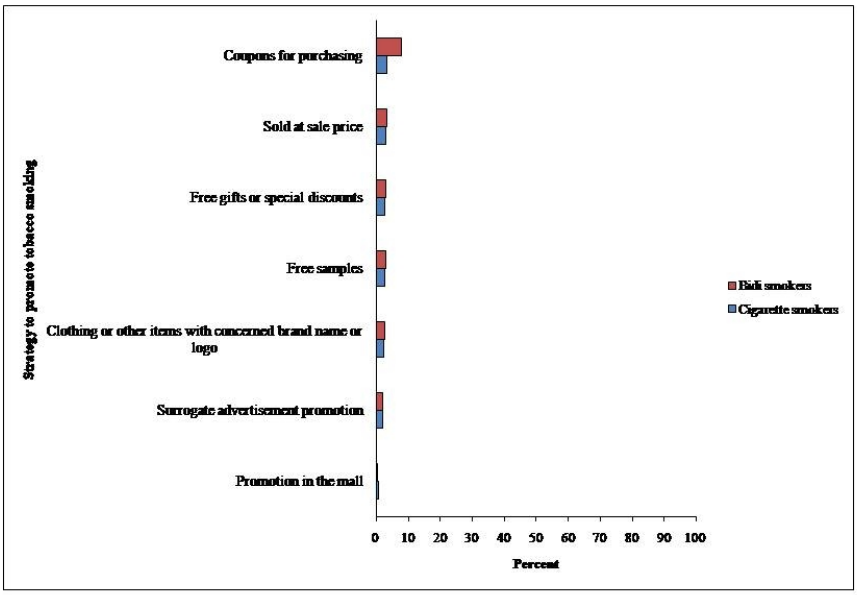


Figure 1: Cessation method used by the current smokers who attempted to quit tobacco in last 12 months, GATS 2016-17

171x76mm (150 x 150 DPI)



Distribution of promotional strategies encouraging smoking noticed by the current tobacco smokers in past 30 days, GATS 2016-17

254x190mm (96 x 96 DPI)

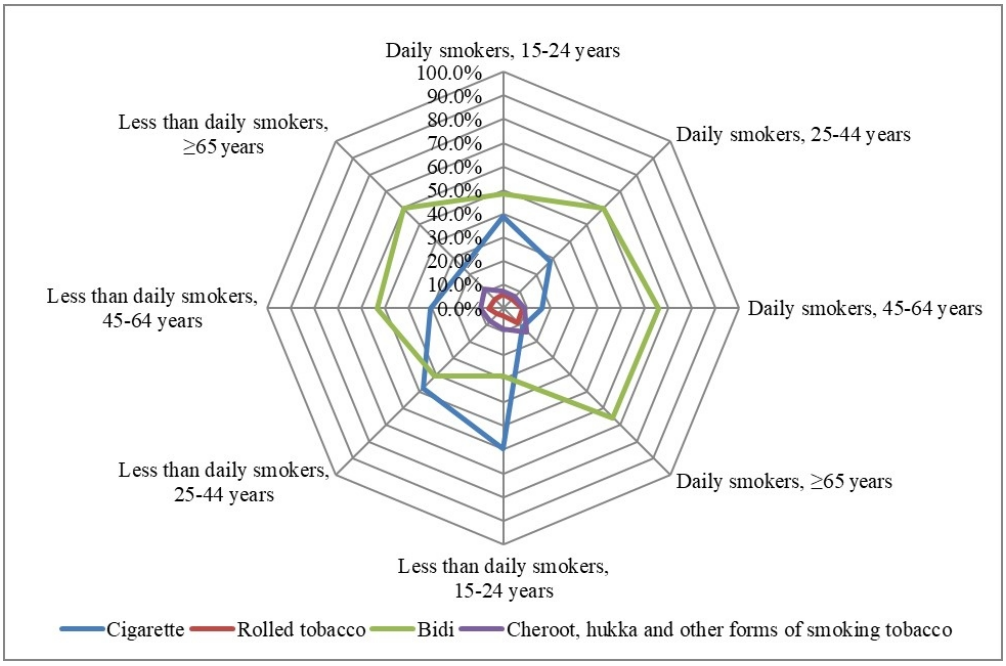


Figure 3: Age-wise distribution of smoking tobacco product use among current daily and non-daily tobacco smokers, GATS 2016-17

165x108mm (150 x 150 DPI)

The following questions were used to conduct the analysis:

Code	Question
A03	How old are you?
A04	What is the highest level of education you have completed?
A05	Which of the following best describes your main work status over the past 12 months?
A09	Do you belong to a scheduled caste, scheduled tribe, other backward caste, or none of these groups?
A11	What is your marital status? Would you say single, married, separated, divorced, or widowed?
B01	Do you currently smoke tobacco on a daily basis, less than daily, or not at all?
B04, B05, B08, B09	(daily smokers) How old were you when you first started smoking tobacco daily?How many years ago did you first start smoking tobacco daily? (less than daily)how old were you when you first started smoking tobacco daily? How many years ago did you first start smoking tobacco daily?
B07	How soon after you wake up do you usually have your first smoke?
D01	The next questions ask about any attempts to stop smoking that you might have made during the past 12 months. Please think about tobacco smoking. During the past 12 months, have you tried to stop smoking?
D03 (D03A to D03E)	During the past 12 months, did you use any of the following to try to stop smoking tobacco?
D08	Which of the following best describes your thinking about quitting smoking?
G01 (G01A to G01I)	In the last 30 days, have you noticed information about the dangers of smoking tobacco or that encourages quitting in any of the following places?
G04 (G04A to G04K)	In the last 30 days, have you noticed any advertisements or signs promoting smoking tobacco products in the following places?
G06 (G06A to G06G)	In the last 30 days, have you noticed any of the following types of cigarette promotions?
G206 (G206A to G206G)	In the last 30 days, have you noticed any of the following types of Bidi promotions?
H01	Based on what you know or believe, does smoking tobacco cause serious illness?
HH07	Based on what you know or believe, has smoking already done any harm to your body? Would you say definitely no, probably no, probably yes, or definitely yes?

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	3,4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4,5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4
Bias	9	Describe any efforts to address potential sources of bias	*2*
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	5
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6,7
		(b) Give reasons for non-participation at each stage	6,7
		(c) Consider use of a flow diagram	6,7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6
		(b) Indicate number of participants with missing data for each variable of interest	5
Outcome data	15*	Report numbers of outcome events or summary measures	5
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6,7
		(*b*) Report category boundaries when continuous variables were categorized	6,7
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	6,7
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	10

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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.