

# Is Mass Media Exposure Associated with Tobacco and Alcohol Consumption Behaviour: Evidence from India

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## Research Article

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# Abstract

Tobacco and alcohol consumption are one of the leading lifestyle-related causes of avoidable mortality worldwide. India is the second-largest consumer of tobacco globally after China. The pattern of tobacco smoking, tobacco chewing and alcohol consumption varies across the states and regions of India. Past literature has provided varying evidence regarding the influence of media on the tobacco and alcohol consumption behaviour of Indian people in specific regions and/or specific age brackets. The current study examined the association between media exposure in households and the individual consumption behaviour of tobacco and alcohol in the Indian population while simultaneously accounting for unobserved heterogeneity at the state level. The analysis was performed separately for both rounds of India Human Development Survey (IHDS) cross-sectional datasets. Multivariable standard logit regression models and random-intercept logit regression models were used to fulfil the study objectives. The study showed that exposure to radio and television media in households was associated with a high risk of smoking tobacco and drinking alcohol in both rounds of IHDS. However, exposure to newspaper media in households translated to a lower risk of tobacco and alcohol consumption in both rounds. People aged 20-59 years were highly likely to consume tobacco or alcohol compared to younger individuals in both rounds of data. Additionally, females are more likely to chew tobacco compared to their male counterparts. The study also provides evidence of the presence of a high level of heterogeneity in the risk of smoking tobacco, chewing tobacco and drinking alcohol across the states of India. The findings of the study highlight the need for devising effective policies that curb the role of radio and television mass media as a promotional medium for tobacco and alcohol consumption among the Indian population.

## Introduction

Over the years, media had played an influential role in every person's life. Exposure to mass media has not only brought information among people but has also shaped perception in people's minds through the information provided by them. The role of different media sources such as print media, broadcast media and others cannot be denied, as they have served as a means of communication to their audiences. The media holds the power to both promote and control any kind of behaviour among their audiences. Thus, the role of media can be seen as both pro and anti-agents of knowledge related to human health (National Cancer Institute, 2008). Several studies had linked media with alcohol and tobacco consumption among the population. Some literature had brought forward the influence of media towards promoting the consumption (Wakefield et al., 2003; Anderson et al., 2009; Nunez-Smith et al., 2010) while some have shown the discouraging role of media with all forms of tobacco and alcohol consumption (Holak & Reddy, 1986; Young et al., 2018; National Cancer Institute, 2008, pp. 357–423).

Tobacco and alcohol use are the biggest preventable cause of death across the world. According to the World Health Organisation (WHO), almost 3 million deaths were reported among people who consume alcohol in 2016 (Hammer et al., 2018). Further, 155 million adolescents worldwide, aged 15–19 years were current drinkers in 2016 (Hammer et al., 2018). In developed countries, despite several pieces of

evidence about the harmful impact of consuming these substances, nearly 4,000 young people initiate their first cigarette each day (National Cancer Institute, 2008). India is the second-largest tobacco consumer of the world (John et al., 2009) however the statistics from the second round data of Global Adult Tobacco Survey (GATS), had shown that almost 92.4% of people believe that smoking leads to serious illnesses among people (Ministry of Health and Family Welfare Government of India, 2017). The report of the round 4 of National Family Health Survey (NFHS) of India revealed that almost 30% and 45% of men consume alcohol and different forms of tobacco respectively (Factsheet, 2017). Past literature had also shown that alcohol consumption not only affected the health of men but also adversely affects the health of women and children. As alcohol consumption can lead to negative consequences on a newborn child (Schoeps et al., 2018), the association is also seen with the risk of unintended pregnancy and lifelong disorder in children like foetal alcohol spectrum disorders (Chudley et al., 2005; Connery et al., 2014). In India, 38.7% and 30.2% of adults were exposed to passive smoking at home and workplace respectively (Ministry of Health and Family Welfare Government of India, 2017). The role of media behind such consumption behaviour can be influential, both negatively and positively.

Different research evidence had brought forward the consumption pattern of alcohol and tobacco in developed and developing countries (Sinha et al., 2011; Singh & Ladusingh, 2014; Anand & Roy, 2016). Some studies show that the consumption of alcohol and tobacco is most common among men than women in India (Anand & Roy, 2016; Mohan et al., 2018). Different traditions and social norms also promote these kinds of consumptions especially in rural areas and people usually prefer traditional drinks over the modern ones (Chakrabarti et al., 2012). Level of education and occupational status were prominent determinants of alcohol and tobacco in the study of Anand & Roy (2016) They found that men working in the informal sectors were more prone to these products. In the study by Singh & Ladusingh (2014) tobacco use was also found to be significantly varying among the states and regions of India. Alcohol trade is also an important source of revenue in India, where non-commercial production of alcohol is the primary livelihood of women from Assam and Sikkim (Chakrabarti et al., 2012). Smoking and drinking alcohol is still a taboo among women in certain parts of the country but chewing tobacco is common among women due to their acceptability in society, ease of availability and inexpensiveness (Gupta et al., 2016; Sauvaget et al., 2008). Thankappan & Thresia, (2007) had shown that ban on smoking in the public places of India had resulted in an increment in smokeless tobacco consumption in India. Further, the marketing of these products is done by promoting them as an inalienable part of the consumer's lifestyle. Direct and indirect advertisement of these products through the media influences the consumers and encourages them to use it. According to the study by Mathivanan et al., (2015), children are the vulnerable section of society when it comes to media influence. Children are easily influenced by mass media exposure because of their inability to differentiate between the reality and the fantasy world created through different mass media messages. The same study had also portrayed the role of peer influence behind the consumption of tobacco and alcohol by Indian children. However, the media had also played a supportive role towards reducing smoking and tobacco consumption rate. Different campaigns are promoted through media sources against the pro-tobacco and pro-alcohol marketing strategies of companies (Young et al., 2018; National Cancer Institute, 2008). Viswanath et al., (2010) had

shown in their study that exposure to newspapers is a reducing factor behind the rate of tobacco consumption. However, the same study highlighted that exposure to television was associated with a higher prevalence of smoking among men and an increase in the prevalence of chewing tobacco among both men and women in India.

Previous research has provided evidence that media plays an important role in shaping the attitudes of individuals towards the consumption of alcohol and tobacco (McCool et al., 2014; National Cancer Institute, 2008). However, majority of these studies were based on developed countries. There is a dearth of research evidence, which documents the role of mass media behind tobacco and alcohol consumption behaviour in developing countries like India. Past research on the influence of media on the consumption behaviour of alcohol and tobacco has classified the impact into two categories\_ positive impact and negative impact (National Cancer Institute, 2008; Viswanath et al., 2010). However, these studies focused on people from specific regions as well as from particular age brackets of India. The objective of the current study is to understand the role of media behind the tobacco and alcohol consumption behaviour of the Indian population across all regions and age groups. According to (National Cancer Institute, 2008) an extensive study of the role of media in control and promotion of different consumption behaviour among people, requires a multilevel modelling approach where the individual-level factors show how individual behaviour matters while an upper level helps to understand how the upper level of media structure influences them. Thus, the current study examines the association of media exposure in household with tobacco and alcohol use among individuals simultaneously accounting for the unobserved heterogeneity at the state level.

## Methods

### Data

This study used the first and second round of India Human Development Survey (IHDS). IHDS round I is a nationally representative, a multi-topic survey of 41,554 households in 382 districts, 1503 villages, and 971 urban neighbourhoods of India conducted during 2004–05 (Desai et al., 2008). The IHDS round II is also a multi-topic panel survey of 42,152 households in 384 districts, 1420 villages, and 1042 urban neighbourhoods of India conducted during 2011–12 (Desai & Vanneman, 2015). Both rounds of IHDS have been conducted in all states and union territories of India (except for the two union territories of Andaman and Nicobar Islands and Lakshadweep) using a multi-stage stratified random sampling. For details regarding the IHDS sampling design please refer to (Desai et al., 2010).

During the first and second rounds of IHDS, data for tobacco and alcohol consumption were collected from 33116 and 34090 individuals respectively. These subsets of observations from the original cross-sectional datasets were used respectively from both rounds for analysis. Any observations with missing information regarding tobacco and alcohol consumption were retained for analysis. The association between media exposure and tobacco and alcohol consumption was examined separately for both rounds using the same set of the outcome, explanatory, and control variables.

## Outcome variables

During the first round of IHDS, interviewers collected information about whether an individual “smokes cigarettes, bidis or hukkah”, “chews tobacco” and “drinks alcohol”. The answers were coded into three categories—“never”, “sometimes”, “daily”. For analytical purpose the information was converted into binary nature—persons in “sometimes” or “daily” category were coded into “yes” and otherwise they were coded as “no”. Thus, the three outcome variables used in the first round were—whether a person smokes tobacco (no, yes), whether a person chews tobacco (no, yes), and whether a person drinks alcohol (no, yes).

A similar procedure was used in the second round of IHDS too for the construction of outcome variables. In the second round, interviewers collected information about whether an individual “smokes cigarettes”, “smokes bidis or hukkah”, “chews tobacco” and “drinks alcohol”. The information was coded into four categories—“never”, “rarely”, “sometimes”, “daily”. For analysis, the persons in “sometimes” or “daily” category were coded as “yes” and otherwise they were coded as “no”. The variables “smoking cigarettes” and “smoking bidis or hukkah” were combined into a single variable indicating whether a person smokes tobacco (yes, no). Persons who smoked either or both cigarettes, bidis or hukkah were coded as “yes”; otherwise they were coded as “no”. The other two outcome variables in the analysis of second-round data are—whether the person chews tobacco (no, yes) and whether the person drinks alcohol (no, yes).

## Explanatory variables

The indicators of mass media exposure are used as the explanatory variables in both rounds of datasets. During the first round, interviewers asked respondents that how often do people in the household “listen to radio”, “read the newspaper” and “watch television (TV)”. The three questions were asked separately for men, women, and children of the household, and answers were recorded under three categories —“never”, “sometimes”, “daily”. This information was combined to construct three binary variables—whether anyone in the household listens to radio (no, yes), whether anyone in the household reads the newspaper (no, yes) and whether anyone in the household watches TV (no, yes). This study constructed variable, the households in “sometimes” and “daily” category in the original variable as “yes”; otherwise, they were recoded to “no”.

A similar procedure of recording was used for the mass media exposure-related variables in the second round of IHDS. Interviewers in the second round asked respondents how often do people in the household “listen to radio”, “read the newspaper” and “watch TV”. Again, the three questions were asked separately for men, women, and children in the household, and answers were recorded under three categories —“never”, “sometimes”, “daily”. The information was combined to construct three binary variables—whether anyone in the household listens to radio (no, yes), reads the newspaper (no, yes), and watches TV (no, yes). Households in “sometimes” and “daily” category in the original variable were recoded to “yes” and otherwise they were recoded to “no” in the constructed variable.

## Control variables

Based on previous research, several factors that affect the media exposure, tobacco, and alcohol consumption behaviour of individuals were identified. These factors were individual-level demographic characteristics, household socio-economic characteristics, and state-level relevant characteristics. Accordingly, the following control variables were included for analysis—age category of the individual (grouped in interval of 10 years); sex of individual (male, female); level of education of individual (no formal schooling, standard 1–5, standard 6–10, standard > 10); current working status of individual (not working, working); current marital status of individual (unmarried, married); highest educational level of an adult male aged more than 21 years in the household (no formal schooling, standard 1–5, standard 6–10 and standard > 10); highest educational level of an adult female aged more than 21 years in the household (no formal schooling, standard 1–5, standard 6–10 and standard > 10); wealth quintile of household (poorest, poor, middle, rich and richest); caste of the household head (other backward class (OBC), scheduled castes (SC), scheduled tribes (ST), others); religion of the household head (hindu, muslim, others); place of residence (rural, urban); region (central, northern, southern, western, eastern, north-eastern).

Very few of the control variables had observations with missing information. In the first round of IHDS, there were 589 and 699 missing cases in the highest educational level of household female adult and household male adult variables respectively out of 33116 cases. In the second round of IHDS, there were 45, 523 and 707 missing cases in the caste of household head, highest educational level of household female adult and highest educational level of household male adult variables respectively out of 34090 cases. The observations with missing cases for a particular variable were either recoded as “0” or to the “others” category as appropriate. Since the number of individuals with missing information were small relative to the overall sample size, this recoding will not bias the analysis done in this paper.

## Analytical Methods

In the beginning, the current study shows the overall distribution of individuals as well as the distribution of individuals who smoke tobacco, chew tobacco and drink alcohol respectively across the relevant demographic, socio-economic and state-level variables used in the dataset. Then the study provided evidence of the presence of unobserved state-level heterogeneity in the data using random intercept logit models with individuals at the first level and the state an individual belongs to at the second level. In both rounds of IHDS, individuals have been grouped under 28 states and 5 union territories and each of such entity (states as well as the union territories) has been considered as a separate state for analysis. There were no individuals who belonged to multiple states and there were no states without any individuals in them. Further, the study provides evidence for the association between mass media exposure in households and tobacco and alcohol consumption behaviour in individuals using multivariable standard logit regression models and random intercept logit regression models, before and after controlling for

state-level heterogeneity respectively. Logit regression models were used as the dependent variables are binary.

To give evidence of unobserved state-level heterogeneity, the study estimated a null model (empty random intercept logit model with no explanatory and control variables) and a full model (random intercept logit model with all the explanatory and control variables) for each of the three indicators of tobacco and alcohol consumption. Clustering and heterogeneity in the random intercept logit models was measured using the intra-class correlation coefficient (ICC) and median odds ratio (MOR) respectively. The ICC is the ratio of variation in the risk of tobacco or alcohol consumption across the states (second level units) to the sum of the individual-level and state-level variation (Merlo et al., 2006). In the case of two-level random intercept logit regression models, the individual-level variation is fixed and the ICC is a function of only the state-level variance whose value lies within 0 and 1. The higher the value of ICC the greater is the degree of clustering of observation within the state. The MOR gives the median of the ratio of the propensity of tobacco or alcohol consumption among all pairs of individuals belonging to high-risk and low-risk states (Merlo et al., 2006). The MOR too is a function of the state-level variance whose value is always greater than or equal to 1. A high value of MOR denotes a greater level of heterogeneity in the risk of tobacco or alcohol consumption across the states. To give evidence of the association between media exposure and tobacco and alcohol consumption behaviour this study estimated a standard logit regression model (model without controlling for unobserved heterogeneity) and random intercept logit model (model after controlling for unobserved heterogeneity) for each of the three indicators of tobacco and alcohol consumption. Association in the standard and random intercept logit regression models were shown using odds ratios. The odds ratio for standard logit regression models gives the likelihood of tobacco or alcohol consumption among the individuals within media exposure compared to those individuals without media exposure after controlling the effect of the control variables (Cameron & Trivedi, 2005). The interpretation for odds ratio is similar in the case of random intercept logit regression models except that they additionally control for the effect of unobserved state-level heterogeneity (Goldstein, 2011; Snijders & Bosker, 2011).

All the above analytical procedures were followed separately for both rounds of the IHDS dataset. All statistical estimations were performed using the STATA software (StataCorp, 2013).

## Results

### Sample characteristics

*Table– 1* shows the distribution of individuals who smoke tobacco, chew tobacco as well as drink alcohol in the first round of IHDS (2004–05). Overall, there were 33116 individuals out of which 19281, 19460 and 10292 persons smoked tobacco, chewed tobacco and drank alcohol respectively. 51.2%, 59.4% and 66.6% of the individuals who smoked tobacco belonged to households that listened to radio, does not read newspaper and watched TV respectively. Among the individuals who smoked tobacco, 94.5% were male, 41.3% have had no formal schooling, 56.8% were currently working, 88% were married and 80.7%

lived in rural households. Similarly, among the individuals who chewed tobacco 52.3%, 57% and 67.3% belonged to household that listened to radio, does not read newspaper and watched TV respectively. Additionally, 22%, 43.2%, 50.8%, 83% and 82.2% of the individuals chewing tobacco were female, had no formal schooling at all, were currently working, were currently married and lived in rural households respectively. Again, 50.8%, 57% and 70.1% of the individuals who drink alcohol belonged to households that does not listen to radio, does not read newspaper and watched TV respectively. Additionally, among the individuals who drink alcohol, 94% were male, 41.7% have had no formal schooling, 66.7% were currently working, 89.5% were currently married and 80.5% lived in rural households. In addition, more than 45% of the individuals who consume tobacco or alcohol are aged between 30 and 49 years. More than 50% of the individuals consuming tobacco belong to the eastern and central region of India. The eastern and southern region of India accounts for more than 50% of the individuals who consume alcohol.

*Table–2* shows the distribution of individuals who consume tobacco and alcohol during the second round of IHDS (2011–12). Second round of IHDS interviewed 34090 respondents out of which 14688, 21085 and 9877 individuals smoked tobacco, chewed tobacco and drank alcohol respectively. Among the individuals who smoked tobacco 67.4%, 52.6% and 78.8% belonged to household that does not listen to radio, does not read newspaper and watched TV respectively. Additionally, 93.7%, 40%, 85.5%, 87.3% and 77.1% of the individuals smoking tobacco were male, had no formal schooling at all, were currently working, were currently married and lived in rural households respectively. Similarly, 65%, 51.4% and 77.1% of the individuals who chewed tobacco belonged to households that does not listen to radio, does not read newspaper and watched TV respectively. Additionally, among the individuals who chewed tobacco, 20.7% were female, 39.5% have had no formal schooling, 76.9% were currently working, 80.9% were currently married and 77.6% lived in rural households respectively. Again, among the individuals who drink alcohol 70.1%, 52.5% and 77.4% belonged to household that does not listen to radio, does not read newspaper and watched TV respectively. Additionally, 96%, 37.3%, 90.1%, 88.7% and 74.9% of the individuals smoking tobacco were male, had no formal schooling at all, were currently working, were currently married and lived in rural households respectively. In addition, more than 40% of the individuals who consume tobacco or alcohol are aged between 30 and 49 years. More than 50% of the individuals consuming tobacco belong to the eastern and central region of India. The eastern, central and southern region of India accounts for more than 74% of the individuals who consume alcohol.

## **State-level heterogeneity and clustering**

*Table–3* gives estimate of the state-level unobserved heterogeneity in the risk of tobacco and alcohol consumption and clustering of observations across states using the random intercept logit models used for analysis of the first round of IHDS data. In case of models with “individual smokes tobacco or not” as the outcome variable, the amount of clustering among individuals within the same state, denoted by ICC of the null model (with no explanatory and control variables) and full model (with all explanatory and control variables), is 0.259 and 0.172 respectively. Similarly, for models with “individual chews tobacco or

not” as the outcome variable the ICC for null model 0.435 which decreases to 0.189 in the full model. Again, for models with “individual drinks alcohol or not” as the outcome variable the ICC for the null model and full model is 0.307 and 0.275 respectively. The analysis shows that the observations for individuals who consume tobacco or alcohol are clustered within the same states. The MOR of the propensity of smoking tobacco, chewing tobacco and drinking alcohol is 2.78, 4.56 and 3.16 times higher for individuals belonging to high-risk states compared to the individuals belonging to low-risk states in the null models. The MOR decreases to 2.20, 2.31 and 2.90 in the full models for smoking tobacco, chewing tobacco and drinking alcohol respectively. The analysis shows that the MOR for all the models is greater than 2.00 and hence there is heterogeneity in the risk of tobacco and alcohol consumption of individuals across the states.

*Table-4* gives evidence of the state-level heterogeneity in the risk of tobacco and alcohol consumption and clustering of observations across states in the second round of IHDS data. The ICC for null models of smoking tobacco, chewing tobacco and drinking alcohol are 0.257, 0.355 and 0.271 respectively. For full models of smoking tobacco and chewing tobacco, the ICC decreases to 0.184 and 0.287 respectively whereas, the ICC increases to 0.289 for the model with drinking alcohol as the outcome variable. Similar to the first round, the observations for individuals who consume tobacco or alcohol are clustered within the same states in the second round of IHDS. The MOR of the propensity of smoking tobacco, chewing tobacco and drinking alcohol more than 2 times higher for individuals belonging to high-risk states compared to the individuals belonging to low-risk states in the all the models. Hence, there is heterogeneity in the risk of tobacco and alcohol consumption of individuals across the states.

## **Association of mass media exposure and tobacco and alcohol consumption using state level heterogeneity**

*Table-5* shows the association between different modes of mass media exposure in household and tobacco and alcohol consumption among individuals in the first round of IHDS. In the models that did not control for unobserved state-level heterogeneity, the odds of smoking tobacco is 1.07 times higher (standard error (SE: 0.029; p-value < 0.05) and 0.91 times lower (SE: 0.031; p-value < 0.01) for individuals who belong to households where the household members listen to radio and read newspaper respectively. Similarly, the odds of chewing tobacco is 1.09 times higher (SE: 0.030; p-value < 0.01), 1.18 times higher (SE: 0.041; p-value < 0.01) and 0.93 times lower (SE: 0.031; p-value < 0.01) for individuals from households that listen to radio, read newspaper and watch TV respectively for models without unobserved state-level heterogeneity. Again, the odds of drinking alcohol is 1.06 times higher (SE: 0.029; p-value < 0.05), 1.10 times higher (SE: 0.038; p-value < 0.01) and 1.13 times higher (SE: 0.038; p-value < 0.01) for individuals from households that listen to radio, read newspaper and watch TV respectively for models without unobserved state-level heterogeneity. The pattern of association between the outcome and explanatory variables remains similar for models that control for unobserved state-level heterogeneity. Individuals have 1.08 times higher (SE: 0.032; p-value < 0.01) and 0.92 times lower (SE: 0.028; p-value < 0.01) chances to smoking and chewing tobacco respectively when they belong to

households where the household members listen to radio. Similarly, individuals have 0.93 times lower (SE: 0.033; p-value < 0.05) and 1.07 times higher (SE: 0.038; p-value < 0.1) chances of smoking tobacco and drinking alcohol respectively when they belong to households that watch TV.

*Table-6* shows the association between different modes of mass media exposure and tobacco and alcohol consumption in the second round of IHDS. The odds of smoking tobacco is 1.19 times higher (SE: 0.034; p-value < 0.01) and 0.90 times lower (SE: 0.027; p-value < 0.01) for individuals from households where the household members listen to radio and read newspaper respectively in case of models without unobserved heterogeneity. Similarly, the odds of chewing tobacco is 0.93 times lower (SE: 0.027; p-value < 0.01) and 1.17 times higher (SE: 0.036; p-value < 0.01) for individuals from households that listen to radio and read newspaper respectively for models without unobserved state-level heterogeneity. Again, the odds of drinking alcohol is 0.95 times lower (SE: 0.031; p-value < 0.1) for individuals from households that read newspaper. The pattern of association between the outcome and explanatory variables remains similar for models that control for unobserved state-level heterogeneity. Individuals have 1.11 times higher (SE: 0.035; p-value < 0.01), 0.91 times lower (SE: 0.029; p-value < 0.01) and 1.09 times higher (SE: 0.037; p-value < 0.01) odds of smoking tobacco, chewing tobacco and drinking alcohol respectively when they belong to households where the household members listen to radio.

## Discussion

Using both rounds of the India Human Development Survey; this study provides evidence of the association of mass media exposure with tobacco and alcohol consumption behaviour among the Indian population simultaneously accounting for unobserved heterogeneity at the state-level. In the first round of IHDS, listening to radio was associated with a higher likelihood of smoking tobacco, while lesser chance of smoking was seen among people with exposure to television. During the second round, this relationship had changed where exposure to both television and radio showed a higher likelihood of smoking tobacco. This change might be due to the ban on visual advertisement of smoking. However, different companies had also come up with strategies to influence the consumption behaviour among people. The association of media with the tobacco chewing behaviour were low as such habits are culturally acceptable and smokeless tobacco products are inexpensive and widely available across India (Gupta, 2003; Sauvaget et al., 2008). The findings of the current study contradicted those of (Viswanath et al., 2010) where positive association between television and chewing tobacco was seen. In the current study, reading newspapers was positively associated with alcohol consumption behaviour in the first round, while there is no association of mass media exposure with alcohol consumption in the second round. Generally, the newspaper does not carry contents that promote these kinds of consumption; however, it is likely to carry content that limit the consumption behaviour among people. Additionally, it is likely that the readership of newspapers consists of educated people who are conscious of the harmful effect of tobacco and alcohol consumption and inhibit themselves from such risky behaviour. Similar results were also seen in the study of Viswanath et al.,(2010).

Because of analysing data of the overall population, this study noticed patterns in the consumption behaviour among different age groups. Results related to the control variables were not shown in the tables of multivariable analysis. However, this study found that people in the age group of 20–69 years were highly likely to consume tobacco or alcohol compared to people in the younger ages in both rounds of IHDS. This might be due to influence of social relations in these ages where consumption behaviour among people in the same social groups influences others to pick up the similar behaviour. The current study also found that in both rounds of IHDS the female population were more likely to consume smokeless tobacco in comparison to their male counterparts and these findings were similar to the study by Gupta, P. C. (2003). The study also found that people with an above primary level of education are less likely to smoke tobacco and consume alcohol in comparison to individuals who had no formal schooling in both rounds of IHDS. Additionally the study also found that, people living in the urban areas were less prone to consume alcohol or smoke tobacco compared to their rural counterparts in the first round. However, during the second round a higher likelihood of tobacco and alcohol consumption was seen among people living in urban areas compared to people living in rural areas. Consumption of smoking tobacco and drinking alcohol was also highly prevalent among working people compared to people who were not involved in any occupation in both rounds of IHDS.

Different forms of media have the right to express their opinion in their own style along with the responsibility to educate, inform, and entertain people. Previous literature had brought forward both pros and cons of media exposure in households on the tobacco and alcohol consumption behaviour of individuals. The intention of this study is to provide evidence for both the supportive and resistive role of mass media exposure behind alcohol and tobacco consumption behaviour of the Indian population. A difference in association across various media sources in the current study highlighted the importance of understanding that the source through which information is received also matters. The study results show that visual media (that is television) is a promoting agent of tobacco and alcohol consumption behaviour in the first round. However, during the second round visual media has emerged as an anti-agent of tobacco and alcohol consumption in India, which might be a result of anti-promotion campaigns of the Indian government. In contrast to this, print media had emerged as an anti-promotion agent of tobacco and alcohol consumption in both rounds of IHDS, which is because the readers of newspapers are more critical consumers than those exposed to visual media. Moreover, the content published in a newspaper is more health prone and oftentimes carry messages and stories about the harmful effect of these consumption behaviour. Across regions and states, the consumption pattern of tobacco and alcohol were found to be significantly varying in the current study.

(Singh & Ladusingh (2014) in their study on India had shown that there is variation across the states in the pattern of consuming tobacco and alcohol. Chakrabarti et al. (2012) had shown in their study that every state has a different consumption pattern where in some states consumption is prominent by tradition whereas in some states generating materials for consumption is the livelihood of the people. However, there is a lack of research evidence that shows the association of media exposure with alcohol and tobacco consumption behaviour while simultaneously controlling for the variation in the risk of consumption at the state-level. The current study fills this research gap. Findings of this study have also

brought attention to different media sources that act like a pro and anti-agent of tobacco and alcohol consumption. Visual media (television), which is most popular among the population, emerged as a pro agent while print media (that is newspaper) emerged as an anti-agent. One of the most important strengths of this study is that it included the whole population to see a pattern of consumption in contrast to other studies where population in specific age brackets were included. This result can also be useful in generalizing the situation in case of other developing nations. However, because of unavailability of information, the current study is unable to provide evidence for the role of the various types of content shown through each mode of mass media. Clearly, further research is necessary in this direction. Additionally, the emergence of the use of computers and mobile phones and role behind the promotion of tobacco and alcohol consumption behaviour could not be highlighted in this study. The current study determines association and not causality among the mass media exposure and tobacco or alcohol consumption behaviour among the Indian population. However, no evidence was found in the available literature about the causal effect of tobacco and alcohol consumption on the mass media exposure in people.

This study will help the concerned people and policymakers to understand the overall influence that different mass media sources exert on the chances of picking up risky lifestyle behaviours like smoking tobacco, chewing tobacco or drinking alcohol. In spite of the presence of Cable Television Networks Amendment Act, which bans advertising of tobacco and alcohol products in India since 2000, mass media exposure emerged as an influential factor behind the tobacco and alcohol consumption behaviour in the Indian population. The tobacco and alcohol selling companies have found and used variety of methods for indirect advertising of their products. Proper execution of the anti-tobacco and anti-alcohol promotion campaigns of the government is necessary. Youngsters who usually have the curiosity of trying new things in their life should be made aware about the role of media messages as well as the pros and cons of indulging in tobacco and alcohol consumption. It is common knowledge that India is undergoing a demographic transition that would result in a higher proportion of working-age group population. These people will contribute towards the development of the country. Thus, it becomes a shared responsibility of policymakers and people to ensure that the population does not suffer from avoidable causes of disability and mortality like tobacco and alcohol consumption.

## **Declarations**

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*Conflicts of Interest* There is no conflict of interest in any of the authors.

*Ethical Approval* IHDS datasets used for analysis are publicly available with no information that discloses the identity of the respondents. Thus, there was no need for prior permission and ethical approval for using the datasets. The data can be obtained from the IHDS website (Desai et al., 2008; Desai & Vanneman, 2015).

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## Tables

**Table 1: Distribution of individuals in the first round of IHDS by relevant demographic, socioeconomic and state-level characteristics**

Variables	Total Population		Smokes Tobacco		Chews Tobacco		Drinks Alcohol	
	N	%	N	%	N	%	N	%
<b>Household members listen to radio</b>								
No	16930	49.2	9710	48.8	9761	47.7	5244	50.8
Yes	16186	50.8	9571	51.2	9699	52.3	5048	49.2
<b>Household members read newspaper</b>								
No	18576	57.4	10961	59.4	11133	57.0	5654	57.0
Yes	14540	42.6	8320	40.6	8327	43.0	4638	43.0
<b>Household members watch TV</b>								
No	10126	31.9	5968	33.4	6250	32.7	2967	29.9
Yes	22990	68.1	13313	66.6	13210	67.3	7325	70.1
<b>Age-grouped by 10 years</b>								
0-9	43	0.1	21	0.1	30	0.2	12	0.2
10-19	610	2.0	227	1.3	490	2.7	110	1.4
20-29	4889	15.3	2551	14.0	3157	16.3	1564	16.1
30-39	8078	23.8	4633	23.8	4729	23.3	2906	28.1
40-49	7972	24.2	4958	25.6	4414	23.1	2726	26.6
50-59	5777	17.4	3611	18.7	3237	16.5	1711	16.1
60-69	3745	11.6	2164	11.2	2207	12.0	887	8.2
70-79	1579	4.4	872	4.0	946	4.5	318	2.5
80+	423	1.3	244	1.2	250	1.3	58	0.7
<b>Sex of individual</b>								
Male	27609	83.7	18280	94.5	14770	78.0	9712	94.0
Female	5507	16.3	1001	5.5	4690	22.0	580	6.0
<b>Level of education of individual</b>								

No Formal Schooling	13555	42.6	7525	41.3	8307	43.2	3937	41.7
Standard 1-5	6715	20.9	4058	21.5	4038	21.0	2115	21.9
Standard 6-10	9825	28.1	5983	28.9	5430	27.5	3280	28.2
Standard >10	3021	8.4	1715	8.4	1685	8.3	960	8.2
<b>Current working status of individual</b>								
Not working	15373	46.3	8282	43.2	9570	49.2	3607	33.3
Working	17743	53.7	10999	56.8	9890	50.8	6685	66.7
<b>Current marital status of individual</b>								
Married	28455	85.3	17124	88.0	16250	83.0	9271	89.5
Unmarried	4661	14.7	2157	12.0	3210	17.0	1021	10.5
<b>Highest educational level of male adult (21+ years)</b>								
No Formal Schooling	8992	28.7	5270	29.8	5410	28.2	2955	31.7
Standard 1-5	5970	18.8	3442	18.8	3683	19.0	1892	20.3
Standard 6-10	8669	26.4	5115	26.2	5101	26.8	2589	24.3
Standard >10	9485	26.0	5454	25.2	5266	25.9	2856	23.7
<b>Highest educational level of female adult (21+ years)</b>								
No Formal Schooling	17784	56.5	10659	58.2	10666	56.8	5535	59.1
Standard 1-5	5034	15.1	2814	14.5	3051	15.3	1524	13.7
Standard 6-10	5624	16.4	3117	15.7	3320	16.7	1701	15.2
Standard >10	4674	11.9	2691	11.7	2423	11.2	1532	12.0
<b>Wealth quintile of household</b>								
Poorest	7460	26.3	3752	24.6	5362	30.3	2269	26.7

Poor	7147	24.1	4224	25.0	4518	25.0	2053	22.5
Medium	6958	20.5	4329	21.2	3781	18.8	2196	21.8
Rich	6547	17.5	4014	17.6	3421	16.0	2103	17.2
Richest	5004	11.5	2962	11.5	2378	9.9	1671	11.7
<b>Caste of household head</b>								
OBC	12811	40.4	7306	39.5	7885	41.8	3398	36.5
SC	7521	24.4	4612	25.8	4216	23.5	2780	29.6
ST	3983	10.4	1944	8.8	2910	11.9	1846	16.6
Others	8801	24.8	5419	25.9	4449	22.8	2268	17.3
<b>Religion of household head</b>								
Hindu	27046	83.4	15619	81.9	16001	84.4	8584	86.6
Muslim	3657	11.4	2469	13.6	1978	10.3	395	3.9
Others	2413	5.2	1193	4.5	1481	5.2	1313	9.5
<b>Place of residence</b>								
Rural	24641	80.6	14316	80.7	14694	82.2	7686	80.5
Urban	8475	19.4	4965	19.3	4766	17.8	2606	19.5
<b>Region</b>								
Central	7663	26.6	4280	26.4	5490	31.5	1658	17.9
Northern	6522	11.0	5282	15.8	1568	4.7	2316	10.6
Southern	5683	16.4	3574	18.0	2270	9.5	2294	26.8
Western	4302	14.9	1476	8.8	3351	18.5	1122	12.2
Eastern	6572	25.8	3028	24.1	5077	30.3	2069	27.1
North-eastern	2374	5.3	1641	6.9	1704	5.6	833	5.4
<b>Total</b>	<b>33116</b>	<b>100</b>	<b>19281</b>	<b>100</b>	<b>19460</b>	<b>100</b>	<b>10292</b>	<b>100</b>

**Table 2: Distribution of individuals in the second round of IHDS by relevant demographic, socioeconomic and state-level characteristics**

Variables	Total Population		Smokes Tobacco		Chews Tobacco		Drinks Alcohol	
	N	%	N	%	N	%	N	%
<b>Household members listen to radio</b>								
No	24172	67.0	10321	67.4	14841	65.0	7204	70.1
Yes	9918	33.0	4367	32.6	6244	35.0	2673	29.9
<b>Household members read newspaper</b>								
No	16584	50.4	7330	52.6	10676	51.4	4811	52.5
Yes	17506	49.6	7358	47.4	10409	48.6	5066	47.5
<b>Household members watch TV</b>								
No	6398	21.2	2874	21.2	4298	22.9	1813	22.6
Yes	27692	78.8	11814	78.8	16787	77.1	8064	77.4
<b>Age-grouped by 10 years</b>								
0-9	67	0.2	5	0.0	29	0.1	6	0.0
10-19	717	2.3	110	0.8	541	2.6	76	0.8
20-29	4530	13.6	1375	9.5	3329	15.6	1222	12.9
30-39	7205	20.2	2927	19.3	4679	21.1	2442	24.4
40-49	8087	23.4	3810	26.0	4717	22.0	2673	27.0
50-59	6402	18.8	3163	21.8	3602	17.2	1866	18.6
60-69	4515	13.8	2130	14.7	2627	13.6	1117	11.6
70-79	1940	5.7	884	5.8	1168	5.8	362	3.7
80+	627	2.0	284	2.2	393	1.9	113	1.0
<b>Sex of individual</b>								
Male	28306	83.1	13851	93.7	16413	79.3	9501	96.0
Female	5784	16.9	837	6.3	4672	20.7	376	4.0
<b>Level of education of individual</b>								

No Formal Schooling	12542	38.5	5574	40.0	8050	39.5	3329	37.3
Standard 1-5	6947	19.8	3246	22.0	4289	19.2	2066	20.5
Standard 6-10	10959	31.1	4594	29.9	6594	30.7	3445	32.6
Standard >10	3642	10.6	1274	8.1	2152	10.5	1037	9.5
<b>Current working status</b>								
Not working	7191	21.6	2108	14.5	4853	23.1	1010	9.9
Working	26899	78.4	12580	85.5	16232	76.9	8867	90.1
<b>Current marital status</b>								
Married	28335	82.5	12852	87.3	17115	80.9	8784	88.7
Unmarried	5755	17.5	1836	12.7	3970	19.1	1093	11.3
<b>Highest educational level of male adult (21+ years)</b>								
No Formal Schooling	7784	25.1	3677	28.2	5002	25.5	2286	26.6
Standard 1-5	5768	17.0	2587	18.4	3696	16.8	1701	17.6
Standard 6-10	13064	36.8	5552	35.7	8070	37.4	3944	38.1
Standard >10	7474	21.0	2872	17.7	4317	20.4	1946	17.7
<b>Highest educational level of female adult (21+ years)</b>								
No Formal Schooling	15266	47.8	7189	51.9	9823	49.2	4497	50.3
Standard 1-5	5323	15.2	2256	15.3	3378	15.3	1486	14.5
Standard 6-10	9248	25.5	3597	23.1	5611	25.0	2631	24.4
Standard >10	4253	11.5	1646	9.7	2273	10.5	1263	10.8
<b>Wealth quintile of household</b>								
Poorest	7463	27.7	3036	27.1	5584	32.1	2074	27.3
Poor	7933	23.5	3473	24.8	5374	24.8	2105	22.2
Medium	7399	20.1	3284	20.0	4442	19.2	2100	20.7

Rich	6158	16.2	2749	16.7	3267	13.7	1903	17.0
Richest	5137	12.5	2146	11.4	2418	10.3	1695	12.9
<b>Caste of household head</b>								
OBC	13649	41.1	5635	39.5	8866	42.5	3412	37.7
SC	8005	24.4	3876	28.4	4597	22.6	2840	28.8
ST	3921	11.1	1362	8.5	2828	12.6	1629	17.4
Others	8515	23.4	3815	23.7	4794	22.3	1996	16.1
<b>Religion of household head</b>								
Hindu	28235	83.1	12103	83.8	17745	83.9	8666	88.2
Muslim	3980	11.5	1933	12.8	2405	11.1	267	2.9
Others	1875	5.4	652	3.4	935	5.0	944	8.9
<b>Place of residence</b>								
Rural	24795	75.6	10998	77.1	15678	77.6	7100	74.9
Urban	9295	24.4	3690	22.9	5407	22.4	2777	25.1
<b>Region</b>								
Central	9615	32.0	3919	31.7	7346	38.3	2301	25.4
Northern	6925	11.6	4397	17.4	2431	7.2	2619	13.3
Southern	5566	15.5	2629	18.5	2532	9.7	2309	25.4
Western	4186	13.4	866	6.8	3296	16.2	678	7.9
Eastern	6206	23.8	2012	20.9	4606	25.8	1488	24.0
North-eastern	1592	3.7	865	4.7	874	2.7	482	3.9
<b>Total</b>	<b>34090</b>	<b>100</b>	<b>14688</b>	<b>100</b>	<b>21085</b>	<b>100</b>	<b>9877</b>	<b>100</b>

**Table 3: Indicators of state-level heterogeneity and clustering in the sample of the first round of IHDS using a random effect logit model**

Measures	Smokes tobacco		Chews tobacco		Drinks alcohol	
	Null model	Full model	Null model	Full model	Null model	Full model
<b>Variance</b>	1.149	0.685	2.531	0.769	1.456	1.249
<b>Intra-class Correlation Coefficient (ICC)</b>	0.259	0.172	0.435	0.189	0.307	0.275
<b>Median Odds Ratio (MOR)</b>	2.78	2.20	4.56	2.31	3.16	2.90
<b>No of persons</b>	33,116	33,116	33,116	33,116	33,116	33,116
<b>No of states</b>	33	33	33	33	33	33

Note – (1) Null model denotes an empty model without any covariates (2) Full model is a model with all the covariates

**Table 4: Indicators of state-level heterogeneity and clustering in the sample of the second round of IHDS using the random effect logit model**

Measures	Smokes tobacco		Chews tobacco		Drinks alcohol	
	Null model	Full model	Null model	Full model	Null model	Full model
<b>Variance</b>	1.141	0.743	1.808	0.909	1.224	1.339
<b>Intraclass Correlation Coefficient (ICC)</b>	0.257	0.184	0.355	0.217	0.271	0.289
<b>Median Odds Ratio (MOR)</b>	2.77	2.28	3.61	2.48	2.87	3.02
<b>No of persons</b>	34,090	34,090	34,090	34,090	34,090	34,090
<b>No of states</b>	33	33	33	33	33	33

Note – (1) Null model denotes an empty model without any covariates (2) Full model is a model with all the covariates

**Table 5: Results of multivariable analysis showing the association (odds ratio) between media exposure and tobacco and alcohol consumption in the first round of IHDS**

Variables	Model without unobserved heterogeneity			Model with unobserved heterogeneity		
	Smokes tobacco	Chews tobacco	Drinks alcohol	Smokes tobacco	Chews tobacco	Drinks alcohol
<b>Household members listen to radio</b>						
No ®	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.07**	1.09***	1.06**	1.08***	0.92***	1.04
	(0.029)	(0.030)	(0.029)	(0.032)	(0.028)	(0.031)
<b>Household members read newspaper</b>						
No ®	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.91***	1.18***	1.10***	1.00	1.00	1.12***
	(0.031)	(0.041)	(0.038)	(0.037)	(0.037)	(0.041)
<b>Household members watch TV</b>						
No ®	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.96	0.93**	1.13***	0.93**	1.04	1.07*
	(0.032)	(0.031)	(0.038)	(0.033)	(0.037)	(0.038)
<b>No of persons</b>	<b>33,116</b>	<b>33,116</b>	<b>33,116</b>	<b>33,116</b>	<b>33,116</b>	<b>33,116</b>
<b>No of states</b>				<b>33</b>	<b>33</b>	<b>33</b>

Note – (1) Standard error (SE) is given in brackets (2) Statistical significance is denoted by asterisks where \*\*\* p-value<0.01, \*\* p-value<0.05, \* p-value<0.1 (3) ® denotes reference category (4) While analysing we have controlled for different variables: age category; sex of individual; level of education; current working status; current marital status; highest educational level of an adult male aged more than 21 years in the household; highest educational level of an adult male aged more than 21 years in the household; wealth quintile of the household; caste of the household head; religion of the household head; place of residence; Region

**Table 6: Results of multivariable analysis showing the association (odds ratio) between media exposure and tobacco and alcohol consumption in the second round of IHDS**

Variables	Model without unobserved heterogeneity			Model with unobserved heterogeneity		
	Smokes tobacco	Chews tobacco	Drinks alcohol	Smokes tobacco	Chews tobacco	Drinks alcohol
<b>Household members listen to radio</b>						
No ®	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.19***	0.93***	0.98	1.11***	0.91***	1.09***
	(0.034)	(0.027)	(0.030)	(0.035)	(0.029)	(0.037)
<b>Household members read newspaper</b>						
No ®	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.90***	1.17***	0.95*	0.95	0.99	1.00
	(0.027)	(0.036)	(0.031)	(0.031)	(0.033)	(0.035)
<b>Household members watch TV</b>						
No ®	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.05	0.96	1.02	1.02	1.04	0.97
	(0.038)	(0.036)	(0.041)	(0.039)	(0.041)	(0.041)
<b>No of persons</b>	<b>34,090</b>	<b>34,090</b>	<b>34,090</b>	<b>34,090</b>	<b>34,090</b>	<b>34,090</b>
<b>No of states</b>				<b>33</b>	<b>33</b>	<b>33</b>

Note – (1) Standard error (SE) is given in brackets (2) Statistical significance is denoted by asterisks where \*\*\* p-value <0.01, \*\* p-value <0.05, \* p-value <0.1 (3) ® denotes reference category (4) While analysing we have controlled for different variables: age category; sex of individual; level of education; current working status; current marital status; highest educational level of an adult male aged more than 21 years in the household; highest educational level of an adult male aged more than 21 years in the household; wealth quintile of the household; caste of the household head; religion of the household head; place of residence; Region