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# The association between the retail price of manufactured cigarettes and bidis on current smoking status in India

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## Type

Research paper

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## Keywords

GATS, Price, Tobacco Use, Current smoking

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## Abstract

### Introduction

In India, the retail prices of bidis and cigarettes varied between the two Global Adult Tobacco Surveys (GATS) conducted in 2009/10 and 2016/17. The relationship between the retail price of smoked tobacco products and their use is unclear for India. Our study thus aimed to use available datasets to investigate the association between the retail price and current smoking status of bidis and cigarettes in India.

### Methods

Current smoking status data for bidis and cigarettes were obtained from the two GATS rounds. The average state-level retail prices of bidis and cigarettes were obtained from India's Consumer Price Index- Industrial Workers database. Descriptive statistics were used to describe current smoking status patterns. Generalized Linear Mixed Models (GLMM) were used to investigate the association between the retail prices and current smoking status of bidis and cigarettes.

### Results

For cigarettes, an increase in the average retail price by one Indian Rupee was associated with a reduction in the odds of being a current smoker of 7% (OR 0.925 [95% CI = 0.918 – 0.932],  $p < 0.001$ ). For bidis, the association between the retail price and current smoking status was not statistically significant (OR 1.01 [95% CI = 1.00 - 1.02],  $p = 0.082$ ).

### Conclusions

Current increases in the retail prices of tobacco products in India seem to have an impact on the use of cigarettes but not bidis. This highlights the need for tobacco product tax increases that result in sufficient retail prices increases to make all tobacco products less affordable and reduce their use.

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## Explanation letter

Thank you for the valuable comments from reviewers on our manuscript and for opportunity to improve the same.

All the authors have reviewed the manuscript and tried our best to clarify the queries. We are now submitting our revised manuscript with highlights along with explanation to reviewers' comments. If

any further modifications are required, we are glad to address them.

Kindly consider our revised manuscript in your esteemed journal.

Looking forward for positive response.

With best regards,

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1 The association between the retail price of manufactured cigarettes and bidis on current  
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#### 4 ABSTRACT

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27 reduce their use.

28 **Keywords:** Tobacco Use, GATS, Price, Current smoking.

## 29 Introduction

30 Tobacco use is one of the leading causes of death globally.<sup>1</sup> Eighty percent of mortality due  
31 to tobacco use is in low- and middle-income countries (LMICs).<sup>2</sup> Tobacco smoking can  
32 result in serious health consequences such as tuberculosis, respiratory diseases,  
33 cardiovascular diseases and neoplasm.<sup>3</sup> Globally, India occupies second position in both  
34 consumption and production of tobacco.<sup>3,4</sup> Bidis (tobacco hand-rolled, inexpensive, small  
35 and wrapped in dried tendu leaves) and cigarettes are two common tobacco smoking forms in  
36 India.<sup>5</sup> Compared to cigarettes, bidis are commonly used by low socio-economic status  
37 people due to easy availability and lower cost.<sup>6</sup> Unfortunately, bidi smoking has been  
38 reported to be a stronger risk factor for cancer of the hypopharynx and supraglottis as it  
39 appears to deliver some toxic components of tobacco smoke in greater amounts than  
40 conventional cigarettes.<sup>7</sup> The life expectancy of cigarette and bidi smokers is on an average  
41 6-10 years less than that of non-smokers.<sup>9</sup> According to India's Global Adult Tobacco  
42 Surveys (GATS), the prevalence of tobacco use among adults in India has decreased from  
43 34.6% to 28.6% between 2009/10 and 2016/17, with 42.4% of men and 14.2% of women  
44 currently using tobacco.<sup>10</sup> Similarly, there has been a decline in the prevalence of current bidi  
45 smoking from 9.2% to 7.7% and of current cigarette smokers from 5.7% to 4.0% in the inter-  
46 survey period.<sup>10</sup> The consumption pattern of bidis and cigarettes varies in the 29 states and  
47 seven union territories in India due to diversity in culture, habits and economic status.  
48 <sup>3,5,11,12,13</sup> For instance current prevalence of smoked forms of tobacco use in southern state of  
49 Karnataka was 11.9% in 2009/10 and 8.8% in 2016/17, whereas in the northern territory of  
50 Delhi this was 17.4% and 11.3% respectively.<sup>14,15</sup>

51 Tobacco product price is an important economic determinant of tobacco consumption.<sup>16</sup>  
52 Policies that increase the real consumer price (i.e., inflation adjusted) of tobacco products  
53 have been shown to reduce tobacco use, particularly if they reduce affordability of the  
54 products (i.e., the percentage of income required to buy specific units of a tobacco  
55 product).<sup>17,18</sup> Taxation of tobacco products for example represents one of the most effective  
56 means of tobacco control: a 10% increase in tax could reduce cigarette smoking by 2%.<sup>19,20</sup>  
57 Tobacco taxes in India are complex in structure. During the study period, both central and  
58 state governments levied taxes on tobacco products. For example, for bidis and cigarettes, the  
59 central government imposed tax on product characteristics such as stick length, presence of  
60 filter, machine or hand made and quantity. The state governments on the other hand had the  
61 authority to impose Value-added Tax (VAT) on tobacco products in the GATS period,

62 62 resulting in varying tobacco product taxes and prices across states.<sup>21</sup> This has been cited as  
63 63 one of the reasons for the observed variations in tobacco use prevalence and consumption  
64 64 patterns across states.<sup>3,22,23</sup>

65 65  
66 66 Tobacco companies work to limit the impact of taxes on tobacco product prices through  
67 67 market segmentation and setting lower prices for those consumers who are most price-  
68 68 sensitive, e.g., those of lower socio-economic status. They achieve this for example through  
69 69 having different price tiers or point-of-sale price discounts offers. In order to offset these  
70 70 tobacco company strategies, there is an increased interest in non-tax policy approaches to  
71 71 raising tobacco product prices, for example minimum price laws that set a single floor price  
72 72 below which cigarettes cannot be sold.<sup>24,25,26</sup> Such strategies have been shown, through sales  
73 73 modelling studies, to potentially reduce smoking prevalence, with suggestions that the effects  
74 74 may be greater than achieved through taxation alone.<sup>24,25,27</sup> They also seem to have a greater  
75 75 relative impact on smokers in lower socio-economic groups as tobacco product prices  
76 76 generally tend to be lower more income-deprived neighbourhoods, hence could help reduce  
77 77 health inequalities.<sup>25,27, 28</sup> Studies have demonstrated that higher cigarette prices have a  
78 78 negative effect on cigarette consumption.<sup>29,25</sup> A recent study concluded that higher bidi and  
79 79 cigarette prices can lower the probability of bidi or cigarette smoking onset in India.<sup>6</sup>  
80 80 However, the relationship between the retail prices of tobacco products and the prevalence of  
81 81 their use in India is unclear. In our study, we thus investigated the association between the  
82 82 retail prices and current smoking of cigarettes and bidis, adjusting for various socio-  
83 83 demographic factors and accounting for state-level variations.

## 84 84 Methods

85 85 The study was conducted after obtaining ethics committee approval from the University of  
86 86 York, UK (HSRGC/2019/346/E) and Manipal Academy of Higher Education, India (MAHE  
87 87 EC/002/2021)

### 89 89 Data sources

90 90 Our analysis was based on data from the GATS in India and the Consumer Price Index for  
91 91 Industrial Workers (CPI-IW) database managed by the Labour Bureau Government of India  
92 92 (<http://labourbureau.cpi.gov.in/webform6.aspx>).<sup>30</sup>

94 94 India's Ministry of Health & Family Welfare conducted two rounds of the GATS, one in  
95 95 2009/10 (GATS-1), and the other in 2016/17 (GATS-2).<sup>14,15</sup> The GATS targets all Indian  
96 96 residents, aged 15 and above, and living in their primary residence prior to the survey date.  
97 97 The GATS collects information on respondent's demographic and socio-economic  
98 98 characteristics, tobacco use (smoking and smokeless) and cessation, second-hand smoke  
99 99 exposure, tobacco related expenditures, media exposure to anti-tobacco information and  
100 100 tobacco advertisement, knowledge attitudes and perceptions towards tobacco use. There were  
101 101 69,296 and 74,037 individual observations in GATS-1 and GATS-2, respectively. Data from  
102 102 these two GATS were combined for the analysis.

103 103  
104 104 The CPI-IW database publishes state-level average monthly retail prices of tobacco products  
105 105 computed using data from selected industrially important centres based on brand name,  
106 106 filter/nonfilter (for cigarettes), and number of sticks or units. The database contains  
107 107 information on a large number of local or subnational bidi brands, with one popular brand  
108 108 (Ganesh bidi) being identifiable as a common brand with national reach. The information of  
109 109 cigarette brands on database were recorded with length shorter than 69 mm category of local  
110 110 or subnational brands. The database covers data starting from January 2006 to present. We  
111 111 assumed that any impact of change in retail price on individual-level smoking status would  
112 112 take at least a year to manifest,<sup>31</sup> hence we retrieved 2008 and 2015 retail prices which are  
113 113 one year prior to GATS-1 and GATS-2 respectively.

#### 114 114 **Dependent variables:**

115 115  
116 116 For the two dependent variables, current bidi smoking status and current cigarette smoking  
117 117 status, we used responses to the following GATS question to categorise respondents as  
118 118 current bidi smoker/non-smoker and current cigarette smoker/non-smoker: "On average, how  
119 119 many of the following products do you currently smoke each day? Also, let me know if you  
120 120 smoke the product, but not every day". Those who reported smoking one or more bidi each  
121 121 day, or smoking bidi but not every day were considered as current bidi smokers; whilst those  
122 122 who indicated they did not smoke any bidi were current non-smokers (bidi). Similarly, those  
123 123 who reported smoking one or more manufactured cigarettes each day, or smoking  
124 124 manufactured cigarettes but not every day were considered as current cigarette smokers;  
125 125 whilst those who indicated they did not smoke any manufactured cigarettes were current non-  
126 126 smokers (cigarette). The two variables were categorised independent of each other and did

127 127 not consider dual users, i.e., smoking bidi and cigarette at the same time, which constituted  
128 128 approximately 1.4% of our dataset.

### 129 129 **Independent variables:**

130 130  
131 131  
132 132 The average monthly retail prices, in Indian Rupees (Rs), for bidi and manufactured  
133 133 cigarettes were obtained from the CPI-IW database. As the pack sizes varied across products  
134 134 and states, the recorded retail prices were converted into prices of standard pack sizes in the  
135 135 Indian market: 25 sticks of bidis and 10 sticks of cigarettes. For each of the products, i.e.,  
136 136 bidis and cigarettes, the retail price per standard pack for a state was estimated with a two-  
137 137 step average method: first calculate the mean price of all products over the entire year for  
138 138 each centre, then calculate the average of the mean prices of all centres in a state as the retail  
139 139 price of a product for that state.

140 140 The following GATS socio-demographic variables were considered for the analysis based on  
141 141 empirical or theoretical literature reporting their association with current smoking status: age  
142 142 (as a continuous variable), residence (rural or urban), gender (female or male), level of  
143 143 education (No formal schooling, Primary school completed, secondary school completed,  
144 144 higher secondary school completed or college and above completed), work status  
145 145 (Government employee, non-government employee, self-employed, student, homemaker,  
146 146 retired or unemployed), smoking allowed in every room of house (yes or no), and wealth  
147 147 quintile (1=Lower, 2=Lower-middle, 3=Middle, 4=Middle-upper or 5=Upper) based on  
148 148 modified Kuppaswamy socioeconomic scale 2020.<sup>32</sup> For our analysis, a few variables were  
149 149 recategorised from their original categories in GATS due to very few observations within  
150 150 each state. Specifically, for level of education, “Less than primary school completed” and  
151 151 “primary school completed” were recategorised as “primary school completed”, “less than  
152 152 secondary school completed” and “secondary school completed” were recategorised as  
153 153 “secondary school completed”, “college / university completed” and “post graduate degree  
154 154 completed” were recategorised as “College and above Completed”; while “higher secondary  
155 155 school completed” and “No formal schooling” remained unchanged for the analysis. For  
156 156 work status, the GATS categories ‘daily wage/casual labourer’ and ‘self-employed’ were  
157 157 recategorised as ‘self-employed’; whilst categories ‘unemployed able to work’, and  
158 158 ‘unemployed unable to work’ were recategorised as ‘unemployed’; and categories  
159 159 “government employee”, ‘non-government employee’, ‘student’, ‘homemaker’ and ‘retired’



160 160 remained unchanged for the analysis. Values were considered missing where responses were  
161 161 blank, or the respondent refused to answer. Observations with missing values for any of the  
162 162 included variables were excluded from the analysis.

## 164 164 Data analysis

165 165 The analysis was carried out using RStudio software version 3.6.1  
166 166 (<https://www.rstudio.com/>). We conducted descriptive analysis, summarising the average age  
167 167 of current smokers at the time of the survey, and the proportion of current smokers by the  
168 168 GATS derived socio-demographic variables, separately for bidi and manufactured cigarettes.  
169 169 To take into account the variation between states and GATS waves and predictors on both  
170 170 state-level and individual-level, we used Generalized Linear Mixed Models (GLMM) to  
171 171 analyse the association between retail price and current smoking status across the two GATS  
172 172 survey time points for bidi and cigarette separately, controlling for socio-demographic  
173 173 variables, with states and GATS waves as random effect to account for clustering effect on  
174 174 state level and survey level.<sup>33</sup>

175 175 First, multilevel mixed-effects univariate logistic regression analyses were conducted to  
176 176 assess the empirical relationship between each independent variable and each dependent  
177 177 variable. The univariate analyses were used to select factors with  $p < 0.2$  for inclusion in the  
178 178 multivariate analyses.<sup>34,35</sup> For both current bidi smoking status and current cigarette smoking  
179 179 status, all independent variables had a  $p$  value  $< 0.2$  in the univariate analyses, and were  
180 180 therefore included in multivariate analyses. For the multivariate analysis, odds ratios (ORs)  
181 181 and their 95% confidence intervals were used as the measures of association, using a  
182 182 significance level of 0.05.

183 183 Hosmer-lemeshow test (HL test) and Akaike Information Criterion (AIC) were used to assess  
184 184 the model goodness of fit. Intra-class correlation coefficients (ICCs) was reported to  
185 185 attribute the variance accounted for by the states and the GATS survey period.

## 186 186 Results

187 187 For bidi, average retail price data was available for 23 out of the 24 states included in the  
188 188 CPI-IW database. For these 23 states, we retrieved 82.3% observations from GATS-1 (57,012  
189 189 individual observations out of 69,296) and 81.0% observations from GATS-2 (59,985  
190 190 individual observations out of 74,037), constituting a total of 116,997 observations after

191 191 excluding observations with data missing on covariates. For cigarette smoking, average retail  
192 192 price data was available for all 24 states in the CPI-IW database. For these 24 states we  
193 193 retrieved 84.8% and 84.4% observations respectively from GATS-1 (58,735 individual  
194 194 observations out of 69,296) and from GATS-2 (62,476 individual observations out of  
195 195 74,037), with a total of 121,211 after excluding observations with data missing on covariates.

196 196 In GATS-1, the prevalence of bidi smoking and cigarette smoking in the analysis samples were  
197 197 8.9% (5,085/57,012) and 6.1% (3,603/58735) respectively; and in GATS-2 these were 7.8%  
198 198 (4,695/59,985) and 3.3% (2,055/62,476) respectively. The results of descriptive analysis are  
199 199 presented in Table 1. Table 2 shows the results of univariate analyses: all considered factors had  
200 200 a p value <0.2 for both bidis and cigarettes and were included in the multivariate analysis.

201 201  
202 202 In the multivariate analysis, the average retail price of cigarette was statistically significantly  
203 203 associated with current smoking status for cigarettes. When the average retail price increases by  
204 204 one Indian Rupee, the odds of being a current smoker are reduced by 7% (OR 0.925 [95% CI =  
205 205 0.918 – 0.932], p <0.001) (Table 3). An ICC of 23% and 11% was obtained, implying 23% of  
206 206 variation in current cigarette smoking status is attributed to GATS survey periods and 11%  
207 207 attributed to state variation. For bidis, the association between the retail price and current  
208 208 smoking status was not statistically significant (OR 1.01 [95% CI = 1.00 - 1.02], p = 0.082). An  
209 209 ICC of 1% and 11% , indicated that only 1% of the variation in current smoking status is  
210 210 attributed to GATS survey period and 11% attributed to state variation.

211 211  
212 212 Older individuals were more likely to be bidi smoker, while the difference in age for cigarette  
213 213 smoking were not statistically significant. Those who are male, were more likely to be current  
214 214 smokers for both bidis and cigarettes compared to females. In addition, those living in a  
215 215 household where smoking is allowed in every room were more likely to be current cigarette and  
216 216 bidi smokers than those living in a household where smoking is not allowed in every room.  
217 217 Whilst those living in urban areas were less likely to be current bidi smokers than those living in  
218 218 the rural areas (OR 0.83 [95% CI=0.78,0.88], p<0.001), they were more likely to be current  
219 219 cigarette smokers than those living in the rural areas. Comparing to those completed college or  
220 220 above education, people with lower education levels (Primary, secondary and higher secondary  
221 221 schooling) were more likely to be smoking bidi. For cigarette, while those in the middle levels of  
222 222 education were more likely to be smoking than those with college and above education, no  
223 223 difference was found between the lowest level of education category (no formal schooling) and

224 224 the highest (college and above). Student, Home maker, unemployed and retired were less likely  
225 225 to be current bidi and cigarette smokers as compared to government employee. Self-employed  
226 226 people were less likely than government employees to be smoking cigarettes but did not differ in  
227 227 likelihood of smoking bidi. Those in the lower, lower-middle, middle and middle-upper wealth  
228 228 quintile were more likely to be current bidi smokers, while those in the upper wealth quintile  
229 229 were more likely to be cigarette smokers.

## 230 230 Discussion

231 231 In our study, an increase in the average retail price per standard pack of commonly sold  
232 232 brands of manufactured cigarettes by one Indian Rupee was accompanied by a reduction in  
233 233 the odds of being a current smoker of 7%, taking clustering effect of states, GATS survey  
234 234 periods and other socio-demographic factors into consideration. For bidis, the association  
235 235 between the retail price and current smoking status was not statistically significant.

236 236 In India, tax levels for bidis are significantly lower than those for cigarettes and smokeless  
237 237 tobacco products.<sup>36</sup> In addition, the bidi industry has many small producers who take  
238 238 advantage of the tax concession that are available for small producers.<sup>36,37</sup> Bidis are therefore  
239 239 cheaper, and tend to be more affordable at lower increments in tax/price when compared to  
240 240 cigarettes.<sup>36,38</sup> For example, in their projection of the affordability of cigarettes and bidis from  
241 241 2017 to 2025, Rana and colleagues found that whilst the affordability for cigarettes decreased  
242 242 to -9.9% after a 100% increase in tax, that of bidi decreased to -8.61% only after a 200%  
243 243 increase in tax by the end of 2025.<sup>39</sup>

244 244 Because they are cheaper, bidis are usually smoked by the people of lower socioeconomic  
245 245 status, whilst cigarettes tend to be smoked by those of higher socioeconomic status.<sup>40</sup> This is  
246 246 consistent with our findings where those in the upper wealth quintile were less likely to be  
247 247 bidi smokers but more likely to be cigarette smokers when compared to those in the lower to  
248 248 middle-upper wealth quintiles. However in the present study we could not capture the  
249 249 scenario of switching to cheaper products since we could not follow individual decisions with  
250 250 the secondary database. With regards to residence, those in urban areas were more likely to  
251 251 be current smokers of manufactured cigarettes, and less likely to be current smokers of bidis  
252 252 than those in the rural areas in our study. Our observations with respect to education status  
253 253 revealed a notable reduction in the likelihood of cigarette smoking with increasing levels of  
254 254 education. In contrast, the education effect on bidi smoking, although existed, was not as  
255 255 prominent. However, the reduction in users of cigarettes was higher in each education

category than the bidis between the two GATS surveys. Although consumers in India perceive bidis to be an inferior product relative to cigarettes, there is still a possibility that cigarette smokers switch to bidi smoking when they cannot afford to buy cigarettes because of its high price.<sup>41,39</sup> Thus, the fact that current increases in the price of bidis do not seem to reduce the likelihood of bidis use by individuals has a potential to result in widening of health inequalities between the rich and the poor, the educated and uneducated, and rural versus urban populations. In addition, if cigarette smokers shift to bidi use as the cigarettes become more expensive, the change in smoking prevalence in the country will be negligible.<sup>39</sup>

In India, retail prices of tobacco products vary widely between states due to a number of reasons. For example, during the two GATS period, there was VAT system, where in central and state taxes were imposed separately. Transportation costs from producing states to consuming states may result in price differences across states for the same brand.<sup>42</sup> Income disparities between states also influence price variation, as well as affordability among tobacco products across the states.<sup>21</sup> The percentage changes in retail price on bidis and cigarettes between the two GATS periods varied widely between states. For example, the price of 25 sticks of bidis was Rs 4.60 in West Bengal and Rs 7.6 in Tamil Nadu states during 2009/10, but in 2016/17 this was Rs 8.40 and Rs 21.50 respectively. Similarly, the price of 10 sticks of cigarettes was Rs13.30 in Haryana state and Rs23.40 in Gujarat state during 2009/10, but in 2016/17 this was Rs 69.00 and Rs51.80 respectively.<sup>21</sup> In our study, these state-level and time period differences had a significant impact on the changes in current cigarette smoking but not for bidi smoking across states. Previous studies by Abdulkader et al and Subramanian et al on the tobacco consumption pattern in various regions in India also demonstrated that tobacco control activities vary across the regions and between different states, and this variation contributes to different patterns of change in prevalence of smoking.<sup>43,44</sup>

Our study used retail prices which do not account for inflation or income growth. This was due to lack of data to estimate affordability (i.e. the percentage of income required to buy specific units of bidis or cigarettes), which adjusts for the consumer's purchasing power, and is thereby considered an important indicator of the impact of tobacco-control fiscal policies.<sup>21</sup> Nevertheless, tobacco product retail prices are a major economic determinant of tobacco demand; and our study provides empirical evidence to underscore the fact that increasing prices without taking income growth into account might not lead to the desired effect of reduction in smoking prevalence.<sup>21,17</sup>

289 289 For the purpose of analysis, we defined and calculated a single standard unit price. In reality,  
290 290 however, there are a variety of products and brands available for both bidis and cigarettes  
291 291 with different sizes. It is possible that users of certain size or brand might be more sensitive to  
292 292 price change than those of the other and our analyses would have missed this difference. As  
293 293 our sample was drawn from GATS, it was naturally limited by the sample selection criteria of  
294 294 the survey. For instance, we might have missed migrant population due to the criterion of  
295 295 living in the address prior to the survey date. Since the GATS involves data of individuals  
296 296 above the age of 15 years, we could not draw any conclusion regarding those under 15 years  
297 297 old who might be more sensitive to price change. The data on our outcome of interest, current  
298 298 smoking status, was retrieved from an existing source of GATS where it is collected through  
299 299 self-report. There is a social desirability bias when self-reporting behaviours such as  
300 300 smoking, especially among females, which could lead to under-reporting and therefore  
301 301 estimation errors. Dual smokers of bidi and cigarettes were not considered for analysis  
302 302 because of differences in retail price of bidi and cigarettes. However, only ~1.4% of  
303 303 observations in our dataset were dual smokers of bidis and cigarettes. The interaction  
304 304 between the various background characteristics with the states could not be explored due to  
305 305 singularities in the model estimation. The CPI-IW database did not include data on retail  
306 306 prices of tobacco products from the following states which were therefore excluded from  
307 307 analysis: Jammu & Kashmir, Uttarakhand, Sikkim, Arunachal Pradesh, Nagaland, Manipur,  
308 308 Mizoram and Meghalaya. Cigarettes are sold in length that varies from 55 mm to 85 mm, but  
309 309 data in majority of states is only available for cigarettes of shorter than 69 mm length. We  
310 310 also did not include smokeless tobacco in our analysis. These limitations have an impact on  
311 311 the generalizability of our findings.

312 312 To the best of our knowledge, our study is the first to assess the association between the retail  
313 313 price of manufactured cigarettes and bidis and current smoking status in India, taking into  
314 314 account state-level variations to fit into India's national context. This study was conducted  
315 315 using large dataset from high-quality sources, which increases confidence in the validity of  
316 316 the results. The linking of two national representative surveys with the price of the tobacco  
317 317 products over the survey period, is to the best of our knowledge a novel approach. Future  
318 318 studies could explore the impact of the Goods and Services Tax (GST) implemented in 2017  
319 319 on the use of the different tobacco products; as well as the impact of retail prices on the use  
320 320 of smokeless tobacco products, which are the predominant type of tobacco products used in  
321 321 India. This would facilitate policy making and strengthening of tobacco control across all

322 322 tobacco products, which will result in improvements in the health of general population in  
323 323 India.

## 324 324 Conclusion

325 325 Our study suggests that current increase in the retail prices of smoked tobacco products in  
326 326 India seem to have an impact on manufactured cigarette use but not bidi use. This highlights  
327 327 the need for tobacco product tax increase that are sufficient to make all tobacco products less  
328 328 affordable and reduce their use. This is particularly so for bidis, which have remained more  
329 329 affordable at lower increments in tax as compared to cigarettes. In addition, eliminating the  
330 330 tax exemptions for small producers, which are often exploited by bidi producers, could  
331 331 reduce their affordability and use.

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**Table 1**

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**Table 1: General characteristics of study population**

	Bidi				Cigarettes			
	GATS1		GATS2		GATS1		GATS2	
	Overall frequency / Mean ± SD	Current bidi smokers: frequency (%) / Mean ± SD	Overall frequency / Mean ± SD	Current bidi smokers: frequency (%) / Mean ± SD	Overall frequency / Mean ± SD	Current cigarette smokers: frequency (%) / Mean ± SD	Overall frequency / Mean ± SD	Current cigarette smokers: frequency (%) / Mean ± SD
<b>Age</b>	38.8 ± 14.9	45.2 ± 13.8	39.0 ± 15.7	45.8 ± 14.4	38.7 ± 14.9	40.4 ± 12.7	38.9 ± 15.7	39.4 ± 13.6
<b>Residence</b>								
Rural	32585	3664 (11.2%)	37685	3681 (9.8%)	33903	1811 (5.3%)	39510	1111 (2.8%)
Urban	24427	1421 (5.8%)	22300	1014 (4.5%)	24832	1792 (7.2%)	22966	944 (4.1%)
<b>Gender</b>								
Female	29135	454 (1.6%)	32706	344 (1.1%)	30037	120 (0.4%)	34219	48 (0.1%)
Male	27877	4631 (16.6%)	27279	4351 (15.9%)	28698	3483 (12.1%)	28257	2007 (7.1%)
<b>Education</b>								
No formal schooling	15918	2019 (12.7%)	15713	1731 (11.0%)	16584	542 (3.3%)	16506	281 (1.7%)
Primary School completed	13410	1750 (13.0%)	13068	1588 (12.2%)	13712	931 (6.8%)	13442	494 (3.7%)
Secondary school completed	16162	999 (6.2%)	17613	1096 (6.2%)	16643	1210 (7.3%)	18453	785 (4.3%)
Higher Secondary School completed	4930	183 (3.7%)	6336	187 (3.0%)	5073	379 (7.5%)	6617	225 (3.4%)
College and above Completed	6458	105 (1.6%)	7220	91 (1.3%)	6589	538 (8.2%)	7046	269 (3.6%)
<b>Work status</b>								
Government Employee	2850	184 (6.5%)	2134	120 (5.6%)	2966	391 (13.2%)	2301	154 (6.7%)
Non - Government Employee	11085	1466 (13.2%)	17668	2329 (13.2%)	11164	1174 (10.5%)	17850	940 (5.3%)
Self – Employed	15728	2564 (16.3%)	10546	1535 (14.6%)	16151	1571 (9.7%)	10969	711 (6.5%)
Student	4151	16 (0.4%)	4485	11 (0.2%)	4388	99 (2.3%)	4774	49 (1.0%)

<b>Table 1</b>								
Home n	19994	390 (2.0%)	21540	268 (1.2%)	20702	140 (0.7%)	22848	65 (0.3%)
Retired	1033	135 (13.1%)	1387	136 (9.8%)	1051	97 (9.2%)	1436	53 (3.7%)
Unemployed	2100	322 (15.3%)	2204	295 (13.4%)	2201	129 (5.9%)	2274	83 (3.6%)
<b>Wealth quintile</b>								
Lower	13124	1771 (13.5%)	12194	1516 (12.4%)	13317	481 (3.6%)	12749	290 (2.3%)
Lower- middle	10638	1288 (12.1%)	13721	1494 (10.9%)	10882	596 (5.5%)	14085	446 (3.2%)
Middle	10687	1020 (9.5%)	10707	823 (7.7%)	11246	800 (7.1%)	11196	416 (3.7%)
Middle-upper	11433	701 (6.1%)	11478	593 (5.2%)	11803	867 (7.3%)	11990	448 (3.7%)
Upper	11130	305 (2.7%)	11885	269 (2.3%)	11487	859 (7.5%)	12456	455 (3.7%)
<b>Smoking allowed in every room</b>								
No	12543	1141 (9.1%)	11001	1265 (11.5%)	13073	1119 (8.6%)	12001	565 (4.7%)
Yes	11520	2445 (21.2%)	9226	1876 (20.3%)	12051	1046 (8.7%)	10058	533 (5.3%)

**Table 2**

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**Table 2: Association of socio-demographic and economic factors with current smoking status (Bidis and cigarettes) in the study population, including two waves of GATS, from univariate analysis.**

	Current Bidi smoking			Current Cigarettes smoking		
	N of current Smoker (%) / Mean ± SD	OR (95% CI)	P - value	N of current Smoker (%) / Mean ± SD	OR (95% CI)	P - value
<b>Age</b>	45.5 ± 14.1	1.03 (1.028-1.031)	<0.001	40.1 ± 13.1	1.01 (1.004-1.007)	<0.001
<b>Residence</b>						
Rural	7345 (10.5%)	1		2922 (4.0%)	1	
Urban	2435 (5.2%)	0.47 (0.45-0.49)	<0.001	2736 (5.7%)	1.41 (1.33-1.49)	<0.001
<b>Gender</b>						
Female	798 (1.3%)	1		168 (0.3%)	1	
Male	8982 (16.3%)	15.20 (14.12-16.36)	<0.001	5490 (9.6%)	40.12 (34.45-46.73)	<0.001
<b>Education</b>						
No formal schooling	3750 (11.9%)	9.38 (8.13,10.81)	<0.001	823 (2.5%)	0.41(0.37-0.45)	<0.001
Primary School completed	3338 (12.6%)	10.76 (9.32-12.41)	<0.001	1425 (5.2%)	0.88 (0.81-0.96)	0.005
Secondary school completed	2095 (6.2%)	4.82 (4.17-5.57)	<0.001	1995 (5.7%)	0.98(0.90-1.07)	0.632

**Table 2**

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Higher Secondary School completed	370 (3.3%)	2.32 (1.95-2.75)	<0.001	604 (5.2%)	0.92(0.82-1.02)	0.108
College and above Completed	196 (1.4%)	1		807 (5.8%)	1	
<b>Work status</b>						
Government Employee	304 (6.1%)	1		545 (10.3%)	1	
Non - Government Employee	3795 (13.2%)	2.74 (2.43-3.09)	<0.001	2114 (7.3%)	0.76 (0.69-0.84)	<0.001
Self – Employed	4099 (15.6%)	3.18 (2.82-3.59)	<0.001	2282 (8.4%)	0.78 (0.71-0.86)	<0.001
Student	27 (0.3%)	0.05 (0.03-0.07)	<0.001	148 (1.6%)	0.15 (0.12-0.18)	<0.001
Home maker	658 (1.6%)	0.25 (0.22-0.29)	<0.001	205 (0.5%)	0.04 (0.04-0.05)	<0.001
Retired	271 (11.2%)	2.22 (1.87-2.63)	<0.001	150 (6.0%)	0.61 (0.50-0.73)	<0.001
Unemployed	617 (14.3%)	2.91 (2.52-3.35)	<0.001	212 (4.7%)	0.45 (0.38-0.53)	<0.001
<b>Wealth quintile</b>						
Lower	3287 (13.0%)	6.23 (5.69-6.81)	<0.001	771 (3.0%)	0.51 (0.47-0.56)	<0.001
Lower- middle	2782 (11.4%)	5.79	<0.001	1042 (4.2%)	0.76	<0.001

**Table 2**

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		(5.28-6.35)			(0.70-0.83)	
Middle	1843 (8.6%)	4.15 (3.77-4.56)	<0.001	1216 (5.4%)	0.96 (0.89-1.04)	0.360
Middle-upper	1294 (5.6%)	2.50 (2.26-2.76)	<0.001	1315 (5.5%)	0.99 (0.92-1.07)	0.823
Upper	574 (2.5%)	1		1314 (5.5%)	1	
<b>Smoking allowed in every room</b>						
No	2406 (10.2%)	1		1684 (6.7%)	1	
Yes	4321 (20.8%)	2.28 (2.16-2.41)	<0.001	1579 (7.1%)	1.07 (1.00-1.15)	0.061
<b>Average retail Price of 25 sticks of bidis</b>	-	0.96 (0.95-0.97)	<b>&lt;0.001</b>			
<b>Average retail price of ten cigarettes</b>				-	0.94 (0.94-0.95)	<b>&lt;0.001</b>

**Table 2**

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**Table 3: Association of socio-demographic and economic factors with current smoking status (bidis and cigarettes) in the study population inclusive of two waves of GATS, from multivariate analysis.**

	Current bidi smoking		Current Cigarette smoking	
	Adjusted OR (95% CI)	P – value	Adjusted OR (95% CI)	P – value
<b>Age</b>	1.03 (1.024-1.028)	<0.001	0.999 (0.997-1.001)	0.332
<b>Residence</b>				
Rural	1		1	
Urban	0.83 (0.78-0.88)	<0.001	1.33 (1.25-1.41)	<0.001
<b>Gender</b>				
Female	1		1	
Male	17.70 (15.92-19.69)	<0.001	39.86 (32.48-48.93)	<0.001
<b>Education</b>				
No formal schooling	6.91 (5.87-8.13)	<0.001	0.94(0.83-1.06)	0.329
Primary School completed	5.51(4.70-6.47)	<0.001	1.12 (1.00-1.24)	0.048
Secondary school completed	3.21(2.74-3.76)	<0.001	1.22(1.11-1.34)	<0.001
Higher Secondary School completed	2.13(1.78-2.56)	<0.001	1.14(1.01-1.28)	0.029
College and above Completed	1		1	
<b>Work status</b>				
Government Employee	1		1	
Non - Government Employee	1.15(1.00-1.32)	0.047	0.90(0.80-1.00)	0.049
Self – Employed	1.02(0.89-1.18)	0.733	0.81(0.72-0.90)	0.0001
Student	0.08(0.05-0.12)	<0.001	0.20(0.17-0.25)	<0.001

**Table 3**[Download source file \(15.34 kB\)](#)

Home maker	0.75(0.63-0.90)	0.001	0.79(0.64-0.98)	0.029
Retired	0.61(0.50-0.74)	<0.001	0.53(0.44-0.65)	<0.001
Unemployed	0.75(0.64-0.89)	0.001	0.60(0.50-0.72)	<0.001
<b>Wealth quintile</b>				
Lower	1.85(1.65-2.07)	<0.001	0.41(0.36-0.46)	<0.001
Lower- middle	2.22 (1.99-2.48)	<0.001	0.60 (0.54-0.66)	<0.001
Middle	1.88(1.68-2.10)	<0.001	0.77(0.70-0.85)	<0.001
Middle-upper	1.53(1.37-1.71)	<0.001	0.87(0.80-0.95)	0.002
Upper	1		1	
<b>Smoking allowed in every room</b>				
No	1		1	
Yes	6.02(5.64-6.42)	<0.001	2.95(2.76-3.15)	<0.001
<b>Average retail Price of 25 sticks of bidis</b>	1.01 (1.00-1.02)	<b>0.082</b>	-	
<b>Average retail price of ten cigarettes</b>	-		0.925 (0.92-0.93)	<0.001

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**Tables**

Table 1 - [Download source file \(15.38 kB\)](#)

Table 1: General characteristics of study population

Table 2 - [Download source file \(16.44 kB\)](#)

Table 2: Association of socio-demographic and economic factors with current smoking status (Bidis and cigarettes) in the study population, including two waves of GATS, from univariate analysis.

Table 3 - [Download source file \(15.34 kB\)](#)

Table 3: Association of socio-demographic and economic factors with current smoking status (bidis and cigarettes) in the study population inclusive of two waves of GATS, from multivariate analysis.