



Published in final edited form as:

*Tob Control*. 2019 March ; 28(2): 220–226. doi:10.1136/tobaccocontrol-2018-054290.

## Compliance with point-of-sale tobacco control policies and student tobacco use in Mumbai, India

Ritesh Mistry<sup>1</sup>, Mangesh S Pednekar<sup>2</sup>, William J McCarthy<sup>3</sup>, Ken Resnicow<sup>1</sup>, Sharmila A Pimple<sup>4</sup>, Hsing-Fang Hsieh<sup>1</sup>, Gauravi A Mishra, and Prakash C Gupta<sup>2</sup>

<sup>1</sup>Department of Health Behavior and Health Education, University of Michigan, Ann Arbor, Michigan, USA

<sup>2</sup>Healis Sekhsaria Institute for Public Health, Mumbai, India

<sup>3</sup>Department of Health Policy and Management, University of California, Los Angeles, California, USA

<sup>4</sup>Department of Preventive Oncology, Tata Memorial Hospital, Mumbai, India

### Abstract

**Background**—We measured how student tobacco use and psychological risk factors (intention to use and perceived ease of access to tobacco products) were associated with tobacco vendor compliance with India’s Cigarettes and Other Tobacco Products Act provisions regulating the point-of-sale (POS) environment.

**Methods**—We conducted a population-based cross-sectional survey of high school students (n=1373) and tobacco vendors (n=436) in school-adjacent communities (n=26) in Mumbai, India. We used in-class self-administered questionnaires of high school students, face-to-face interviews with tobacco vendors and compliance checks of tobacco POS environments. Logistic regression models with adjustments for clustering were used to measure associations between student tobacco use, psychological risk factors and tobacco POS compliance.

**Results**—Compliance with POS laws was low overall and was associated with lower risk of student current tobacco use (OR 0.48, 95% CI 0.26 to 0.91) and current smokeless tobacco use

---

**Correspondence to:** Dr Ritesh Mistry, Department of Health Behavior and Health Education, University of Michigan School of Public Health, Ann Arbor, MI 48109, USA; riteshm@umich.edu.

**Contributors** RM originated the study concept and design, conducted the data analysis and wrote the paper. MSP assisted with developing the student survey protocol and provided comments on drafts of the paper. SAP and GAM assisted with developing the vendor survey protocols and provided comments on the paper. WJM, PCG and KR provided guidance on the overall paper concept, and critically edited the paper. H-FH provided input on data analysis and critically edited the paper. All authors agreed to the content of the submitted version.

**Correction notice** This article has been corrected since it published Online First. The % values have been added to Table 1 for the ‘Tobacco harms education at school’ rows.

**Competing interests** None declared.

**Patient consent** Not required.

**Ethics approval** Institutional Review Boards of Tata Memorial Hospital, Healis Sekhsaria Institute for Public Health, University of California Los Angeles and University of Michigan.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data sharing statement** De-identified data from the study can be made available from the corresponding author on reasonable request.

(OR 0.40, 95% CI 0.21 to 0.77), when controlling for student-level and community-level tobacco use risk factors. Compliance was not associated with student intention to use tobacco (OR 0.50; 95% CI 0.21 to 1.18) and perceived ease of access to tobacco (OR 0.73; 95% CI 0.53 to 1.00).

**Conclusions**—Improving vendor compliance with tobacco POS laws may reduce student tobacco use. Future studies should test strategies to improve compliance with tobacco POS laws, particularly in low-income and middle-income country settings like urban India.

## INTRODUCTION

The global burden from tobacco use in low-income and middle-income countries is expected to rise.<sup>1</sup> Over 1 billion tobacco-related deaths are projected in the 21st century.<sup>2</sup> India experiences an estimated 900 000 smoking-related deaths annually, which are mostly attributable to *bidi* use,<sup>3</sup> and an additional 300 000 from smokeless tobacco use, the more common form of tobacco.<sup>4</sup> Youth in India commonly start tobacco use with flavoured smokeless products such as *paan*, *zarda*, *gutka* or as a dentifrice such as *mishri* and tobacco toothpowder.<sup>5</sup> In adults, 42% of men and 14% of women use tobacco regularly, and in adolescents 19% of males and 8% of females report current use.<sup>6,7</sup>

The 2003 Cigarettes and Other Tobacco Products Act (COTPA)<sup>8</sup> was a legislative milestone for the Government of India. COTPA regulates the tobacco point-of-sale (POS) in meaningful ways. At the time of study, it banned the sale of tobacco within 100 yards of educational institutions and to persons below 18 years old, and requires the POS to display a sign that reads ‘it is illegal to sell tobacco to persons below 18 years of age’ in the local languages. COTPA restricts POS tobacco promotion as follows: (1) advertisements are only allowed at the POS; (2) limited to two or fewer tobacco advertisements; (3) the size of advertisement boards can be no more than 60 cm by 90 cm; (4) the content of advertisements is limited to only the brand name and product image; and (5) at least 25% of the surface area of tobacco advertisements must include a health warning. While some jurisdictions outside of India have complete restrictions on POS tobacco promotion (eg, New Zealand), India has partial restrictions.

Research about the impact of tobacco POS restrictions on tobacco use is an important priority.<sup>9,10</sup> Systematic reviews<sup>11–13</sup> have found that POS marketing increased youth susceptibility to tobacco use and stimulated impulse purchases in users.<sup>14</sup> A challenge is tobacco POS policy implementation,<sup>15</sup> particularly *compliance* in settings where high compliance has been difficult to achieve.<sup>16–18</sup> Tobacco control policy compliance in India has been consistently low for POS restrictions on advertisement size<sup>19</sup> and bans on the sale and marketing of tobacco near schools.<sup>16,20,21</sup> Reports from other countries<sup>22–31</sup> have been wide ranging, with studies from Europe,<sup>27,30</sup> the Americas<sup>22–26,31</sup> and New Zealand,<sup>28</sup> showing high levels of POS compliance and studies from the Middle East<sup>32</sup> and South Asia<sup>16,17,19–21,33,34</sup> showing moderate to low compliance levels. There was low compliance with POS tobacco advertisement restrictions (Lebanon)<sup>32</sup> and signage stating no sale to minors (Norway, India),<sup>16,30</sup> and moderate to low compliance with bans on the tobacco sale and marketing near schools (Mexico, India).<sup>2,12,5</sup> When partial POS restrictions were in place

in New Zealand, some non-compliance was about tobacco placement near children's products.<sup>28</sup>

Studies suggest presence of an inverse relationship between tobacco control policy compliance and tobacco use. In Japan, decreased smoking prevalence was attributed to high compliance with tobacco control laws.<sup>35</sup> Higher compliance with bans on tobacco sale to minors was associated with lower youth smoking.<sup>3637</sup> Compliance checks and strong enforcement of underage tobacco sale laws are linked with reduced smoking.<sup>3839</sup> The effectiveness of laws that ban smoking in public places, for example, requires adequate policy implementation, enforcement and compliance at the community level.<sup>4041</sup> Tobacco POS regulations have been introduced in many regions, but few studies measure the impact of compliance. One study of Ireland<sup>27</sup> found that POS compliance was associated with reduction in recall of tobacco displays and perceived smoking prevalence. The study did not find an association between compliance and smoking prevalence. Complete restrictions on tobacco POS promotions could reduce youth tobacco use.<sup>304243</sup>

In this study, we measured the association between tobacco use among Mumbai high school students and school-adjacent community level vendor compliance with COTPA tobacco POS policies. We also measured the association between vendor compliance and psychological risk factors for student tobacco use (intention to use tobacco and perceived ease of access to tobacco). We hypothesised that students in communities with higher vendor compliance with tobacco POS laws will have lower intention to use tobacco, perceived ease of access to tobacco and tobacco use. We expect these results because higher compliance with tobacco POS laws will reduce student access to tobacco products and exposure to tobacco promotion, which are known risk factors for student tobacco use and tobacco use intention.

44

## METHODS

### Design

We conducted a cross-sectional population-based survey of high school students in Mumbai, India. Adapting the methods outlined by the Global Youth Tobacco Survey (GYTS),<sup>21</sup> we used a two-stage cluster sampling design. We sampled 26 public and private high schools using probabilities based on the number of students in each school. School administrators provided a list of 8, 8 and 10 standard classes. One 8th, 9th or 10th standard class was randomly sampled from each school. All students in sampled classes were eligible to complete an in-class self-administered questionnaire in English or *Marathi* (n=1533). Passive parental consent was obtained and students provided written assent. The school-level and class-level response rates were 100% and 99%, respectively. The study sample included participants with complete data on all study variables (n=1373). Sensitivity analysis showed no sociodemographic differences between the study and excluded sample.

We conducted a tobacco vendor survey in school-adjacent communities.<sup>16</sup> Geographic information system (GIS) data were collected about the latitude and longitude of each sampled school's perimeter, and all tobacco vendors and advertisements within a 500 m radius of school perimeters. This radius was used because it was a feasible walking distance

for students and within resource constraints. Trained field investigators walked along all roads near each school and mapped all tobacco vendors and advertisements using ESRI's ArcPad Version 8.0 and Trimble Juno GIS enabled handheld computers. All advertisements visible from streets or sidewalks were recorded including those at the POS. From the list of mapped tobacco vendors, a simple random sample of up to 20 per school-neighbourhood was recruited for interview and direct observations of the POS (n=436), which was defined as the areas where any goods were displayed and sale transactions were made. The vendor response rate was 99%. Elsewhere,<sup>21</sup> we reported the number of vendors within 100 yards of schools to assess compliance with another important provision of COTPA, but that is not a focus of the current study.

### Student-level factors

The questionnaire items about tobacco use, psychological risk factors and covariates were based on the GYTS India.<sup>6</sup>

**Student tobacco use**—We used binary measures: ever tobacco use, current tobacco smoking, current smokeless tobacco use and current tobacco use (any form). *Ever tobacco use* was defined as a positive response to: “Tobacco can be smoked as cigarette, *bidi*, cigar, *chutta*, *dhumti*, or it can be smoked in a *hukka*, *chilum*, pipe, etc. It can be chewed as *gutka*, *pan masala*, betel-quid, *khaini*, *mawa*, *zarda*, or applied as *mishri*, *gul*, *bajjar*, snuff, tobacco toothpaste, tobacco tooth powder etc. Have you ever tried or experimented with any such form of tobacco, even once or twice?” *Current tobacco smoking* was defined as a positive response to: “During the past 30 days, did you smoke tobacco in any form?” *Current smokeless tobacco use* was defined as a positive response to either of the following two questions: “During the past 30 days, did you chew tobacco in any form?” or “During the past 30 days, did you apply tobacco in any form?” *Current tobacco use* was defined as past 30-day use of smoking and/or smokeless forms of tobacco.

**Psychological risk factors**—We used binary measures of intention to use tobacco and perceived ease of access to tobacco products. Intention to use was measured by asking respondents if they will smoke a cigarette, a *bidi*, or a waterpipe, or chew a tobacco product in the next: (1) 12 months; and (2) 5 years (1=definitely not, 2=probably not, 3=probably yes, 4=definitely yes). Responses of 2–4 on either item were defined as an indicator for intention to use (1=yes, 0=no). Ease of access to tobacco products was measured by asking “Do you think it would be easy or hard for you to get cigarettes or other tobacco products if you wanted them?” (1=very easy, 2=sort of easy, 3=sort of hard, 4=very hard). Response of 1–2 were recoded as 1=easy, and responses 3–4 were recoded as 0=hard.

### Community-level compliance with POS laws

The main exposure variable was community-level tobacco vendor compliance with POS laws. For each school-adjacent community, vendor compliance scores were averaged to compute community level scores, which were then grouped into quartiles. Tobacco vendor compliance was measured by direct POS observations. A field investigator noted whether a sign was displayed in the local language about the ban on tobacco sales to minors (1=yes, 0=no); two or fewer advertisements were displayed (1=yes, 0=no); for each tobacco

advertisement, investigators noted if (1) it was within the size limit, (2) 25% of the surface displayed a health warning and (3) it included only brand name and/or product image. To be compliant with advertisement provisions, all advertisements at the POS needed to meet the requirements. A standardised POS compliance score (z-score) was computed from the sum of the compliance items (Cronbach's alpha=0.83).

### Covariates

These student-level covariates were included: age, gender, religion, monthly pocket money, parental tobacco use, friends' tobacco use, positive attitudes towards tobacco and tobacco prevention education at schools. Age was recoded in three categories: 1=11–13 years, 2=14 years and 3=15–17 years. Gender was measured as 1=male and 2=female. Religion was measured as 1=Hindu, 2=Muslim, 3=Other (Christian, Buddhist, Jain, Sikh and Other). Monthly pocket money was measured by asking, "In a usual month (30 days) how much pocket money do you get (including money you earn, if any)" (1=no pocket money, 2=less than Rs. 10 (US\$0.15) to 6=more than Rs. 100 (US\$1.54)). We created a binary variable (1=yes, 0=no) to indicate having any pocket money, that is, responses 2–6. Parental tobacco use was measured by asking, "Do your parents smoke, chew or apply tobacco?" (1=none, 2=both, 3=father only, 4=mother only, 5=I don't know). We recoded the responses into three categories: 1=neither ('none' and 'I don't know'), 2=either ('father only' or 'mother only') and 3=both. Friends' tobacco use was measured with two questions: "Do any of your closest friends smoke?" and "... chew or apply tobacco?" (1=none of them to 4=all of them). We created binary variable (1=yes, 0=no) that indicated having friends who use tobacco, that is, responses 2–4 to either question. Positive tobacco attitudes was measured with six items, for example: "boys (girls) who smoke or chew tobacco have more friends or less friends", "smoking or chewing tobacco makes boys (girls) look more attractive or less attractive" (1=less, 2=no difference, 3=more), "chewing tobacco helps in some ways like relieving toothache, morning motion" (1=no help, 2=helps a little, 3=helps a lot) and so on. We created a single positive tobacco attitudes score by summing responses to the six items (Cronbach's alpha=0.58). Tobacco prevention education at schools was measured using three questions, "During the last school year: (1) were you taught ... about the dangers of smoking or chewing tobacco; (2) did you discuss ... the reasons why people your age smoke or chew tobacco; (3) were you taught ... about the (health) effects of smoking or chewing tobacco?" (1=yes, 2=no, and 3=not sure). We recoded the responses to 1=yes and 0=no or not sure and created a sum (Cronbach's alpha=0.59).

At the community level, we included the number of tobacco vendors and advertisements within 500 metres of schools, both of which were associated with student tobacco use in a previous study.<sup>21</sup> In ArcGIS,<sup>45</sup> the layer of data for 500-metre school buffer zones were spatially joined with geocoded tobacco vendors and advertisements data, yielding the number of vendors and advertisements in school communities (500 m buffer). We also included annual school fees categorised into tertiles as a school-level proxy for socioeconomic status.<sup>21</sup>

## Analysis

First, we calculated frequencies of study variables. Second, we calculated measures of central tendency and spread for community-level influences. Third, due to a hierarchical data structure with students nested within communities (one school per community; community variables were characteristics of the area surrounding sampled schools), we used multilevel random-effects regression<sup>46,47</sup> models with random intercepts for schools to estimate the association between community-level factors and student tobacco use as well as psychological risk factors, while controlling for the covariates. We did not assess current tobacco smoking because of the low prevalence rate (3%). Each community-level measure was grouped into quartiles. The continuous forms of community variables were not correlated with tobacco use outcomes (data not shown). For all the multilevel random-effects regression models, likelihood ratio tests did not reject the null hypothesis that *rho* (ie, the proportion of the total variance contributed by the community-level variance component) was equal to zero (likelihood ratio tests: current tobacco smoking,  $p=1.000$ ; current smokeless tobacco use,  $p=0.497$ ; intention to use tobacco,  $p=0.088$ ; and ease of access to tobacco,  $p=0.496$ ). All models were reverted to ordinary regression with clustering.<sup>46</sup> All statistical analyses were conducted using Stata Version 12.0 with an alpha level of 0.05. We used the command *xtlogit* for multilevel random-effects regression, and for ordinary regression we used the *svy: logistic* command with Taylor-linearised variance estimation to account for any within-school and classroom correlations.<sup>48</sup>

## RESULTS

Most students were 14 or older (63%), female (59%), Hindu (60%) or Muslim (18%), and received monthly pocket money (52%). About 30% reported parental tobacco use and 31% reported one or more friends as using tobacco. About 7% of students reported current (past 30-day) tobacco use (6% smokeless and 3% smoking), 11% reported intention to use tobacco and 11% reported easy access to tobacco products (table 1). Flavoured smokeless products were preferred, for example, *gutka*, *zarda*, *pan masala* with tobacco and other products (3.5%), followed by tobacco toothpowder (1.5%), *mishri*, a powdered roasted tobacco product (1.5%), cigarettes (0.9%), hookah or waterpipes (0.9%) and *bidis* (0.8%).

Compliance was very low for health warnings on advertisements and signage about the ban on sales to minors, while it was moderate for advertisement size and content, and somewhat high for number of ads. Only 10% of tobacco vendors displayed signage about the ban on sales to minors. About 84% displayed two or fewer tobacco advertisements, but of those who displayed advertisements, 68% were compliant with the content limits, 67% with the size limit, and only 8% were compliant with the requirement for a health warning (table 2). Only 4% of vendors were fully compliant. There was variability in community-level compliance and other community factors. On average, there were 59 tobacco vendors (range 2–199) and 16 tobacco advertisements (range 1–64) within 500 m of schools (table 3).

Students at schools in communities within the highest quartile of POS compliance scores were at lower risk of current tobacco use (OR 0.48, 95% CI 0.25 to 0.94) and current smokeless tobacco use (OR 0.40, 95% CI 0.21 to 0.77) than students in the lowest quartile, when controlling for student and community covariates. The data also show that student

factors such as being Muslim, receiving pocket money, parental tobacco use, friends' tobacco use, ease of access to tobacco and positive attitudes towards tobacco were associated with tobacco use. Higher school fees was associated with current smokeless tobacco use (table 4). POS compliance was not associated with intention to use tobacco (OR 0.50; 95% CI 0.21 to 1.18) and perceived ease of access to tobacco (OR 0.73; 95% CI 0.53 to 1.00) (table 5). Student reports of tobacco prevention education at schools were not associated with any outcome.

## DISCUSSION

Improving vendor compliance with tobacco POS laws is critical to tobacco control policy implementation.<sup>16</sup> Our results were consistent with the hypotheses that higher compliance with tobacco POS laws would be associated with lower current tobacco (any form) and lower current smokeless tobacco use. We did not find significant associations between compliance and intention to use tobacco or perceived ease of access to tobacco.

Youth in India may prefer smokeless tobacco compared with smoking for several reasons. Smokeless products are often flavoured, widely available, cheap and sold in single serving packets. Smokeless tobacco use is also easy to hide. Our findings suggest that students typically use tobacco as flavoured products, and as a dentifrice (eg, *mishri*, tobacco toothpowder). Many states in India, including Maharashtra where Mumbai is located, have since banned the sale of *gutka*, but compliance needs improvement.<sup>4950</sup> Banning tobacco flavourings may be a worthwhile strategy for curbing youth tobacco use in India.

There are several ways in which compliance with tobacco POS laws could lower student tobacco use risk. First, compliance with the requirement to display a sign about the ban on tobacco sale to minors shows a clear anti-tobacco message deterring underage purchases thereby reducing student tobacco use risk.<sup>2438</sup> Second, compliance with advertisement restrictions lowers exposure to pro-tobacco messages.<sup>51</sup> POS advertising bans, for example, were correlated with lower smoking in a previous study.<sup>52</sup> These influences may be associated with tobacco use, intention to use and ease of access.

Few interventions have been designed to improve compliance with tobacco POS laws.<sup>1253</sup> We have not found any such interventions in low-income and middle-income countries. The existing evidence base points to strategies that can be adapted for India such as vendor education about POS laws, establishing and maintaining compliance, as well as enforcement efforts focused on improving compliance.<sup>315455</sup> In order to overcome barriers, tobacco vendors may benefit from clear instruction and training.<sup>56</sup> Penalty infringement notices, a graduated system of fines, retail outlet inspections, non-compliance counselling to correct infractions and undercover compliance checks by minors have been effective,<sup>3157</sup> as have community organising and norm change strategies.<sup>5859</sup> Changing COTPA's partial ban on POS displays to a complete ban could facilitate enforcement and compliance.<sup>42</sup>

In a study of stakeholders in India, recommendations included using aesthetically pleasing signs outlining tobacco laws to display at vendor locations.<sup>60</sup> Educational and community awareness approaches were supported by vendors, who cited community and cultural norms

as prominent factors in non-compliance.<sup>34</sup> Mass media, group education and small media interventions like flyers and posters to improve compliance have also been recommended by vendors.<sup>21</sup>

A high proportion of tobacco vendors report current tobacco use,<sup>21</sup> therefore educating them about the harms and delivering cessation services to users may be helpful in improving POS compliance. Tobacco-using vendors, compared with non-users, were more likely to report they would participate in educational interventions about tobacco POS compliance.<sup>21</sup> Tobacco vendors, as stakeholders, can support POS policies. In the USA<sup>56</sup> and New Zealand,<sup>61</sup> for example, tobacco retailers did not expect that a ban on tobacco promotional displays would create business risk, and many supported tobacco POS regulation.

Firmly established roles, responsibilities and accountability structures are needed to create norms that promote and reinforce compliance and enforcement. A multinational study showed that high compliance with comprehensive smoke-free laws was associated with robust local enforcement activities.<sup>62</sup> Current enforcement of POS policies in India appears to lack coordination and is inconsistent.<sup>63</sup> The Government of India Ministry of Health has the central enforcement authority, but improvements in communication and coordination between the federal Ministry and local agencies is needed, for example, identification of local enforcement agencies like health ministries, police departments and schools.<sup>63</sup> Legally requiring compliance checks for existing and new tobacco POS laws could be helpful. Finally, public awareness of existing sale, marketing and smoke-free laws is important.

There are a notable strengths and limitations to this study. First, a critical limitation is that we did not include a measure of compliance with the ban on tobacco sales to minors. Due to resource limitations, we could not make direct objective measurements of vendor compliance with this important provision. Despite this limitation, we measured vendor compliance with other important POS provisions through direct observation. Second, this study was based on a cross-sectional population-based samples in Mumbai, therefore limiting the generalisability and precluding causal inferences. Nevertheless, a wealth of information was gained about tobacco POS compliance and student tobacco use. Finally, our sample size of current tobacco users was relatively small (n=101 current tobacco users and n=84 current smokeless tobacco users). A larger sample would have given us more power to detect effects at lower levels of compliance, which showed associations with tobacco use in the hypothesised direction, but were not statistically significant.

## CONCLUSION

Compliance with tobacco control laws in India needs improvement.<sup>19–2133</sup> Improving compliance with tobacco POS laws in school-adjacent communities may reduce student tobacco use. Strategies to improve compliance to tobacco POS laws are needed for low-income and middle-income countries where compliance is not the norm and resources for enforcement are scarce. Finally, implementing a complete ban on POS tobacco displays and promotion might narrow the scope for misinterpretation of laws, improve compliance and reduce youth tobacco use.



## Acknowledgements

The authors are thankful to the project staff in India and the USA for their hard work and dedication to the project. We are also thankful for the cooperation of the Municipal Corporation of Greater Mumbai, Office of the Director of Education—Mumbai, and all the participating schools, students and tobacco vendors.

**Funding** Fulbright-Nehru Scholar Program, Jonsson Cancer Center Foundation and National Cancer Institute/ National Institutes of Health (R01CA201415).

## REFERENCES

1. Gajalakshmi C, Jha P, Ranson K. Global patterns of smoking and smoking-attributable mortality In: Jha P, Chaloupka F, eds. Tobacco control in developing countries. Washington D.C: Oxford University Press, 2000:9–39.
2. Jha P Avoidable global cancer deaths and total deaths from smoking. *Nat Rev Cancer* 2009;9:655–64. [PubMed: 19693096]
3. Jha P, Jacob B, Gajalakshmi V, et al. A nationally representative case-control study of smoking and death in India. *N Engl J Med* 2008;358:1 137–47. [PubMed: 18172168]
4. Sinha DN, Palipudi KM, Gupta PC, et al. Smokeless tobacco use: a meta-analysis of risk and attributable mortality estimates for India. *Indian J Cancer* 2014;51 Suppl 1:73. [PubMed: 24947101]
5. Sinha DN, Mathur N, Nazar GP, et al.; Smokeless tobacco use among youth In: Gupta PC, Arora M, Sinha D, eds. Smokeless tobacco and public health in India. New Delhi, India: Government of India, Ministry of Health and Family Welfare, 2012:343.
6. WHO. *Global Youth Tobacco Survey (GYTS): India—2009*. World Health Organization, 2010.
7. WHO. *Global Adult Tobacco Survey (GATS): India—2016–17*. World Health Organization, 2017.
8. Ministry of Law and Justice. COTPA: cigarette and other tobacco products (prohibition of advertisement and regulation of trade and commerce, production, supply, and distribution) act, 2003, 2003.
9. DHHS US. Preventing tobacco use among youth and young adults: a report of the Surgeon General. Washington, D.C: Dept, of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2012.
10. Who report on the global tobacco epidemic, 2008—The MPOWER package. Geneva: World Health Organization, 2008.
11. Paynter J, Edwards R. The impact of tobacco promotion at the point of sale: a systematic review. *Nicotine Tob Res* 2009; 11:25–35. [PubMed: 19246438]
12. Robertson L, McGee R, Marsh L, et al. A systematic review on the impact of point-of-sale tobacco promotion on smoking. *Nicotine Tob Res* 2015;17:2–17. [PubMed: 25173775]
13. Robertson L, Cameron C, McGee R, et al. Point-of-sale tobacco promotion and youth smoking: a meta-analysis. *Tob Control* 2016;25:e83–89. [PubMed: 26728139]
14. Wakefield MA, Germain D, Durkin SJ. How does increasingly plainer cigarette packaging influence adult smokers' perceptions about brand image? An experimental study. *Tob Control* 2008;17:416–21. [PubMed: 18827035]
15. Levy DT, Friend KB. Strategies for reducing youth access to tobacco: a framework for understanding empirical findings on youth access policies. *Drugs* 2002;9:285–303.
16. Mistiy R, Pimple S, Mishra G, et al. Compliance with point-of-sale tobacco control policies in school-adjacent neighborhoods in Mumbai, India. *Am J Health Promot* 2015;30:433–40. [PubMed: 26389976]
17. Patel S, Rendell H, Maudgal S, et al. Tobacco industry tactics with advertisements at the point of sale in Mumbai. *Indian J Cancer* 2013;50:245–9. [PubMed: 24061466]
18. Mead EL, Rimal RN, Cohen JE, et al. A two-wave observational study of compliance with youth access and tobacco advertising provisions of the Cigarettes and Other Tobacco Products Act in India. *Nicotine Tob Res* 2016;18:1363–70. [PubMed: 26610937]

19. Chaudhry S, Chaudhry S, Chaudhry K. Point of sale tobacco advertisements in India. *Indian J Cancer* 2007;44:131–6. [PubMed: 18322354]
20. Elf JL, Modi B, Stillman F, et al. Tobacco sales and marketing within 100 yards of schools in Ahmedabad City, India. *Public Health* 2013;127:442–8. [PubMed: 23608024]
21. Mistiy R, Pednekar M, Pimple S, et al. Banning tobacco sales and advertisements near educational institutions may reduce students' tobacco use risk: evidence from Mumbai, India. *Tob Control* 2015;24:e100–e107. [PubMed: 23958643]
22. DiFranza JR, Celebucki CC, Moweiy PD. Measuring statewide merchant compliance with tobacco minimum age laws: the Massachusetts experience. *Am J Public Health* 2001;91:1124–5. [PubMed: 11441743]
23. Dovell RA, Mowat DL, Dorland J, et al. Changes among retailers selling cigarettes to minors. *Can J Public Health* 1996;87:66–8. [PubMed: 8991749]
24. Frick RG, Klein EG, Ferketich AK, et al. Tobacco advertising and sales practices in licensed retail outlets after the Food and Drug Administration regulations. *J Community Health* 2012;37:963–7. [PubMed: 22197961]
25. Hernández-Ávila JE, Tirado-Ramírez E, Santos-Luna R, et al. Use of Geographical Information Systems for billboards and points-of-sale surveillance in two Mexico cities. *Salud Pública de México* 2007;49:s241–s246.
26. Klein EG, Ferketich AK, Abdel-Rasoul M, et al. Smokeless tobacco marketing and sales practices in Appalachian Ohio following federal regulations. *Nicotine Tob Res* 2012;14:880–4. [PubMed: 22318692]
27. McNeill A, Lewis S, Quinn C, et al. Evaluation of the removal of point-of-sale tobacco displays in Ireland. *Tob Control* 2011 ;20:137–43. [PubMed: 21088060]
28. Quedley M, Ng B, Sapre N, et al. In sight, in mind: retailer compliance with legislation on limiting retail tobacco displays. *Nicotine Tob Res* 2008;10:1347–54. [PubMed: 18686182]
29. Rose SW, Myers AE, D'Angelo H, et al. Retailer adherence to Family Smoking Prevention and Tobacco Control Act, North Carolina, 2011. *Prev Chronic Dis* 2013; 10:E47. [PubMed: 23557638]
30. Scheffels J, Lavik R. Out of sight, out of mind? Removal of point-of-sale tobacco displays in Norway. *Tob Control* 2013;22:e37–42. [PubMed: 22678299]
31. Stead LF, Lancaster T. Interventions for preventing tobacco sales to minors (Review). *Cochrane Database of Systematic Reviews* 2008; 1.
32. Salloum RG, Nakkash RT, Myers AE, et al. Point-of-sale tobacco advertising in Beirut, Lebanon following a national advertising ban. *BMC Public Health* 2013;13:534. [PubMed: 23731766]
33. Aghi M, Oswal K, Pednekar M, et al. Pictorial warnings on tobacco products at the point of sale in India. *Tob Control* 2012;21:450–1. [PubMed: 22427362]
34. 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;22:324–30. [PubMed: 22387521]
35. Yorifuji T, Tanihara S, Takao S, et al. Regional disparities in compliance with tobacco control policy in Japan: an ecological analysis. *Tob Control* 2011 ;20:374–9. [PubMed: 21427196]
36. Dai H, Hao J. The effects of tobacco control policies on retailer sales to minors in the USA, 2015. *Tobacco Control*. 2017.
37. Friend KB, Lipper-Kreda S, Grube J. The impact of local U.S. tobacco policies on youth tobacco use: a critical review. *Open J Prev Med* 2011 ;01:34–43.
38. DiFranza JR, Savageau JA, Fletcher KE. Enforcement of underage sales laws as a predictor of daily smoking among adolescents: a national study. *BMC Public Health* 2009;9:107. [PubMed: 19374735]
39. Rigotti NA, DiFranza JR, Chang Y, et al. The effect of enforcing tobacco-sales laws on adolescents' access to tobacco and smoking behavior. *N Engl J Med* 1997;337:1044–51. [PubMed: 9321533]
40. Lovato CY, Sabiston CM, Hadd V, et al. The impact of school smoking policies and student perceptions of enforcement on school smoking prevalence and location of smoking. *Health Educ Res* 2007;22:782–93. [PubMed: 16987941]

41. Wakefield MA, Chaloupka FJ, Kaufman NJ, et al. Effect of restrictions on smoking at home, at school, and in public places on teenage smoking: cross sectional study. *BMJ* 2000;321:333–7. [PubMed: 10926588]
42. Edwards R, Ajmal A, Healey B, et al. Impact of removing point-of-sale tobacco displays: data from a New Zealand youth survey. *Tob Control* 2017;26:392–8. [PubMed: 27377342]
43. 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;17:761–8. [PubMed: 25283169]
44. Flay BR, Petraitis J, Hu FB. Psychosocial risk and protective factors for adolescent tobacco use. *Nicotine Tob Res* 1999; 1 Suppl 1:559–565.
45. Desktop ArcGIS Release 10 [program], Redlands, CA: Environmental Systems Research Institute, 2011.
46. McCulloch CE, Searle SR. Generalized, linear and mixed models. New York, NY: John Wiley and Sons, 2001.
47. Raudenbush SW, Bryk AS. Hierarchical linear models: applications and data analysis methods'. Sage Publications Inc, 2002.
48. Farhat J, Robb A. Applied survey data analysis using stata: The Kauffman firm survey data, 2014.
49. Nair S, Schensul JJ, Bilgi S, et al. Local responses to the Maharashtra gutka and pan masala ban: a report from Mumbai. *Indian J Cancer* 2012;49:443–7. [PubMed: 23442411]
50. Pimple S, Gunjal S, Mishra GA, et al. Compliance to Gutka ban and other provisions of COTPA in Mumbai. *Indian J Cancer* 2014;51 Suppl 1:60.
51. Arora M, Reddy KS, Stigler MH, et al. Associations between tobacco marketing and use among urban youth in India. *Am J Health Behav* 2008;32:283–94. [PubMed: 18067468]
52. Shang C, Huang J, Cheng KW, et al. Global evidence on the association between POS advertising bans and youth smoking participation. *Int J Environ Res Public Health* 2016;13:306.
53. Whyte G, Gendall P, Hoek J. Advancing the retail endgame: public perceptions of retail policy interventions. *Tob Control* 2014;23:160–6. [PubMed: 23842946]
54. Jason LA, Billows WD, Schnopp-Wyatt DL, et al. Long-term findings from Woodridge in reducing illegal cigarette sales to older minors. *Eval Health Prof* 1996;19:3–13. [PubMed: 10186901]
55. Landrine H, Klonoff EA, Fritz JM. Preventing cigarette sales to minors: the need for contextual, sociocultural analysis. *Prev Med* 1994;23:322–7. [PubMed: 8078853]
56. Rose SW, Emery SL, Ennett S, et al. Retailer opinions about and compliance with family smoking prevention and tobacco control act point of sale provisions: a survey of tobacco retailers. *BMC Public Health* 2015;15:884. [PubMed: 26362769]
57. Smyth C, Freeman B, Maag A. Tobacco retail regulation: the next frontier in tobacco control? *Public Health Res Pract* 2015;25:e2531529. [PubMed: 26243488]
58. Altman DG, Wheelis AY, McFarlane M, et al. The relationship between tobacco access and use among adolescents: a four community study. *Soc Sci Med* 1999;48:759–75. [PubMed: 10190639]
59. Forster JL, Murray DM, Wolfson M, et al. The effects of community policies to reduce youth access to tobacco. *Am J Public Health* 1998;88:1193–8. [PubMed: 9702146]
60. Turner MM, Rimal RN, Lumby E, et al. Compliance with tobacco control policies in India: an examination of facilitators and barriers. *Int J Tuberc Lung Dis* 2016;20:411–6. [PubMed: 27046725]
61. Jaine R, Russell M, Edwards R, et al. New Zealand tobacco retailers' attitudes to selling tobacco, point-of-sale display bans and other tobacco control measures: a qualitative analysis. *N Z Med J* 2014;127:53–66.
62. Peruga A, Hayes LS, Aguilera X, et al. Correlates of compliance with national comprehensive smoke-free laws. *Tobacco Control*. 2017.
63. Panda B, Rout A, Pati S, et al. Tobacco control law enforcement and compliance in Odisha, India —implications for tobacco control policy and practice. *Asian Pac J Cancer Prev* 2012;13:4631–7. [PubMed: 23167393]

### What this paper adds

- ▶ Compliance is an important aspect of tobacco control policy implementation, yet there is limited research about how compliance with point-of-sale laws is associated with youth tobacco use, particularly in low-income and middle-income countries.
- ▶ This study showed that higher community-level compliance with point-of-sale tobacco control policies was associated with lower risk of student tobacco use in Mumbai, India.
- ▶ We discuss implications for promoting compliance in order to improve implementation of tobacco control policies at the community level.

**Table 1**

## Student characteristics (n=1373)

Student characteristics	n	%
Age (years)		
11–13	502	36.6
14	506	36.9
15–17	365	26.6
Gender		
Male	556	40.5
Female	817	59.5
Religion		
Hindu	820	59.7
Muslim	249	18.1
Other	304	22.1
Monthly pocket money		
Yes	710	51.7
No	663	48.3
Parental tobacco use		
None	962	70.1
One parent uses tobacco	368	26.8
Both parents use tobacco	43	3.13
Friends use tobacco		
Yes	424	30.9
No	949	69.1
Ease of access to tobacco		
Hard	1020	74.3
Easy	353	25.7
Tobacco harms education at school		
Yes	774	56.4
No	388	28.3
Not sure	211	15.4
Intention to use tobacco		
Yes	152	11.1
No	1212	88.9
Ever use tobacco		
Yes	160	11.7
No	1208	88.3
Current tobacco use (any form)		
Yes	101	7.4
No	1272	92.6

<b>Student characteristics</b>	<b>n</b>	<b>%</b>
Current tobacco smoking		
Yes	38	2.77
No	1333	97.2
Current smokeless tobacco use		
Yes	84	6.15
No	1282	93.9

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

**Table 2**

Tobacco vendor compliance with point-of-sale (POS) laws (n=436)

	n	%
Presence of sign saying illegal to sell to minors	45	10.3
Two or fewer tobacco advertisements	366	83.9
Each tobacco advertisement was size compliant	120	67.8*
Each tobacco advertisement was content compliant	121	68.4*
Each tobacco advertisement was health warning compliant	14	7.8*

\* Percentages based on the denominator of tobacco vendors that displayed at least one tobacco advertisement at the POS (n=177).

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

**Table 3**

Community tobacco environment (n=26)

	<b>n, Communities</b>	<b>%, Communities</b>	<b>n, Students</b>	<b>%, Students</b>
Community-level vendor compliance with POS laws (quartiles)				
Low	6	23.1	329	24.0
Low-middle	7	26.9	353	25.7
Middle-low	6	23.1	326	23.7
High	7	26.9	365	26.6
	<b>Mean</b>	<b>Median</b>	<b>SD</b>	<b>Range</b>
Community-level vendor compliance with POS laws *	0.00	0.04	0.41	-1.00-0.58
Tobacco vendors within 500 m	58.96	49	43.91	2-199
Tobacco ads within 500 m	15.38	13	13.1	1-64

\* Standardised z-score.

POS, point of sale.



**Table 4**

Logistic regression of student tobacco use, community compliance with POS laws and covariates (n=1373)

	Adjusted OR (95% CI)					
	Current tobacco use			Current smokeless tobacco use		
Male	1.21	0.78	1.88	1.26	0.82	1.91
Age (referent=11–13 years)						
14	0.99	0.51	1.93	1.20	0.60	2.38
15–17	1.39	0.80	2.43	1.48	0.85	2.59
Muslim	1.95 <sup>**</sup>	1.17	3.26	1.83 <sup>*</sup>	1.05	3.19
Has pocket money	1.81 <sup>***</sup>	1.23	2.66	2.13 <sup>***</sup>	1.47	3.10
Parent tobacco use (referent=none)						
One parent	2.18 <sup>***</sup>	1.39	3.40	1.86 <sup>*</sup>	1.01	3.45
Both parents	4.79 <sup>***</sup>	2.32	9.90	4.06 <sup>**</sup>	1.37	12.04
Has friends who use tobacco	2.65 <sup>***</sup>	1.52	4.61	2.42 <sup>**</sup>	1.41	4.17
Tobacco easy to access	2.31 <sup>***</sup>	1.41	3.77	2.31 <sup>***</sup>	1.41	3.77
Positive tobacco attitudes score	1.63 <sup>**</sup>	1.13	2.36	1.52 <sup>*</sup>	1.06	2.17
Tobacco prevention education at school	0.99	0.77	1.27	1.04	0.81	1.32
School fees (referent=low)						
Middle	0.60	0.35	1.03	0.45 <sup>*</sup>	0.25	0.79
High	0.58	0.20	1.67	0.67	0.20	2.20
Community-level vendor compliance (referent=low)						
Low-middle	0.57	0.27	1.20	0.58	0.28	1.18
Middle-high	0.80	0.43	1.51	0.65	0.32	1.33
High	0.48 <sup>*</sup>	0.25	0.94	0.40 <sup>**</sup>	0.21	0.77

Due to unstable estimates resulting from a low sample size of current tobacco smokers, the outcome of current tobacco smoking was not included. Models were further adjusted for number of tobacco vendors and number of tobacco ads.

\* p<0.05,

\*\* p<0.01,

\*\*\* p<0.001.

**Table 5**

Logistic regression psychological risk factors, community compliance with point-of-sale laws and covariates (n=1373)

	Adjusted OR (95% CI)					
	Intention to use			Ease of access		
Male	1.74 <sup>*</sup>	1.01	2.99	1.17	0.84	1.61
Age (referent=11–13 years)						
14	0.91	0.52	1.61	0.70 <sup>*</sup>	0.52	0.93
15–17	0.92	0.48	1.77	0.88	0.66	1.17
Muslim	0.99	0.52	1.89	1.06	0.56	2.02
Has pocket money	2.35 <sup>***</sup>	1.58	3.49	1.35 <sup>*</sup>	1.02	1.78
Parent tobacco use (referent=none)						
One parent	1.50	0.88	2.55	1.21	0.79	1.85
Both parents	1.64	0.69	3.90	0.27	0.07	1.02
Has friends who use tobacco	3.71 <sup>***</sup>	2.22	6.19	1.55 <sup>*</sup>	1.09	2.20
Tobacco easy to access	2.0 <sup>***</sup>	1.37	2.92	–	–	–
Positive tobacco attitudes score	1.76 <sup>**</sup>	1.22	2.54	1.61 <sup>**</sup>	1.21	2.14
Tobacco prevention education at school	1.04	0.84	1.29	1.06	0.91	1.24
School fees (referent=low)						
Middle	1.85	0.75	4.53	0.78	0.49	1.23
High	3.57	0.99	2.89	0.92	0.64	1.32
Community-level vendor compliance (referent=low)						
Low-middle	0.70	0.35	1.39	1.55	1.08	2.21
Middle-high	0.51	0.22	1.19	0.98	0.66	1.45
High	0.50	0.20	1.23	<sup>†</sup> 0.73	0.52	1.02

Models were further adjusted for number of tobacco vendors and number of tobacco ads.

\*  
p<0.05,

\*\*  
p<0.01,

\*\*\*  
p<0.001,

<sup>†</sup>  
p=0.063.