Tobacco cessation in Northeast India: The impact of mass media on changing habits

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ABSTRACT

INTRODUCTION Tobacco use presents a substantial public health challenge, leading to adverse health consequences and avoidable deaths on a global scale. This research concentrated on the North Eastern States of India and explored the impact of mass media on tobacco cessation, considering various sociodemographic factors.

METHODS We conducted a secondary dataset analysis of the Global Adult Tobacco Survey India (2016–2017). Statistical analysis involved univariate analysis to assess population distribution, log-rank tests for capturing average quitting times, and Cox's proportional hazards model to estimate hazard ratios for quitting tobacco. The Cox model was applied to elucidate the impact of independent variables on the time until tobacco quitting events. Kaplan-Meier survival analysis was conducted for smoked and smokeless tobacco users, with separate graphs for various demographic factors.

RESULTS The data analysis reveals noteworthy associations between tobacco cessation and sociodemographic factors. Gender differences are evident, with females showing a later average quitting time than males, emphasizing gender-related disparities. Education level, wealth index, occupation, and marital status emerge as significant factors, indicating that higher level of education and lower wealth are associated with earlier tobacco quitting. The study highlights the positive impact of mass media exposure on tobacco cessation.

CONCLUSIONS This study provides significant insights into the challenges of tobacco cessation in the North Eastern States of India. The findings suggest the need for customized anti-tobacco campaigns, enhanced educational initiatives, improved healthcare accessibility, and the implementation of policies discouraging tobacco use.

INTRODUCTION

Tobacco consumption is considered as one of the major behavioral risk factors and an underlying cause of adverse health, disability and preventable deaths[1]. More than 8 million people die each year due to tobacco-related disease worldwide[2], and these numbers are likely to increase over the coming decades[3]. Most of the deaths projected to occur in low- and middle-income countries[2,3]. India was the second main tobacco consumer after China in 2016[4]. However, the trend in tobacco consumption slightly declined[5] due to effective population-level strategies and law, price increase and restrictions on the availability of tobacco[6]. Although a recent estimate has revealed that 266.8 million Indian adults consume any form of tobacco, and over one million deaths are attributed to tobacco-related diseases every year. The prevalence of tobacco use is highest in northeastern states of the country[4]. Tobacco use is significantly associated with a large and growing cause of premature mortality, morbidity and disability for all ages in the country[3]. The annual economic burden from tobacco constitutes approximately 1.04% of India's GDP, and the direct health expenditure on treating tobacco-related diseases accounts for 5.3% of the total private and public health expenditures in India per year[7]. Therefore, reducing the burden of health and economic consequences of tobacco is obviously of paramount importance in the field of public health.

Evidence identified tobacco cessation as the most cost-effective intervention to reduce tobacco-related disease and premature mortality than other tobacco control programs[1,8,9]. Evidence also suggests that older age, higher level of education, health problems and counselling from

health professionals contribute to tobacco cessation[10-12]. India has endorsed MPOWER (Monitor, Protect, Offer help, Warn, Enforce and Raise taxes) as a tool to help implement the World Health Organization's Framework Convention on Tobacco Control in 2004[13]. These tools include reducing affordability through taxation on tobacco products, passing smoke-free laws, mandating health warnings about the dangers of tobacco on the packaging, banning tobacco advertising, and offering help for the cessation of tobacco use, promotion, and sponsorship to control the demand and supply of tobacco[14]. Article 12 of the FCTC requires signatories to promote and strengthen public awareness of tobacco control issues using available communication tools, including mass media campaigns[1]. Research from developed countries has shown that mass media can be successful in disseminating harmful information regarding tobacco consumption and play an important role in discouraging all forms of tobacco[8,15,16]. Mass-media interventions consist of communication through television, radio, newspaper, billboards, and print media to encourage or motivate tobacco cessation. Mass media campaigns legitimize community action on tobacco control and trigger other interventions over a large population[15].

Initial evidence from India has found that advertising related to tobacco and smoking is positively associated with a higher smoking rate due to brand name or celebrity smoking, especially among youth populations[17,18]. However, on the other hand, recent evidence shows that the anti-smoking message delivered through mass media have encouraged tobacco cessation in India[12,19]. In addition, Pierce and Gilpin[20] found that information regarding smoking and health in news media are associated with smoking cessation but not initiation. Kar et al.[21] reported that Indian adults exposed to anti-tobacco messages in newspapers/magazines and cinemas and those who belong to the northeastern region are more willing to quit than their counterparts.

Little is known about role of mass media on quitting tobacco use in North Eastern States of India. This study provides insights into the current use of mass media among tobacco products users to design and implement effective tobacco legislation or to design successful intervention programs to combat increasing tobacco use. We aimed to test the hypotheses that adults exposed to more anti-tobacco advertising through mass media will be more likely to stop smoking successfully. Moreover, the primary goal of the current study was to evaluate the pattern of quitting smoking and smokeless tobacco use among Indian adults and to assess the impact of mass media on tobacco cessation.

METHODS

Study design and participants

The present secondary analysis was based on the data from the second round of Global Adult Tobacco Survey India (GATS 2 India) 2016–2017. This survey was conducted by the Tata Institute of Social Sciences (TISS), under the stewardship of the Ministry of Health and Family Welfare (MoHFW), New Delhi. Its specific objective was to obtain reliable estimates for various dimensions of tobacco use in different regions of the country[4]. The survey covered 30 states of the country and two union territories. GATS-2 was conducted with 84047 households and 74037 individuals aged ≥15 years.

Outcome variables

Though GATS 2 collected data on tobacco use of any form, this study considered the individuals who were either users of smoked tobacco or smokeless tobacco.

In the survey, six specific questions pertaining to both smoked and smokeless tobacco use were used in each section. Initially, a screening question (Question B04) was asked to identify current daily smokers, asking: 'How old were you when you first started smoking tobacco daily?'. For respondents who were uncertain about the age at which they began daily smoking, a follow-up question (Question B05) was asked: 'How many years ago did you first start smoking tobacco daily?'. Similar sets of questions were posed to individuals who smoked tobacco less than daily and those who were former smokers (Questions B08, B09, B11, and B12).

Parallel questions were asked to smokeless tobacco users. Question C04 asked: 'How old were you when you first started using smokeless tobacco daily?'. In cases where respondents did not recall the exact age, a subsequent question (Question C05) asked: 'How many years ago did you first start using smokeless tobacco daily?' Additional questions were similarly directed at those who used smokeless tobacco less than daily or were former users (Questions C08, C09, C11, and C12).

To convert these responses into time-to-event variables, the duration from initiation to cessation was calculated for former tobacco users, for whom the age of quitting tobacco use was available. For current users of either smoked or smokeless tobacco, where quitting age was not available, these individuals were treated as censored observations in the time-to-event analysis.

Independent variables

The independent variables considered under the current study were sex (male, female), marital status (unmarried, married, other), residence (rural, urban), education level (no education, primary education, secondary education, higher education), occupation (working/non-working), and media (exposed/unexposed). Household wealth index was estimated as assets of the household, and accordingly, principal component analysis (PCA) was employed for the construction of wealth index where each household was assigned a total score based on the availability of specific assets. Households were then ranked according to these scores, and the wealth index was divided into quintiles. The first quintile represents the individuals belonging to 20% of households with lowest wealth score up to the top representing 20% of the highest wealth score[22].

Statistical analysis

A univariate analysis was performed to assess the distribution of the study population. A log-rank test was conducted and the average quitting time of both smoked tobacco users and smokeless tobacco users, by background characteristics, was captured separately. Age at initiation of tobacco and age at quitting were used to compute the time variable. The censored cases in the study were those who were continuing tobacco use till the date of survey, for this study. In order to estimate the hazard ratio for quitting tobacco, the Cox[23] proportional hazard model was used based on the formula:

$$\lambda(t|z) = \lambda_0(t) \times \exp(\beta_1 z_1 + \beta_2 z_2 + \ldots + z_p \beta_p)$$

where $\lambda(t|z)$ is the hazard rate at time t, z_p is a predictor variable, $\lambda_0(t)$ is the baseline hazard (when all predictors are zero), and $\beta_1,\ldots,\beta_p$ are coefficients representing the contribution of each predictor variable. This model was used to explain the effect of independent variables with time until the occurrence of the event, which in our case is the quitting of smoked and smokeless tobacco.

Kaplan-Meier survival analysis was conducted to investigate the relationship of the survival distribution to the covariates under study[24]. The graph of Kaplan-Meier analysis was obtained by sex, residence, occupation, education level, wealth index and mass media exposure for smoked tobacco users and smoked tobacco users separately. However, in the current study an attempt has been made to capture the

Table 1. Log-rank test and average quitting time of the smoked tobacco users, by background characteristics, GATS-2, India

Characteristics	Quitting time (years)			
	Mean	95% CI	Log-rank	p
Sex				
Male	54.27	50.110–58.448	3.50	0.061
Female	66.74	61.067–72.414		
Residence				
Urban	50.81	47.628–54.003	1.26	0.261
Rural	59.81	55.115–64.514		
Education level				
No education	63.87	57.329–70.422	18.37	0.000
Primary	51.99	49.472–54.516		
Secondary	52.35	49.73–54.985		
Higher	43.91	38.069–49.766		
Wealth index				
Poorest	46.65	43.588–49.716	9.17	0.057
Poorer	48.91	45.822–51.999		
Middle	50.94	47.247–54.634		
Richer	54.05	51.476–56.639		
Richest	66.87	60.780–72.970		
Occupation				
Working	60.68	53.695–67.665	2.86	0.091
Non-working	54.04	49.653–58.430		
Marital status				
Single	56.85	47.359–66.342	5.41	0.067
Married	56.45	51.594–61.320		
Other	54.46	47.213–61.722		
Media				
Exposed	52.58	50.677–54.496	1.36	0.243
Non-exposed	61.27	55.338–67.202		

progression of quitting tobacco in all the northeastern states of the country using Kaplan-Meier survival analysis and Cox's proportional hazard ratio[25]. Results are presented with 95% confidence intervals, after adjusting for GATS sampling weight. All analyses was done with SPSS 12.

RESULTS

Table 1 presents the average quitting point in time of smoked tobacco users along with the log-rank test, by background characteristics. The average quitting point in time of smoked tobacco was 66.7 years for females and 54.2 years for males. The average quitting time was higher among the respondents belonging to rural areas. Considering education level, the average quitting time of smoked tobacco was inversely proportional to education level. That is, the average quitting time of smoked tobacco among those with no education is 63.9 years compared to those with higher education level, which is 43.9 years. The average quitting time of smoked tobacco among the poorest is 46.7 years whereas among the richest it is 66.8 years. Working respondents had an average quitting time of 60.6 years, whereas for non-workers it is 54.0 years. The average quitting time of smoked tobacco among the married and the single was more or less the same. The average quitting time of smoked tobacco is more among the respondents who were not exposed to mass media. Apart from this, results from log-rank test for all the background characteristics suggested that there is significant difference in mean quitting time of smoked tobacco by education level

Table 2. Log-rank test and average quitting time of the smokeless tobacco users, by background characteristics GATS-2, India

Characteristics	Quitting time (years)			
	Mean	95% CI	Log-rank	p
Sex				
Male	63.01	60.391–65.645	8.39	0.004
Female	76.82	72.052–81.599		
Residence				
Urban	74.67	69.585–79.764	0.63	0.425
Rural	68.76	64.964–72.561		
Education level				
No education	70.48	66.231–74.746	24.45	0.000
Primary	66.67	64.296–69.054		
Secondary	71.94	65.722–78.166		
Higher	51.95	42.306–61.613		
Wealth index				
Poorest	55.90	50.590–61.223	11.53	0.021
Poorer	75.39	69.523–81.266		
Middle	63.47	60.729–66.220		
Richer	69.35	65.072–73.629		
Richest	63.41	61.208–65.623		
Occupation				
Working	58.69	56.625–60.758	0.22	0.079
Non-working	75.34	70.955–79.735		
Marital status				
Single	49.94	48.102–51.791	2.16	0.039
Married	74.42	70.954–77.904		
Other	70.14	65.589–74.704		
Media				
Exposed	73.26	69.211–77.309	6.05	0.014
Non-exposed	66.79	64.149–69.448		

and wealth index.

Table 2 presents the average quitting time of smokeless tobacco users along with the log-rank test, by background characteristics under study. Findings suggested that the average quitting time of smokeless tobacco was 76 years for females and 63 years for males. The average quitting time was higher among the urban dwellers. In addition, the average quitting time for smokeless tobacco was 70.4 years for respondents with no education and 51.9 years for the those with higher education. Considering the wealth index, it was found that the average quitting time for smokeless tobacco is highest among respondents from the poorer section, followed by those from the richer section. The average quitting time of smokeless tobacco was higher among the working respondents. The maximum average quitting time of smokeless tobacco was among the married respondents. Apart from this, the average quitting time of smokeless tobacco was higher among the respondents who were exposed to mass media. However, results from the log-rank test for all the background characteristics suggested that there is a significant difference in the mean quitting time of smoked tobacco by sex, education level, wealth index, marital status, and exposure to mass media.

Table 3 presents the Cox proportional hazard ratio of quitting smoked and smokeless tobacco by background characteristics under study. Findings from the current

Table 3. Cox proportional hazard ratio of quitting tobacco among smoked and smokeless tobacco users by background characteristics under study GATS-2, India

Characteristics	Quitting smoked tobacco		Quitting smokeless tobacco	
	HR	95% CI	HR	95% CI
Sex				
Male	1			
Female	0.77	0.52–1.16	0.60***	0.42–0.89
Residence				
Urban	1			
Rural	1.04	0.77–1.41	1.09	0.75–1.61
Education level				
No education	1			
Primary	1.54**	1.08–2.21	1.06	0.69–1.67
Secondary	1.79***	1.21–2.69	1.89***	1.20–3.00
Higher	2.84***	1.53–5.30	1.88*	0.9–3.97
Wealth index				
Poorest	1			
Poorer	1.09	0.69–1.75	0.74	0.44–1.29
Middle	1.11	0.68–1.82	0.84	0.47–1.50
Richer	1.00	0.63–1.62	0.70	0.40–1.25
Richest	0.91	0.54–1.52	0.74	0.41–1.35
Occupation				
Working	0.67***	0.51–0.90	0.82**	0.57–1.192
Non-working	1			
Marital status				
Single	1			
Married	0.66*	0.42–0.95	0.86**	0.47–0.96
Other	0.84	0.48–1.50	1.09	0.51–2.32
Media				
Exposed	1.01**	1.01–1.44	1.21**	1.07–1.70
Non-exposed	1			

*p<0.05. **p<0.01. ***p<0.001.

study documented the education level, occupation, marital status and mass media exposure of a person as significant determinants of quitting smoked tobacco among the users. Considering education level, it was found that compared to the uneducated, those with primary, secondary, and higher education, were 1.54 times ($p<0.05$), 1.79 times ($p<0.01$), and 2.84 times ($p<0.01$) more likely to quit smoking tobacco, respectively. However, education level showed a significant positive association with quitting smoked tobacco. Working (OR=0.68; $p<0.01$) and married (OR=0.67; $p<0.10$) respondents had lower odds of quitting smoked tobacco compared to the non-working and those who were single.

Considering smokeless tobacco users, this study identified that sex, education level, occupation, marital status and mass-media exposure of a person were significant determinants of quitting smokeless tobacco. Female respondents were 0.61 ($p<0.01$) times less likely to quit smokeless tobacco compared to males. Respondents with secondary and higher education were 1.8 times more likely to quit smokeless tobacco compared to thethose who are uneducated. Respondents who were either working (OR=0.83; $p<0.05$) or married (OR=0.86; $p<0.05$) were less likely to quit smokeless tobacco compared to the non-working and the single.

However, when considering exposure to mass media, findings suggested that respondents exposed to mass media were 1.01 and 1.22 times more likely to quit smoked and smokeless tobacco compared to the non-exposed, respectively.

Supplementary file Figure 1 depicts the Kaplan-Meier survival curve showing the quitting time of smoked tobacco by different background characteristics. The survival curve for education level shows that the quitting time of smoked tobacco among highly educated users, was lower than that of the uneducated. Considering mass-media exposure, the quitting of smoked tobacco was earlier among those exposed to mass media.

Supplementary file Figure 2 depicts the Kaplan-Meier survival curve showing the quitting time of smokeless tobacco users by different background characteristics. The survival curve for education level showed that the quitting time of smokeless tobacco was lower among the highly educated users, compared to the uneducated. In addition, the quitting time of smokeless tobacco was earlier among those exposed to mass media.

DISCUSSION

The growth of the population, coupled with strategic initiatives by the tobacco industry, has driven the rise of tobacco consumption, particularly in low-income nations. These factors have led to millions of people becoming fatally addicted to tobacco every year. However, recent studies reveal that the prevalence of smoking is highest in the northeastern states of India, while the use of smokeless tobacco products is most common in the Empowered Action Group (EAG) states of the country[14]. The World Health Organization, in its convention on Tobacco control, constructs a framework to increase awareness among citizens about health hazards caused by tobacco consumption, exposure to tobacco smoke and the health benefits of living a tobacco-free life[14].

The findings presented in the study provide valuable insights into the factors affecting tobacco cessation among different demographic groups. Our findings revealed that females tend to quit smoked tobacco at an average age of 66.7 years, whereas males quit at 54.2 years. This indicates a significant difference in quitting patterns between genders. In prospective observational studies, it has been observed that women are less inclined to quit smoking compared to men. Consequently, women are at a greater risk of experiencing the long-term consequences of smoking. Alarmingly, healthcare practitioners might not be fully aware of women's heightened vulnerability to smoking-related diseases. Addressing this issue is crucial because smoking cessation interventions should be customized for women, considering the distinct reasons behind their smoking habits and the unique obstacles they face in successfully quitting[26,27]. Similar gender disparities exist in case of smokeless tobacco as well, with females quitting at an average of 76 years and males at 63 years. This suggests that females, in general, tend to quit tobacco habits later than males, regardless of the type of tobacco used. Information gathered from treatment studies often indicates that women are less successful in quitting smoking compared to men. However, these findings have been challenged, primarily due to conflicting data from epidemiological studies. The aim of this review was to resolve this discrepancy. By examining evidence from both efficacy and effectiveness trials, along with prospective observational studies on relapse, it became evident that women encounter greater challenges in sustaining long-term abstinence from smoking compared to men[28].

The current study found that an inverse relationship between education and quitting time. Individuals with no education quit at 63.9 years, while those with higher education quit at 43.9 years, hence higher education significantly shortens the quitting time. Educated individuals quit smokeless tobacco earlier than those with no education. This highlights the importance of education in tobacco cessation campaigns. An analysis of national health survey data in Finland, using an adjusted regression model, revealed that individuals with a higher level of education were more likely to quit smoking compared to those with basic education[29].

Quitting time is significantly different based on wealth index, with the poorest quitting at 46.7 years and the richest at 66.8 years. Financial disparities influence tobacco cessation rates significantly. Surprisingly, the quitting time is highest among the poorer section, indicating other factors might be at play, potentially access to healthcare and awareness; these findings align with previous studies

that have studied smoking and smokeless tobacco cessation rates and revealed significant disparities. Individuals with low wealth index exhibited higher chances of quitting compared to those with a high asset index. Despite the well-documented health risks associated with smoking, the economic implications have been understudied.

Although a direct causal link cannot be established, it appears that smokers fund their tobacco expenses from income that non-smokers can save. Consequently, reducing smoking rates could assist in household incomes, particularly among the economically disadvantaged, underscoring the potential economic benefits of anti-smoking initiatives[30,31]. Working individuals have a slightly higher quitting time compared to non-workers (60.6 years vs 54.0 years). Working individuals tend to quit smokeless tobacco later. Previous research has underscored the significant health and economic implications of smoking for both individuals and society as a whole. For male office workers who currently smoke, it was found that working more than 52 hours per week is linked to a reduced intention to quit smoking. To gain a more comprehensive understanding, future studies should explore additional work-related factors, including job-related stress and physical workload[32,33]. Married and single individuals have similar quitting times, indicating that marital status might not be a significant factor in smoked tobacco cessation.

Lastly, the current study disclosed that mass media plays a vital role in raising public awareness, especially in diverse social classes and castes, regarding public health issues. Our study focused on the impact of mass-media exposure, particularly anti-tobacco advertisements in India, on adults. It revealed a positive influence, leading to early tobacco cessation. The constant media barrage, including television screens, billboards, and mobile internet access, significantly shapes beliefs and behaviors, notably concerning smoking. Online platforms offer cost-effective experimentation for communication techniques. Research indicates that exposure to outdoor tobacco ads and magazine information prompts smoking initiation. Behavioral change aligns closely with recent media exposure, emphasizing the need for consistent and frequent tobacco control media campaigns to effectively reduce smoking prevalence among adults[8,34,35].

Limitations

Global Adult Tobacco Survey India is a cross-sectional survey rather than a longitudinal design, so the survival analysis conducted in the present study only takes into account individuals present at the time of the survey that excludes those who may have quit tobacco long ago and are no longer affected by tobacco-related issues. Moreover, this study does not capture follow-up information on individuals who reported quitting and have remained tobacco-free over time, and regarding their quit attempts across time. In addition, all data on tobacco use and cessation are self-reported, potentially introducing recall bias and reputational bias, as the timing of tobacco initiation and cessation is based on retrospective self-reported data in a cross-sectional survey, which may affect the accuracy of the time-to-event analysis.

CONCLUSIONS

This study underscores the intricate relationship between sociodemographic factors and tobacco cessation. Addressing these complexities is essential for desinging effective, targeted interventions that can reduce tobacco use across varied communities. The study also provides important insights into the role of mass media in influencing tobacco consumption in India, while examining the socio-economic factors linked to this behavior. It is vital for the government to plan and enforce comprehensive policies to regulate tobacco consumption and its widespread prevalence in the country. Education level, occupation, marital status, and mass-media exposure significantly influence quitting both smoked and smokeless tobacco. Higher education, non-working status, and exposure to mass media increase the likelihood of quitting.

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AUTHORS' CONTRIBUTION
All authors: conceptualization and design of study, drafting of the manuscript, critical revision of the manuscript for important intellectual content. DP: analysis and interpretation of data. All the authors read and approved of the final version of the manuscript.

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