**Title:** **The predictors of cigarette smoking, smokeless tobacco consumption and use of both forms** **in adolescents in South Asia: a secondary analysis of the Global Youth Tobacco Surveys (GYTS)**

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**Abstract**

Background: Tobacco uptake in adolescents is associated with a range of predictors. We examined the predictors of cigarette smoking, smokeless tobacco (ST) consumption and use of both ST and cigarettes among adolescents in four South Asian countries.

Methods: We analysed the Global Youth Tobacco Surveys (GYTS) data for Bangladesh (2013), India (2009), Pakistan (2013), and Sri-Lanka (2015), using multinomial regression to examine associations between several predictors and tobacco use.

Results: Data from 23,681 adolescents were analyzed. Overall, 82.8% of the study population were between 13 and 15 years and 52.7% were girls, 2% were cigarette smokers, 6.5% were ST users and 1.1% used both ST and cigarettes, in the past 30-days. Exposure to smoking in public places was associated with past 30-days smoking (RRR 5.59, 95%CI 4.28-7.28), ST use (RRR 2.07, 95%CI 1.84-2.32) and use of both ST and cigarettes (RRR 11.42, 95%CI 7.44-17.54). Exposure to tobacco use in electronic media and being offered free tobacco products were associated with all forms of tobacco use. Shopkeepers’ refusal to sell cigarettes protected adolescents from smoking (RRR 0.47, 95%CI 0.36-0.63) and ST use (RRR 0.65, 95%CI 0.45-0.95). However, exposure to anti-tobacco mass media messages was not protective for any form of tobacco use. Adolescents taught at school about harmful effects of tobacco were less likely to use ST; no evidence of this association was observed for smoking.

Conclusion: The associations between tobacco use and pro-tobacco factors were strong but the associations with anti-tobacco factors lacked strength and consistency in this study population.

What the study adds:

The predictors of adolescents using different tobacco products, crucial to inform and evaluate tobacco control efforts, are poorly understood. We investigated associations between several environmental level factors and cigarette smoking, ST consumption and use of both forms among adolescents; where most of the previous studies focused on individual level factors. Our study found strong associations between tobacco use and pro- tobacco factors and lack of strength and consistency in associations between anti-tobacco factors and tobacco use in the study population. Our results indicate that the current tobacco control policies need strengthening to curb the tobacco epidemic in these countries.

**INTRODUCTION**

Tobacco use among youth is a global public health challenge.1 In 2016, an estimated 13.6% adolescents aged 12-15 years were current tobacco users in 68 low- and middle-income countries (LMICs).2 Most smokers start smoking in adolescence 1; and among those adolescents who experiment with smoking, between one-third and one-half become regular smokers.3 In fact, youth are highly vulnerable to tobacco industry marketing4,5 and hence targeted.6 Tobacco use is common among adolescents in South Asia.7 The prevalence of current tobacco use in 13-15 year olds in Bangladesh, India, Pakistan and Sri Lanka is 9.2, 14.6, 10.7 and 3.7%, respectively.8 Smokeless tobacco (ST) use is a particular concern9 with its prevalence being 4.5, 9.0, 5.3 and 2.4% in the four afore-mentioned countries, respectively.8

The high prevalence of adolescent tobacco use in South Asia can be attributed to several factors. Tobacco products are diverse and encompass smoking and smokeless forms.10 In contrast, tobacco control regulations are considerably weak.11 Cultural acceptability, high level of addictiveness12, easy accessibility, low cost13, and lack of prohibitive legislation and limited awareness of health effects are the main factors encouraging ST use in the South Asian population.14

Tobacco uptake among youth is influenced by several anti- and pro- tobacco factors. There is sufficient evidence on the predictors of smoking among youth, primarily in high-income countries (HIC); these include socio-demographic, personal/psychological, social and environmental factors.15 Pro-tobacco marketing16 and exposure to cigarette advertising and promotion17 increase tobacco use among adolescents; these include direct-to-consumer strategies like receiving mail from tobacco companies and pop-ups while browsing Internet.18 Moreover, exposure to smoking in public places and mass media (pro-tobacco depictions in films, television and videos) are considered to increase the risk for smoking uptake in youth.16,19 On the other hand, factors such as bans on tobacco point-of-sale display and mass media campaigns are considered protective.20,21 The evidence on the effectiveness of school-based educational programmes in preventing smoking uptake is mixed.22 Only a handful of studies from South Asia have so far identified anti- and pro- tobacco factors (for instance, age, gender, family and peer influence, exposure to smoking at home and public places, availability of tobacco products, teaching of smoking hazards in schools) influencing uptake of smoking23,24, ST consumption25 and tobacco use in general 26,27 among youth.

The evidence supporting the World Health Organization (WHO) - Framework Convention on Tobacco Control (FCTC), while applicable to all forms of tobacco, is mostly derived from research conducted on smoking and mainly from HIC. Given that, country level policies formulated on the grounds of such evidence may have limited transferability to low income settings, particularly where ST and use of both tobacco products is a major problem. A detailed analysis of the predictors of tobacco use behaviour (smoking, ST and use of both ST and cigarettes) is particularly important to inform tobacco control policies. Most of the previous studies in South Asia focused on individual-level knowledge and attitudes and  family and peer influences on smoking or on tobacco use, in general. Very limited studies have investigated predictors of cigarette smoking, ST consumption and use of both ST and cigarettes as separate behaviours among adolescents and considered wider environmental predictors.

Our study aims to test the associations between several pro- and anti-tobacco predictors and smoking, ST consumption and concurrent use of both forms among adolescents. We hypothesized that the anti-tobacco factors (refused to purchase cigarettes due to age restrictions, exposure to anti-tobacco mass media messages, exposure to anti-tobacco messages at community events, and taught in class about the dangers of tobacco use, health warning on cigarette pack’ would be negatively associated with tobacco use, whilst pro-tobacco factors (exposed to tobacco use in electronic media, offered free tobacco products, and exposure to cigarettes at any public places, advertisement at point of sell, exposure at school premises) would be positively associated with tobacco use (Supplementary Figure 1).

**METHODS**

We conducted a secondary analysis of the Global Youth Tobacco Surveys (GYTS) datasets for Bangladesh (2013), India (2009), Pakistan (2013), and Sri-Lanka (2015), accessible freely from the US Centre for Disease Control and Prevention (CDC) website.28 GYTS is a cross sectional survey, designed by the WHO and CDC for measuring tobacco prevalence in school going children (aged between 11 to 19 years), conducted in 151 countries.29 GYTS is a school-based survey that employed a two-stage cluster sampling design. GYTS questionnaires were paper-based bubble sheets that were self-administered in classrooms and anonymised to ensure confidentiality. Survey methods and procedures are detailed elsewhere.30–33

Obtaining the analytical sample

A total of 3,245 students from Bangladesh, 11,768 from India34, 8,723 from Pakistan and 1,505 from Sri Lanka took part in GYTS. Data for 24 students from India, 47 from Pakistan and 2 from Sri Lanka were dropped from the analyses due to missing outcome and these were not different from the rest of the study participants. The total number of students surveyed with response rates and numbers analysed were presented in Figure 1.

The GYTS questionnaire included the following topics: tobacco use (smoking and ST), cessation, second-hand smoke (SHS), pro- and anti-tobacco media messages and advertising, access to and availability of tobacco products, and knowledge and attitudes towards tobacco. The following variables were available for the four countries and were used in the analysis.

The outcome variable was derived from ‘any cigarette smoking and/or ST use in the past 30 days’. To obtain this variable, the responses to the following questions were merged, “During the past 30 days, on how many days did you smoke cigarettes?” and “During the past 30 days, on how many days did you use smokeless tobacco?” The response options for these questions were: 0 days, 1 or 2 days, 3-5 days, 6-9 days, 10-19 days, 20-29 day or all 30 days (with only exception for ST use in Pakistan- “During the past 30 days, did you use any form of smokeless tobacco products?”). The response options were dichotomized for the respective questions into no use (0 days) and any use (> 1 day), before merging the questions. The derived outcome variable after merging the smoking and ST questions had four categories: i). neither smoked cigarette nor used any ST in the past 30-days, ii). exclusive cigarette smoking in the past 30-days, iii). exclusive ST use in the past 30-days, and iv).Use of both ST and cigarettes in the past 30-day.

Explanatory variables were hypothesised as anti-tobacco and pro-tobacco, as follows.

Anti-tobacco variables: i). ‘refused to purchase cigarettes due to age restrictions’ (Question in survey: “During the past 30 days, did anyone refuse to sell you cigarettes because of your age?” with response options: I did not try to buy; yes, someone refused to sell me cigarettes because of my age; and no, my age did not keep me from buying cigarettes). ii). ‘exposure to anti-tobacco mass media messages’ (Question in survey: “During the past 30 days, did you see or hear any anti- tobacco media messages on TV, radio, internet, billboards, posters, newspapers, magazines or movies?” with response options: yes and no). iii). ‘exposure to anti-tobacco messages at community events’ (Question in survey: “During the past 30 days, did you see or hear any anti- tobacco media messages at sports events, fairs, concerts, or community events, or social gatherings?” with response options: did not go to sports events, fairs, concerts, or community events, or social gatherings in the past 30 days; yes; and no). iv). ‘taught in class about the dangers of tobacco use’ (Question in survey: “During the past 12 months, were you taught in any of your classes about the dangers of tobacco use?” with response options: yes, no and don’t know).

Pro-tobacco variables: i). ‘exposed to tobacco use in electronic media’ (Question in survey: “During the past 30 days, did you see any people using tobacco when you watched TV, videos, or movies?” with response options: did not watch TV, videos, or movies in the past 30 days; yes and no). ii). ‘offered free tobacco products’ (Question in survey: “Has a person working for a tobacco company ever offered you a free tobacco product?” with response options: yes and no. iii). ‘exposure to cigarettes at any public places’ was used for analysis. We derived this variable from the following two questions: “During the past 7 days, on how many days has anyone smoked in your presence, inside any enclosed public place, other than your home?”; and “During the past 7 days, on how many days has anyone smoked in your presence, at any outdoor public places?”. The response options for both questions were: 0 days, 1-2 days, 3-4 days, 5-6 days, or 7 days. These two variables were merged to create the new variable ‘any exposure in public places’, which was defined as no exposure if the response was 0 days for both original variables otherwise they were considered to be exposed.

Sociodemographic variables: age (“How old are you?” with response options, 11 years old or younger, 12, 13, 14, 15, 16, 17 years old or older), sex (“What is your sex?” with response options, male and female) and country were considered as confounding factors. GYTS data does not provide any socio-economic information.

Three additional factors available for all countries except India were used in an additional analysis. i). ‘health warning on cigarette pack’: (Question in survey: “During the past 30 days, did you see any health warning on cigarette Packages?” With response options: yes, I didn’t think much of them; yes, it led me to think about quitting smoking or not starting smoking; no). ii). ‘seen any advertisements or promotions for tobacco products at points of sale’ (Question in survey: “During the past 30 days, did you see any advertisements or promotions for tobacco products at points of sale [stores, shops, street vendor])?” with response options: did not visit any points of sale in the past 30 days; yes and no). iii). ‘exposure to cigarette at school premises’ (Question in survey: “During the past 30 days, did you see anyone smoke inside the school building or outside on school property? with response options: yes and no).

**Statistical analysis**

Absolute and relative frequencies were provided for demographic variables (country, age, sex) and for the distribution of anti- and pro-tobacco predictors by the type of tobacco used. Pearson’s Chi-square tests were used to detect bivariate associations between the covariates (age, sex, country, anti- and pro-tobacco predictors) and tobacco use. Outcome ‘past 30 days any tobacco use’ was analysed using multinomial logistic regression (with ‘neither smoked cigarette nor used any ST in past 30 days’ as the reference category), adjusted for explanatory variables: refused purchase of cigarettes due to age restrictions, anti-tobacco media messages on mass media, anti-tobacco messages on community events, and taught in class about the dangers of tobacco use, cigarettes smoking exposure, offered free tobacco products, watching people using tobacco in TV and likely confounders: age, sex and country. The relative risk ratio (RRR) and 95% confidence intervals (CI) were reported.

Additional analysis was run for the combined data of Bangladesh, Pakistan and Sri-Lanka controlling for the following additional variables: health warning on pack, advertisements at points of sale and exposure to cigarettes at school premises. The results of the additional analysis were compared to those of the primary model excluding India.

All analyses were performed using STATA (version 16).35 Statistical significance level was set at 0.05 a priori. We did not account for the survey design as we were interested in the associations only and not nationally representative estimates. As the proportion of missing data on our variables of interest was low (<10%), all statistical analyses were conducted on complete cases only.

**RESULTS**

Data from a sample of 23,681 adolescents collected between 2009 and 2015 were analyzed. Overall, 13.1% of the total sample were from Bangladesh, 47.8% from India, 32.9% from Pakistan and 6.3% from Sri-Lanka. Overall, 82.8% of the study population were between 13 and 15 years and 52.7% were girls. Country wise, the highest percentage of exclusive smoking in the past 30-day was reported in India (2.4%), followed by Pakistan (1.8%), Bangladesh (1.3%) and SriLanka (0.7%). On the other hand, the highest percentage of exclusive ST use in the past 30-day was reported in SriLanka (27.2%), followed by India (6.1%), Pakistan (4.1%) and Bangladesh (3.6%) (Supplementary Table 1). Exposure to pro- and anti-tobacco factors by countries are presented in Supplementary Tables 2, 3 and 4.

The overall self-reported use of any tobacco (in the past 30-days) in our sample (smoking, ST or both) was 9.5% (exclusive smoking 2.0%, exclusive ST use 6.4%, and use of both ST and cigarettes in the past 30-day 1.1%) (Table 1). Tobacco use was more common in males (54.1%) than in females (45.9%). Among anti-tobacco factors, 4.4% participants in our sample were refused purchase of cigarettes by the sellers due to age restrictions. Fifty-nine percent reported being taught in class about dangers of tobacco, while 70.1% and 34.9% reported being exposed to anti-tobacco messages via mass media and at community events, respectively. Among pro-tobacco factors, highest reported exposure was for tobacco use in electronic media (64.1%), followed by cigarette smoking in public places (42.4%), and offers of free tobacco products (9.5%) (Table 1).

The results of adjusted multinomial regression on the associations between anti- and pro-tobacco factors with tobacco use showed that those who were refused purchase of cigarettes due to age restrictions were less likely to be smokers (RRR 0.47, 95% CI 0.36-0.63) or ST users (RRR 0.65, 95% CI 0.45-0.95), compared to those who were not refused at the point of sale. However, this association was not observed among users of both ST and cigarettes in the past 30-days. No associations were observed between exposure to anti-tobacco messages in the mass media and any form of tobacco use. Those exposed to anti-tobacco messages at community events were more likely to be exclusive smokers (RRR 1.59, 95% CI 1.15-2.20), exclusive ST users (RRR 1.80, 95% CI 1.54-2.11), or using both forms (RRR 2.20, 95% CI 1.41-3.44) compared to those not exposed.Those who were taught about tobacco-related harms in schools were less likely to be ST users (RRR 0.64, 95% CI 0.56-0.76) than those who were not taught; however, no association was observed with smoking or use of both ST and cigarettes (Table 2).

Among pro-tobacco predictors, tobacco use in electronic media, offer of free tobacco products and exposure to smoking at public places increased the risk of all forms of tobacco use. Those exposed to tobacco use in electronic media were twice as likely to be exclusive smoker (RRR 2.14, 95% CI 1.39-3.31), 1.62 times to be ST user (RRR 1.62, 95% CI 1.33-1.96), and 2.62 times to be users of both forms (RRR 2.62, 95% CI 1.31-5.26) than those not exposed. Those offered a free tobacco product were also more likely to be exclusive smokers (RRR 1.45, 95% CI 1.05-2.00), ST users (RRR 1.48, 95% CI 1.23-1.78) and users of both forms (RRR 1.99, 95% CI 1.34-2.94) than those who were not offered. Among pro-tobacco factors, the strongest associations were observed for exposure to cigarette smoking in public places. Those being exposed were nearly six times more likely to be smokers (RRR 5.59, 95% CI 4.28-7.28), twice as likely to be ST users (RRR 2.07, 95% CI 1.84-2.32) and eleven times more likely to be users of both forms (RRR 11.42, 95% CI 7.44-17.54) than those who were not exposed (Table 2).

**Additional analysis**

The restricted analyses of Bangladesh, Sri-Lanka and Pakistan data prior to adding any additional variables showed that the estimates for smoking and use of both forms were almost similar to the main analysis. While for ST use, no association observed for ‘taught in the class on dangers of tobacco’, which was the case in the main analysis (Table 3).

The adjusted estimates of the additional three variables (health warning on pack, advertisements at points of sale and exposure to cigarette at school premises) showed that exposure to cigarette smoking within school premises was positively associated with any form of tobacco use. However, those exposed to ‘health warnings on cigarette packs’ were more likely to be exclusive smokers (RRR 2.00, 95% CI 1.26-3.17) or users of both ST and cigarettes (RRR 4.16, 95% CI 1.75-9.92) than those who were not exposed. Associations of other variables with smoking and use of both forms were generally similar to the main model (Supplementary Table 5).

**DISCUSSION**

Our findings suggest that ST was the most common form of tobacco use in this study population. Tobacco use in adolescents was positively and strongly associated with all hypothesised pro-tobacco predictors i.e. exposure to tobacco use in electronic media, offer of free tobacco products and exposure to smoking in public places. Among anti-tobacco predictors, only shopkeepers’ refusal to sell cigarettes to adolescents were protective against smoking and ST use. Being taught at school about the harmful effects of tobacco was only partially protective i.e. from ST use but not from cigarettes. Exposure to anti tobacco mass media messages was not protective from any form of tobacco use. Furthermore, exposure to anti-tobacco messages at community events was positively associated with tobacco use. It is possible that those using tobacco may be more sensitised towards reporting exposure to anti-tobacco messages at the community events. A positive association was also observed between exposure to ‘health warnings on cigarette packs’ with smoking and use of both forms, which is plausible as cigarette users are likely to be more exposed to health warnings than non-users. For ST use, a lack of association was not unexpected as most of the ST products in South Asia are sold without health warnings.36

Our study found that the proportion of tobacco use increased markedly between ages 12–13 years and age 14–15 years, and among boys, which was similar to the Xi et al. findings based on data from 68 LMICs2. GYTS data from 1999 to 2005 in 131 countries, showed that 54.2% adolescents were exposed to smoking in public places.37 This figure was 42.4% in our study. Similar to our study, Xi et al. found that second hand smoke exposure (55.9%) (exposure at any public places and exposure at home and parental tobacco use) was a risk factor for adolescent’s tobacco use (OR 2.56, 95% CI 2.43-2.69)2. However, these two studies reported weighted prevalence where as our study reported the proportion in the study sample.

Consistent with our findings, one study in Karachi showed that access to free tobacco products influenced tobacco related behaviour among adolescents.25 Easy or sometimes free access to tobacco products and lack of restrictions on sales to minors increased the possibility of tobacco use among youths.27

Our finding of a strong association between exposure to tobacco in media and tobacco use among adolescents was similar to the evidence from Republic of Congo GYTS-2006 study reporting that those exposed to tobacco advertisement on TV, billboards and in newspapers/magazines were twice as likely to be current ST users than those who were not exposed.38 Another study reported that a reduction in mass media exposure to tobacco products decreases the appeal of smoking among adolescents.39 A Cochrane systematic review has also confirmed that nonsmoking adolescents who were more aware of or receptive to tobacco advertising were more likely to become smokers later and cigarette advertising and promotion increased smoking in youth.17

Similar to our study, anti-tobacco media messages showed no association with tobacco use and areca nut use in a study in Mumbai.40 A possible explanation, as noted in this study, is that the anti-tobacco messages, because they are not specifically designed for targeting younger audiences, might have a reduced impact and inadvertently draw attention to tobacco.Our study also did not observe any protective effect of exposure of health warning on cigarette packs among this age group. This was supported by other studies that reported pictorial health warning on pack do not increase youth's expectations to be non-smokers a year later.41 and have no effect on beliefs about cancer or addiction among non-smoking adolescent boys.42

The previous round of GYTS data from Bangladesh, Sri-Lanka and Nepal reported that class lessons on the dangers of smoking was associated with reduced tobacco usage among adolescents.27 However, we found no evidence of association with teaching harms of tobacco in school with smoking or use of both forms in this study population, which is in line with the mixed evidence-base on the effect of school-based educational programmes on youth smoking uptake.22

Limitations and strengths: Our study has some limitations which deserve mentioning. First, we did not account for survey weights in our analysis as we were interested in the associations and not nationally representative estimates. However, the prevalence of current cigarette smoking and ST use as reported in the study population was broadly similar to the nationally representative prevalence data reported by the countries (only exception of poat 30-days ST use in Sri Lanka. Please see Supplementary Table 6 for details). Second, the GYTS data are self-reported, which might not necessarily reflect the true prevalence. Being cross sectional data, an analysis based on GYTS cannot infer causality. Besides, reverse causality could be an issue, which might explain the observed positive association between tobacco use and exposure of ‘anti tobacco messages at community events’ and ‘health warning on cigarette packs’ as the users might report the exposure more than the non users. Third, we merged data from surveys that collected information in different years (2009, 2013 and 2015), therefore, comparison of proportions between countries should be made with caution. In addition, surveys were done before 2010 in India, therefore these data are relatively old, which emphasises the need for countries to strengthen tobacco surveillance, including repeating surveys at regular intervals. Fourth, the current tobacco use was defined as using any tobacco form on at least 1 day in the past 30 days, which might include a proportion of experimenters alongside regular tobacco users. The GYTS questionnaire asked specific questions for cigarette smoking only but did not ask for ST. For example, whether they were refused purchase of ST products due to their age, question on ST exposure outside the home or public places, health warning on ST pack was not asked (apart from Bangladesh). Finally, as we wanted to emphasize the wider environmental determinants of tobacco use, we did not include individual level factors and the exposure at home or parental tobacco use which might have some confounding effect on the observed associations.

Despite these limitations, our study has several notable strengths. The study included a large sample of 23,681 students from 4 LMICs. The GYTS relies on standard procedures for the selection of participants. Nearly the same procedure and questions were applied in all countries, which makes the rationale for merging the data sets to test the hypothesised associations. Most of the previous studies in this region focused on individual level knowledge, attitude and family and peer level of behavioural determinants of tobacco use but not on the wider environmental predictors as explored in our study. Unlike our study, very limited studies have investigated the associations of these environmental level factors with cigarette smoking, ST and dual use separately among adolescents.

Although Bangladesh, India, Pakistan and Sri Lanka are signatory of WHO-FCTC and have country specific tobacco control laws and policies, tobacco uptake among youth is still high in these countries. Anti-tobacco policies under FCTC have not been adequately implemented in South Asian countries10,43 and social acceptability of ST consumption44 makes it even harder to implement these comprehensively. Our study reveals that the associations between different forms of tobacco use and pro-tobacco factors were strong, whereas anti-tobacco factors lacked strength and consistency in the study population. Our study also suggests that the current form of anti-tobacco media and social campaigns were unlikely to have worked in the study population. Tobacco control strategy should focus on strengthening and enforcing comprehensive bans on smoking in public places, tobacco advertising (including electronic media exposure), sponsorship and promotions on sale to minors to eliminate pro-tobacco influences in youth.

**References**

1. National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health. *Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General*. Atlanta (GA): Centers for Disease Control and Prevention (US); 2012. Available at: https://www.ncbi.nlm.nih.gov/books/NBK99237/.

2. Xi B, Liang Y, Liu Y, et al. Tobacco use and second-hand smoke exposure in young adolescents aged 12-15 years: data from 68 low-income and middle-income countries. *Lancet Glob Heal*. 2016;4(11):e795-e805. doi:10.1016/S2214-109X(16)30187-5.

3. ASH. *Smoking Statistics: Who Smokes and How Much*.; 2018. Available at: https://ash.org.uk/information-and-resources/fact-sheets/smoking-statistics-who-smokes-and-how-much/.

4. Pierce JP, Sargent JD, Portnoy DB, et al. Association Between Receptivity to Tobacco Advertising and Progression to Tobacco Use in Youth and Young Adults in the PATH Study. *JAMA Pediatr*. 2018;172(5):444-451. doi:10.1001/jamapediatrics.2017.5756.

5. Pierce JP, Sargent JD, White MM, et al. Receptivity to Tobacco Advertising and Susceptibility to Tobacco Products. *Pediatrics*. 2017;139(6). doi:10.1542/peds.2016-3353.

6. Wen CP, Chen T, Tsai Y-Y, et al. Are marketing campaigns in Taiwan by foreign tobacco companies targeting young smokers? *Tob Control*. 2005;14(suppl\_1):i38-i44. doi:10.1136/tc.2004.007971.

7. Rani M, Thamarangsi T, Agarwal N. Youth tobacco use in South-East Asia: Implications for tobacco epidemic and options for its control in the region. *Indian J Public Heal*. 2017;61(Suppl 1):S12-S17. doi:10.4103/ijph.IJPH\_241\_17.

8. World Health Organization. *WHO Report on the Global Tobacco Epidemic, 2017: Monitoring Tobacco Use and Prevention Policies*. World Health Organization; 2017. Available at: https://apps.who.int/iris/handle/10665/255874.

9. Sinha DN, Kumar A, Bhartiya D, et al. Smokeless Tobacco Use Among Adolescents in Global Perspective. *Nicotine Tob Res*. 2017;19(11):1395-1396. doi:10.1093/ntr/ntx004.

10. National Cancer Institute, world Health Organization. Monograph 21. The Economics of Tobacco and Tobacco Control. *NIH Publ No 16-CA-8029A*. 2016. Available at: http://cancercontrol.cancer.gov/brp/tcrb/monographs. Accessed December 18, 2019.

11. Anderson CL, Becher H, Winkler V. Tobacco Control Progress in Low and Middle Income Countries in Comparison to High Income Countries. *Int J Environ Res Public Heal*. 2016;13(10). doi:10.3390/ijerph13101039.

12. Mushtaq N, Huque R, Beebe LA, Shah S, Siddiqi K. Evaluation of tobacco dependence measures in South Asian smokeless tobacco users. *Drug Alcohol Depend*. 2019;203:66-71. doi:10.1016/J.DRUGALCDEP.2019.05.034.

13. Schensul JJ, Nair S, Bilgi S, et al. Availability, accessibility and promotion of smokeless tobacco in a low-income area of Mumbai. *Tob Control*. 2013;22(5):324-330. doi:10.1136/tobaccocontrol-2011-050148.

14. Kakde S, Bhopal RS, Jones CM. A systematic review on the social context of smokeless tobacco use in the South Asian population: Implications for public health. *Public Health*. 2012;126(8):635-645. doi:10.1016/j.puhe.2012.05.002.

15. Wellman RJ, Dugas EN, Dutczak H, et al. Predictors of the Onset of Cigarette Smoking: A Systematic Review of Longitudinal Population-Based Studies in Youth. *Am J Prev Med*. 2016;51(5):767-778. doi:10.1016/j.amepre.2016.04.003.

16. Wellman RJ, Sugarman DB, DiFranza JR, Winickoff JP. The extent to which tobacco marketing and tobacco use in films contribute to children’s use of tobacco: a meta-analysis. *Arch Pediatr Adolesc Med*. 2006;160(12):1285-1296. doi:10.1001/archpedi.160.12.1285.

17. Lovato C, Watts A, Stead LF. Impact of tobacco advertising and promotion on increasing adolescent smoking behaviours. *Cochrane Database Syst Rev*. 2011;(10). doi:10.1002/14651858.CD003439.pub2.

18. Soneji S, Ambrose BK, Lee W, Sargent J, Tanski S. Direct-to-consumer tobacco marketing and its association with tobacco use among adolescents and young adults. *J Adolesc Health*. 2014;55(2):209-15. doi:10.1016/j.jadohealth.2014.01.019.

19. Leão T, Kunst AE, Schreuders M, Lindfors P, Kuipers MA, Perelman J. Adolescents’ smoking environment under weak tobacco control: A mixed methods study for Portugal. *Drug Alcohol Depend*. 2019;204:107566. doi:10.1016/J.DRUGALCDEP.2019.107566.

20. Dunlop S, Kite J, Grunseit AC, et al. Out of Sight and Out of Mind? Evaluating the Impact of Point-of-Sale Tobacco Display Bans on Smoking-Related Beliefs and Behaviors in a Sample of Australian Adolescents and Young Adults. *Nicotine Tob Res*. 2015;17(7):761-8. doi:10.1093/ntr/ntu180.

21. White VM, Durkin SJ, Coomber K, Wakefield MA. What is the role of tobacco control advertising intensity and duration in reducing adolescent smoking prevalence? Findings from 16 years of tobacco control mass media advertising in Australia. *Tob Control*. 2015;24(2):198-204. doi:10.1136/tobaccocontrol-2012-050945.

22. Thomas RE, McLellan J, Perera R. School-based programmes for preventing smoking. *Cochrane Database Syst Rev*. 2013;(4):CD001293. doi:10.1002/14651858.CD001293.pub3.

23. Al-Sadat N, Misau AY, Zarihah Z, Maznah D, Tin Tin Su TT. Adolescent Tobacco Use and Health in Southeast Asia. *Asia Pacific J Public Heal*. 2010;22(3\_suppl):175S-180S. doi:10.1177/1010539510372835.

24. Rahman MM, Ahmad SA, Karim MJ, Chia HA. Determinants of Smoking Behaviour Among Secondary School Students in Bangladesh. *J Community Health*. 2011;36(5):831-838. doi:10.1007/s10900-011-9382-6.

25. Hussain A, Zaheer S, Shafique K. Individual, social and environmental determinants of smokeless tobacco and betel quid use amongst adolescents of Karachi: a school-based cross-sectional survey. *BMC Public Health*. 2017;17(1):913. doi:10.1186/s12889-017-4916-1.

26. Oswal KC. Factors Associated With Tobacco Use Among Adolescents in India. *Asia Pacific J Public Heal*. 2015;27(2):NP203-NP211. doi:10.1177/1010539511436322.

27. Kabir MA, Goh K-L, Khan MH. A cross-country comparison of tobacco consumption among youths from selected South-Asian countries. *BMC Public Health*. 2013;13:379. doi:10.1186/1471-2458-13-379.

28. CDC. Centre for Disease Control and Prevention. Available at: https://www.cdc.gov/tobacco/global/index.htm. Accessed February 10, 2019.

29. Warren CW, Lee J, Lea V, et al. Evolution of the Global Tobacco Surveillance System (GTSS) 1998–2008. *Glob Heal Promot*. 2009;16(2\_suppl):4-37. doi:10.1177/1757975909342181.

30. GYTS Pakistan. *Global Youth Tobacco Survey (GYTS) Fact Sheet Pakistan 2013*.; 2013. Available at: http://www.emro.who.int/images/stories/tfi/documents/GYTS\_FS\_PAK\_2013.pdf?ua=1. Accessed December 22, 2019.

31. GYTS Sri Lanka. *Global Youth Tobacco Survey (GYTS) Fact Sheet Sri Lanka 2015*.; 2015. Available at: http://origin.searo.who.int/tobacco/data/gyts\_sri\_lanka\_2015\_factsheet.pdf. Accessed December 22, 2019.

32. GYTS Bangladesh. *Global Youth Tobacco Survey (GYTS) Fact Sheet Bangladesh 2013*.; 2013. Available at: http://origin.searo.who.int/tobacco/data/ban\_gyts\_factsheet\_2013.pdf?ua=1.

33. GYTS India. *GYTS India. Global Youth Tobacco Survey (GYTS) Fact Sheet India 2009*.; 2009. Available at: https://www.who.int/fctc/reporting/Annexoneindia.pdf. Accessed December 22, 2019.

34. Gajalakshmi V, Kanimozhi C V. A Survey of 24,000 Students Aged 13–15 Years in India: Global Youth Tobacco Survey 2006 and 2009. *Tob Use Insights*. 2010;3:1179173X1000300001. doi:10.1177/1179173X1000300001.

35. StataCorp LLC. Stata statistical software: release 16. College Station, TX. 2019.

36. Mehrotra R, Yadav A, Sinha DN, et al. Smokeless tobacco control in 180 countries across the globe: call to action for full implementation of WHO FCTC measures. *Lancet Oncol*. 2019;20(4):e208-e217. doi:10.1016/S1470-2045(19)30084-1.

37. Warren CW, Jones NR, Eriksen MP, Asma S. Patterns of global tobacco use in young people and implications for future chronic disease burden in adults. *Lancet*. 2006;367(9512):749-753. doi:10.1016/S0140-6736(06)68192-0.

38. Rudatsikira E, Muula AS, Siziya S. Current use of smokeless tobacco among adolescents in the Republic of Congo. *BMC Public Health*. 2010;10:16. doi:10.1186/1471-2458-10-16.

39. Gilmore AB, Fooks G, Drope J, Bialous SA, Jackson RR. Exposing and addressing tobacco industry conduct in low-income and middle-income countries. *Lancet (London, England)*. 2015;385(9972):1029-43. doi:10.1016/S0140-6736(15)60312-9.

40. Shroff H, Surani N. Mass media exposure to tobacco messages among secondary school children in Mumbai. *Indian J Public Health*. 2012;56(2):159. doi:10.4103/0019-557X.99917.

41. Nonnemaker J, Farrelly M, Kamyab K, Busey A, Mann N. *Experimental Study of Graphic Cigarette Warning Labels: Final Results Report*.; 2010.

42. Pepper JK, Cameron LD, Reiter PL, McRee A-L, Brewer NT. Non-Smoking Male Adolescents’ Reactions to Cigarette Warnings. Barengo NC, ed. *PLoS One*. 2013;8(8):e65533. doi:10.1371/journal.pone.0065533.

43. Mamudu H, Cairney P, Studlar D. Global public policy: does the new venue for transitional tobacco control challenge the old way of doing things? *Public Adm*. 2016;93(4):856-873. doi:10.1111/padm.12143.

44. Anwar S, Williams SA, Scott-Smith J, et al. A Comparison of Attitudes and Practices of Gutka Users and Non-users in Chitrakoot, India. A Pilot. *Prim Dent Care*. 2005;12(1):5-10. doi:10.1308/1355761052894176.

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Table 1 Bivariate analyses of distribution of tobacco use (Exclusive smoking, Exclusive ST and use of both forms) by demographic characteristics, pro- and anti-tobacco factors: data from Bangladesh, India, Pakistan and Sri-Lanka (presented as count and %; N max=23,681)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Total, N (%) | | Non-user  21,430 (90.49) | | Exclusive smoker  469 (1.98) | | Exclusive smokeless tobacco  1,527 (6.45) | | User of both forms  255 (1.08) | | P value (x2 test) |
|  |  | n | % | n | % | n | % | n | % | n | % |  |
| Country | Bangladesh | 3,092 | 13.06 | 2,929 | 13.67 | 41 | 8.74 | 112 | 7.33 | 10 | 3.92 | < 0.001 |
| India | 11,318 | 47.79 | 10,178 | 47.49 | 277 | 59.06 | 690 | 45.19 | 173 | 67.84 |
| Pakistan | 7,784 | 32.87 | 7,265 | 33.90 | 140 | 29.85 | 320 | 20.96 | 59 | 23.14 |
| SriLanka | 1,487 | 6.28 | 1,058 | 4.94 | 11 | 2.35 | 405 | 26.52 | 13 | 5.10 |
| Sex | Male | 11,102 | 47.31 | 9,742 | 45.86 | 339 | 73.38 | 850 | 56.14 | 171 | 68.67 | < 0.001 |
| female | 12,365 | 52.69 | 11,500 | 54.14 | 123 | 26.62 | 664 | 43.86 | 78 | 31.33 |
| Age | ≤11-12 years | 2,069 | 8.79 | 1,940 | 9.11 | 26 | 5.60 | 87 | 5.72 | 16 | 6.40 | < 0.001 |
| 13-15 years | 19,496 | 82.83 | 17,606 | 82.65 | 376 | 81.03 | 1,314 | 86.39 | 200 | 80.00 |
| 16-≥17 years | 1,973 | 8.38 | 1,757 | 8.25 | 62 | 13.36 | 120 | 7.89 | 34 | 13.60 |
| Refused to purchase cigarettes\* | Did not try to buy | 21,558 | 91.61 | 20,037 | 93.97 | 109 | 24.17 | 1,365 | 90.04 | 47 | 19.34 | < 0.001 |
| Yes | 1,045 | 4.44 | 728 | 3.41 | 137 | 30.38 | 75 | 4.95 | 105 | 43.21 |
| No | 929 | 3.95 | 557 | 2.61 | 205 | 45.45 | 76 | 5.01 | 91 | 37.45 |
| Exposure to anti-tobacco mass media messages\* | Yes | 16,367 | 70.09 | 14,812 | 70.03 | 330 | 72.53 | 1,056 | 70.45 | 169 | 68.15 | 0.601 |
| No | 6,986 | 29.91 | 6,339 | 29.97 | 125 | 27.47 | 443 | 29.55 | 79 | 31.85 |
| Exposure to anti-tobacco messages at community events\* | *I did not go to any event\** | 8,204 | 34.99 | 7,729 | 36.39 | 86 | 18.70 | 348 | 23.18 | 41 | 16.67 | < 0.001 |
| Yes | 10,114 | 43.14 | 8,845 | 41.65 | 280 | 60.87 | 823 | 54.83 | 166 | 67.48 |
| No | 5,127 | 21.87 | 4,664 | 21.96 | 94 | 20.43 | 330 | 21.99 | 39 | 15.85 |
| Taught in class on dangers of tobacco in past 12 month | Yes | 13,787 | 58.92 | 12,615 | 59.54 | 263 | 57.42 | 757 | 50.20 | 152 | 61.54 | < 0.001 |
| No | 6,705 | 28.66 | 6,049 | 28.55 | 139 | 30.35 | 446 | 29.58 | 71 | 28.74 |
| *I don’t know* | 2,907 | 12.42 | 2,522 | 11.90 | 56 | 12.23 | 305 | 20.23 | 24 | 9.72 |
| Exposed to tobacco use in electronic media\* | *Did not watch TV\** | 4,909 | 21.01 | 4,488 | 21.22 | 88 | 19.01 | 266 | 17.65 | 67 | 27.24 | < 0.001 |
| Yes | 14,986 | 64.15 | 13,427 | 63.50 | 334 | 72.14 | 1,066 | 70.74 | 159 | 64.63 |
| No | 3,467 | 14.84 | 3,231 | 15.28 | 41 | 8.86 | 175 | 11.61 | 20 | 8.13 |
| Offered free tobacco product ever | Yes | 2,207 | 9.54 | 1,908 | 9.10 | 77 | 17.00 | 172 | 11.64 | 50 | 20.75 | < 0.001 |
| No | 20,933 | 90.46 | 19,060 | 90.90 | 376 | 83.00 | 1,306 | 88.36 | 191 | 79.25 |
| Exposure to cigarette at any public places | Yes | 10,030 | 42.44 | 8,574 | 40.09 | 369 | 78.85 | 873 | 57.32 | 214 | 84.58 | < 0.001 |
| No | 13,601 | 57.56 | 12,813 | 59.91 | 99 | 21.15 | 650 | 42.68 | 39 | 15.42 |

**\*** Past 30 days

Table 2: Result of adjusted\* multinomial logistic regressions on association between tobacco use (Exclusive smoking, Exclusive ST and dual use) *(Ref category: non-smoker and non ST user)* and related covariates: data from Bangladesh, India, Pakistan and Sri-Lanka (N=22,007)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Exclusive smoking | | | Exclusive ST use | | | Use of both forms | | |
|  |  | RRR | 95% CI | P value | RRR | 95% CI | P value | RRR | 95% CI | P value |
| ***Anti-tobacco factors*** | | | | | | | | | | |
| Refused to purchase cigarettes  (Past 30 days)*(ref:No)* |  |  |  |  |  |  |  |  |  |  |
| *did not try to buy* | 0.01 | 0.01, 0.02 | < 0.001 | 0.46 | 0.35, 0.60 | < 0.001 | 0.01 | 0.01, 0.02 | < 0.001 |
| *Yes* | 0.47 | 0.36, 0.63 | < 0.001 | 0.65 | 0.45, 0.95 | 0.026 | 0.86 | 0.61, 1.23 | 0.416 |
| *Exposure to anti-tobacco mass media messages (past 30 days)*  *(ref=No)* |  |  |  |  |  |  |  |  |  |  |
|  | *Yes* | 1.18 | 0.90, 1.55 | 0.229 | 0.96 | 0.83, 1.10 | 0.541 | 0.94 | 0.66, 1.33 | 0.735 |
| *Exposure to anti-tobacco messages at community events (past 30 days)*  *(ref: No)* |  |  |  |  |  |  |  |  |  |  |
|  | *I did not go to any event in past month* | 0.71 | 0.49, 1.03 | 0.069 | 0.58 | 0.49, 0.69 | < 0.001 | 0.49 | 0.29, 0.86 | 0.012 |
|  | *Yes* | 1.59 | 1.15, 2.20 | 0.005 | 1.80 | 1.54, 2.11 | < 0.001 | 2.20 | 1.41, 3.44 | 0.001 |
| *Taught in class on dangers of tobacco in past 12 month (ref=No)* |  |  |  |  |  |  |  |  |  |  |
|  | *Yes* | 0.95 | 0.73, 1.24 | 0.712 | 0.64 | 0.56, 0.76 | < 0.001 | 1.11 | 0.78, 1.57 | 0.556 |
|  | *I don’t know* | 1.11 | 0.76, 1.63 | 0.577 | 1.55 | 1.31, 1.83 | < 0.001 | 0.73 | 0.40, 1.35 | 0.319 |
| ***Tobacco use motivating factors*** | | | | | | | | | | |
| *Exposed to tobacco use in electronic media in past 30 days**(ref: No)* |  |  |  |  |  |  |  |  |  |  |
|  | *Did not watch TV in last 30 days* | 1.76 | 1.08, 2.88 | 0.023 | 1.41 | 1.13, 1.76 | 0.003 | 4.34 | 2.09, 9.00 | < 0.001 |
|  | *Yes* | 2.14 | 1.39, 3.31 | 0.001 | 1.62 | 1.33, 1.96 | <0.001 | 2.62 | 1.31, 5.26 | 0.007 |
| *Offered free tobacco product ever*  *(ref: no)* |  |  |  |  |  |  |  |  |  |  |
|  | *Yes* | 1.45 | 1.05, 2.00 | 0.022 | 1.48 | 1.23, 1.78 | <0.001 | 1.99 | 1.34, 2.94 | 0.001 |
| *Exposure to cigarette at any public places (ref: no****)*** |  |  |  |  |  |  |  |  |  |  |
|  | *Yes* | 5.59 | 4.28, 7.28 | <0.001 | 2.07 | 1.84, 2.32 | <0.001 | 11.42 | 7.44, 17.54 | < 0.001 |
| ***Other co-variates*** | | | | | | | | | | |
| *Sex (ref: male)* |  |  |  |  |  |  |  |  |  |  |
|  | *female* | 0.55 | 0.43, 0.71 | <0.001 | 0.73 | 0.65, 0.82 | <0.001 | 0.61 | 0.44, 0.85 | 0.003 |
| *Age (ref:* ≤*11-12 years)* |  |  |  |  |  |  |  |  |  |  |
|  | *13-15 years old* | 1.75 | 1.04, 2.94 | 0.034 | 2.24 | 1.72, 2.93 | <0.001 | 1.17 | 0.64, 2.13 | 0.617 |
|  | *16-*≥*17 years old* | 2.30 | 1.27, 4.17 | 0.006 | 1.60 | 1.15, 2.21 | 0.005 | 1.36 | 0.66, 2.82 | 0.405 |

\* Adjusted for country, age and sex

Table 3: Association between tobacco use (Exclusive smoking, Exclusive ST and Use of both forms) *(Ref category: non-smoker and non ST user)* and related covariates (result of adjusted analyses Multinomial logistic regression data from Bangladesh, Pakistan and Srilanka (without the additional variables) (N=11,441)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Exclusive smoking | | | Exclusive ST use | | | Use of both forms | | |
|  |  | RRR | 95% CI | P value | RRR | 95% CI | P value | RRR | 95% CI | P value |
| ***Anti-tobacco factors*** |  |  |  |  |  |  |  |  |  |  |
| Refused to purchase cigarettes  *(Past 30 days) (ref:No)* |  |  |  |  |  |  |  |  |  |  |
|  | *did not try to buy* | 0.05 | 0.03, 0.08 | <0.001 | 0.24 | 0.17, 0.34 | <0.001 | 0.02 | 0.01, 0.05 | <0.001 |
|  | *Yes* | 0.86 | 0.53, 1.40 | 0.549 | 0.37 | 0.23, 0.60 | <0.001 | 0.33 | 0.16, 0.68 | 0.003 |
| *Exposure to anti-tobacco mass media messages (past 30 days)*  *(ref=No)* |  |  |  |  |  |  |  |  |  |  |
|  | *Yes* | 1.20 | 0.83, 1.75 | 0.331 | 1.51 | 1.25, 1.81 | <0.001 | 1.52 | 0.85, 2.73 | 0.160 |
| *Exposure to anti-tobacco messages at community events (past 30 days)*  *(ref: No)* |  |  |  |  |  |  |  |  |  |  |
|  | *I did not go to any event in past month* | 0.55 | 0.36, 0.83 | 0.005 | 0.70 | 0.57, 0.87 | 0.001 | 0.39 | 0.19, 0.80 | 0.011 |
|  | *Yes* | 0.82 | 0.53, 1.29 | 0.398 | 2.42 | 1.97, 2.96 | <0.001 | 1.92 | 1.04, 3.53 | 0.037 |
| *Taught in class on dangers of tobacco in past 12 month (ref=No)* |  |  |  |  |  |  |  |  |  |  |
|  | *Yes* | 1.30 | 0.87, 1.95 | 0.202 | 0.90 | 0.75, 1.09 | 0.281 | 1.37 | 0.74, 2.52 | 0.316 |
|  | *I don’t know* | 1.64 | 0.96, 2.79 | 0.070 | 1.35 | 1.05, 1.74 | 0.017 | 0.93 | 0.37, 2.37 | 0.886 |
| ***Tobacco use motivating factors*** |  |  |  |  |  |  |  |  |  |  |
| *Exposed to tobacco use in electronic media in past 30 days (ref: No)* |  |  |  |  |  |  |  |  |  |  |
|  | *Did not watch TV in last 30 days* | 1.50 | 0.80, 2.80 | 0.204 | 1.31 | 1.01, 1.68 | 0.037 | 1.05 | 0.41, 2.72 | 0.914 |
|  | *Yes* | 1.97 | 1.14, 3.41 | 0.015 | 1.27 | 1.01, 1.59 | 0.041 | 1.49 | 0.67, 3.32 | 0.327 |
| *Offered free tobacco product ever*  *(ref: no)* |  |  |  |  |  |  |  |  |  |  |
|  | *Yes* | 2.08 | 1.28, 3.38 | 0.003 | 1.72 | 1.30, 2.28 | <0.001 | 3.88 | 2.08, 7.25 | <0.001 |
| *Exposure to cigarette at any public places (ref: no****)*** |  |  |  |  |  |  |  |  |  |  |
|  | *Yes* | 3.04 | 1.99, 4.63 | 0.000 | 1.24 | 1.06, 1.46 | 0.008 | 5.02 | 2.44, 10.32 | <0.001 |
| ***Other co-variates*** |  |  |  |  |  |  |  |  |  |  |
| *Sex (ref: male)* |  |  |  |  |  |  |  |  |  |  |
|  | *female* | 0.27 | 0.17, 0.43 | 0.000 | 0.74 | 0.63, 0.87 | <0.001 | 0.17 | 0.07, 0.39 | <0.001 |
| *Age (ref:* ≤*11-12 years)* |  |  |  |  |  |  |  |  |  |  |
|  | *13-15 years old* | 1.50 | 0.69, 3.22 | 0.302 | 2.23 | 1.58, 3.14 | <0.001 | 1.44 | 0.43, 4.88 | 0.552 |
|  | *16-*≥*17 years old* | 3.71 | 1.66, 8.30 | 0.001 | 2.12 | 1.43, 3.15 | <0.001 | 3.09 | 0.86, 11.02 | 0.082 |