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Short Report

Youth activity spaces and daily exposure to tobacco outlets

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ABSTRACT

We explored whether exposure to tobacco outlets in youths' broader activity spaces differs from that obtained using traditional geographic measures of exposure to tobacco outlet within buffers around homes and schools. Youths completed an initial survey, daily text-prompted surveys, and carried GPS-enabled phones for one week. GPS locations were geocoded and activity spaces were constructed by joining sequential points. We calculated the number of tobacco outlets around these polylines and around homes and schools. Results suggest that activity spaces provide a more accurate measure of tobacco outlet exposures than traditional measures. Assessing tobacco outlet exposure within activity spaces may yield significant information to advance the field.

1. Background

Exposure to tobacco outlets may be an important factor in initiation and use of tobacco by adolescents. In particular, such exposure may increase access to tobacco, exposure to tobacco advertising and promotion, and exposure to others who use tobacco. All of these factors are related to youth tobacco use (Botello-Harbaum et al., 2009; Carpenter and Cook, 2008; DiFranza et al., 2009; Ding, 2003; Henriksen et al., 2004, 2010; Lipperman-Kreda et al., 2012; Wakefield and Chaloupka, 2000). Controls over the number of tobacco outlets and their distance from residential areas or schools are frequently advocated approaches to reduce youth exposure and access to tobacco products and thus their tobacco use.

A modest body of cross-sectional research has investigated the association between exposure to tobacco outlets around schools or residential areas and tobacco use among youths (Chan and Leatherdale, 2011; Henriksen et al., 2008; Leatherdale and Strath, 2007; Author et al., 2014b; Lovato et al., 2007; McCarthy et al., 2009; Novak et al., 2006; Pokorny et al., 2003; West et al., 2010). Results of these studies are mixed. Some studies have found no or small effects (Leatherdale and Strath, 2007; Lovato et al., 2007; McCarthy et al., 2009; Pokorny et al., 2003) and others have shown stronger associations with youth smoking (Chan and Leatherdale, 2011; Henriksen et al., 2008; Author et al., 2014b; Novak et al., 2006; West et al., 2010).

The existing research, however, has considered exposure to tobacco outlets based on defined administrative units (e.g., census tract or ZIP code) or buffers (typically 0.5–1 mile) surrounding youths' homes or schools. These approaches fail to capture exposure to tobacco outlets in the broader environment where youths spend their time (i.e., activity spaces). For example, outlets that sell tobacco to youths may not be located near schools or homes, but rather located on the travel paths from schools to homes or around other important spaces such as community centers, parks, or malls. Exposure to tobacco outlets in these areas would not be captured by traditional measures (Sherman et al., 2005).

Research on other health behaviors has compared individuals' exposure to risk factors in both residential and non-residential areas. For example, a study in the Seattle, WA area found statistically significant differences in exposure measures associated with dietary and physical activity (e.g., number of fast food restaurants) between home and non-home built environments (Hurvitz and Moudon, 2012). Comparing residential neighborhoods and activity spaces, another study showed greater exposure to supermarkets and farmers' market in activity spaces among women of reproductive age in North Carolina (Crawford et al., 2014). Similarly, a study in Detroit identified associations between activity space environmental exposures (i.e., fast food outlets and supermarket availability) and dietary behaviors using two types of activity space measures (i.e., a standard deviation ellipse and daily path area) (Zenk et al., 2011). No associations were found between residential area exposures and these outcomes. These results suggest that considering individuals' exposures to tobacco outlets in the broader environment may improve our understanding of effects of such exposures on tobacco use. To explore this possibility, we conducted an exploratory study to assess whether exposure to tobacco outlets in youths' broader activity spaces differs from traditional geographic measures of number of tobacco outlet within 800 m (i.e., ≈ 0.5 mile) around homes and schools.

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2. Methods

2.1. Participants

We recruited a small convenience sample of 11 youths (ages 14–18, 4 males) in 3 California cities in the San Francisco Bay Area. Youths were recruited through flyers distributed to youth organizations. Researchers obtained parental consent for participation in the study followed by assent from the youth. Institutional review board approval was obtained before implementation of the study.

2.2. Procedures

Youths completed an initial brief survey and then met with research staff to get prepaid GPS-enabled smartphones and chargers. Youths were asked to charge the phone nightly and to always carry it with them for one week. During this week, they also completed daily text-prompted surveys. As compensation for their participation, they received $10 for completing the initial brief survey, $5 for each daily survey they completed, and $15 bonus if they completed all surveys. Additionally, they received $30 for return of the phone at the end of the study and $10 for return of the charger.

2.3. Measures

2.3.1. Activity spaces

Location coordinates (latitude and longitude) and timestamps were identified every 60 s by GPS application, which ran automatically in the background and transmitted location data to a secure database. We geocoded these locations and constructed activity spaces by joining sequential points. Because our tobacco outlet data were limited to those within the three study cities (Lipperman-Kreda et al., 2014b), we only considered line segments that fell completely within city boundaries. We also geocoded home address and school address obtained from youths.

2.3.2. Exposure to tobacco outlets

Since comprehensive address lists of tobacco outlets in California are not readily available, a physical count of all tobacco outlets in 45 California cities was undertaken as part of a large-scale study (Lipperman-Kreda et al., 2014a). We obtained planning and zoning data from each of these cities. Zoning code definitions were reviewed to indicate which areas could include tobacco retailers and map books of all retail/commercial areas within the city were made. Field observations in the cities were then conducted to document the addresses of tobacco outlets.

Of the 45 cities, we recruited youths from 3 cities in the San Francisco Bay Area. We geocoded the tobacco outlet addresses and used ArcGIS, version 10.1 software (ESRI, 2011) to calculate the number of tobacco outlets using 50 m and 100 m buffers around activity space polylines and 800 m buffers around youth homes and schools (see Fig. 1). We selected 50 m and 100 m buffer size around activity space polylines to more precisely capture the immediate vicinity around travel routes. For comparison with activity spaces we used two approaches to calculate traditional measures of exposure (Oliver et al., 2007). First, home and school locations were geocoded to the street address, and the 800 m buffers formed by radii around these points. We calculated counts of outlets within these circular buffers. Because we had tobacco outlet locations only within the cities, we clipped buffers at city boundaries, adjusting our calculations of the land area captured in the buffer accordingly. Second, we calculated counts of outlets within 800 m travel distance of homes and schools along the roadway network.

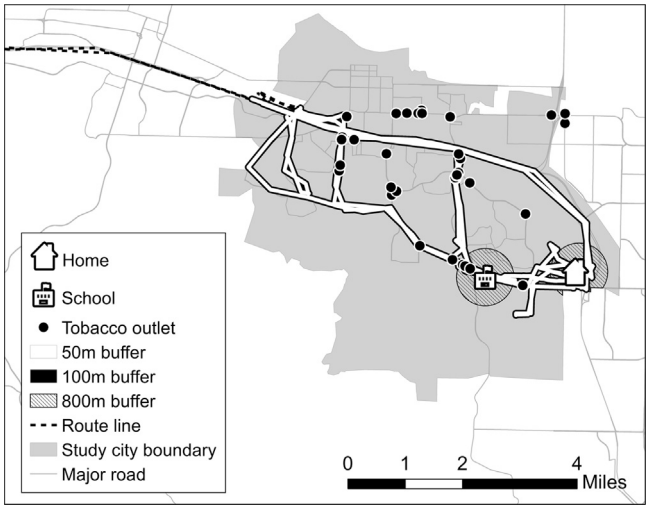

Fig. 1. An adolescent's activity space and exposure to tobacco outlets within activity space and around school and home.

2.3.3. Tobacco use

In the initial survey, youths were first asked about lifetime use of (1) cigarettes, (2) cigars, cigarillos, or little cigars, (3) smokeless tobacco, and (4) any other form of tobacco (other than cigarettes, cigars or smokeless tobacco). Respondents who reported ever use of any of these products were then asked about their frequency of using that product in the past 12 months on a seven-point scale ("Never" to "Every Day"). In the daily surveys, youths were asked about their use of each of these products that day (yes and no).

2.4. Data analysis

We used the weekly and daily data to describe exposure using the different measures and explore the associations between the exposure measures and youth tobacco use. For analyses using daily data, we excluded days in which youths were tracked for less than 360 min to better represent *daily* activity spaces. To account for missing data in the time youth spent outside the study cities, we also multiplied the number of tobacco outlets within activity spaces by the proportion of time the youth was within his/her city of residence on that day (Mean = 0.87). Daily data included a total of 69 days of GPS data with an average number of 6.3 days per youth (range: 5 to all 7 days). For these 69 days, we had 60 daily surveys (87%) completed by the youths. We used Generalized Estimating Equations with repeated measures to account for the nested design (days within participants).

3. Results

Six youths reported past year tobacco use on the initial survey. On average, there were 18.5 and 22.4 tobacco outlets in the 50 m and 100 m buffers around activity spaces, respectively, compared with an average of 3.9 outlets within 800 m of both youth homes and schools using the circular buffers and an average of 2.0 and 1.6 outlets within 800 m travel distance along the roadway network. The average number of outlets within 50 m and 100 m of activity spaces among past year tobacco users was 22 and 25.7, respectively, compared with 15 and 18.4 within 50 m and 100 m of activity spaces of non-users. Using traditional exposure measures of 800 m buffers around youth homes and schools, these differences were less pronounced. Specifically, among past year tobacco users, the average number of outlets within 800 m of homes and schools was 2.4 and 4.7, respectively, and 0.0 and 1.8 within 800 m