

Tobacco retail outlet advertising practices and proximity to schools, parks and public housing affect Synar underage sales violations in Washington, DC

Thomas R Kirchner,^{1,2,3} Andrea C Villanti,^{1,2} Jennifer Cantrell,^{2,4} Andrew Anesetti-Rothermel,^{1,5} Ollie Ganz,² Kevin P Conway,⁶ Donna M Vallone,^{2,3} David B Abrams^{1,2,3}

¹The Steven A. Schroeder National Institute for Tobacco Research and Policy Studies, Legacy, Washington, DC, USA

²Department of Health, Behavior and Society, Johns Hopkins School of Public Health, Baltimore, Maryland, USA

³Department of Oncology, Lombardi Comprehensive Cancer Center, Georgetown University Medical Center, Washington, DC, USA

⁴Department of Research and Evaluation, Legacy, Washington, DC, USA

⁵Department of Epidemiology, School of Public Health, West Virginia University, Morgantown, West Virginia, USA

⁶Division of Epidemiology, Services and Prevention Research, National Institute on Drug Abuse, National Institutes of Health, Bethesda, Maryland, USA

Correspondence to

Dr Thomas R Kirchner, The Steven A. Schroeder National Institute for Tobacco Research and Policy Studies, Legacy, 1724 Massachusetts Ave, NW, Washington, DC 20036, USA; tkirchner@legacyforhealth.org

Received 18 July 2013

Accepted 29 January 2014

ABSTRACT

Objective To examine the cross-sectional association between illicit sales of tobacco to minors, Washington DC tobacco outlet advertising practices, retail store type, the demographic make-up of the area surrounding each outlet, and the proximity of each outlet to high schools, recreational parks and public housing.

Participants Seven hundred and fifty tobacco outlets in the DC area, n=347 of which were randomly selected for inspection by the Synar Inspection Program in 2009–2010.

Main outcome measures The presence of tobacco advertisements on the interior and exterior of each outlet, and illicit tobacco sales to Synar Inspection Program youth volunteers.

Results The presence of tobacco advertisements on the exterior of gas stations was much greater than on other retail store types (OR=6.68; 95% CI 4.05 to 11.01), as was the absence of any advertisements at bars or restaurants that sold tobacco (OR=0.33; 95% CI 0.22 to 0.52). Exterior tobacco advertisements were also more likely in predominantly African–American areas of the city (OR=3.11; 95% CI 2.28 to 4.25), and particularly likely on storefronts located closer to parks (OR=1.87; 95% CI 1.06 to 3.28). Illicit sales to minors were more common at gas stations (OR=3.01; 95% CI 1.5 to 6.3), outlets that displayed exterior tobacco advertisements closer to parks (OR=3.36; 95% CI 1.38 to 8.21), and outlets located closer to high schools in majority African–American block groups (OR=1.29; 95% CI 1.07 to 1.58).

Conclusions Findings demonstrate that while illicit tobacco sales to minors are occurring at acceptably low rates by Synar standards, illicit sales vary considerably by retail store type, advertising approach and proximity to high schools, parks and African–American residential areas. Future work may help inform regulatory efforts to reduce youth access at the neighbourhood, city, state and national levels.

Youth tobacco use prevention remains a key focus of tobacco control efforts, largely through laws reducing exposure to tobacco marketing and restricting access to tobacco products. Studies indicate that youth access laws can slow increases in adolescent smoking and reduce smoking prevalence and cigarette consumption, yet high retailer compliance is necessary before these changes occur.^{1 2}

The US Congress passed the Synar amendment in 1992, providing funding from the Substance Abuse and Mental Health Services Administration

(SAHMSA) to states to enact and enforce a prohibition on the sale of tobacco to minors. The regulation requires that all 50 states and nine jurisdictions (including the District of Columbia (DC)) enforce a youth tobacco sales prohibition via unannounced inspections across a representative sample of tobacco outlets, and that they maintain an annual non-compliance rate of less than 20%.^{3 4}

Complementing the Synar programme, the Food and Drug Administration (FDA) asserted jurisdiction over tobacco products in 1996, and began to enforce federal regulations prohibiting the sale of tobacco to minors in 1998, a period that ended 2 years later when federal regulation of tobacco was terminated by the US Supreme Court.^{3 5} Passage of the 2009 Family Smoking Prevention and Tobacco Control Act reinstated the FDA with authority to enforce youth access laws,⁶ supported by a strategic partnership between the FDA youth sales inspection programme and the existing Synar programme.⁷ Importantly, the provision from the 1996 FDA rules prohibiting exterior advertising within 1000 feet of schools and playgrounds was not included in the 2009 law, and was instead issued as part of an Advance Notice of Proposed Rulemaking that has not yet been acted upon.⁸

The role of two potentially important factors remains unclear and warrants additional research. First, it is uncertain how the proposed ban on exterior tobacco advertising near schools, playgrounds and parks would affect youth access to tobacco.^{9 10} While point-of-sale tobacco (POST) marketing has been linked to the initiation and escalation of youth tobacco use,¹¹ two studies of California schools have reported that proximity of the school to at least one tobacco outlet was not associated with increased smoking prevalence.^{12 13} A limitation of school-centric approaches, which focus on proximity of only one outlet per school and/or aggregated density around schools, is the failure to capture the full range of factors affecting youth access as it occurs across all outlets in the city. And although no studies specifically address the link between parks and illicit sales to minors, our focus on parks is driven by the present policy debate and proposed rule that includes proximity to parks.

Second, it is unknown whether youth access to tobacco via illicit sales differs by area characteristics, such as income and concentration of racial and ethnic minorities, which have previously been associated with higher levels of POST

To cite: Kirchner TR, Villanti AC, Cantrell J, et al. *Tob Control* Published Online First: [please include Day Month Year] doi:10.1136/tobaccocontrol-2013-051239

Research paper

advertising^{14 15} and practices,^{16 17} which, in turn, have been linked with susceptibility to smoking,¹⁸ and an increased likelihood of smoking initiation.^{11 19} While youth access is believed to contribute to tobacco-related health disparities in these vulnerable populations, the degree to which disproportionate youth sales are contributing to this association remains unclear.²⁰

The current study analyses Washington DC Synar data to explore the association between youth sales violations and several environmental features associated with youth tobacco use: advertising on the interior and exterior of the outlet, retail store type of the outlet, demographic characteristics of the area surrounding the outlet, and the proximity of the outlet to the closest high school, recreational park and high-density public housing development. Synar data on underage tobacco sales provides a nationwide metric of the propensity of outlets located near schools, parks or underserved neighbourhoods to sell tobacco to minors, and thus may provide valuable information about youth access. Although one study using underage sales data from St Paul, Minnesota, USA, found no differences in compliance check failures by retail store type, advertising practices, or neighbourhood demographics, the proximity of each outlet to schools, parks or other specific features was not examined.²¹ The present paper extends this approach by incorporating data on the proximity of all DC tobacco outlets to high schools, recreational parks and high-density public housing.

METHODS

Washington, DC, Synar Inspection program

Established in 2004, the DC Synar Inspection programme is administrated by the Addiction Prevention and Recovery Administration within the Department of Health, in partnership

with the Metropolitan Police Department, the Department of Consumer and Regulatory Affairs and the Alcohol Beverage Regulation Administration. Complementing the Synar programme, an FDA Tobacco Retail Compliance Contract was awarded in 2011, and the two initiatives are both part of its overall effort to curb tobacco sales to minors. Accompanied by programme staff and a Police Officer who wait outside, a volunteer under age 18 years enters each randomly preselected store and attempts to purchase a pack of cigarettes. Sales violations are recorded but enforcement penalties are communicated to the storeowner at a later date. Penalties include possible loss of tobacco license, a fine of up to \$1000 and 90 days in jail.

Of the 750 retail outlets that were observed in 2011–2012, 46.3% (n=347) were inspected by the Synar programme. The present analysis is based on the most recent sales violation data for all 347 compliance checks conducted during 2009–2010 (figure 1).

Washington DC high schools, parks and public housing

To enable simultaneous modelling of the range of factors affecting youth sales at each tobacco outlet in the city, a geodatabase was established incorporating spatial location information on high schools, recreational parks and public housing developments together with DC municipal boundaries, geographic features, street network and US Census-based demographic variables.

Schools

Spatial data on the location of all public schools (n=128) was merged with data on the location of charter (n=112) and independent/private schools (n=62) to capture the school environment in 2010. In a preliminary data-cleaning step, schools that

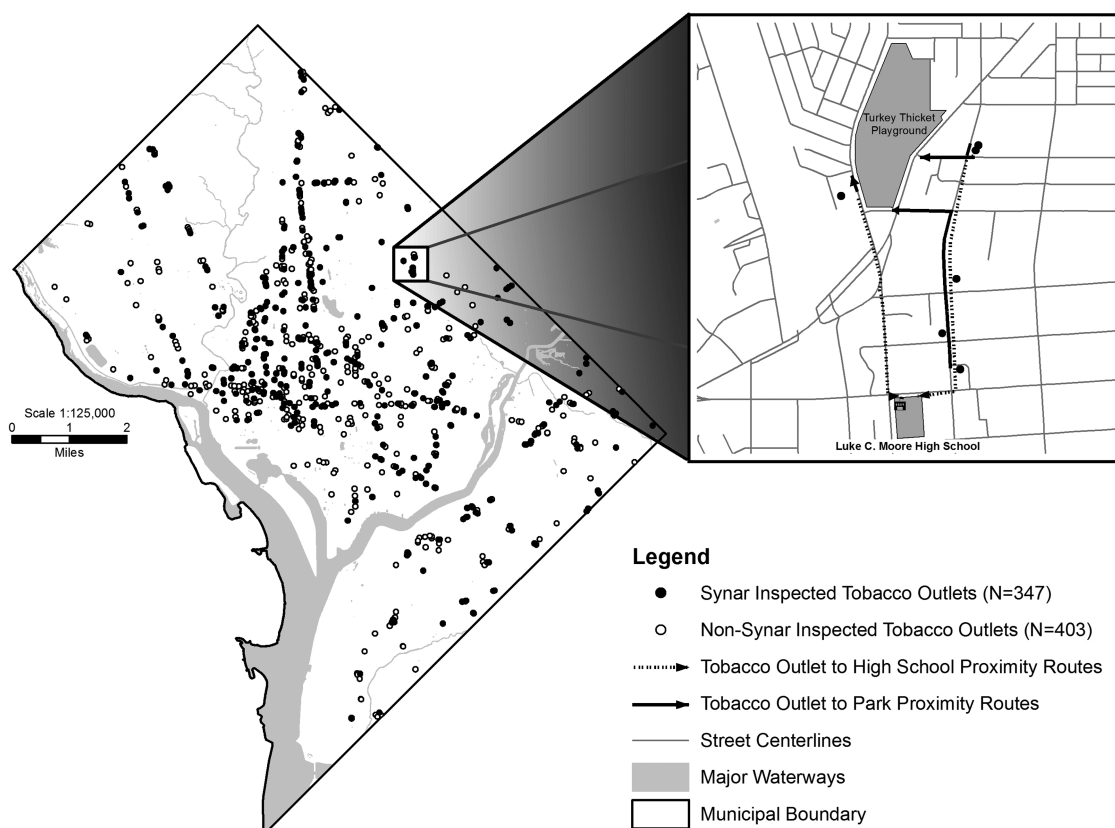


Figure 1 Geographic distribution of tobacco outlets (background) and prototypical network proximity routes to a DC playground and high school (inset).

had either zero total student enrolments or had a duplicate address were excluded. Only high schools were retained for the present analysis, resulting in a total of 45 schools, comprising 18 public, 13 charter and 14 private high schools.

Recreational parks

Spatial data for the location of all parks and recreation properties were categorised into three classes according to the amenity information listed for each: non-recreational roadway green space (eg, circles, medians and triangles; $n=217$), parks ($n=71$), and recreation areas ($n=71$). Non-recreational roadway green space areas characteristic of DC were then excluded from the analysis as they are not representative of the parks and recreation areas typically used by youth, leaving a final combined set of parks and recreation areas ($n=142$).

Public housing

Spatial data for the location ($n=56$) and associated address points ($n=2437$) of all public housing developments were obtained from the Housing Authority.

Tobacco outlet proximity to high schools, parks and public housing

A dataset was created that linked DC street network data to the location of all tobacco outlets, schools, parks and public housing, allowing us to calculate 'network routes' extending from each tobacco outlet to the other features (figure 1). For each retail tobacco outlet, geospatial proximity to the closest DC high school, park and public housing development was calculated within a 1600 m (ie, 1 mile) radius. Because they are based on the existing street network, network routes established the area through which people can actually gain walkable access to each outlet. Polygons representing the grounds associated with each school, park and public housing development were transformed to a string of point locations, the closest of which was then used as the destination point for the network proximity route connecting the feature to any nearby tobacco outlets. To properly measure the walking distance to each outlet, all street network restrictions were removed (ie, one-way streets and non-routable roads). If no school, park or public housing fell within an outlet's 1600 m radius, a missing value was generated for that proximity value. Distributional analyses confirmed that proximity to high schools and public housing were normally distributed. Skew within the park proximity data was successfully corrected via square root transformation. To clarify presentation of results, geospatial proximity values were all rescaled to represent a 100 m change in distance.

Tobacco outlet interior versus exterior advertising

Trained fieldworkers visited all retail outlets that were licensed to sell tobacco ($n=1060$). Training included significant supervised practice documenting real-world tobacco advertising with mobile assessment technologies. Data collection occurred between September 2011 and March 2012. The sequence of assessments was randomised geographically to prevent spatio-temporal bias due to variation in point-of-sale advertising over the course of the observation period. ArcGIS software (V10.1) was used to geo-code the location of each outlet (later field verified during data collection), and to create daily routes and guide fieldworkers through the city. Data collected by field staff included retail store type as well as counts and photographs of exterior and interior advertising signs and displays. Reliability was ensured with repeated evaluation of inter-rater reliability versus an independent rater (ie, Chronbach's α at least 0.80). All

data uploaded wirelessly to a database that was monitored by the study coordinator. Outlets were excluded if they were no longer in business or not open to the public ($n=212$), or did not sell tobacco despite having a license ($n=98$), yielding a final sample of 750 outlets. Stores were found to fall into one of six groups: (1) convenience ($n=215$; eg, 7-Eleven; no gas and only prepackaged food); (2) gas station ($n=92$); (3) grocery store ($n=83$); (4) liquor store ($n=152$); (5) mass retailer ($n=62$; eg, Walmart); or (6) restaurant/bar ($n=146$). For this analysis, we evaluated the role of retail store type, along with the presence versus absence of any tobacco advertising signage on the exterior and/or interior of each outlet. Additional detail about the surveillance methodology appears elsewhere.^{17 22}

Tobacco outlet Census 2010 block-group demographics

Tobacco outlet point locations were spatially joined with their corresponding US Census block-group sociodemographics. Because data on household income are not provided by the 2010 Census, we focused our analysis on proportion of African-Americans in each block group. In DC, this variable is a proxy for socioeconomic disparities because the area is almost entirely populated by African-Americans (50.7%) and Caucasians (42.4%), and is characterised by high levels of long-standing segregation that correspond closely with household income.²³

STATISTICAL ANALYSES

In a preliminary step, the distribution of the outlet-proximity data was evaluated, and transformations were used to correct departures from normality. A series of bivariate analyses was used to determine whether any observed effects on sales violations would be influenced by non-random selection of outlets. Mean comparison *t* tests were used to evaluate whether outlets selected for Synar inspection were different from those that were not selected regarding block-group demographics or proximity to high schools, parks and public housing. Bivariate logit models were used to evaluate differences in inspection likelihood due to retail store type, interior and/or exterior advertising practices. Bivariate predictors of advertising practices were also explored to clarify inferences about the way advertising may have interacted with other factors to influence illicit sales in the multivariate models that follow. Convenience store was used as the default reference group for retail store type, primarily because it was the most common category. The dummy reference group was changed to analyse each retail store type versus the others.

Multivariate logistic regression was used to investigate the link between the probability of a youth sales violation (given an inspection), advertising on the interior and exterior of the outlet, retail store type of the outlet, the demographic make-up of the area surrounding the outlet, and the proximity of the outlet to the closest high school, recreational park and public housing development. Census 2010 block group data on the proportion of African-American residents was categorised into quartilesⁱ. A step-up model building approach was employed, with significant bivariate effects ($p<0.05$) entered into a joint,

ⁱThe use of quartile categories based on the distribution is a common approach when there is no prior theory to support a particular threshold or cutoff. This approach makes no assumptions about linearity and is easy to interpret. A comparison with a tertile split revealed no difference in terms of direction or significance. Cut-points were 11.4%, 56.1% and 89.1%.

Research paper

Table 1 Tobacco outlet proximities by inspection status: Washington, DC

Proximity to*	Not inspected (n=403) Mean (SD) metres	Inspected (n=347) Mean (SD) metres	Difference Metres	t
High schools	840 (335.1)	832 (354.5)	8.1	0.641
Public	946 (353.3)	962 (366.2)	-15.3	-0.323
Private	973 (366.9)	989 (366.0)	-15.8	0.597
Charter	1020 (378.0)	977 (436.9)	43.8	0.799
Parks	458 (314.6)	456 (293.2)	1.7	0.505
Public housing	823 (365.6)	748 (364.1)	74.8	1.074

t Values, all non-significant ($p>0.28$) including square root-transformed distance to parks.

*Proximities among outlets within 1600 m of each feature.

multivariate model to investigate their relative leverage. To probe significant effects that did emerge and clarify presentation of the results, model-based predicted values were calculated and then converted to represent the relative odds of a sales violation per unit change in each of the explanatory variables.

RESULTS

Of the 347 outlets that were inspected, 14.4% ($n=50$) violated the municipal youth sales law by selling a tobacco product to the designated Synar representative. This non-compliance rate (14.4%) was below the 20% rate designated acceptable under the Synar regulation. The likelihood of inspection was unrelated to the proportion of African-American residents per block group ($t=0.38$), the six retail categories ($ORs<1.02$; 95% CI 0.95 to 1.10), nor interior ($OR=1.05$; CI 0.71 to 1.56) or exterior ($OR=1.19$; CI 0.89 to 1.61) tobacco advertisement location.

Tobacco outlet proximity to high schools, parks and housing

Altogether, tobacco retailers within 1600 m of each feature were located an average of 836.11 m ($n=631$; median=810.89; $SD=344.03$) from the closest high school, 457.37 m ($n=740$; median=392.44; $SD=304.64$) from the closest park, and 787.96 m ($n=619$; median=786.38; $SD=366.54$) from the closest public housing development. Table 1 presents the raw outlet proximities for outlets that underwent Synar inspection ($n=347$) versus those that did not ($n=403$). Preliminary analyses confirmed the representativeness of the outlets selected for inspection, demonstrating that the proximity of inspected outlets to the features under study here were not different than the same proximities to non-inspected outlets ($ts<|1.1|$; table 1).

Retail store type, block-group demographics and advertising practices

Tobacco-product advertisements were observed in 80.1% ($n=601$) of outlets. Of those with tobacco advertisements, 328 (43.7% of all stores) featured interior ads only, while the remaining 273 (36.4% of all stores) also displayed tobacco advertisements on the exterior. Gas stations were more likely to display exterior tobacco advertisements than any of the other categories ($OR=6.68$; 95% CI 4.05 to 11.01). On the other hand, bars and restaurants were less likely to display either interior or exterior ads than the other categories ($ORs>0.33$; 95% CI 0.22 to 0.52).

Table 2 Tobacco outlet proximities and interior versus exterior advertising

Proximity type	No ads (n=149) Mean (SD) metres	Interior ads (n=328) Mean (SD) metres	Exterior ads (n=273) Mean (SD) metres
High schools	863 (341.8)	798 (327.1)	865 (360.6)
Public	1050 (360.9)	934 (353.0)	923 (357.7)*
Private	911 (341.6)	950 (373.9)	1110 (346.2)*†
Charter	1094 (397.8)	987 (391.0)	986 (416.0)
Parks	530 (339.2)	469 (325.9)‡	405 (245.2)*†
Public housing	904 (371.5)	809 (368.9)‡	711 (345.1)*†

Exterior ads are always in addition to interior ads.

*Interior and exterior ads more likely than no ads, $p<0.01$.

†Exterior ads more likely than interior ads alone, $p<0.01$.

‡Interior ads more likely than no ads, $p<0.01$.

The presence of interior and exterior tobacco advertisements was significantly more likely at outlets located within block groups with a higher proportion of African-American residents. Analysed across quartiles categorised by proportion of African-American population, block groups greater than 56% African-American were 2.7 times more likely to display interior advertisements ($OR=2.73$; 95% CI 1.78 to 4.19), and over three times more likely to display exterior advertisements than block groups with a less than or equal to 56% African-American population ($OR=3.11$; 95% CI 2.28 to 4.25).

Tobacco outlet proximities, block-group demographics and advertising practices

Each 100 m decrease in distance to a public high school increased the likelihood of exterior, but not interior, advertising by about 10% ($OR=1.10$; 95% CI 1.03 to 1.09), while each 100 m increase in distance from a private high school increased the likelihood of exterior advertising by about 15% ($OR=1.15$; 95% CI 1.06 to 1.24; table 2). Proximity to parks and public housing was positively associated with the likelihood of advertisements on the interiors ($ORs>1.12$; 95% CI 1.08 to 1.16) and exteriors ($ORs>1.09$; 95% CI 1.07 to 1.11) of outlets (table 2). A model including all bivariate proximity effects revealed that proximity to parks alone remained significantly associated with advertising ($OR=1.87$; 95% CI 1.06 to 3.28).

Tobacco outlet proximities, advertising practices and Synar youth sale violations

Results indicate that gas stations were more likely to incur a youth sales violation than the other retail store types combined, while liquor stores were less likely to record a violation, regardless of proximity to parks, high schools or public housing (table 3). Among outlets in block groups with a greater than 56% African-American population, each 100 m decrease in proximity to a high school was found to increase the likelihood of a sales violation (figure 2). Among outlets with exterior tobacco advertisements, each 100 m decrease in proximity to a park was associated with an increase in the likelihood of a sales violation, while proximity to parks was not associated with youth sales when there were no exterior advertisements (table 3; figure 3). A multivariate model including all significant effects revealed that the effects of exterior advertising near parks, as well as the effect of high schools in predominantly African-American block groups, remained significant (table 3).

Table 3 Predictors of youth sales violations

Outlet characteristics	Bivariate OR (95% CI)	Interactions with proximity (metres) on violations			Multivariate OR (95% CI)
		High schools OR (95% CI)	Parks† OR (95% CI)	Public housing OR (95% CI)	
Retail store type					
Convenience	0.74 (0.4 to 1.5)	1.76 (0.6 to 4.8)	0.83 (0.7 to 1.0)	0.84 (0.7 to 1.1)	‡
Gas	3.01 (1.4 to 6.3)**	2.44 (0.8 to 7.1)	1.10 (0.9 to 1.4)	1.12 (0.9 to 1.4)	2.48 (1.0 to 6.5)
Grocery	0.95 (0.4 to 2.6)	0.57 (0.1 to 2.9)	1.08 (0.7 to 1.6)	0.85 (0.6 to 1.2)	‡
Liquor	0.25 (0.1 to 0.7)**	0.22 (0.0 to 1.5)	1.42 (0.9 to 2.2)	1.10 (0.8 to 1.5)	0.29 (0.1 to 1.0)
Mass retailer	2.03 (0.8 to 5.1)	0.60 (0.2 to 2.0)	1.02 (0.8 to 1.3)	0.95 (0.7 to 1.3)	‡
Restaurant/bar	1.10 (0.5 to 2.3)	0.71 (0.3 to 1.9)	0.91 (0.7 to 1.2)	1.13 (0.9 to 1.4)	‡
US census block group					56% African-American
56% African-American	1.18 (0.6 to 2.2)	1.29 (1.1 to 1.6)**	2.59 (1.1 to 6.2)*	0.99 (0.8 to 1.2)	X HS: 1.36 (1.1 to 1.7)** X Parks: 2.01 (0.6 to 6.8)
Tobacco ads					Exterior Ads
Interior	1.15 (0.5 to 2.7)	1.07 (0.8 to 1.5)	2.89 (0.8 to 10.0)	0.76 (0.6 to 1.0)	X HS: 0.71 (0.6 to 0.9)**
Interior+exterior	1.30 (0.7 to 2.4)	0.87 (0.7 to 1.1)	3.31 (1.3 to 8.1)**	0.91 (0.7 to 1.1)	X Parks: 3.77 (1.2 to 12.3)*

All interaction analyses controlled for bivariate effects of retail store type, block group demographics, and advertising practices.

*p<0.05.

**p<0.01.

†Square root-transformed proximity to parks.

‡Not included in multivariate model.

DISCUSSION

This paper examined whether a range of factors influenced the outcome of Synar youth sales inspections conducted in Washington, DC, during 2009–2010. Overall, results show that youth sales violations, while acceptably low (14.4%) by Synar standards, varied considerably by retail store type, surrounding residential demographics, and interior versus exterior advertising practices. The presence of tobacco advertisements on the exterior of gas stations was particularly common, as was the absence of advertisements at bars or restaurants. Exterior tobacco advertisements were more likely in predominantly African-American areas of the city, and interior and exterior advertising was greater at outlets that were located closer to public high schools, parks and public housing developments. A multivariate model revealed that proximity to parks was a particularly strong predictor of exterior advertisements—controlling for schools and public housing effects. Gas stations were more likely to incur violations, as were outlets that displayed

exterior tobacco advertisements closer to parks, and outlets located closer to high schools in majority African-American block groups.

The general pattern of results is strikingly consistent, although the exact pattern would not have been predicted a priori. Relative to the other retail categories, reduced sales violations at liquor and convenience stores was unanticipated. The differential effects of proximity to public versus private high schools on youth sales was also stronger than expected, although it is interesting that the geographic distribution of public and private high schools corresponds closely to demographic segregation across the city, and thus fits with the observed interaction between proximity to public high schools, proportion of African-American residents, and youth sales violations.

Strengths and limitations

This paper features a number of strengths. The fact that field-based surveillance of the point-of-sale environment was

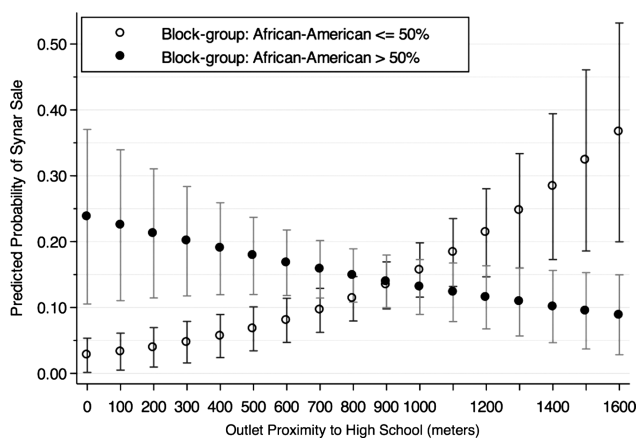


Figure 2 Model-based predicted probability of a Synar tobacco sale, plotted as a function of proximity to high schools (metres) and US Census block group African-American population surrounding each outlet.

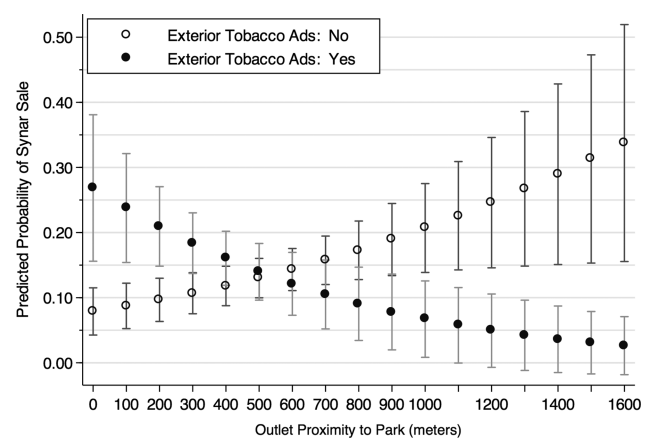


Figure 3 Model-based predicted probability of a Synar tobacco sale, plotted as a function of proximity to parks (metres) and tobacco advertising posted on the exterior of each outlet.

Research paper

conducted at every outlet allowed inclusion of the effects of advertising practices in the analyses, and in doing so, also allowed formal evaluation of whether outlets were differentially selected for inspection in a way that would interfere with the inference that could be drawn about the independent variables under study. Comprehensive surveillance also made it possible to verify that there were no tobacco outlets inspected by the Synar programme in 2009–2010 that were no longer in business or no longer selling tobacco products at the time of point-of-sale assessment used for this research. Multivariate modelling allowed comparison of the relative leverage of each covariate on violation likelihood.

A limitation on the inference that can be drawn from analysis of Synar underage sales data is that violation rates are calculated annually and at the level of the retailer, not the individual purchase attempt level, so the data cannot be used to estimate actual rates of underage tobacco sales. Actual underage sales would need to account for highly variable sales volume levels between retailers, as well as self-selection effects, as youths seek out outlets known to sell to minors. Another limitation of the present analysis is that the Synar inspection data was collected about 1.5 years prior to our field-based assessment of POST practices, leaving open the possibility that POST practices changed in the interim. Mitigating this concern is the fact that variance in POST practices is related far more to retail store type and management than to seasonal variation in product availability or marketing,²⁴ and that the Synar inspection data included information about each outlet's name, retail store type and owner, which made it possible for us to verify that our POST assessments took place at the same store that had been inspected by the Synar programme (not a different store occupying the same address).

An overarching limitation of any community-based research of this kind is the inability to measure all factors that affect the phenomena being studied. Adolescent access to cigarette vending machines, other illegal or social sources of tobacco, and difficulties in confirming age at purchase in online transactions have all been shown to be barriers to the success of underage access laws²⁵; the present work does not account for these aspects of youth access. Additionally, to the extent that sales violations are influenced by the clerk who happens to be on duty when an inspection occurs, inspections conducted with different clerks within the same outlet may have produced different results. The findings are also limited to the POST landscape in the Washington, DC, area, indicating a need for replication in other geographical areas. Future work will also need to account for variables that are likely to interact with the likelihood of youth sales, including product landscapes, local POST policies and economic conditions, as well as flow of underage consumers through each outlet.

CONCLUSIONS

POST advertising and regulatory compliance data could yield valuable insight about corresponding variation in youth tobacco use observed at the neighbourhood, city, state and national levels. Yet, the nature of the association between outlets and other community-level factors has proven difficult to capture. Results of this study support the notion that the geographic proximity of tobacco outlets to schools and parks affects youth access, and lend novel data on the specific role played by illicit underage tobacco sales. Agent-based simulation models may increase our understanding of, and policy implications for, the reported associations.

What this paper adds

- In addition to outlet-specific factors, such as retail store type, interior and exterior tobacco advertising, and surrounding residential demographics, this paper incorporated the proximity of each outlet to the closest high school, park and public housing development in a series of bivariate and multivariate models. Results indicate that underage sales violations represent a valuable metric that may help inform regulatory actions that can be specifically designed to reduce youth access while avoiding unreasonable restriction on retailers' legal right to communicate with their adult customers. Specifically, the present findings suggest that the Food and Drug Administration's (FDA) proposed rule banning exterior advertisements near schools and playgrounds may significantly reduce youth access to tobacco.⁸
- Thanks to their strategic partnership,⁷ the national FDA Tobacco Retail Compliance Inspection programme, and the SAMHSA Synar Program, are now operating synergistically, using common methods for underage sales inspections and reporting. As such, the present data on Synar sales may inform efforts to identify links between FDA youth sales compliance checks and tobacco use patterns observed in households across the country. Residential proximity to retail tobacco outlets could increase tobacco use by reducing real or perceived barriers to tobacco product acquisition, or by increasing residents' exposure to tobacco-related product marketing and promotion.^{22 26 27} This is especially true among youth, as they are disproportionately reliant on local outlets' willingness to sell tobacco to minors.

Acknowledgements We thank Judy Donovan and Thomas Randolph (DC Department of Health); Charles Carusi and Nina Hamburg (Westat); Catherine Corey and Priscilla Callahan-Lyon (FDA); and Nahla Hilmi (NIH/NIDA) for their participation in this project and contributions to the manuscript.

Contributors TRK and AA-R lead design of the study, processed the dataset, and conducted the analyses. TRK and ACV conceived and wrote the paper. AA-R, ACV, JC, OG, KPC, DMV and DBA contributed to study design and provided substantial feedback on the paper.

Funding This project has been funded in whole, or in part, with federal funds from the National Institute on Drug Abuse, National Institutes of Health, and the Food and Drug Administration, Department of Health and Human Services under Contract #HHSN271201100027C. Funding for the primary data collection was provided by the American Legacy Foundation. The project was also funded by the Centers for Disease Control and Prevention CPPW Contract from the DC Department of Health (DC DoH contract #PO358719) (PI: Kirchner).

Competing interests The authors have no competing interests to declare. The views and opinions expressed in this presentation are those of the authors only and do not necessarily represent the views, official policy or position of the US Department of Health and Human Services or any of its affiliated institutions or agencies.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement We have shared the data used in this manuscript with the District of Columbia Department of Health, which partially funded the collection of this data.

REFERENCES

- 1 DiFranza JR, Savageau JA, Aisquith BF. Youth access to tobacco: the effects of age, gender, vending machine locks, and "it's the law" programs. *Am J Public Health* 1996;86:221–4.
- 2 Wakefield M, Chaloupka F. Effectiveness of comprehensive tobacco control programmes in reducing teenage smoking in the USA. *Tob Control* 2000;9:177–86.

- 3 DiFranza JR, Dussault GF. The federal initiative to halt the sale of tobacco to children—the Synar Amendment, 1992–2000: lessons learned. *Tob Control* 2005;14:93–8.
- 4 State law regarding sale of tobacco products to individuals under age of 18. H.R. Sec. 96.130, 1992.
- 5 FDA v Brown & Williamson Tobacco Corp. 529 U.S. 120, 2000.
- 6 Family Smoking Prevention and Tobacco Control Act. H.R. 1256, 2009.
- 7 US Food and Drug Administration, Center for Tobacco Products. A strategic partnership: FDA tobacco retail compliance inspection contracts and the SAMHSA Synar Program, 2010. <http://www.fda.gov/downloads/TobaccoProducts/NewsEvents/UCM284343.pdf>
- 8 FDA Center for Tobacco Products Update. Advance notice of proposed rulemaking related to the regulation of outdoor advertising of cigarettes and smokeless tobacco, 2010. <http://www.fda.gov/TobaccoProducts/NewsEvents/ucm207650.htm>
- 9 Luke DA, Ribisl KM, Smith C, et al. Family Smoking Prevention And Tobacco Control Act: banning outdoor tobacco advertising near schools and playgrounds. *Am J Prev Med* 2011;40:295–302.
- 10 Ribisl KM. Research gaps related to tobacco product marketing and sales in the Family Smoking Prevention and Tobacco Control Act. *Nicotine Tob Res* 2012;14:43–53.
- 11 Henriksen L, Schleicher NC, Feighery EC, et al. A longitudinal study of exposure to retail cigarette advertising and smoking initiation. *Pediatrics* 2010;126:232–8.
- 12 Henriksen L, Feighery EC, Schleicher NC, et al. Is adolescent smoking related to the density and proximity of tobacco outlets and retail cigarette advertising near schools? *Prev Med* 2008;47:210–14.
- 13 McCarthy WJ, Mistry R, Lu Y, et al. Density of tobacco retailers near schools: effects on tobacco use among students. *Am J Public Health* 2009;99:2006–13.
- 14 Laws MB, Whitman J, Bowser DM, et al. Tobacco availability and point of sale marketing in demographically contrasting districts of Massachusetts. *Tob Control* 2002;11(Suppl 2):iii71–3.
- 15 Siahpush M, Jones PR, Singh GK, et al. The association of tobacco marketing with median income and racial/ethnic characteristics of neighbourhoods in Omaha, Nebraska. *Tob Control* 2010;19:256–8.
- 16 Barbeau EM, Wolin KY, Naumova EN, et al. Tobacco advertising in communities: associations with race and class. *Prev Med* 2005;40:16–22.
- 17 Cantrell J, Kreslake J, Ganz O, et al. Marketing Little Cigars and Cigarillos (LCC): availability, advertising, price and associations with neighborhood demographics across a diverse metropolitan area. *Am J Public Health* 2013;103:1902–9.
- 18 Feighery EC, Henriksen L, Wang Y, et al. An evaluation of four measures of adolescents' exposure to cigarette marketing in stores. *Nicotine Tob Res* 2006;8:751–9.
- 19 Slater SJ, Chaloupka FJ, Wakefield M, et al. The impact of retail cigarette marketing practices on youth smoking uptake. *Arch Pediatr Adolesc Med* 2007;161:440–5.
- 20 Glantz SA. Preventing tobacco use—the youth access trap. *Am J Public Health* 1996;86:156–8.
- 21 Widome R, Brock B, Noble P, et al. The relationship of point-of-sale tobacco advertising and neighborhood characteristics to underage sales of tobacco. *Eval Health Prof* 2012;35:331–45.
- 22 Kirchner TR, Cantrell J, Ansetti-Rothermel A, et al. Geospatial exposure to point-of-sale tobacco: Real-time craving and smoking cessation outcomes. *Am J Prev Med* 2013;45:379–45.
- 23 DC Department of Health. District of Columbia Behavioral Risk Factor Surveillance System Annual Report, 2008.
- 24 Terry-McElrath Y, Wakefield M, Giovino G, et al. Point-of-purchase tobacco environments and variation by store type—United States, 1999. *Morb Mortal Wkly Rep* 2002;51:184–7.
- 25 Daynard RA, Parmet W, Kelder G, et al. Implications for tobacco control of the multistate tobacco settlement. *Am J Public Health* 2001;91:1967–71.
- 26 Reitzel LR, Cromley EK, Li Y, et al. The effect of tobacco outlet density and proximity on smoking cessation. *Am J Public Health* 2011;101:315–20.
- 27 Kirchner TR, Cantrell J, Ansetti-Rothermel A, et al. Individual mobility patterns and real-time geo-spatial exposure to point-of-sale tobacco marketing. In: *Proceedings of ACM Wireless Health (WH2012)*. New York, NY, USA: ACM, 2012.



Tobacco retail outlet advertising practices and proximity to schools, parks and public housing affect Synar underage sales violations in Washington, DC

Thomas R Kirchner, Andrea C Villanti, Jennifer Cantrell, et al.

Tob Control published online February 25, 2014
doi: 10.1136/tobaccocontrol-2013-051239

Updated information and services can be found at:
<http://tobaccocontrol.bmj.com/content/early/2014/02/25/tobaccocontrol-2013-051239.full.html>

These include:

References

This article cites 20 articles, 8 of which can be accessed free at:
<http://tobaccocontrol.bmj.com/content/early/2014/02/25/tobaccocontrol-2013-051239.full.html#ref-list-1>

P<P

Published online February 25, 2014 in advance of the print journal.

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

Advance online articles have been peer reviewed, accepted for publication, edited and typeset, but have not yet appeared in the paper journal. Advance online articles are citable and establish publication priority; they are indexed by PubMed from initial publication. Citations to Advance online articles must include the digital object identifier (DOIs) and date of initial publication.

To request permissions go to:
<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:
<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:
<http://group.bmj.com/subscribe/>