SRNT   OXFORD

Original investigation

Reducing Disparities in Tobacco Retailer Density by Banning Tobacco Product Sales Near Schools

Kurt M. Ribisl PhD[1,2], Douglas A. Luke PhD[3], Doneisha L. Bohannon MPH[3], Amy A. Sorg MPH[3], Sarah Moreland-Russell PhD[3]

[1]Department of Health Behavior, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC; [2]Lineberger Comprehensive Cancer Center, University of North Carolina at Chapel Hill, Chapel Hill, NC; [3]Center for Public Health Systems Science, George Warren Brown School of Social Work, Washington University in St Louis, St Louis, MO

Corresponding Author: Kurt M. Ribisl, PhD, Department of Health Behavior, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Rosenau Hall CB7440, Chapel Hill, NC 27599, USA. Telephone: 919-843-8042; Fax: 919-966-2921; E-mail: kurt_ribisl@unc.edu

Abstract

Introduction: This study examined whether a policy of banning tobacco product retailers from operating within 1000 feet of schools could reduce existing socioeconomic and racial/ethnic disparities in tobacco retailer density.

Methods: We geocoded all tobacco retailers in Missouri ($n = 4730$) and New York ($n = 17\ 672$) and linked them with Census tract characteristics. We then tested the potential impact of a proximity policy that would ban retailers from selling tobacco products within 1000 feet of schools.

Results: Our results confirmed socioeconomic and racial/ethnic disparities in tobacco retailer density, with more retailers found in areas with lower income and greater proportions of African American residents. A high proportion of retailers located in these areas were in urban areas, which also have stores located in closer proximity to schools. If a ban on tobacco product sales within 1000 feet of schools were implemented in New York, the number of tobacco retailers per 1000 people would go from 1.28 to 0.36 in the lowest income quintile, and from 0.84 to 0.45 in the highest income quintile. In New York and Missouri, a ban on tobacco product sales near schools would either reduce or eliminate existing disparities in tobacco retailer density by income level and by proportion of African American.

Conclusions: Proximity-based point of sale (POS) policies banning tobacco product sales near schools appear to be more effective in reducing retailer density in lower income and racially diverse neighborhoods than in higher income and white neighborhoods, and hold great promise for reducing tobacco-related disparities at the POS.

Implications: Given the disparities-reducing potential of policies banning tobacco product sales near schools, jurisdictions with tobacco retailer licensing should consider adding this provision to their licensing requirements. Since relatively few jurisdictions currently ban tobacco sales near schools, future research should examine ways to increase and monitor the uptake of this policy, and assess whether it has an impact upon reducing exposure to tobacco marketing and on tobacco product availability and use.

Introduction

It is well established that there are disparities in tobacco use and in the resulting burden of disability and death resulting from tobacco use. In the 2014 National Health Interview Survey, 26.3% of individuals below the poverty line were current smokers, but only 15.2% of individuals at or above the poverty line were smokers.[1] Although the smoking rate for African American and white smokers did not differ,[1] lung cancer incidence and mortality is significantly higher in African American men.[2] There are also notable disparities in the number and density of tobacco retailers in economically disadvantaged and racially diverse neighborhoods. In the earliest study on the topic, Hyland and colleagues[3] examined all licensed tobacco retailers in Erie County, New York and found 4.0 retailers per 10 kilometers of roadway in the lowest income quartile and only 1.2 in the highest income quartile. They observed similar disparities by race with 4.2 retailers in the quartile with the highest percentage of African Americans and 2.0 in the quartile with the lowest. Similar disparities have been found in Iowa[4,5] and in a national study[6] that measured density as the number of tobacco outlets per 1000 residents. Taken together, these studies show that there are disparities in the number of tobacco retailers and tobacco retailer density in communities.

The tobacco industry aggressively prices and advertises tobacco products in low socioeconomic status and racially diverse neighborhoods.[7–9] Scholars have written about the concept of "racialized geography,"[10] which relates race, class, and place to the disproportionate marketing of tobacco products. People from similar socioeconomic status and racial backgrounds often live near each other or cluster together, which allows the tobacco industry to conveniently segment customers at the point of sale (POS) because it is easy to identify the neighborhood demographics in a tobacco retailer catchment area. Given these dual patterns of residential and retailer clustering, POS policies have the potential to diminish or eliminate these disparities in tobacco retailer density by reducing access to and exposure to tobacco products. One POS policy option is a ban on tobacco product sales near schools.[11,12] This policy can be implemented as a stand-alone policy or as part of a broader tobacco retailer licensing program, and typically involves banning tobacco sales within a set distance (eg, 1000 feet) of the perimeter of the school property boundary. The purpose of the present study is to examine whether the policy of banning tobacco product retailers from operating within 1000 feet of schools would reduce existing socioeconomic status and racial/ethnic disparities in tobacco retailer density. The present study builds on an earlier study[11] of New York and Missouri retailers that examined the potential impact of FDA restrictions on tobacco product advertising near schools and parks.

Methods

ESRI ArcMap version 10.1[13] was used to conduct a spatial analysis to examine disparities in the distribution of retailers near schools in two states (Missouri and New York). Missouri and New York were chosen because they have a good mix of urban, suburban, and rural areas and have good data available on tobacco retailer locations from retailer licenses. Retailer location data were obtained from each state's tobacco licensing or tracking departments as described in our earlier paper.[11] School location data were obtained from the Missouri Department of Elementary and Secondary Education, the New York State Education Department, and New York City's MapPluto. Location data were then geocoded for spatial analysis in our Geographic Information System. School location data for Missouri were already geocoded and had a 100% success rate. Geolytics, Inc. was contracted to geocode both states' retailer lists and New York school locations. They successfully matched 79% of retailer addresses in Missouri, 80% for New York, and 91.5% of New York Schools. Geographic Information System shapefiles for census tracts in Missouri and New York were obtained from ESRI. Tract-level demographic information was obtained from the 2005–2009 American Community Survey 5-year estimates.[14] Median income, percent of African American residents, and percent of Hispanic residents were included in the analysis. Census tracts were divided into quintiles based on median income, percent of African American residents, and percent of Hispanic residents.

Geographic Information System spatial analysis was used to examine the impact of a 1000-foot perimeter tobacco sales ban near schools. Given that point data were used for Missouri and New York schools, buffer zones of 1250 feet and 1150 feet were used for Missouri and New York, respectively. These buffer distances were used as a proxy for a 1000-foot ban as our previous research showed that these were the closest approximations of the extra distance between the school centroid (centerpoint) and the school property boundary (ie, a polygon shape) when working with point data.[11] Spatial analysis for each state detailed the number of retailers that would be affected by a 1000-foot tobacco sales ban. The number of retailers that would be affected by a 1000-foot sales ban was then calculated by quintile using spatial analysis. From there, the "baseline retailer" density (number of retailers per 1000 people) and the "post 1000-foot tobacco sales ban" density were calculated for each quintile. The percent of retailers affected overall by quintile was also calculated by dividing the number affected in each quintile by the total number of retailers in that quintile. Chi-square analyses were conducted across quintiles for each demographic indicator.

Results

The primary purpose of this paper is to evaluate whether a policy banning tobacco product retailers from operating within 1000 feet of schools would reduce disparities in tobacco retailer density. We present pre- and post-ban disparities in density, and explore the potential mechanisms to explain why this policy may work differently based on the neighborhood composition.

Pre-ban Disparities in Tobacco Retailer Density

The existing retailer density was assessed by examining the number of tobacco retailers per 1000 people in the pre-ban condition, which is depicted by the blue lines in Figures 1 and 2. Tobacco retailer density was greater in the lowest income quintiles compared to the highest income quintiles in both New York and Missouri. For New York, the density was the highest (1.28 retailers per 1000 people) in the lowest income quintile, but then appeared to level off for the remaining four quintiles (range: 0.76 to 0.88). Retailer density in New York was 52.4% higher in the poorest quintile compared to the wealthiest. For Missouri, there was more of a decreasing linear trend by income, with retailer density decreasing at each of the income quintiles.

Retailer density was greater in the quintile with the highest proportion of African American residents compared to the quintile with the lowest for both New York and Missouri. Retailer density was similar in New York for Hispanic neighborhoods, but in Missouri there was more of a U-shaped curve with retailer density being the highest in the quintiles with the most and least Hispanic residents.
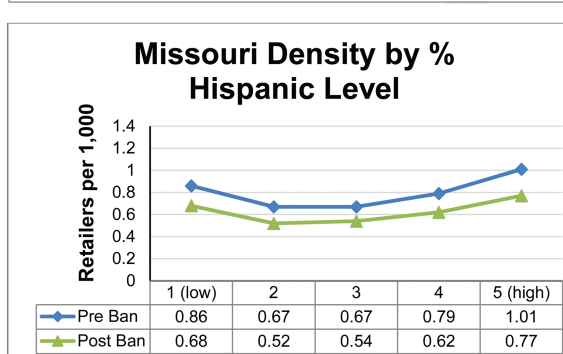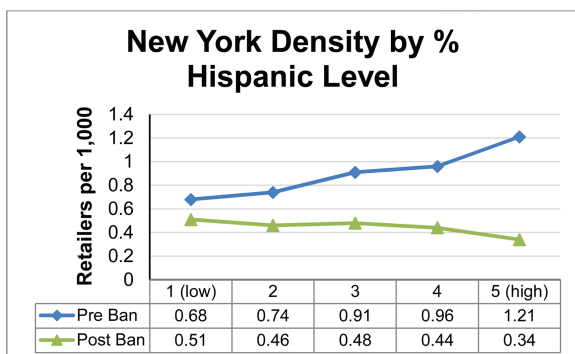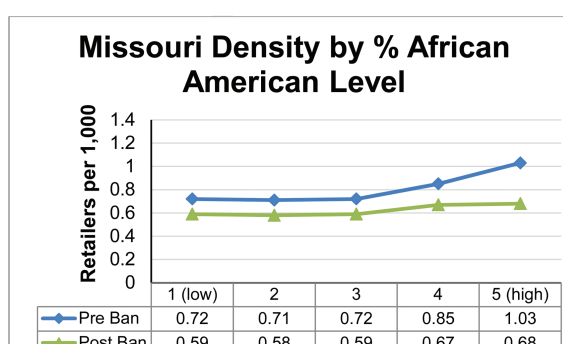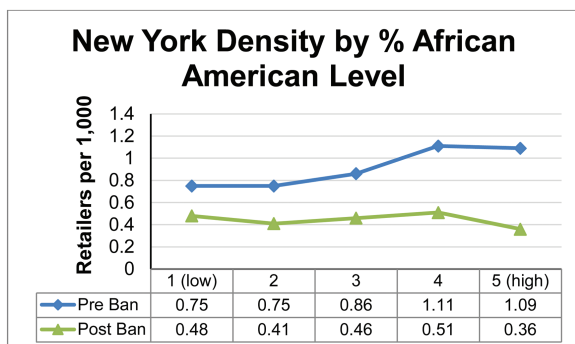
New York Density by Income Level

	1 (low)	2	3	4	5 (high)
Pre Ban	1.28	0.88	0.77	0.76	0.84
Post Ban	0.36	0.43	0.47	0.49	0.45

Missouri Density by Income Level

	1 (low)	2	3	4	5 (high)
Pre Ban	1.18	1.03	0.87	0.67	0.48
Post Ban	0.82	0.8	0.7	0.56	0.37

New York Density by % African American Level

	1 (low)	2	3	4	5 (high)
Pre Ban	0.75	0.75	0.86	1.11	1.09
Post Ban	0.48	0.41	0.46	0.51	0.36

Missouri Density by % African American Level

	1 (low)	2	3	4	5 (high)
Pre Ban	0.72	0.71	0.72	0.85	1.03
Post Ban	0.59	0.58	0.59	0.67	0.68

New York Density by % Hispanic Level

	1 (low)	2	3	4	5 (high)
Pre Ban	0.68	0.74	0.91	0.96	1.21
Post Ban	0.51	0.46	0.48	0.44	0.34

Missouri Density by % Hispanic Level

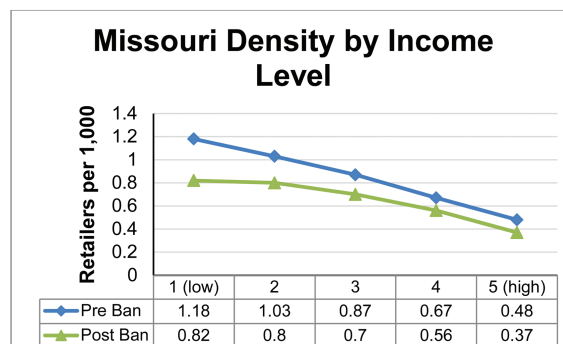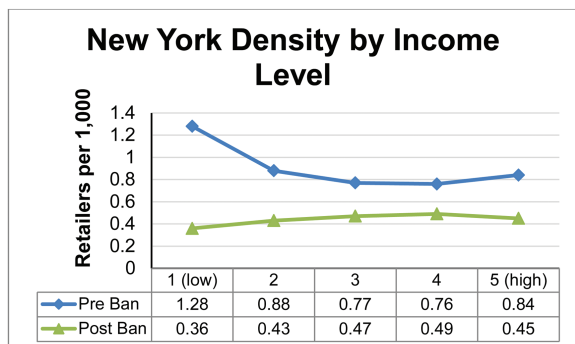|	1 (low)	2	3	4	5 (high)
Pre Ban	0.86	0.67	0.67	0.79	1.01
Post Ban	0.68	0.52	0.54	0.62	0.77

Figure 1. Pre- and post-ban tobacco retailer density in New York by census tract income and racial/ethnic composition.

Figure 2. Pre- and post-ban tobacco retailer density in Missouri by census tract income and racial/ethnic composition.

In summary, most of the analyses showed greater tobacco retailer density in areas with lower income or more racially/ethnically diverse residents.

Impact of a Policy Banning Tobacco Product Sales Near Schools on Retailer Density

If tobacco retailers were banned within 1000 feet of schools, the green lines in Figures 1 and 2 depict the resulting retailer density. Whereas most of the blue pre-ban lines showed disparity gradients, the green post-ban lines were flatter, indicating smaller disparities. In fact, in several cases, the disparities were eliminated and in some cases changed direction. In the case of Hispanic neighborhoods, Missouri had a U-shaped pre-ban retailer density pattern, and while this pattern generally remained, the ban was successful in lowering density in each of the quintiles.

Supplementary Figure 1 illustrates the mechanism by which the proximity ban may lead to disparities reduction. The map in the figure that depicts the radial (circular) buffer around New York schools and the points represent tobacco retailers. Lower income areas have

more tobacco retailers that are within the buffer zone compared to higher income areas. In the post-ban lower panel, the buffers have no retailers because they would not be allowed near schools. As a result, there is a differential reduction in the number of retailers in lower income areas because these areas are more affected by a ban on tobacco retailers near schools.

Impact of 1000-Foot Ban on Store Distance and Affected Retailers

Table 1 shows retailer characteristics for the various income and racial/ethnic categories before and after the ban. The mean distance from a school to the nearest retailer was lower in the lowest income quintile than it was for nearly all other quintiles in Missouri and New York. There was a strong linear inverse relationship between store distance and the proportion of African Americans. Retailers in areas with a high proportion of African Americans were much closer to stores than areas with a low proportion of African Americans. In Missouri, for instance, in the highest quintile, the average store was only 1787 feet away but was 10 913 feet away in the lowest quintile.

Table 1. Retailer Pre- and Post-ban Proximity to Schools and Density in New York and Missouri by Income Level and Racial/Ethnic Composition

	New York					Missouri				
Quintile	Retailers	Avg. nearest store distance[a]	Pre-ban density	Post-ban density	% Affected	Retailers	Avg. nearest store distance	Pre-ban density	Post-ban density	% Affected
	Income level					Income level				
1 (low)	4712	683	1.28	0.36	38.1	927	5301	1.18	0.82	27.7
2	3209	3465	0.88	0.43	18.3	1062	6758	1.03	0.80	22.9
3	2783	3284	0.77	0.47	12.4	1033	6965	0.87	0.70	19.3
4	3064	2641	0.76	0.49	12.3	929	7923	0.67	0.56	14.4
5 (high)	3677	2183	0.84	0.45	18.9	718	4947	0.48	0.37	15.6
	% African American					% African American				
1 (low)	2562	3395	0.75	0.48	10.3	816	10 913	0.72	0.59	13.7
2	3233	3457	0.75	0.41	16.4	906	9494	0.71	0.58	15.4
3	3766	2691	0.86	0.46	19.8	977	4603	0.72	0.59	18.1
4	4327	1385	1.11	0.51	26.0	1055	3341	0.85	0.67	22.0
5 (high)	3700	747	1.09	0.36	27.6	922	1787	1.03	0.68	30.8
	% Hispanic					% Hispanic				
1 (low)	2410	4640	0.68	0.51	6.7	800	10 646	0.86	0.68	16.8
2	2906	3172	0.74	0.46	12.3	826	7679	0.67	0.52	18.1
3	3679	1956	0.91	0.48	19.5	921	6099	0.67	0.54	17.9
4	3741	1304	0.96	0.44	22.8	1014	4629	0.79	0.62	21.3
5 (high)	4852	657	1.21	0.34	38.7	1115	3180	1.01	0.77	25.9

The number of census tracts varied from 950 to 967 per quintile in New York and 262–263 per quintile in Missouri.

[a]Mean nearest store distance represents the average distance (in feet) from a school to the closest retailer from before the ban.

Finally, the proportion of affected retailers is higher in lower income areas and generally in areas that have a higher proportion of African American and Hispanic residents. These patterns show that the policy would have a greater impact in these areas.

Discussion

There was a greater density of tobacco retailers in lower income and racially diverse neighborhoods in New York and in lower income and African American neighborhoods in Missouri. However, based on our Geographic Information System analyses, most of these existing disparities would be eliminated by a policy that would ban retailers from selling tobacco products within 1000 feet of schools. This policy of banning the sale of tobacco products near schools appears to have a greater impact in census tracts that are lower income and have a higher proportion of African American and Hispanic residents. That is because these populations are overrepresented in urban areas where tobacco retailers are located closer to schools. As a result, this policy has a strong pro-equity impact.

Hill and colleagues[15] recently reviewed the impact on socioeconomic inequalities of six standard tobacco control policies: price increases, smoke-free policies, advertising bans, mass media campaigns, warning labels, smoking cessation support, and community-based programs combining several interventions. They found that price increases had a strong pro-equity effect; in other words, this policy helped reduce disparities in smoking rates by income level. However, the other policies showed little potential to reduce disparities and some types of cessation programs actually increased disparities because they helped higher income individuals quit at a higher rate than lower income individuals. Although these standard tobacco control policies are effective in reducing population rates of tobacco use, it is disappointing that most of these policies did little to reduce income disparities in smoking.

In contrast, the POS policy of banning tobacco sales near schools has the potential to have a strong pro-equity effect. This is important because the tobacco companies have a long history of targeting lower income and racial/ethnic minority groups. To our knowledge this study is the first to identify the potential pro-equity impact of banning tobacco product sales near schools. In fact, this policy, if fully implemented, appears to not only reduce disparities, but it is so potent that it could possibly change their direction by placing more tobacco retailers and a greater density of tobacco retailers in high-income than low-income areas, and in areas with more white residents than African American or Hispanic ones.

Banning tobacco product sales near schools can be done via a tobacco retailer licensing program.[12] Typically a local government will issue a license, which is essentially a permit to sell tobacco products. Governments can attach requirements to the license, such as restricting outlets from being near schools or too close to an existing retailer. Several jurisdictions already have these proximity policies in place. In 2010, Santa Clara County, CA banned tobacco sales at any new retailers within 1000 feet of schools. In 2009, New Orleans banned the sale of tobacco products within 300 feet of schools, playgrounds, churches and sites that offered structured care for youth.

The results of our analysis assume that this policy would be implemented all at once, whereas, many jurisdictions are concerned about litigation from tobacco retailers claiming that the government has taken something of value (ie, their ability to sell tobacco products), which is restricted by the fifth amendment of the Constitution that addresses government "takings." As a result, some governments only apply the policy to new retailers, although there are some legal arguments that could be made for implementing the policy on existing retailers as well.[12] San Francisco recently implemented an innovative policy to reduce disparities in the number of tobacco retailers by placing a "cap" of 45 tobacco retailers in each of the legislative districts. In 2011, the low-income district that includes the Tenderloin had 270 permits, whereas higher income areas had only 37–45 permits. San Francisco "grandfathered in" existing retailers with their policy and officials estimated the number of retailers would be cut in half within 15 years.[16] The San Francisco policy also bans new retailers from operating within 500 feet of schools or each other.[16] Chicago bans the sale of all flavored tobacco products, including menthol, within 500 feet of any school (unless the retailer derives greater than 80% of their revenue from tobacco products). Given that the majority of youth who have experimented with tobacco started with a flavored product,[17] and the heavy targeting of menthol products to African American youth,[7] such a policy is also worth pursuing. And unlike a ban on all tobacco sales near schools where retailers are grandfathered in, such a policy can be implemented immediately as it was done in Chicago.

This study has several strengths and limitations. Strengths included a census of retailers in two states and that our findings were replicated in both New York and Missouri. One of the limitations is that these analyses were based on geocoded points rather than polygons or exact boundaries around a retailer. A typical policy would create a 1000-foot buffer around the perimeter of the school property. Given the lack of readily available data on parcels for the thousands of schools in these two states, we used a point and then created a buffer zone around the point with a correction accounting for the estimated distance between the point and the edge of the property boundary. In some cases, stores would be outside the 1000 buffer around a perimeter, but would be within a radial buffer around a point. The reverse is also possible. We do not believe that this limitation will seriously bias our analysis in either direction. Another limitation is that this analysis focused on the potential impact banning tobacco sales near schools, but some jurisdictions include other youth-serving locations such as day care centers or parks, or restrict proximity to other retailers. The goal was to test the impact of the core strategy, which typically involves banning sales near schools. Future studies should evaluate whether these other youth-serving policies also have a pro-equity impact.

While we believe our findings would likely be generalizable to other places, future studies should examine whether similar findings would hold true internationally. Because our study was a test of the projected impact of a policy, we were unable to test the impact of this policy on actual youth smoking behavior. Finally, it is possible that disparities in retailer density would be unaffected if stores relocated just outside of the allowable buffer zone, but moving because of restrictions on one product seems unlikely given that tobacco retailers typically sell many other products (eg, gasoline, food, drinks).

Banning tobacco product sales near schools has the potential to remedy substantial disparities in the number and density of tobacco retailers. Not only would this policy change the physical or built environment, it also would reduce youth exposure to tobacco product advertising and marketing. Studies have shown that youth smoking rates are related to the density of tobacco retailers near schools[18] and tobacco retailer proximity,[19] although one study found that youth smoking frequency was related to retailer density near youth homes, but not proximity to retailers.[20] Since our study found that a policy banning tobacco sales near schools would reduce overall

retailer density, retailer proximity to schools, and retailer density near schools we believe it holds potential for ultimately reducing youth smoking. Communities with tobacco retailer licensing should consider banning tobacco sales near schools to reduce existing disparities in the number of tobacco retailers in their community.

Supplementary Material

Funding

Declaration of Interests

I have read the journal's policy and the authors of this manuscript have the following competing interests: KMR is the Chair of the Board of Directors of Counter Tools (http://countertools.org), a 501(c)(3) nonprofit organization from which he receives compensation. Counter Tools provides technical assistance on POS tobacco control issues and distributes store mapping and store audit tools. KMR also has a royalty interest in a store mapping and audit system owned by the University of North Carolina at Chapel Hill but these systems were not used in this study. KMR has served as an expert consultant in litigation against tobacco companies.

References

1. Jamal A, Homa DM, O'Connor E, et al. Current cigarette smoking among adults - United States, 2005–2014. *MMWR. Morb Mortal Wkly Rep*. 2015;64(44):1233–1240.

2. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2015. *CA Cancer J Clin*. 2015;65(1):5–29.

3. Hyland A, Travers MJ, Cummings KM, Bauer J, Alford T, Wieczorek WF. Tobacco outlet density and demographics in Erie County, New York. *Am J Public Health*. 2003;93(7):1075–1076.

4. Peterson NA, Lowe JB, Reid RJ. Tobacco outlet density, cigarette smoking prevalence, and demographics at the county level of analysis. *Subst Use Misuse*. 2005;40(11):1627–1635.

5. Schneider JE, Reid RJ, Peterson NA, Lowe JB, Hughey J. Tobacco outlet density and demographics at the tract level of analysis in Iowa: implications for environmentally based prevention initiatives. *Prev Sci*. 2005;6(4):319–325.

6. Rodriguez D, Carlos HA, Adachi-Mejia AM, Berke EM, Sargent JD. Predictors of tobacco outlet density nationwide: a geographic analysis. *Tob Control*. 2013;22(5):349–355.

7. Henriksen L, Schleicher NC, Dauphinee AL, Fortmann SP. Targeted advertising, promotion, and price for menthol cigarettes in California high school neighborhoods. *Nicotine Tob Res*. 2012;14(1):116–121.

8. Siahpush M, Jones PR, Singh GK, Timsina LR, Martin J. The association of tobacco marketing with median income and racial/ethnic characteristics of neighbourhoods in Omaha, Nebraska. *Tob Control*. 2010;19(3):256–258.

9. Lee JG, Henriksen L, Rose SW, Moreland-Russell S, Ribisl KM. A systematic review of neighborhood disparities in point-of-sale tobacco marketing. *Am J Public Health*. 2015;105(9):e8–18.

10. Yerger VB, Przewoznik J, Malone RE. Racialized geography, corporate activity, and health disparities: tobacco industry targeting of inner cities. *J Health Care Poor Underserved*. 2007;18(4 suppl):10–38.

11. Luke DA, Ribisl KM, Smith C, Sorg AA. Family Smoking Prevention And Tobacco Control Act: banning outdoor tobacco advertising near schools and playgrounds. *Am J Prev Med*. 2011;40(3):295–302.

12. Ackerman A, Etow A, Bartel S, Ribisl KM. Reducing the number and density of tobacco retailers: policy and solutions and legal issues [published online ahead of print April 28, 2016]. *Nicotine Tob Res*.

13. Environmental Systems Research Institute. *ArcGIS Desktop: Release 10.1 [computer program]*. Redlands, CA: ESRI; 2012.

14. United States Census Bureau. 2005–2009 American Community Survey 5-year estimates. 2011. http://ftp2.census.gov/. Accessed November 6, 2013.

15. Hill S, Amos A, Clifford D, Platt S. Impact of tobacco control interventions on socioeconomic inequalities in smoking: review of the evidence. *Tob Control*. 2014;23(e2):e89–e97.

16. Sabatini J. SF approves 50 percent reduction in tobacco-selling stores. *San Francisco Examiner*. 2014. http://archives.sfexaminer.com/san-francisco/sf-approves-50-percent-reduction-in-tobacco-selling-stores/Content?oid=2913907. Accessed June 9, 2016.

17. Ambrose BK, Day HR, Rostron B, et al. Flavored tobacco product use among US youth aged 12-17 years, 2013-2014. *JAMA*. 2015;314(17):1871–1873.

18. Henriksen L, Feighery EC, Schleicher NC, Cowling DW, Kline RS, Fortmann SP. Is adolescent smoking related to the density and proximity of tobacco outlets and retail cigarette advertising near schools? *Prev Med*. 2008;47(2):210–214.

19. West JH, Blumberg EJ, Kelley NJ, et al. Does proximity to retailers influence alcohol and tobacco use among Latino adolescents? *J Immigr Minor Health*. 2010;12(5):626–633.

20. Lipperman-Kreda S, Mair C, Grube JW, Friend KB, Jackson P, Watson D. Density and proximity of tobacco outlets to homes and schools: relations with youth cigarette smoking. *Prev Sci*. 2014;15(5):738–744.