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Ex ante evaluation of the impact of tobacco control policy measures aimed at the point of sale in the Netherlands

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ABSTRACT

Introduction The Netherlands aims to implement stricter tobacco control policies targeting the retail environment. This paper is an ex ante policy evaluation of the potential impact of the current tobacco display and advertising ban as well as future tobacco sales bans on tobacco outlet visibility and availability.

Methods Between September 2019 and June 2020, all potential tobacco retailers in four Dutch cities (Amsterdam, Eindhoven, Haarlem and Zwolle) were visited and mapped using Global Positioning System. For each retailer selling tobacco, we completed a checklist on the visibility of tobacco products and advertising. Expected reductions in tobacco outlet visibility and availability were calculated per policy measure in absolute numbers (percentage or percentage point decrease) as well as density and proximity.

Results Out of 870 tobacco outlets, 690 were identified with visible tobacco products/advertising. The display ban in supermarkets and small outlets (respectively) is expected to decrease the number (−15; −42 percentage points), outlet density per 10 000 capita (−0.9; −2.6) and proximity in metres (+27 m; +400 m) of outlets with visible products/advertising. The upcoming bans on vending machines and sales in supermarkets are expected to decrease the number (−12%; −31%), density (−0.7; −1.9) and proximity (+12 m; +68 m) of tobacco outlets. Further changes in the number, density and proximity (respectively) of tobacco outlets may be achieved with future sales bans in petrol stations (−7%; −0.4; +60 m) and particularly with a ban on sales in small outlets (−43%; −2.7; +970 m).

Conclusion A display ban and a sales ban in small outlets will contribute most to reducing tobacco outlet visibility and availability, assuming that no market shift towards other tobacco outlets will take place.

INTRODUCTION

High tobacco outlet visibility and availability are problematic, as exposure to tobacco products and promotion is associated with smoking behaviour.[1] It increases smoking susceptibility[2] and initiation,[3 4] impulse purchases[5] and it may hinder smoking cessation efforts.[6] Tobacco outlet availability (ie, the number, density and proximity of tobacco outlets) determines the intensity of exposure to tobacco outlets, which in turn impacts smoking behaviour, susceptibility and initiation.[7–10] In addition, proximity of outlets determine the degree of access to tobacco outlets, which is negatively associated with smoking cessation success.[11 12] Display and advertising bans on tobacco prohibit visibility of tobacco promotion at the point of sale (POS). Banning tobacco sales in specific outlets may reduce the availability of tobacco.

Currently, tobacco is still omnipresent in the retail environment in the Netherlands. It is estimated that in the Netherlands, tobacco is sold at nearly 16 000 points of sale, including sales through vending machines.[13] A vast majority of tobacco sales take place in supermarkets, petrol stations and tobacco specialist shops.[14] Supermarkets form the largest share of tobacco outlets (40%), accounting for 55% of total tobacco sales.[13] A pilot study on the visibility of tobacco products in Amsterdam in 2018 found that around 80% of supermarkets and 100% of tobacco specialist shops visibly displayed tobacco.[15] Tobacco advertisements were found in all tobacco specialist shops but were rarely present in other tobacco outlets.[15]

In 2018, the Dutch government concluded the National Prevention Agreement, which contained several tobacco control policies targeting the POS. In July 2020, the Netherlands implemented the tobacco display ban removing tobacco products from sight in supermarkets. In January 2021, the ban was extended to small tobacco outlets (eg, convenience stores, newsagents, bookstores), prohibiting visible tobacco products and advertisements both inside and outside. Tobacco specialist shops were exempted. In the upcoming years, tobacco vending machines will be prohibited in 2022, and tobacco sales by supermarkets in 2024. The Agreement sets out the intention to further phase out tobacco sales after 2030 by prohibiting sales in petrol stations and small outlets. However, it is not yet certain these policies will be implemented, especially given a recent change of government.

In this paper, we performed an ex ante policy evaluation of the likely impact of the current and potential upcoming policies on tobacco outlet visibility and availability (ie, the number, density and proximity of tobacco outlets) in Dutch cities. We audited the situation at tobacco outlets before the POS policies implemented in July 2020, and predicted the extent of reduction in tobacco outlet visibility and availability that could result from current and upcoming policies to inform policy makers about the relative effectiveness of these policies, and to set an example for other countries.

METHODS

An observational audit of retail outlets was conducted in four cities in the Netherlands: Amsterdam, Eindhoven, Haarlem and Zwolle. These cities are located in different parts of the country, and represent a variety in terms of area size, age structure and ethnic composition.

Between September 2019 and June 2020, all streets within the four cities were systematically walked through by one of the 23 independent observers—each covering distinct neighbourhoods—and checked to identify tobacco retailers. All potential tobacco outlets were visited to check for tobacco sales. If stores sold tobacco, they were identified as tobacco retailers and the locations recorded using Esri's ArcGIS Collector mobile app V.19.0.2.[16] For each tobacco retailer, an observational checklist within the same mobile app was completed to specify the level of internal and external visibility of tobacco products and advertisements.

Briefly, this included items on the visibility of tobacco packs, physical and electronic advertising and vending machines. Based on the checklist used by Nuyts *et al*,[15] the checklist was completed directly after or while visiting stores. Prior to data collection, the independent observers received a training.

After auditing the four cities, to check the observer reliability, a total of 11% of administratively defined wards (between 7 and 10 areas per city) were revisited by another observer to check for missed tobacco outlets and possible differences in the tobacco product and advertising visibility. Those areas contained 26% of all mapped tobacco outlets. In 1.7% of all checked outlets, we made minor adjustments to the reported tobacco advertising visibility. However, this never resulted in different visibility as defined in this paper. Three additional cafés selling tobacco through vending machines were identified in one of the four cities and were added during the check.

Variables

Outlets selling tobacco were categorised as: supermarkets (regular supermarkets and small supermarkets 'to go'), petrol stations, small outlets (newsagents, bookstores, telephone stores, kiosks, liquor stores and night shops), the hospitality industry (snack bars, bars, cafés, restaurants, casinos, hotels) and tobacco specialist shops (ie, outlets selling a minimum of 90 different tobacco brands, with a minimum shop area of 10 m^2).

Availability

Tobacco outlet availability was reported in terms of number, density and proximity. Density was measured as number of outlets per km^2 and per 10 000 capita. Data on population numbers were provided by Statistics Netherlands.[17] Proximity was calculated as the average Euclidean distance (ie, straight line) in metres from the centre of a postal code area to the nearest tobacco outlet. Postcodes contained all four numerical digits and both letters of Dutch postcode system. These areas correspond to a block of houses or street side and are therefore the smallest administrative unit, averaging 10–20 households or around 2500 m^2 in urban areas.[18] These calculations were repeated per type of tobacco outlet (eg, supermarkets, petrol stations, small outlets, hospitality industry and tobacco specialist shops).

Visibility

The calculations for tobacco outlet availability were repeated for outlets with any visibility, which was defined as having internal and/or external visibility of tobacco products or advertising. Tobacco outlets had 'any internal visibility' if tobacco packs, tobacco advertising (other than packs) or a tobacco vending machine were visible inside the store. Tobacco outlets had 'any external visibility' if the following were visible from outside the store: tobacco packs, tobacco advertisements (other than packs), signboard on façade, signboard on sidewalk, posters in shop window, posters inside the store (through shop window), advertisements on terrace fence or tobacco indication in outlet name. There were no tobacco outlets with external visibility that did not also have internal visibility.

Analyses

A Geographic Information System was used to map the spatial distribution of tobacco retailers with their internal and external tobacco product/advertising visibility. Using ArcMap for Desktop 10.4.1., we created a thematic map per city and for the city centre of Amsterdam separately, because of its different function as a tourist area. The maps show the level of visibility of tobacco products and advertising for each tobacco outlet (no visibility, internal only, and internal and external) at baseline (2020).

The same software was used to calculate tobacco outlet density per km^2 and capita, and proximity of tobacco outlets to postcode areas, and to describe these indicators for all outlets and by type of outlet. We then predicted the change in the number of POS, density per km^2 and capita and proximity of POS to postcodes areas after each policy would come into effect. We calculated the predicted reduction in tobacco visibility after the display and advertising ban for (1) supermarkets (July 2020) and (2) small outlets (January 2021), and (3) the ban on vending machines (January 2022). We also calculated the predicted sequential reduction in tobacco availability after (1) the ban on tobacco vending machines (January 2022), as well as after the tobacco sales bans in (2) supermarkets (2024), (3) petrol stations (after 2030), and (4) small outlets (after 2030).

In Amsterdam, two regions were excluded from these analyses because they are not an urban residential area: *Westpoort,* which is a port area, and *Landelijk Noord*, which is a rural area north of Amsterdam too small to be an independent municipality.

Per policy measure, the expected absolute and relative reductions in the number of outlets were calculated as well as expected change in per capita density and proximity. For example, to calculate the predicted reduction in density of tobacco outlets after implementation of the supermarket sales ban in 2024, we removed all supermarkets from the data and calculated the density. This density is expected to remain after the supermarket sales ban. By subtracting this density from the density in the complete dataset, we derived the reduction in density. Reduction in visibility was reported as percentage points (pp), because it was calculated as an absolute reduction of percentages of visible tobacco outlets from the total 870 outlets. Reduction in availability (number, density and proximity) were calculated as a relative percentage based on the total 870 outlets. The same calculations were carried out for the subset of outlets that showed any visible tobacco products or advertising at baseline. All calculations assume there will be 100% compliance and no market shift towards other tobacco outlets.

For each city, a map was created for the expected situation that all policies have been implemented after 2030, both in terms of visibility and availability. Additionally, for Amsterdam's city centre only, we mapped the situation as expected after each consecutive policy.

Table 1 Tobacco outlet availability and visibility, and tobacco product visibility per type of tobacco outlet

	Total	Supermarkets	Petrol stations	Small outlets	Hospitality	Tobacco specialist
Tobacco outlet availability						
N (%)	870 (100)	271 (31.1)	62 (7.1)	303 (34.8)	173 (19.9)	61 (7.0)
Per km^2 (N)	2.2	0.7	0.2	0.8	0.4	0.2
Per 10 000 capita (N)	6.2	1.9	0.4	2.2	1.2	0.4
Proximity (metres (SD))	309.8	417.9	1003.6	559.7	751.7	1420.4
	(263.5)	(355.4)	(614.1)	(513.9)	(631.8)	(1373.1)
Tobacco outlet visibility*						
N (%)	690 (79.3)	132 (48.7)	61 (98.4)	287 (94.7)	149 (86.1)	61 (100)
Per km^2 (N)	1.7	0.3	0.2	0.7	0.4	0.2
Per 10 000 capita (N)	4.9	0.9	0.4	2.1	1.1	0.4
Proximity (metres (SD))	348.6	622.1	1007.2	564.0	823.5	1420.4
	(305.1)	(503.7)	(624.0)	(512.5)	(711.6)	(1373.0)
Tobacco product visibility						
Any internal visibility N (%)	690 (79.3)	132 (48.7)	61 (98.4)	287 (94.7)	149 (86.1)	61 (100)
Visibility tobacco products (%)	63.1	46.1	96.8	87.1	25.4	91.8
Visibility of advertisements (%)	20.6	3.3	8.1	38.9	1.2	73.8
Vending machines (%)	15.4	–	3.2	1.0	74.0	1.6
Any external visibility N (%)	439 (50.5)	66 (24.4)	56 (90.3)	232 (76.6)	27 (15.6)	58 (95.1)
Visibility tobacco products (%)	45.1	22.1	90.3	66.0	14.5	85.2
Visibility of advertisements (%)	25.1	3.0	3.2	50.5	2.3	83.6

Small outlets include newsagents, bookstores, night shops, kiosks, telephone shops and liquor stores, but exclude tobacco specialist shops.
*Tobacco outlets with any internal and/or external visibility.

RESULTS

Availability

In the four cities in total, we identified 870 tobacco outlets (table 1). Most were small outlets (n=303) and supermarkets (n=271). There were 173 hospitality venues selling tobacco, mainly through cigarette vending machines (n=128). The remaining tobacco outlets were petrol stations (n=62) and tobacco specialist shops (n=61). On average, there were 2.2 tobacco outlets per km^2 and 6.2 outlets per 10 000 capita. The average shortest distance from postcode centroids to any tobacco outlet was 309.8 m. Average distance was shortest to supermarkets (417.9 m) and small outlets (559.7 m), and furthest to petrol stations (1003.6 m) and tobacco specialist shops (1420.4 m). Figure 1 shows the distribution of proximity for the distinct city (areas) and total of the four cities, which is somewhat right-skewed. In all areas, except for Amsterdam city centre, proximity to tobacco outlets varies between <100 m and approximately 1000 m.

Visibility

In total, 690 (79.3% of 870) outlets had at least one form of internal visibility (table 1). This is on average 4.9 outlets per 10 000 capita. The shortest average distance to a tobacco outlet with visibility was 348.6 m (SD=305.1). Internal visibility was ubiquitous for tobacco specialist shops (100%), petrol stations (98.4%) and small outlets (94.7%). For all types of tobacco outlets, the largest share of internal visibility were visible tobacco products. Visible internal advertising is most often present at tobacco specialist shops (73.8%). External visibility was present at half of all tobacco outlets, mainly at tobacco specialist shops (95.1%), petrol stations (90.3%) and small outlets (76.6%).

Further characterisation of tobacco outlets in the included cities is presented in online supplemental table 1. The city centre of Amsterdam showed a much higher tobacco outlet density per km^2 (21.8) than the rest of the city (2.8) and the other three cities: Eindhoven (1.5), Haarlem (2.6) and Zwolle (0.6).

Ex ante reduction of tobacco outlet visibility and availability

Table 2 shows the predicted impact of POS policies. The display ban for supermarkets was predicted to have reduced the number of visible tobacco outlets by 15.2 pp (from 690 to 558 visible outlets out of 870). The subsequent display ban for small outlets

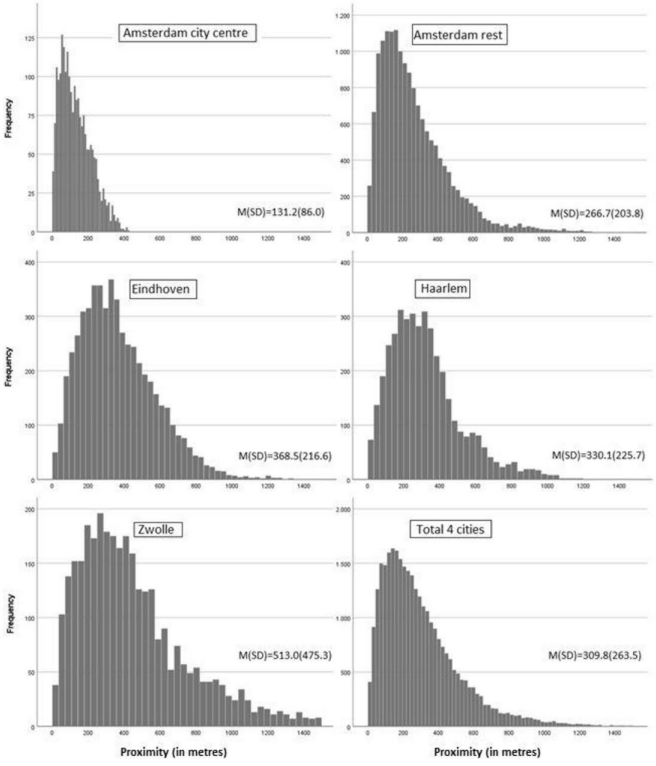

Figure 1 Histograms showing the distribution of proximity (in metres) to tobacco outlets for the total and separately for each city (area) with M(SD).

Table 2 Sequential reduction of tobacco outlet visibility (internal and/or external) and availability after implementation of each policy measure compared with the baseline with 870 outlets of which 690 were with visibility

	Change			Remaining		
	N (%)	Per 10 000 capita	Proximity (m)	N (%)	Per 10 000 capita	Proximity (metres (SD))
Tobacco outlet visibility*						
Baseline total	–	–	–	690 (79.3)	4.9	348.6 (305.1)
Display ban supermarkets (2020)	−132 (15.2 pp)	−0.9	+27.0	558 (64.1)	4.0	375.6 (313.3)
Display ban small outlets (2021)	−364 (41.8 pp)	−2.6	+400.0	194 (22.3)	1.4	775.6 (750.5)
Ban on vending machines (2022)	−133 (15.3 pp)	−1.0	+644.8	61 (7.0)	0.4	1420.4 (1373.0)
Tobacco outlet availability†						
Baseline total	–	–	–	870 (100)	*6.2*	*309.8* (*263.5*)
Ban on vending machines (2022)	−103 (11.8)	−0.7	+12.3	767 (88.2)	5.5	322.1 (269.2)
Sales ban supermarkets (2024)	−271 (31.1)	−1.9	+68.3	496 (57.0)	3.6	390.4 (311.3)
Sales ban petrol stations (≤2030)	−61 (7.0)	−0.4	+59.7	435 (50.0)	3.1	450.1 (388.9)
Sales ban small outlets (≤2030)	−374 (43.0)	−2.7	+970.3	61 (7.0)	0.4	1420.4 (1373.0)

Vending machines were, besides in hospitality venues, also located in three small outlets, two petrol stations and one tobacco specialist shop.
*Sales bans in supermarkets, petrol stations and small outlets were not included as these will not affect outlet visibility.
†Display bans were not included as these will not affect outlet availability.

was predicted to have the largest reduction on tobacco outlet visibility (−41.8 pp), as it prohibits visible tobacco products and advertisements at all tobacco outlets except tobacco specialist shops and vending machines. After full implementation of the display ban, only 22.3% of 870 outlets would be expected to have tobacco product visibility. The distance to a visible tobacco outlet was predicted to increase from 349 m to 776 m after the display bans and to 1420 m after the vending machine ban.

Tobacco outlet availability will not be affected by the display and advertising bans for supermarkets and small outlets. The ban on cigarette vending machines, however, is expected to reduce the number of tobacco outlets by 103 (11.8%), leaving 767 tobacco outlets. This would decrease the number of tobacco outlets per 10 000 capita by 0.7 and increase the average distance to a tobacco outlet by 12 m (from 310 to 322 m). After implementation of the vending machine ban and sales ban in supermarkets, the total number of tobacco outlets would be reduced by 43% to 496. When hereafter the sales ban in petrol stations is implemented, a total reduction of tobacco outlets of 50% is expected, leaving 435 outlets. The largest reduction may be achieved with a sales ban in small outlets (−43.0%). After implementation of all upcoming and intended policy measures, the total number of tobacco outlets would be reduced by 93% compared with the baseline, with only tobacco specialist shops remaining (n=61).

Figure 2 depicts tobacco outlet visibility and availability for each city at baseline and after implementation of all upcoming and intended retail policies. After all policies will be in effect, tobacco outlets will remain primarily visible and concentrated in the city centre. In online supplemental figure 1, the reduction of tobacco outlet visibility and availability is shown per policy measure for Amsterdam's city centre and surrounding areas.

DISCUSSION

In this study, we predicted the impact of current and upcoming tobacco control policies at the POS on tobacco outlet visibility and availability (in terms of number, density and proximity) in four Dutch cities. In 2020, 690 out of 870 tobacco outlets showed visible tobacco products and advertising. The display ban in supermarkets and small outlets, respectively, is expected to reduce the number (−15 pp; −42 pp), density per 10 000 capita (−0.9; −2.6) and proximity (+27 m; +400 m) of tobacco outlets with visible tobacco promotion. The upcoming ban on vending machines and sales in supermarkets is expected to limit tobacco availability by reducing the number (−12%; −31%), density (−0.7; −1.9) and proximity (+12 m; +68 m) of tobacco outlets. These outcomes are most affected by a sales ban in small outlets (−43%, −2.7 and +970 m, respectively). The number of tobacco outlets may reduce by 93% when tobacco sales are allowed in tobacco specialist shops only, which potentially increases tobacco outlet proximity to >1 km.

Limitations

The audit of tobacco retailers was performed by multiple observers who each audited distinct areas, which could increase the risk of interobserver bias. However, subjectivity was limited, because we used a standardised checklist and each observer received a short training prior to their work. After checking a sample of areas, only a few deviations were found. Moreover, we found similar proportions of the different tobacco outlet types as national proportions.[13]

As the audit was performed in the months before implementation of the display ban in supermarkets, some supermarkets may have already taken tobacco out of sight. Therefore, this study may underestimate the effect of the display ban in supermarkets on tobacco outlet visibility.

We used Euclidean distance to calculate the average shortest distance to tobacco outlets from postcode centroids. Although this method is common in geographic analyses, it does not take into account road networks and may therefore not accurately reflect the actual shortest distance to tobacco outlets.[19] Nonetheless, the Netherlands has very dense road networks, especially in cities, and therefore linear distance and road distance are highly correlated.[20] Moreover, studies in the USA[21] and Finland[22] found marginal differences in tobacco outlet proximity between the two methods.

This study included solely urban areas in the Netherlands. Therefore, the results of this study may not be generalisable to Dutch rural areas or the entire country.

International comparison

We predict large potential reductions of tobacco outlets with visible tobacco products and advertising after implementation

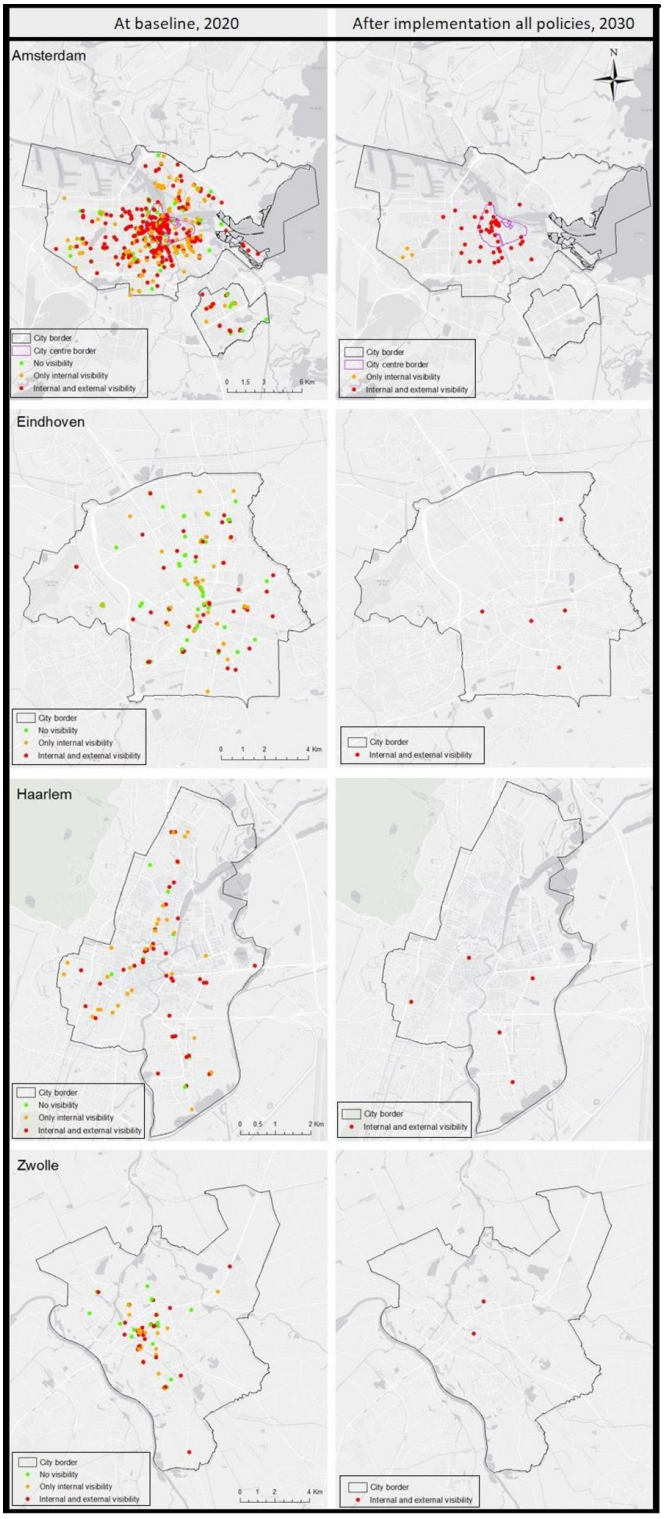

Figure 2 Tobacco outlet visibility and availability in Amsterdam, Eindhoven, Haarlem and Zwolle in 2020, and after implementation of all current and upcoming point of sale policies (≥2030).

of the display and advertising ban in supermarkets (−15 pp) and small outlets (−42 pp). Several ex-post studies in Scotland are in line with our predictions. Although storage units remained highly visible,[23] they found substantial reductions of tobacco product visibility after implementation of POS policies.[24 25] Children and adolescents also reported seeing fewer tobacco displays after implementation of the display ban in England,[26] Ireland[27] and Australia.[28] It is therefore plausible that a reduction of tobacco outlet visibility has actually occurred after implementation of POS policies in the Dutch tobacco retail environment as well.

We also predict large potential reductions of tobacco outlet availability after implementation of a ban on cigarette vending machines (−12%), tobacco sales bans in supermarkets (−31%) and small outlets (−43%). Although most previous reduction studies were based on hypothetical models,[29–31] promising effects of density-reduction policies were reported in a review of studies in New Zealand and the USA.[32] Actual reduction rates were measured in the USA, for example, after implementation of a pharmacy sales ban in New York City (on average −7% per 1000 capita), in Massachusetts (−29%) and California (−51%).[33 34]

Our prediction of substantive reduction of both tobacco outlet visibility and availability assumes full compliance to these policies. A study in Poland found many violations of the POS advertising ban,[35] while studies in Scotland, Ireland and Norway found high compliance rates after implementation of a display ban for small outlets.[25 27 36 37] In Australia, compliance rates were high as well,[38] but in-store violations of the policies were common among unlicensed retailers.[39] This pleads in favour of monitoring compliance alongside strong law enforcement for successful implementation of tobacco control policies at the POS.

Interpretation

We found that tobacco outlet proximity is expected to be marginally affected by tobacco sales bans in supermarkets and petrol stations. Tobacco outlets will remain accessible within 500 m of postcode centroids, which would be a 5.5 min walk or 2.5 min bicycle ride.[40] Tobacco outlet proximity is an important aspect of tobacco control, as it affects smoking outcomes. A study in Finland, for instance, showed 16% increased odds of smoking cessation with every 500 m increase in the distance from home to a tobacco outlet.[12] A sales ban in small outlets would substantially increase the distance from postcode centroids to the nearest tobacco retailer from 450 m to 1420 m. This emphasises the importance of a sales ban in small outlets, which should be prioritised by policy makers.

The predicted large reductions will only occur if a shift in tobacco retail does not emerge. With concern for unintended effects of retail policies, one Dutch study estimated that after the supermarket sales ban, 12.5% of all supermarkets will start a tobacco specialist shop, for which there are no specific legal requirements.[41] Yet, there may be a higher risk that tobacco sales bans would induce a shift towards tobacco sales in other shops. In the Netherlands, a shift may occur towards small outlets, as these are expected to be exempted from tobacco sales bans until at least 2030. In addition, if vape shops are classified as tobacco specialist shops and are therefore exempt from POS policies, their impact could also be disrupted by the emergence of visible e-cigarette displays in vape shops.[25] The introduction of a tobacco retailer licensing system could prevent such market shift if licensing measures limit the number of tobacco outlets. Restriction in the number of outlets based on population[42] or area size,[19] in combination with a minimum distance between tobacco outlets[43] is a promising licensing method to prevent expansion of tobacco outlets of any type.[44]

We found a much higher tobacco outlet density in the city centre of Amsterdam than the other three cities. This is mainly due to the large proportion of small outlets, such as souvenir shops, which sell tobacco products. These large numbers may reflect the unique function of the city centre as tourist area.

A recent study in Barcelona found that the number of alcohol outlets and level of alcohol promotion visibility were higher in tourist areas.[45] The large numbers in our study may also indicate a new trend in the tobacco retail environment. If so, the city centre of Amsterdam could be a precursor of the future situation in other cities. Therefore, we argue for greater attention to retail policies for inner cities.

CONCLUSION

It is expected that the display ban in supermarkets and in small outlets will reduce the number of tobacco outlets with tobacco product and advertising visibility by 57 pp. A sales ban in small outlets is expected to contribute most to reduced tobacco outlet availability (−43%) and proximity (+970 m), which stresses the importance of bringing these policies forward. To reach substantive reduction rates, efforts should be made to monitor and enforce tobacco retailers' compliance, and to prevent a market shift towards other tobacco outlets.

Key messages

What is already known on this topic

⇒ Several countries have implemented tobacco display and advertising bans at the point of sale (POS) as well as sales bans in specific tobacco outlets to reduce tobacco outlet availability and visibility.

⇒ This study is the first ex ante policy evaluation to assess the impact of current and future tobacco control policies at the POS on tobacco outlet availability and visibility in the Netherlands.

What this study adds

⇒ Although bans on tobacco displays, vending machines and sales in supermarkets substantially limit tobacco availability and visibility, a ban on tobacco sales in small outlets was predicted to contribute most to reducing tobacco outlet availability in numbers and density, and increasing the distance to outlets (proximity).

How this study might affect research, practice and/or policy

⇒ There is a need to prioritise the implementation of tobacco control policies targeting small outlets, in order to substantively reduce tobacco availability and visibility.

⇒ It will be important to monitor and enforce tobacco retailers' compliance, and prevent a market shift of tobacco sales towards other outlets.

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