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To cite this article: Monika Arora, Surbhi Shrivastava, Vijay Kumar Mishra & Manu Raj Mathur (2020) Use of Betel Quid in India from 2009 to 2017: An Epidemiological Analysis of the Global Adult Tobacco Survey (GATS), Substance Use & Misuse, 55:9, 1465-1471, DOI: [10.1080/10826084.2020.1726393](https://doi.org/10.1080/10826084.2020.1726393)

To link to this article: <https://doi.org/10.1080/10826084.2020.1726393>



Published online: 22 Jun 2020.



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Use of Betel Quid in India from 2009 to 2017: An Epidemiological Analysis of the Global Adult Tobacco Survey (GATS)

Monika Arora^{a,b}, Surbhi Shrivastava^b, Vijay Kumar Mishra^a, and Manu Raj Mathur^a

^aPublic Health Foundation of India, Gurugram, India; ^bHRIDAY, New Delhi, India

ABSTRACT

Background: Betel quid chewing is a deep-rooted practice in India and neighboring countries, which has migrated to other parts of the world. Betel leaf acts as a carrier for areca nut and most often, smokeless tobacco, both of which are carcinogenic, making betel quid a harmful product. **Objectives:** The first objective was to compare the prevalence of “use of betel quid with tobacco” from GATS-1 to GATS-2. The second was to study the association of “use of betel quid with and without tobacco” with different socio-economic groups (wealth quintiles) according to select background characteristics. **Methods:** This study used data from the Global Adult Tobacco Surveys (GATS), 2009–10 and 2016–17. Logistic regression with adjustment of co-variables (age, gender, residence and education) was used to study association of use of betel quid with different socio-economic groups. **Results:** Highest reduction (40 percent) was seen in “use of betel quid with tobacco” among male youth (15–24 years) over the two rounds of GATS. No change was seen in this form of use among females. The odds of “use of betel quid with tobacco” had a positive gradient with decreasing wealth quintiles. “Use of betel quid without tobacco” showed highest odds among participants with moderate levels of education. **Conclusion:** Health promotion interventions around harmful effects of “betel quid with and without tobacco” are needed for all genders from poorer populations with low education. Stress needs to be laid on universal population-level public health awareness campaigns about the carcinogenic properties of areca nut in betel quid.

KEYWORDS

Betel quid; smokeless tobacco; areca nut; epidemiology; India

Introduction

Betel quid chewing is an ancient practice dating back at least 2000 years in the Indian subcontinent (Reddy & Gupta, 2004) and many parts of Asia, and is still highly prevalent today (WHO International Agency for Research on Cancer, 2012). Today the term “betel quid” for most people is synonymous with “*pan*” or “*paan*,” a chewing product used in India and neighboring countries (like Pakistan, China and Taiwan), mainly comprising of betel leaf, areca nut, catechu, and slaked lime (WHO International Agency for Research on Cancer, 2012). The basic ingredients may be supplemented with condiments, sweetening agents, and particularly in India, betel quid is a predominant carrier of smokeless tobacco (SLT) as well.

Betel quid chewing is deeply rooted in the social customs, heritage, and diversity of India (Gupta, Arora, Sinha, Asma, & Parascandola, 2016), and about six percent (7.1 percent men and 4.5 percent women) of adults use betel quid with tobacco (Tata Institute of Social Sciences & Ministry of Health and Family Welfare Government of India, 2018). This corresponds to a significantly large number ($n = 54.1$ million), making it the fourth most commonly used tobacco product nationally. Furthermore, about 10–20 percent (600 million) of the world’s population chew areca nut (Gupta & Warnakulasuriya, 2002).

The use of areca nut in India has increased due to the presence of commercial versions, such as *supari* (small roasted and flavored pieces of areca nut); *gutka* (industrial mixture of areca nut with lime and tobacco); and *pan masala* (*gutka* without tobacco) (Gupta & Ray, 2004). Other SLT products with areca nut include *kharra*, *mainpuri*, *dohra* and *mawa* (Gupta et al., 2016). Since the habit is common among migrant populations in South Africa, the UK, North America, and Australia, the commercially available ingredients can be imported (Gupta & Ray, 2004). The global footprint of betel quid and areca nut use is also supported by legal export of the substances from the Indian subcontinent (Seair Exim Solutions, 2016). Areca nut is considered a highly profitable commercial plantation crop (Directorate of Arecanut and Spices Development, 2010) with an increase in the total production and area harvested for areca nut in India over the past years (Food and Agricultural Organization of the United Nations, 2018).

This expansive use of betel quid is a cause for concern because although betel leaf itself is not harmful, it acts as a carrier for areca nut and SLT, both of which are carcinogenic, making betel quid a harmful product (Gupta et al., 2016). Areca nut affects almost all organs of the human body, including the brain, heart, lungs, gastrointestinal tract

and reproductive organs (Garg, Chaturvedi, & Gupta, 2014). Moreover, India has one of the highest incidences of oral cancer and pre-cancerous conditions in the world.

However, this widespread national consumption of betel quid is not without differences in background characteristics of the users. While, previous literature has described the variations in the prevalence of SLT use according to background characteristics such as age, gender, wealth and area of residence (Bhan et al., 2012; Rani, Bonu, Jha, Nguyen, & Jamjoum, 2003), a national-level analysis of the difference in use of betel quid between different socio-economic groups as per select background characteristics has not been done.

Recognizing the importance of further epidemiological evidence on use of betel quid to guide its control through policy and programs in India, we have conducted a secondary data analysis of the two rounds of the Global Adult Tobacco Survey (GATS) in India, completed in 2009 (GATS-1) and 2016 (GATS-2) respectively. The first objective was to compare the prevalence of the “use of betel quid with tobacco” during the two waves of GATS India. The second objective was to study the association of use of betel quid (with and without tobacco) in different socio-economic groups (in wealth quintiles) according to select background characteristics namely age, gender, place of residence, and the highest level of education. The key outcome of the paper is to illustrate differences in use of betel quid across different socio-economic groups and their implications for future research and policy in India.

Methods

Study design, setting, and data

This study presents secondary data analysis on the two waves of the Global Adult Tobacco Survey India, GATS-1 in 2009–10 and GATS-2 in 2016–17, which have provided trend data and hence, the ability to evaluate progress in tobacco control. GATS-1 covered all existing 29 states and 2 Union Territories (UTs) at the time, and GATS-2 covered all existing 30 states and 2 UTs of India at the time. A multi-stage sample design was used for both rounds of GATS (Tata Institute of Social Sciences & Ministry of Health and Family Welfare Government of India, 2018). Nationally representative probability sampling was used to provide national and regional (North, Central, East, North-East, West, and South) estimates of tobacco use with its various dimensions (in GATS-1 and GATS-2) and of areca nut (in GATS-2) (International Institute for Population Sciences (IIPS), Ministry of Health and Family Welfare (MoHFW), & Government of India, 2010). From each of the sampled households, one household member, 15 years of age or older, was randomly selected for an individual interview. In the first round 69,296 individual interviews were completed with an overall response rate of 91.8 percent, of which 33,767 and 35,529 were males and females respectively. In the second round, a total of 74,037 individual interviews were completed with an overall response rate of 92.9 percent, of which 33,772 and 40,265 were males and females respectively. Further information on the GATS surveys is

available for open-access on the Global Tobacco Surveillance System (GTSS) website of the Centers for Disease Control and Prevention (CDC) (2015).

Measures

Independent variables

In order to assess the relationship of use of betel quid with age (in years), the latter was transformed from a continuous variable to a categorical variable with age groups of 15–24 years, 25–44 years, 45–64 years, and 65+ years, as per the categorisations provided in GATS (Tata Institute of Social Sciences & Ministry of Health and Family Welfare Government of India, 2018). Education was divided into four categories for the purpose of analysis, namely “no formal schooling,” “less than primary,” “primary but less than secondary,” and “secondary and above.”

Wealth quintile was taken to be the explanatory variable and the co-variables assessed were age, sex (male/female), residence (rural/urban), and highest level of education. Wealth quintiles were computed using the information from the list of household assets provided in the GATS data. Since not all assets were of equal value, inverse proportion weighting approach was applied, which uses the inverse of the proportion of households with an asset as a weight for the indicator, such that the higher weights are given to the least possessed assets (Rutstein & Johnson, 2004). This approach has been previously validated (Nazar, Lee, Arora, & Millett, 2016), and was used to compute a summary score from a list of 10 household assets that the participants possessed (ex. electricity, car, refrigerator, mobile phone, etc.). The summary score was then divided into five successive wealth quintiles, with the lowest quintile (Q1) as the poorest and the highest quintile (Q5) as the wealthiest. Since GATS-2 measured four household assets more than GATS-1, those assets were dropped while calculating the wealth quintiles to maintain uniformity in the analysis.

Outcome variable

The main outcome variable in the study was use of betel quid, categorized into “use of betel quid with tobacco on a daily basis,” and “use of betel quid without tobacco.” For GATS-1 and GATS-2, a dichotomous variable “use of betel quid with tobacco on a daily basis” was computed from the variable “on average, how many times a day do you use betel quid with tobacco.” For GATS-2, the existing variable “do you consume betel quid without tobacco” was used, after recoding it into a dichotomous variable. This variable was not recorded in GATS-1.

Statistical analysis

For both waves of GATS India, descriptive univariate statistical analysis was carried out for the percentage distribution of participants as per the various background characteristics in order to compare them. Bivariate analysis was conducted on GATS-1 and GATS-2 to calculate the prevalence of use of betel quid, with tobacco and without tobacco, by

Table 1. Percentage distribution of participants by background characteristics (%), GATS* India 2009–10 & 2016–17.

	GATS 1 (N=69,296) n (%)	GATS 2 (N=74,037) n (%)
Age group		
15–24 years	13,463 (19.4)	12,105 (16.3)
24–44 years	35,020 (50.5)	36,065 (48.7)
45–64 years	16,123 (23.3)	19,627 (26.5)
65+ years	4,690 (6.8)	6,240 (8.4)
Gender		
Male	33,767 (48.7)	33,772 (45.6)
Female	35,529 (51.3)	40,265 (54.4)
Residence		
Urban	27,471 (39.6)	26,488 (35.8)
Rural	41,825 (60.4)	47,549 (64.2)
Education		
No formal schooling	18,805 (27.1)	18,473 (25.0)
Less than primary	7,992 (11.6)	7,510 (10.2)
Primary but less than secondary	19,547 (28.3)	20,967 (28.3)
Secondary and above	22,812 (33.0)	27,028 (36.5)
Wealth Quintile		
Q1 (poorest)	15,048 (21.7)	19,989 (27.0)
Q2	12,790 (18.5)	12,979 (17.5)
Q3	13,812 (19.9)	13,796 (18.6)
Q4	14,101 (20.3)	12,981 (17.5)
Q5 (most affluent)	13,545 (19.5)	14,292 (19.3)

*Global Adult Tobacco Survey (GATS) is a nationally representative survey, using a consistent and standard protocol across countries including India. GATS enhances countries' capacity to design, implement and evaluate tobacco control programs (MoHFW Government of India, WHO, U.S. Centers for Disease Control and Prevention, & Tata Institute of Social Sciences, 2018).

background characteristics. The results of the bivariate analysis on “use of betel quid with tobacco” were compared between GATS-1 and GATS-2. To compare the difference, we have calculated absolute change and relative change. However, in the case of “use of betel quid without tobacco,” the variable was absent in GATS-1 and only recorded in GATS-2. Therefore, it was not compared between the two surveys.

Logistic regression was carried out using GATS-2 data to calculate the odds ratio (OR) and confidence intervals (CIs) of the dichotomous variables “use of betel quid with tobacco on a daily basis” and “use of betel quid without tobacco” with the background variables. All analyses were undertaken in SPSS (version-22).

Results

Descriptive statistics

Table 1 shows the percentage distribution of participants from GATS-1 and GATS-2 as per select background characteristics. Table 2 shows the prevalence of “use of betel quid with tobacco on a daily basis” in GATS-1 and GATS-2, as per the background characteristics. Table 2 also compares the absolute and relative change in the prevalence of “use of betel quid with tobacco on a daily basis” between the two rounds of GATS.

Overall, participants reporting “use of betel quid with tobacco on a daily basis” have decreased from 5.3 percent to 4.5 percent from 2009 to 2017. The reduction in the prevalence of “use of betel quid with tobacco on a daily basis” from 2009 to 2017 was highest (40 percent) among the youngest age group of 15–24 years. There was around 29 percent decline in males using this form of betel quid but no change was seen in females. People from rural areas revealed a substantial decrease (14 percent), whereas the

decline in urban areas was not the same. There is a discernible difference in change in betel quid with tobacco use between respondents at different levels of education. People with less than primary schooling showed the lowest decline (5.1 percent) and those with secondary and above education showed the highest decline (21 percent). Looking at the change in terms of wealth quintiles, no change was observed in the lowest wealth quintile, and the highest reduction (29.2 percent) was seen in the most affluent quintile.

Table 3 shows the results of the bivariate analysis of “use of betel quid without tobacco” with the background characteristics in GATS-2. This type of use of betel quid was highest among the age group 24–44 years (11.3 percent), among rural residents (11.1 percent) and among people with “less than primary” level of education (13.5 percent). 802 participants from GATS-2 were dual users, i.e. they used betel quid with tobacco on a daily basis and also used betel quid without tobacco.

Regression analysis

Logistic regression analyses were conducted on GATS-2 data for both types of use of betel quid (with tobacco and without tobacco) and wealth quintiles (lowest Q1, highest Q5). First unadjusted analysis was done to obtain the odds ratio and CI for both types of use betel quid. Subsequently, the models were adjusted for each of the background characteristics. The last model was adjusted for all co-variates, i.e. age, gender, place of residence, and highest level of education.

Table 4 shows the results of the regression analysis for “use of betel quid with tobacco on a daily basis” and wealth quintiles, with the highest quintile (Q5) as the reference category. The unadjusted model shows a clear positive gradient in use of betel quid as we move down the wealth quintiles. People in the lowest quintile (Q1) are 4.37 times

Table 2. Prevalence of use of betel quid with tobacco in India by background characteristics, GATS* India 2009–10 & 2016–17.

Background Characteristics	Use of betel quid with tobacco on a daily basis (%)			
	GATS 1 (%)	GATS 2 (%)	Absolute change	Relative change (%)
Age group				
15–24	2.0	1.2	–0.8	–40.0
24–44	5.3	4.5	–0.8	–15.1
45–64	7.1	6.0	–1.1	–15.5
65+	8.8	6.4	–2.4	–27.3
Gender				
Male	5.6	4.0	–1.6	–28.6
Female	5.0	5.0	0.0	0.0
Residence				
Urban	3.8	3.0	–0.8	–21.1
Rural	6.3	5.4	–0.9	–14.3
Education				
No formal schooling	6.8	6.4	–0.4	–5.9
Less than primary	7.8	7.4	–0.4	–5.1
Primary but less than secondary	5.5	4.7	–0.8	–14.5
Secondary and above	2.9	2.3	–0.6	–20.7
Wealth Quintile				
Q1 (poorest)	6.8	6.8	0.0	0.0
Q2	7.3	5.5	–1.8	–24.7
Q3	5.4	4.4	–1.0	–18.5
Q4	4.3	3.2	–1.1	–25.6
Q5 (most affluent)	2.4	1.7	–0.7	–29.2
Overall (India)	5.3 (n = 3661)	4.5 (n = 3338)	–0.8	–15.1

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Table 3. Prevalence of use of betel quid without tobacco in India by background characteristics, GATS* India 2016–17.

Background Characteristics	Use of betel quid without tobacco (%)
Age group	
15–24	8.7
24–44	11.3
45–64	11.0
65+	9.1
Gender	
Male	10.7
Female	10.5
Residence	
Urban	9.8
Rural	11.1
Education	
No formal schooling	9.6
Less than primary	13.5
Primary but less than secondary	12.1
Secondary and above	9.3
Wealth Quintile	
Q1 (poorest)	11.7
Q2	12.1
Q3	10.2
Q4	9.8
Q5 (most affluent)	8.9
Overall (India)	10.6 (n = 7852)

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(CI: 3.80–5.02) and those in Q2 are 3.47 times (CI: 2.99–4.03) more likely to consume betel quid with tobacco than those in Q5. Adjustment for co-variables also shows the same positive gradient in use of betel quid as we go down the wealth quintiles. Adjusting for age and gender showed a significant increase in the odds of consumption among people in all the wealth quintiles. Whereas, adjusting for residence and education showed a significant decrease in the likelihood of

consumption among all the wealth quintiles. A considerable and significant reduction in the OR from the unadjusted model is seen when adjusting for all co-variables in model 6. OR has decreased the most for the lowest wealth quintile Q1 (OR: 3.50, CI: 2.99–4.09), followed by Q2 (OR: 2.91, CI: 2.48–3.41), Q3 (OR: 2.40, CI: 2.05–2.82) and Q4 (OR: 1.80, CI: 1.53–2.12).

The results of the regression analysis on “use of betel quid without tobacco” and wealth quintiles are summarized in Table 5. We have excluded gender ($p=0.33$, CI, 0.98–1.07) from the model based on logistic regression as it showed no association with “use of betel quid without tobacco.” In contrast to the previous unadjusted model, Model 1 in this type of consumption does not show a linear progression as we move down in the wealth quintiles. The highest likelihood of use of betel quid without tobacco is among Q2 (OR: 1.41, CI: 1.30–1.52), followed by Q1 (OR: 1.35, CI: 1.26–1.46). The higher quintiles show much lower odds of use, as seen in Q3 (OR: 1.17, CI: 1.08–1.27) and Q4 (OR: 1.12, CI: 1.03–1.21). After adjusting for age, no change is observed in the OR for Q3 and Q4 but a marginal increase is seen in Q1 (OR: 1.36, CI: 1.27–1.47) and Q2 (OR: 1.42, CI: 1.31–1.45). Adjusting for residence, a significant decrease in the OR is observed among all the wealth quintiles. Adjusting for education shows a significant decline in OR only in Q1, Q2, and Q3. Similarly, model 5 with adjusting for all co-variables showed a significant decrease in OR for Q1, Q2 and Q3, but the higher quintile Q4 did not show any significant change.

Discussion

The data available from GATS India provides an overview of use of betel quid in India and an opportunity to study

Table 4. Odds ratio (OR) and their 95% CI estimated from logistic regression for “use of betel quid with tobacco on a daily basis” and wealth quintiles, GATS* 2 India (2016–17).

	Wealth Quintile (OR [95% CI])				
	Q1 (poorest)	Q2	Q3	Q4	Q5 [®] (most affluent)
Model 1 (Unadjusted)	4.37** [3.80–5.02]	3.47** [2.99–4.03]	2.73** [2.34–3.18]	1.96** [1.67–2.31]	1.00
Model 2 (Adjusted for Age)	4.63** [4.03–5.33]	3.67** [3.16–4.27]	2.92** [2.50–3.40]	2.05** [1.74–2.41]	1.00
Model 3 (Adjusted for Gender)	4.40** [3.83–5.06]	3.51** [3.03–4.08]	2.76** [2.37–3.21]	1.97** [1.67–2.31]	1.00
Model 4 (Adjusted for Residence)	3.82** [3.30–4.43]	3.15** [2.70–3.67]	2.50** [2.14–2.92]	1.86** [1.58–2.19]	1.00
Model 5 (Adjusted for Education)	3.22** [2.78–3.73]	2.78** [2.39–3.25]	2.34** [2.00–2.73]	1.79** [1.52–2.11]	1.00
Model 6 (Adjusted for All Co-variates)	3.50** [2.99–4.09]	2.91** [2.48–3.41]	2.40** [2.05–2.82]	1.80** [1.53–2.12]	1.00

Note: CI-Confidence interval; * $p < 0.05$, ** $p < 0.01$; [®] = Reference category.

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Table 5. Odds ratio (OR) and their 95% CI estimated from logistic regression for “use of betel quid without tobacco” and wealth quintiles, GATS* 2 India (2016–17).

	Wealth Quintile (OR [95% CI])				
	Q1 (poorest)	Q2	Q3	Q4	Q5 [®] (most affluent)
Model 1 (Unadjusted)	1.35** [1.26–1.46]	1.41** [1.30–1.52]	1.17** [1.08–1.27]	1.12** [1.03–1.21]	1.00
Model 2 (Adjusted for Age)	1.36** [1.27–1.47]	1.42** [1.31–1.54]	1.17** [1.08–1.27]	1.12** [1.03–1.21]	1.00
Model 3 (Adjusted for Residence)	1.32** [1.22–1.42]	1.38** [1.27–1.50]	1.15** [1.06–1.25]	1.10* [1.02–1.20]	1.00
Model 4 (Adjusted for Education)	1.31** [1.21–1.42]	1.34** [1.23–1.45]	1.12** [1.03–1.21]	1.08 [0.99–1.17]	1.00
Model 5 (Adjusted for All Co-variates)	1.31** [1.21–1.43]	1.34** [1.23–1.46]	1.11** [1.02–1.21]	1.08 [0.99–1.17]	1.00

Note: CI-Confidence interval; * $p < 0.05$, ** $p < 0.01$; [®] = Reference category.

*Global Adult Tobacco Survey (GATS) is a nationally representative survey, using a consistent and standard protocol across countries including India. GATS enhances countries' capacity to design, implement and evaluate tobacco control programs (MoHFW Government of India, WHO, U.S. Centers for Disease Control and Prevention, & Tata Institute of Social Sciences, 2018)..

the determinants of its use. There is a global consensus with strong supporting evidence that behaviors are not randomly distributed in the population and that varied factors determine their occurrence, known as the “Causes of the Causes” or “Social Determinants of Health”(Gupta et al., 2016). Understanding the differences in the association of select background characteristics with use of betel quid has important health implications. This study comprehensively analyses five factors associated with use of betel quid in India, namely, age, gender, residence, level of education and wealth quintile. It is unique in its analysis of these socio-economic and demographic characteristics. Though tobacco control laws impact tobacco use behavior, use of betel quid remains unattended by policy interventions.

From the analysis of the GATS data, it is clear that adults belonging to the poorest wealth quintile have a 3.5 times higher odds of being a daily user of betel quid with tobacco in comparison to adults from the wealthiest quintile (OR 3.50; CI: 2.99–4.09). Comparing this with findings on tobacco use, being poor has been found to be significantly associated with SLT use in another study (Singh & Ladusingh, 2014). A study by Bhan et al. (2012) has shown a higher absolute prevalence of tobacco use among people with lower wealth (Bhan et al., 2012). Where the findings of

this study differ from tobacco use literature is the significant decline observed in prevalence of use of betel quid with tobacco in rural areas, as opposed to urban areas where no significant decline was found. Age has been found to be an important determinant in other studies on SLT as well (Rani et al., 2003; Reddy & Gupta, 2004; Singh & Ladusingh, 2014). With an increase in age, the likelihood of using tobacco significantly increases in India, as observed with the “use of betel quid with tobacco” in our analysis. With respect to “use of betel quid without tobacco,” this study did not find any pattern with increase in age.

There is difference in use of betel quid with tobacco as per the place of residence and level of education. People from rural areas and those with lower levels of schooling were more likely to consume this form of SLT. This is similar to previous research, where education was found to be one of the most important determinants of tobacco use, irrespective of the form (Singh & Ladusingh, 2014). However, marginal difference was observed among males and females for use of betel quid with tobacco, which is unlike use of smoked tobacco where prevalence among males is higher than in females (Singh & Ladusingh, 2014). Previous literature has found SLT use to be almost equally high for both genders (Rani et al., 2003; Singh & Ladusingh, 2014), as

underscored in this study on betel quid with tobacco as well. However, a disaggregated analysis of SLT use has shown that there is less difference in prevalence between genders for “use of betel quid with tobacco” (male = 7.1 percent, female = 4.5 percent) than for *khaini* (male = 17.9 percent, female = 4.2 percent) and *gutka* (male = 10.8 percent, female = 2.7 percent) (Tata Institute of Social Sciences & Ministry of Health and Family Welfare Government of India, 2018).

Similar to betel quid with tobacco, betel quid without tobacco is also more prevalent in rural populations. But a slightly different picture emerges from the analysis of betel quid without tobacco as per other background characteristics. Due to its culturally-accepted nature, this type of use of betel quid chewing is almost equally prevalent among all age groups and genders. Unlike betel quid with SLT use where a positive gradient is observed with decreasing levels of education and wealth (Bhan et al., 2012; Singh & Ladusingh, 2014), this form is more common among people with moderate levels of education and does not show a linear gradient along the wealth quintiles. This implies that where education has been shown to be protective in tobacco use, the same has not been seen with betel quid use without tobacco, consisting of areca nut.

One of the strengths of the present study is that it is an attempt to understand the extent to which differences exist in the social determinants of use of betel quid in India. To the best of our knowledge, a similar study has not been conducted for this substance in this context before. Moreover, the study analyzed a nationally representative sample from GATS India data which allowed robust analyses. This also helped in undertaking a comparison between the prevalence of use of betel quid with tobacco on a daily basis, as measured in GATS-1 and GATS-2. The limitations include that the GATS provides data from repeated cross-sectional surveys, so it does not allow longitudinal analysis of the use of betel quid over a period of time as it does not track the same sample. Second, since the GATS is self-reported, the possibility of recall bias cannot be ruled out. Third, the variable “use of betel quid without tobacco” was only recorded in GATS-2, and thus does not allow comparison of results for this variable between the two rounds.

The research implications of the study include the need for implementation of programs aimed at reducing use of betel quid. Future surveillance on betel quid with tobacco use should focus more on the vulnerable poor with lower levels of education in rural areas. Research on betel quid without tobacco use should study the awareness of carcinogenic health effects of areca nut among educated people of all age groups, as this study found that people with moderate levels of education consumed it the most. This has global implications as well, since the product is available and consumed in nearly ten regions of the world (WHO International Agency for Research on Cancer, 2012).

The results of this study have many implications for policy as unlike tobacco, for which the WHO Framework Convention on Tobacco Control (FCTC) provides evidence-based measures for reducing use, no global or national

policy exists for the control of betel quid and areca nut use at the national or global level (Mehrtash et al., 2017). The clear positive gradient in “use of betel quid with tobacco on a daily basis” with decreasing levels of education and wealth is an indicator that knowledge and access to information play a significant role in reducing consumption in the population. In contrast, for use of betel quid without tobacco, people with moderate levels of education showed a higher prevalence, pointing toward the lack of awareness about the negative health effects of areca nut in betel quid, such as mucosal changes, pre-neoplastic lesions and development of oral submucous fibrosis attributable to use of betel quid (Gupta & Ray, 2004). Initiation of these awareness campaigns for school-going adolescents and for the general population would aid achievement of Sustainable Development Goal (SDG) 3 (good health and well-being) (United Nations Development Programme, 2019). Therefore, health promotion messaging directed toward use of betel quid, in both SLT form and without tobacco, is needed to prevent this habit from prevailing.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by no specific funding source.

Ethics approval

This study is a secondary analysis of open-source datasets.

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