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Original article

Tobacco retailer density and tobacco retailers near schools in two cities of East India, Ranchi and Siliguri

Nidhi Sejpal Pouranik [a,*], *Sejal Saraf* [b], *Kathy Wright* [c], *Ashish Kumar Pandey* [c], *Sonu Goel* [d], *Rana Jugdeep Singh* [a], *Ryan David Kennedy* [b]

[a] *Tobacco Control Division, International Union Against Tuberculosis and Lung Disease (The Union), New Delhi, Delhi, 110016, India*

[b] *Department of Health, Behaviour & Society, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, 21205, USA*

[c] *Tobacco Control Division, International Union Against Tuberculosis and Lung Disease (The Union), New York City, NY, 10005, USA*

[d] *Department of Community Medicine and School of Public Health, Post Graduate Institute of Medical Education & Research (PGIMER), Chandigarh, 160012, India*

ARTICLE INFO

Article history:
Received 1 June 2021
Received in revised form
23 June 2021
Accepted 2 July 2021
Available online xxx

Keywords:
India
Tobacco retailer density
Tobacco retailers near schools
Tobacco vendor licensing
Tobacco control

ABSTRACT

Background: Passive and active exposure to tobacco smoke is associated with tuberculosis infection and tuberculosis disease. Addressing tobacco use is a critical strategy to address tuberculosis (TB). Studies conducted globally demonstrate that the physical presence and density of tobacco vendors can increase tobacco use in both youth and adults. Little is known about the number and density of tobacco vendors in India, where there are approximately 267 million tobacco users. In India, a national tobacco control law (COTPA, 2003) prohibits the sale of tobacco within 100-yards of an educational institution. Little is known about the number of tobacco vendors operating within 100-yards of schools. This study assesses the number and density of tobacco vendors in the cities of Ranchi (Jharkhand) and Siliguri (West Bengal), and the number of retailers selling tobacco near schools. Both of these jurisdictions have passed local tobacco vendor licensing laws.

Methods: Data collectors conducted a census of tobacco vendors within select wards in each city. Each tobacco vendor was classified as either an independent store, permanent kiosk, temporary kiosk, or street vendor. The location of each tobacco vendor was recorded. Data collectors also noted the location of any school/educational institution. Spatial analysis was conducted using GIS software (QGIS 10.5). 100-yard buffers were mapped around school premises. Tobacco vendor density was calculated by area, by road distance, and by population. Tobacco vendors within 100-yards of school properties were counted.

Results: The study identified 559 tobacco vendors in Ranchi, across three wards, and 367 tobacco vendors in Siliguri, across five wards. When considering the three wards in Ranchi,

* *Corresponding author*. Tobacco Control Division, International Union Against Tuberculosis and Lung Disease (The Union), New Delhi, Delhi, 110016, India.
E-mail address: nidhi.pouranik@theunion.org (N.S. Pouranik).

https://doi.org/10.1016/j.ijtb.2021.07.003

Please cite this article as: Pouranik NS et al., Tobacco retailer density and tobacco retailers near schools in two cities of East India, Ranchi and Siliguri, Indian Journal of Tuberculosis, https://doi.org/10.1016/j.ijtb.2021.07.003

tobacco vendor density was 68 vendors/km^2, 06 vendors/km road, and 08 vendors/1000 population. In Siliguri, the tobacco vendor density was 99 vendors/km^2, 05 vendors/km road, and 07 vendors/1000 population. The study found that 19% (n = 105) of vendors observed in Ranchi and 23% (n = 84) of vendors in Siliguri were located within 100-yards of one or more schools. The most common vendor-type in Ranchi was an independent store (58%) and in Siliguri was a permanent kiosk (52%).

Conclusion: Tobacco vendor density was remarkably high in each of the surveyed wards. The study identified tobacco vendors operating within 100-yards of schools. Fully implementing COTPA, 2003 could reduce vendor density in Ranchi and Siliguri. Each city's tobacco vendor licensing laws could further reduce tobacco vendor density. Other strategies should be considered to further reduce density, including setting limits on tobacco vendor type, area or population. The data from this study can be used to inform future tobacco control strategies for these cities and others in the region.

1. Background

Tobacco use is the leading preventable cause of death and disease in the world today.[1] According to the recent Global Adult Tobacco Survey (GATS), there are approximately 267 million tobacco users in India, representing 29% of the adult population.[2] Tobacco use is estimated to cause more than 1.3 million deaths in India every year; of these, one million are attributed to tobacco smoking and the rest to smokeless tobacco use.[3,4] Tobacco smoking is a known risk factor for many respiratory infections[5] and increases the severity of respiratory diseases. It has been determined that smoking tobacco, or exposure to secondhand tobacco smoke is associated with tuberculosis infection and tuberculosis disease. Further, active smoking is associated with recurrent tuberculosis and tuberculosis mortality.[6,7]

Studies conducted globally demonstrate that the physical presence and density of tobacco vendors can increase tobacco use in both youth and adults.[8-11] Evidence from multiple jurisdictions also suggests that the density of tobacco vendors in close proximity to educational institutions is directly correlated with increased tobacco use initiation, and the notion that tobacco use is common and acceptable.[12-15]

In India, the Cigarettes and Other Tobacco Products Act (COTPA, 2003) mandates a range of strategies to reduce tobacco use. For example, COTPA prohibits the sale of tobacco products within 100-yards of any educational institution.[16] Despite this provision, there is evidence that tobacco vendors continue to sell near educational institutions. A 2010 study in Mumbai identified the location of 1741 tobacco vendors, and determined that 13% (n = 221) were operating within 100-meters of a school property.[17] The study also noted that higher tobacco vendor density near schools was associated with current tobacco use and current smokeless tobacco use.[17]

There are no accurate estimates on the number of tobacco vendors in India; however, their presence is ubiquitous, with large numbers of tobacco vendors operating in various retail settings including permanent structures (such as brick and mortar shops), as well as temporary structures (such as kiosks, mobile vendors). An overview of the retail environment in India in 2011 estimated that 97% of retailers were "unorganized retailers" such as corner or family stores.[18] Tobacco is sold in a variety of settings leading to universal easy-access to these products. Consequently, tobacco is readily available at retail outlets where it is sold alongside everyday products such as milk, bread, etc. and in settings freely accessible to children.[19]

There are multiple ways by which vendor density can be assessed, including number of tobacco vendors by area (i.e., number of vendors per sq. km),[20] number of tobacco vendors by road distance (i.e., number of vendors per km of road). [21,22] and number of tobacco vendors by population.[23] The location of tobacco vendors can also be measured, for example proximity to schools, residences, or to other tobacco retailers.[24] Very little is known about tobacco vendor density in India and there are no published studies detailing tobacco vendor density. Where there are tobacco vendor studies, these pertain to vendor counts near schools[17] and assessment of other issues such as tobacco advertising.[25] For instance, a Mumbai school adjacent neighbourhoods study, 2010 reported an average of eight tobacco vendors present within 100m and 60 tobacco vendors within 500m periphery of schools.[17]

In India, there is a growing interest in adopting and implementing tobacco vendor licencing systems at the municipal level. In its simplest form, vendor licensing systems establish a list of tobacco retailers. Licensing systems can further support tobacco control strategies. For example, the number of available tobacco licenses for a city could be limited by using quotas based on vendor density. Other strategies include restricting available licenses to specific types of retailer; disallowing retailers based on location, such as near schools; and/or limiting proximity of retailers to each other.[19,26]

The cities of Ranchi, Jharkhand, and Siliguri, West Bengal, were selected for the study as they are at the forefront of jurisdictions in India to adopt a Tobacco Vendor Licensing Order, aligned with a national advisory issued by the India Health Ministry in September 2017. The advisory recommends the licensing of tobacco vendors through municipal authorities. Further, it stipulates that licensing can be available on the condition that shops permitted to sell tobacco products cannot sell non-tobacco products such as toffees, candies, chips, biscuits, soft drinks, among others, which are meant for the non-users – particularly children.

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At the time of the study, Ranchi had adopted and issued a public notice of their Tobacco Vendor Licensing Order[27] and Siliguri had adopted their Tobacco Vendor Licensing Order but, not issued a public notice. Neither city had implemented the policy, nor did they have comprehensive lists or records of tobacco vendors. In Ranchi's state of Jharkhand, about one-third (38.9%) of the adult population aged 15 and older use tobacco in some form, while in Siliguri's state of West Bengal 33.5% of adults use tobacco products, both smoked and smokeless. In 2019, the registered population of Ranchi was 1,073,427 and of Siliguri was 513,264.[28,29]

This study conducted a censes of tobacco retailers in select wards. The study also identified any tobacco vendors operating within 100-yards of the perimeter of a school property. Mapping the tobacco vendors' location and then calculating its' density provides helpful information to policymakers that can guide policy responses to reduce overall exposure and access to tobacco across the whole of India.

2. Methods

The study lead was the Institute for Global Tobacco Control (IGTC) at the Johns Hopkins School of Public Health (JHSPH), working in collaboration with the International Union Against Tuberculosis and Lung Disease (The Union). Data collection was conducted by the Postgraduate Institute of Medical Education and Research (PGIMER) Chandigarh.

The study used a cross-sectional observational design.

2.1. Sample

This study conducted a census of all tobacco vendors in select wards in each city. To determine the wards for data collection, PGIMER Chandigarh and The Union compiled details for each of the 53 wards in Ranchi and 47 wards in Siliguri. Each ward was described based on its demographics, and physical assets such as marketplaces/retail areas, educational institutions, public places such as parks, places of worship, and public transportation. To be selected, wards needed to have a retail area and at least one school. Wards were selected that were geographically dispersed from each other, had a range of demographic features, and had diverse public places. The study identified three wards in Ranchi (no.02, 29, 51) and five wards in Siliguri (no.02, 05, 08, 17, 32).

2.2. Training

All data collectors and field co-ordinators attended a three-day training session in December 2019 in Siliguri, West Bengal. Training was provided by staff/faculty from IGTC, staff from The Union, and faculty from PGIMER Chandigarh. Training included practice field work in wards not included in the study sample.

2.3. Data collection procedure

Data collectors were assigned to wards. Data collectors, working in pairs, used a pre-determined walking route to conduct a census of the tobacco vendors. The assigned routes ensured the data collectors traversed all streets within their assigned wards.

The data collectors identified a tobacco vendor either by observing a tobacco pack and/or advertisements on display, by seeing tobacco products being purchased by consumers, or by asking the vendor directly when neither was observed. Educational institutions were also identified in each ward within both cities.

Two mobile applications were used to support data collection. *Google Maps* was used to affirm data collectors' locations and ensure they were within the boundaries of the ward. *MapMyWalk* was used to help trace the path and ensure that each street was only covered once. Data collectors also used paper maps to support their daily data collection efforts.

2.4. Observations

Once a tobacco vendor was identified, data collectors recorded, using a mobile data collection application (EpiCollect), the vendor name, location, and the type of vendor (see Table 1). Note, the definitions for each of these classifications were developed with the help of local experts.

Similarly, for educational institutions, data collectors recorded the institution's name and geo-coordinates. Photographs of the exteriors of the tobacco vendor and educational institutions were captured using EpiCollect as well.

2.5. Data quality

At the end of each data collection day, identified tobacco vendor geo-coordinates were reviewed for each observation to ensure they were in the correct ward.

2.6. Vendor density calculations

Ward area sizes and lengths of road were determined using GIS software (QGIS 10.5).

Tobacco vendor density by ward area (number of vendors/km^2) was calculated by dividing the number of vendors by the area of each selected ward.

Table 1 – Classification of vendor-type.

Vendor-type	Definition
Independent store/supermarket	Establishment that sells a limited variety of goods, including cigarettes, cleaning supplies, and food staples, including grocery/supermarkets
Kiosk, permanent	A small, permanent, enclosed structure, often freestanding, open on one side or with a window, used as a booth to sell cigarettes, bidis, paan products.
Kiosk, temporary	A small, temporary, enclosed structure, often freestanding, open on one side or with a window, used as a booth to sell cigarettes, bidis, paan products
Street vendor	Includes stands, tables, and pushcarts

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Tobacco vendor density by road distance (number of vendors/km) was calculated by dividing the number of vendors by the distance covered by road within each selected ward.

Tobacco vendor density by population (number of vendors/1000 population) was calculated by dividing the number of vendors by the total number of registered population[28,29] (at the time of data collection) within each selected ward.

Presence of tobacco vendors within 100-yards of educational institutions: GIS tools were used to generate 100-yard boundary around educational institutions properties. Property boundaries were identified using Google Maps. In each ward, the number of tobacco vendors within 100-yards of each educational institution was counted; an average number of vendors per educational institution is reported, as well as the range of tobacco vendors and the type of tobacco vendors.

3. Results

A total of N = 926 tobacco vendors were observed, including n = 559 in Ranchi (see Fig. 1), and n = 367 in Siliguri (see Fig. 2). In Ranchi, the highest number of tobacco vendors was observed in ward no.29 (n = 327) and the most common vendor type was an independent store (58%), followed by permanent and temporary kiosk. In Siliguri, the highest number of vendors was observed in ward no.02 (n = 113) and

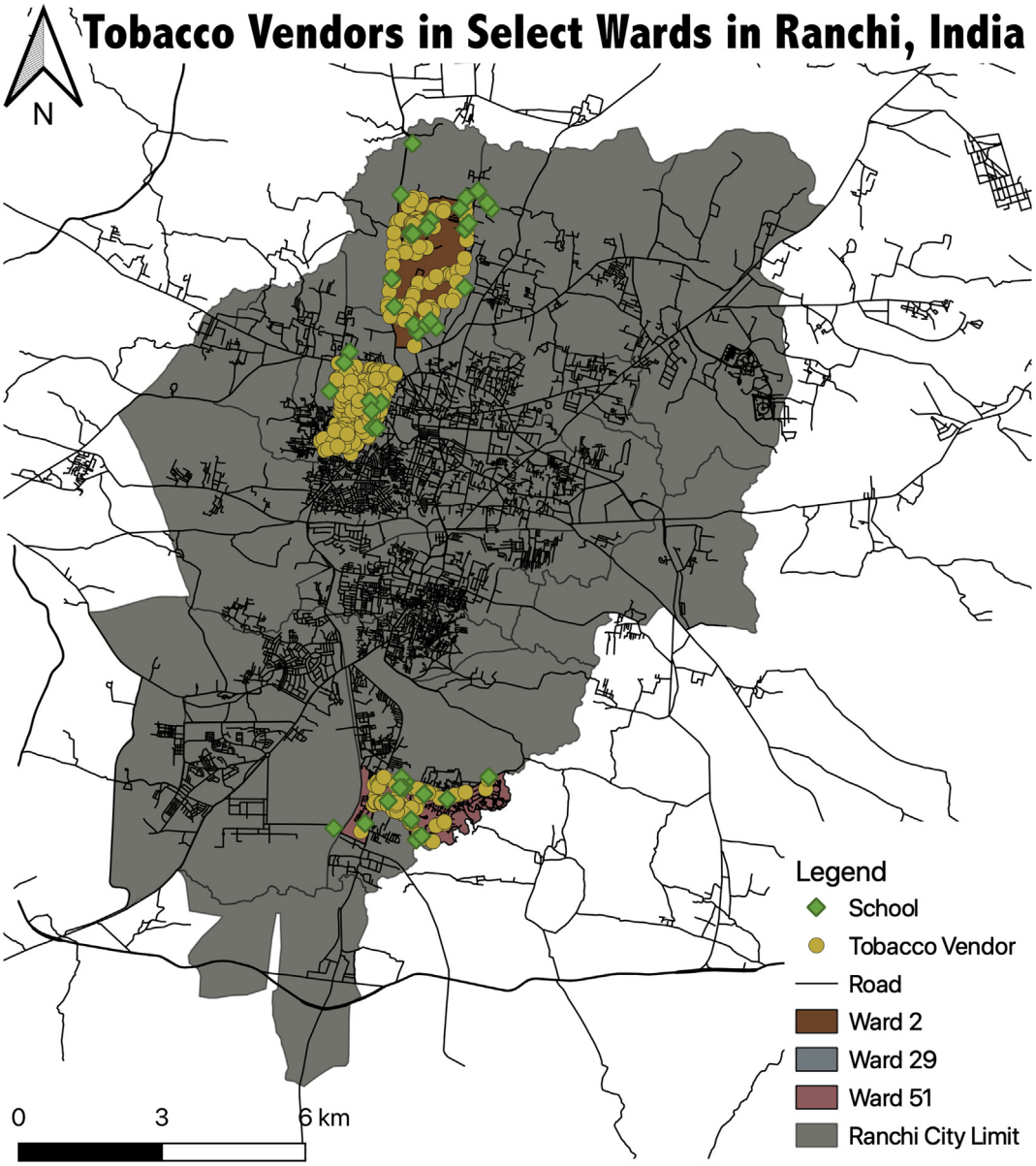

Fig. 1 – Location of tobacco vendors and educational institutions (schools) in three wards in Ranchi.

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Fig. 2 – Location of tobacco vendors and educational institutions (schools) in five wards in Siliguri.

the most common vendor type was a permanent kiosk (52%), followed by temporary kiosk and street vendor (Table 2).

3.1. *Tobacco vendor density by area*

The average tobacco vendor density across three wards in Ranchi was 68 tobacco vendors/km^2 (range: 34–195). In Siliguri, across the five wards, the tobacco vendor density was determined to be 99 tobacco vendors/km^2 (range: 43–237) (see Table 3). Of the three wards in Ranchi, the highest tobacco vendor density by area was observed in ward no.29 with 195 tobacco vendors/km^2; ward nos.02 and 51 had similar tobacco vendor density, with 37 tobacco vendors/km^2 and 34 tobacco vendors/km^2 respectively (see Table 3). In Siliguri, the highest tobacco vendor density was observed in ward no.08 with 237 tobacco vendors/km^2, while ward no.17 had the second highest tobacco vendor density with 142 tobacco vendors/km^2. Tobacco vendor density in ward nos.02 and 05 were found to be similar with 120 tobacco vendors/km^2; ward no.13 reported the lowest vendor density amongst all five wards in Siliguri with 43 tobacco vendors/km^2.

3.2. *Tobacco vendor density by road distance and population*

Per km of road, this study found an average of 06 tobacco vendors/km in Ranchi and 05 tobacco vendors/km in Siliguri (see Table 3). In Ranchi, there are 08 tobacco vendors/1000 population (range: 4–13), and 07 tobacco vendors/1000 population (range: 04–46) in Siliguri.

When comparing the vendor density by road distance and by population measure within the three wards in Ranchi, the highest tobacco vendor density was found to be in ward no.29, with 11 tobacco vendors/km and 06 tobacco vendors/1000

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Table 2 – Number of tobacco vendors in each ward, by vendor-type.

Ward	Independent store/Supermarket % (n)	Permanent Kiosk % (n)	Temporary Kiosk % (n)	Street vendor % (n)	Total
Ranchi					
02	44% (62)	16% (23)	19% (27)	20% (28)	140
29	78% (255)	10% (31)	8% (25)	5% (16)	327
51	9% (08)	73% (67)	12% (11)	7% (06)	92
Total	**58% (325)**	**22% (121)**	**11% (63)**	**9% (50)**	**559**
Siliguri					
02	12% (14)	48% (54)	24% (27)	16% (18)	113
05	1% (01)	61% (44)	22% (16)	15% (11)	72
08	0% (0)	64% (39)	26% (16)	10% (06)	61
17	0% (0)	25% (14)	20% (11)	55% (31)	56
32	22% (14)	63% (41)	6% (4)	9% (06)	65
Total	**8% (29)**	**52% (192)**	**20% (74)**	**20% (72)**	**367**

population respectively (Table 3). Likewise, in Siliguri, tobacco vendor density by road distance and by population measure within the five surveyed wards was also found to be highest in ward no. 08, with 09 tobacco vendors/km and 46 tobacco vendors/1000 population (see Table 3).

We note that some of the more developed wards were relatively smaller in area but had the highest tobacco vendor densities. For example, ward no. 08 in Siliguri has an area of 0.26 km^2, with a total population of 5097 people; this ward had a vendor density of 237 tobacco vendors/km^2 and 46 tobacco vendors/1000 population. Similarly, ward no. 17 in Siliguri has an area of 0.39 km^2 and a total population of 5029 people, and 142 tobacco vendors/km^2, 28 tobacco vendors/1000 population (see Table 3).

3.3. *Tobacco vendors around educational institutions*

In total, there were 36 schools observed in the three wards in Ranchi and 34 schools in the five wards in Siliguri. In Ranchi, n = 105 tobacco vendors were identified operating within 100-yards of a school property. In Siliguri, n = 84 tobacco vendors were identified operating within 100-yards of a school property.

In Ranchi, ward no.29 had the highest number of tobacco vendors near schools with an average of 09 tobacco vendors per school (range: 0–28). Within the five survey wards in Siliguri, ward no. 02 had the highest number of tobacco vendors with an average of 06 tobacco vendors per school (range: 0–28) (Table 4).

The study reviewed what type of tobacco vendor was operating withing 100-yards of a school. In Ranchi, the most common tobacco vendor differed by ward, with wards 02 and 29 having independent shops as the most common type, while ward 51 had more permanent kiosks (see Table 5). In Siliguri, in 04 of the 05 wards, permanent kiosks were the most common tobacco vendor type.

4. Discussion

The results presented in our study indicate that irrespective of methods to calculate the density of tobacco vendors, it is extremely high within both cities. Tobacco vendor density has been studied in other jurisdictions. New York City has approximately 10 tobacco vendors/km^2, [30] meaning that tobacco vendor density across the three wards in Ranchi is nearly seven times higher and nearly 10 times higher across the five wards in Siliguri. When considering tobacco vendor density by population, Denpasar City in Indonesia has about

Table 3 – Tobacco vendor density measures in Ranchi and Siliguri, by ward.

Ward	Total Number of Tobacco Vendors (n)	Area (km^2)	Density by area (tobacco vendors/km^2)	Road distance (km)	Density by road distance (tobacco vendors/km)	Ward-level population (n)	Density by population (tobacco vendors/1000 population)
Ranchi							
02	140	3.79	37	24.77	06	32,200	04
29	327	1.68	195	29.69	11	31,687	06
51	92	2.68	34	41.48	02	7146	05
Overall	**559**	**8.15**	**68**	24.77	**06**	**71,033**	**08**
Siliguri							
02	113	0.94	120	22.20	05	14,327	08
05	72	0.60	120	11.72	06	16,369	07
08	61	0.26	237	6.57	09	5097	46
17	56	0.39	142	8.71	06	5029	28
32	65	1.50	43	21.72	03	11,334	04
Overall	**367**	**3.69**	**99**	22.20	**05**	**52,156**	**07**

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Table 4 – Number and percentage of tobacco vendors near schools by ward.

Ward	Number of schools in each ward	Number of Tobacco vendors within 100-yards of schools (% of all observed tobacco vendors)	Number of Tobacco vendors within 100-yards of each school Mean (range)
Ranchi			
02	18	25 (18%)	02 (0–07)
29	07	54 (17%)	09 (01–28)
51	12	26 (28%)	03 (0–07)
Overall	36	105 (19%)	04 (0–28)
Siliguri			
02	08	34 (30%)	06 (01–15)
05	05	28 (39%)	06 (05–08)
08	03	16 (26%)	05 (01–09)
17	11	05 (9%)	01 (0–04)
32	07	01 (2%)	0 (0–01)
Overall	34	84 (23%)	03 (0–15)

4.6 tobacco vendors per 1000 population[31] and Scotland about 1.6 tobacco vendors per 1000 population.[32] Ranchi and Siliguri have tobacco vendor densities (by population), almost double that of Denpasar and eight times higher than Scotland.

Similarly, when considering the tobacco vendor density measure by road distance, our study reported an average of 06 tobacco vendors/km within the three wards in Ranchi and 05 tobacco vendors/km in the five wards of Siliguri. The vendor density measure by road distance was markedly high compared to a neighbourhood-based study of tobacco retailers in the United States, which reported 0.1 tobacco retailers per km of roadway.[33] The present study's findings suggest that tobacco retailers are ubiquitously located in the cities of Ranchi and Silguri, and that these two cities have tobacco vendor densities substantially higher than other jurisdictions with published results.

This study adds to the evidence that tobacco vendors are operating within 100-yards of schools, despite the provisions in COTPA (2003). About one-fifth of the tobacco vendors identified in our study across the studied wards were located within 100-yards of one or more educational institution (more than was found in the 2010 Mumbai study). If all tobacco vendors operating within 100-yards of educational institutions stopped selling tobacco, tobacco vendor density would be reduced.

In other jurisdictions, tobacco vendor licensing strategies have been used to reduce tobacco vendor density by capping the number of vendors in a neighbourhood.[26,34] Presently, both Ranchi and Silliguri have enacted and started to implement Tobacco Vendor Licensing (TVL), aligned with the national advisory 2017. Licenses can be issued to tobacco vendors by the municipal authorities on the condition that shops provide evidence of a permanent address, and that those permitted to sell tobacco products cannot sell confectionary items such as toffees, candies, chips, biscuits, soft drinks, among others, which are meant for the non-users – particularly children. In addition to fully implementing and enforcing their respective tobacco vendor licensing law, both Ranchi and Siliguri city governments could consider further restrictions including limiting the number of licenses available by area or by population.

Comprehensive tobacco vendor density reduction policies are an excellent potential tool to reduce the public health burden of tobacco use in communities. Embracing tobacco vendor reduction strategies, such as Tobacco Vendor Licensing policy, is also a promising step towards enhancing tobacco control efforts, thereby reducing tuberculosis infection in India.

Table 5 – Type of Tobacco Vendor within 100-yards of school by ward, by vendor-type.

Ward	Independent shop/Supermarket %	Kiosk, permanent %	Kiosk, temporary %	Street vendor %	All Vendor types %
Ranchi					
02	60%	20%	8%	12%	18%
29	81%	11%	3%	3%	17%
51	11%	73%	15%	0%	28%
Total	**59%**	**28%**	**7%**	**4%**	**19%**
Siliguri					
02	8%	55%	14%	20%	30%
05	3%	71%	14%	10%	39%
08	0%	75%	25%	0%	26%
17	0%	40%	20%	40%	9%
32	0%	100%	0%	0%	2%
Total	**4%**	**64%**	**16%**	**14%**	**23%**

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Provenance and peer review

Not commissioned; externally peer reviewed.

Data availability statement

Data are not available to protect the businesses that were observed.

Patient consent for publication

Not required.

Author's contribution

NSP and SS spearheaded the idea for this manuscript. RDK and SS provided substantial contribution to the design of the study in collaboration with RJS, AP, SG and KW. NSP, RDK and SS drafted the manuscript. SS and RDK collated the data. All authors critically reviewed different versions of the manuscript. NSP, RDK, SS and KW contributed to the revisions and all authors gave approval for final manuscript in its present form.

Conflicts of interest

The authors have none to declare.

Acknowledgement

This study is supported under a grant from Bloomberg Initiative to Reduce Tobacco Use to Strengthening Enforcement of TAPS ban with focus on Point-of-Sale through tobacco vendor licensing. The authors also acknowledge civil society organisations namely Socio Economics and Educational Development Society (SEEDS) in Ranchi and Manbhum Ananda Ashram Nityananda Trust (MANT) in Siliguri for their supervision and logistic support to conduct this study.

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Please cite this article as: Pouranik NS et al., Tobacco retailer density and tobacco retailers near schools in two cities of East India, Ranchi and Siliguri, Indian Journal of Tuberculosis, https://doi.org/10.1016/j.ijtb.2021.07.003