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## Objective and perceived measures of tobacco marketing are uniquely associated with cigar use

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### Abstract

**Background:** Few studies have examined associations between perceived and objective exposure to tobacco marketing and youth use of cigars, which are the second most commonly used tobacco product.

**Methods:** We used Geographic Ecological Momentary Assessment data over 14 days from youth aged 16-20 years (n=83 participants, n=948 observations; 34% past month users of any tobacco product) in eight city areas in California. Tobacco outlets in study cities were visited by trained observers to record outlet GPS point locations and outdoor tobacco marketing. We assessed daily perceived exposure to tobacco marketing within participants' activity spaces; daily objective exposure to tobacco outlets with outdoor marketing within 50m of activity space polylines (number of outlets and time spent near outlets); and daily cigar use excluding and including blunts.

**Results:** Controlling for demographics and baseline tobacco use, results from mixed logistic regression models showed that greater perceived exposure to tobacco marketing was positively associated with higher odds of cigar use each day, excluding blunts (aOR: 2.00; 95% CI: 1.03, 3.87) and including blunts (aOR: 1.87; 95% CI: 1.26, 2.77). Also, exposure to a greater number of tobacco outlets with outdoor marketing was associated with higher odds of cigar use each day, excluding blunts (aOR: 1.34; 95% CI: 1.01, 1.78), but not including blunts.

**Conclusions:** Tobacco control efforts should consider both perceived and objective exposure to tobacco marketing and unique associations with blunt use to prevent cigar use.

### Keywords

advertising and promotion; environment; non-cigarette tobacco products

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**Competing interests:** none.

## INTRODUCTION

Tobacco use remains the leading cause of preventable death and disease in the United States. [1] Studies suggest tobacco marketing is an important causal determinant of tobacco use among youth (a classification which includes adolescents and young adults), [2] particularly at the point of sale, which accounts for nearly 80% of the tobacco industries' total marketing budgets. [3] Indeed, systematic reviews and meta-analyses have shown positive associations between point of sale marketing—which includes advertising, price promotions, and product displays—and increased smoking susceptibility, experimentation, and uptake among youth. [4-6]

A common way in which researchers measure exposure to tobacco marketing at the point of sale is through self-reported measures. Of 13 studies included in a recent meta-analysis of tobacco marketing at the point of sale and its effects on youth smoking, 11 used self-reported exposure measures. [5] Although important, self-report measures are limited by recall and same-source bias. Also, while past research has typically considered objective measures by examining exposure to tobacco retail outlets near homes or schools, [7] growing research shows that exposure to tobacco outlets may be more accurately measured by considering activity spaces, [8] which include all of locations that people frequent as part of their daily routines.

As youth tobacco use shifts away from traditional cigarettes, it is also important to understand how tobacco marketing is associated with use of non-cigarette tobacco products. In 2019, 7.6% of high school students reported using cigars in the past 30 days, [9] making cigars the second most commonly used tobacco product by youth and the most commonly used *combustible* tobacco product. [9, 10] But few studies have examined associations between tobacco marketing at the point of sale and youth cigar use. Two studies suggest that recall of tobacco point of sale advertising (general and product specific) is associated with increased curiosity and susceptibility to cigars and cigar use. [11, 12] Both studies, however, relied solely on perceived measures of exposure to tobacco marketing and neither examined blunt use. When researching cigar use, it is important to consider blunts (cigars that have been hollowed out and filled with marijuana) because 1) blunts still contain some or all of the tobacco filler, [13] 2) blunts contain nicotine even if the tobacco filler is removed from the cigar, [13] and 3) cigars, cigarillos, little cigars, or blunt wrappers, used to make blunts, are largely available and marketed in tobacco outlets. [14] Research also shows that blunt use is associated with greater exposure to carbon monoxide than smoking marijuana through other routes of administration (e.g., joints), [15] and that co-use of tobacco and marijuana is associated with increased substance use, [16] mental health problems, [17] and dependence [18] than use of either substance alone.

To address gaps in current research, this study examined whether perceived and objective measures of tobacco marketing were associated with cigar use—both including and excluding blunts—among youth. Based on extant research, [11, 12] we hypothesized that both perceived and objective measures would be associated with cigar use. Due to limited research, we made no specific hypotheses about differences related to blunt use and considered these to be exploratory research questions.

## METHODS

### Study cities and participants

Geographic Ecological Momentary Assessment (GEMA) data were collected from 101 youth aged 16-20 years in 8 mid-sized California city areas. Details on how cities were selected can be seen in previous publications.[19, 20] Data were collected between February 2017 and May 2018. Participants included those who lived in these 8 cities or in cities that were within a 10-mile buffer of the cities. We recruited youth (50% past month tobacco users) through internet and social media advertisements (i.e., Craigslist, Facebook, Twitter, Myspace). Participants also were recruited through flyers distributed to youth organizations in the study cities and by referral. Participants were screened for eligibility (i.e., age, city of residence, speak English, and tobacco use) and parental consent was obtained for those under 18 years old. Participants provided signed consent or assent to participate in the research. The Pacific Institute for Research and Evaluation (PIRE) institutional review board (Federal-wide Assurance #FWA00003078) approved the study.

### Procedures

Upon recruitment, participants completed an online baseline survey (30 min). Research team members then met participants to deliver GPS-enabled phones with a survey application and brief them about study procedures. Participants responded to brief daily surveys and location coordinates (latitude and longitude) were obtained at one-minute intervals for 14 days. The phone survey application was programed to send reminders to complete the survey each evening at 8pm. Participants had a 3-hour window to respond to the survey. Participation compensation included \$10 for completing the initial survey, \$5 for each daily survey, a \$20 bonus if they completed all surveys, and \$50 for returning the phone and charger at the end of the study. Participants could use the phones with unlimited voice and text during the study. All participants received a resource card with information about tobacco use upon study completion.

### Analytical sample

Of the 1483 days, we removed 521 days that were missing either because participants were tracked for less than 360 min or because there were missing data on any of the study variables. We also removed three participants who completed less than 50% of the daily surveys. The final analytic sample therefore included 948 days, which were clustered within 83 participants. Each participant in the study had, on average, 11.4 days of data (SD=2.2).

### Measures

**Daily cigar use**—Participants were asked, 1) “Since this time yesterday, did you smoke any cigar, cigarillo, or little cigar?” and 2) “Since this time yesterday, did you smoke part or all of a cigar, cigarillo or little cigar with marijuana in it (a blunt)?” For each question, participants could respond yes (1) or no (0). We analyzed cigar use excluding blunts (using only the first question above) and cigar use including blunts (using both questions above) separately.

**Perceived exposure to tobacco marketing**—Participants were asked in four separate questions, “Since this time yesterday, did you see any ads for cigarettes, e-cigarettes or any other tobacco or nicotine products inside or outside of a store or on a billboard in or near...” (1) Your neighborhood?, (2) Your school?, (3) Your workplace?, and (4) Anywhere else? For each question, participants could respond yes (1) or no (0). Similar to a prior study,[21] we summed responses to all four questions, such that one unit indicates that participant saw a tobacco ad in one location within their activity spaces and greater scores indicate greater perceived exposure to tobacco marketing.

**Exposure to tobacco outlets with outdoor marketing**—We identified tobacco outlets in the 8 city areas using previously reported methods.[19, 20] Trained field observers visited all outlets between April and June 2017 to record outlet GPS point locations (latitude and longitude) and obtained data about tobacco products and marketing. Outlet observations were conducted using an adapted version of the Standardized Tobacco Assessment for Retail Settings surveillance tool.[22] To assess inter-rater agreement, 13% of the outlets (n=69) were independently visited by two observers (kappa=.67). In the current study, we combined items asking field observers to indicate whether there were (1) any tobacco or nicotine ads (marketing materials) visible from the outside and (2) any price promotions outside the store for any of the following: regular cigarettes, menthol cigarettes, cigarillos/little cigars, large cigars, chew, moist or dry, snuff/snus, loose or pipe tobacco, hookah/shisha, e-cigarette/vape devices, e-hookah, e-cigars, and e-liquid. Indication of yes to any of these items was coded 1 for each outlet.

Tobacco outlet addresses and participants’ GPS locations were geocoded and activity spaces were constructed by joining sequential GPS points into a polyline, which was then buffered and overlaid with tobacco outlet locations.[8] Exposure measures included the number of tobacco outlets with outdoor marketing within 50m of these polylines each day, as well as the number of minutes participants were within 50m of tobacco outlets with outdoor marketing each day. The downloaded GPS data had a field of accuracy of each point (M=20m). To minimize potential errors, we used the 50m buffer. All exposure measures were weighted by the time participants were within the study area. Similar to past research, [20] and given the large correlation between our two objective exposure measures ( $r=0.43$ ), [23] we ran separate models for the number of tobacco outlets with outdoor marketing within 50m of polylines and amount of minutes participants were within 50m of tobacco outlets with outdoor marketing.

**Control variables**—Control variables assessed in the initial survey included sex assigned at birth (male, female, or intersex), race (White or non-White), ethnicity (Latino or non-Latino), age group (less than 18 or 18+), and perceived SES with the item, “Compared with other people in America, how rich or poor do you consider yourself?” Respondents could answer on a Likert scale (1=rich to 7=poor). Researchers have found that perceived SES is associated with health behaviors.[24] We also controlled for baseline tobacco product use. For this variable, we categorized participants as 1) never tobacco product users if they reported never having used cigarettes, cigars, e-cigarettes, or chewing tobacco / snuff / dip, 2) ever tobacco product users if they reported having ever used one of those products but not

within the past 30-days, or 3) past-30 day users if they reported using one of those products within the past 30 days.

### Data analysis

We first examined descriptive statistics for all variables. We then compared both perceived and objective exposure to tobacco marketing by cigar use status on a given day. Finally, we used mixed logistic regression models to examine how perceived and objective exposure to tobacco marketing were associated with cigar use, controlling for clustering of observations within participants over time, demographics, and baseline tobacco use status. Centering was used to parse between- versus within-person variance in our exposure measures. In grand mean centering, we calculated the deviation of each participant's score from the overall mean of each variable. In group mean centering, we calculated the deviation of each observation from the mean for each participant. The grand mean centered variables correspond to the between-participant exposure to tobacco marketing over the course of the entire study (level 2 variables), whereas the group mean centered variables correspond to daily within-participant exposures to tobacco marketing (level 1 variables). We modeled control variables (demographics and baseline tobacco product use) as level 1 variables. The between- and within-participant exposures were examined in the same model. We examined two outcomes in separate models: 1) cigar use, excluding blunts and 2) cigar use, including blunts. Results include adjusted odds ratios (aORs) and 95% confidence intervals (CIs). For all analyses, we used SAS version 9.4 (SAS Inc., Cary, NC, USA).

## RESULTS

### Sample characteristics

Sample characteristics are in Table 1. Of the 83 participants at baseline, 8 reported using cigars in the past 30 days (9.6%) and 29 reported ever using cigars but not within the past 30 days (34.9%). Throughout the study, 13 participants reported any daily cigar use excluding blunts and 28 reported any daily cigar use including blunts. Of the 948 study days, participants reported using cigars, excluding blunts, on 3.6% of days (n=34 days) and reported using cigars, including blunts, on 12.8% of days (n=121 days). On average, participants reported seeing tobacco ads in 0.51 (SD=0.93) areas within their activity spaces each day. In addition, on average participants were exposed to 1.55 (SD=2.11) tobacco outlets with outdoor marketing within 50m of polylines each day and spent, on average, 3.95 (SD=11.25) minutes within 50m of tobacco outlets with outdoor marketing each day (Table 1).

### Descriptive results

Perceived exposure to tobacco marketing was not associated with number of tobacco outlets with outdoor marketing within 50m of activity space polylines ( $r=0.03$ ,  $p=0.30$ ) or amount of time spent within 50m of tobacco outlets with outdoor marketing ( $r=-0.02$ ,  $p=0.59$ ). Perceived exposure to tobacco marketing was higher ( $M=1.53$ ,  $SD=1.13$ ) on days in which participants reported cigar use excluding blunts, compared to no use days ( $M=0.48$ ,  $SD=.90$ ); in other words, on days in which participants reported cigar use excluding blunts, participants reported seeing tobacco ads in 1.5 locations (e.g., in their neighborhood, near

school) within their activity spaces (Table 2). Similar results were observed for cigar use including blunts. Also, participants were exposed to more tobacco outlets with outdoor marketing within 50m of activity space polylines on days in which they reported cigar use excluding blunts (M=2.20; SD=2.48) than days when they did not use cigars (M=1.53, SD=2.09). With regards to cigar use including blunts, participants were exposed to a similar number of tobacco outlets with outdoor marketing within 50m of activity space polylines on days when they used cigars including blunts (M=1.47, SD=2.04) and days when they did not use cigars (M=1.56, SD=2.12). The amount of time spent within 50m tobacco outlets with outdoor marketing was not associated with cigar use, both excluding and including blunts.

### Perceived exposure to tobacco marketing

**Between-participants exposure.**—Controlling for demographics and baseline tobacco use, over the course of the study, greater perceived exposure to tobacco marketing was not associated with cigar use excluding blunts but was associated with higher odds of cigar use including blunts (aOR: 6.91; 95% CI: 2.01, 23.79) (Table 3). In other words, for a one-unit increase in the total number of locations that participants saw tobacco ads in their activity spaces, participants had almost seven times the odds of cigar use including blunts.

**Within-participants exposure.**—Controlling for demographics and baseline tobacco use, greater perceived exposure to tobacco marketing on a given day was associated with higher odds of both cigar use excluding blunts (aOR: 2.00; 95% CI: 1.03, 3.87) and cigar use including blunts (aOR: 1.87; 95% CI: 1.26, 2.77) on that day (Table 3). In other words, for a one-unit increase in number of locations that participants saw tobacco ads in their activity spaces on a given day, participants had double the odds of cigar use including blunts on that day and an 87% increase in the odds of cigar use excluding blunts on that day.

### Objective exposures to tobacco marketing

**Between-participants exposure.**—We found no significant associations between number of tobacco outlets participants were exposed to over the course of the study and cigar use excluding blunts or including blunts (Table 3). Similarly, we found no associations between the amount of time participants spent within 50m of tobacco outlets with outdoor marketing over the course of the study and cigar use excluding blunts or including blunts (Table 4).

**Within-participants exposure.**—We found that exposure to a greater number of tobacco outlets with outdoor marketing within 50m of activity space polylines was associated with higher odds of cigar use excluding blunts each day (aOR: 1.34; 95% CI: 1.01, 1.78) but not including blunts each day (Table 3). In other words, for a one-unit increase in number of tobacco outlets with outdoor marketing that participants were exposed to on a given day, there was a 34% increase in the odds of cigar use excluding blunts on that day. We did not observe any significant associations between amount of time spent within 50m of tobacco outlets with outdoor marketing and cigar use excluding blunts each day or including blunts each day (Table 4).

## DISCUSSION

The current study is one of the first to examine how both perceived and objective measures of exposure to tobacco marketing are associated with cigar use among youth using time-ordered data. We found that perceived exposure to tobacco marketing was associated with cigar use each day (inclusive and exclusive of blunts), but that exposure to a greater number of tobacco outlets with outdoor marketing within activity spaces was only associated with cigar use excluding blunts each day. These observed associations primarily occurred within participants (as opposed to between participants) emphasizing the potential immediate effects of exposure on cigar use (rather than cumulative effects).

Our study confirms previous research that perceived exposure to tobacco marketing at the point of sale is associated with cigar use.[11, 12] Importantly, our findings extend current research by showing that day-to-day exposure to tobacco ads in more areas within individuals' activity spaces was associated with cigar use, both excluding and including blunts. Our study also extends previous research by considering both within- and between-person associations to understand whether effects of perceived exposure to tobacco marketing are immediate or cumulative. Taken together, these findings highlight the importance of using self-reported measures to assess exposure to tobacco marketing. Similar to previous research in other fields (e.g., physical activity, mental health, diet), we found stronger associations with tobacco use for perceived exposure to tobacco marketing versus objectively measured exposure to tobacco marketing.[25-27] This may be because perceived neighborhood measures more directly align with individual's experiences and reflect how individuals interact with their neighborhoods. In addition, in our study, it is likely that self-reported measures capture youth noticing and attending to tobacco marketing. Therefore, using self-reported measures in addition to objective measures, as we did in this study, may provide a more accurate picture of exposure to tobacco marketing among youth.

This is the first study, to our knowledge, that examined how an objective measure of tobacco marketing was associated with cigar use. We found that exposure to a greater number of tobacco outlets with outdoor marketing within 50m of activity space polylines was positively associated with cigar use, excluding blunts each day. Also, only within-participant effects were found, which suggests that effects of day-to-day exposure to tobacco marketing within activity spaces on cigar use may be more immediate than cumulative. This finding aligns with previous research showing the importance of considering tobacco retail exposure in activity spaces, rather than only examining exposure near schools or homes.[8] Interestingly, we did not find an association between amount of time spent near tobacco outlets with outdoor marketing, which suggests that exposure effects may be due to increased opportunities to see tobacco marketing rather than the amount of time of exposure.

An important observation of our findings was the different results for whether our measure of cigar use excluded or included blunts. Our study extends previous findings[11, 12] by showing that exposure to a greater number of tobacco outlets with outdoor marketing within 50m of activity space polylines was associated only with cigar use, excluding blunts, on a given day. Studies showing that youth perceive blunts to be a cannabis product, rather than a tobacco product may help to explain this finding.[28-30] Specifically, if youth do

not consider blunts to be a tobacco product, then exposure to tobacco marketing may not influence their blunt use on a day-to-day basis. On the other hand, our study also found that the between-participants measure of perceived exposure to tobacco marketing was only associated with cigar use, including blunts, which suggests that cumulative exposure to tobacco marketing may shape substance use norms over a longer timeframe and promote blunt use. In other words, longer-term self-reported exposure to tobacco marketing could influence not only just cigar use, but also blunt use. Indeed, research shows that certain cigar attributes, which are often highlighted in tobacco advertisements and price promotions—like their cheap price, appealing flavors, and packaging in resealable foil pouches—can promote youth blunt use.[31] Growing research also shows that cigars and marijuana are explicitly co-marketed in tobacco outlets.[32, 33] Together, these findings indicate that tobacco marketing can influence youth marijuana and tobacco co-use and that policies/interventions seeking to reduce co-use among youth may seek to target tobacco marketing.

Findings lend support to policies restricting exterior advertising and promotions of tobacco products at the point of sale by showing the contribution of both objective and perceived exposures to cigar use among youth and identifying cumulative and immediate effects. While many countries have restricted the advertisement and promotion of tobacco products in a number of different marketing channels, marketing at the point of sale has been the least regulated marketing channel.[34] Our study lends support to policymakers who may wish to consider restricting exterior tobacco marketing at the point of sale, especially since research from other countries shows that these restrictions can reduce exposure to marketing,[35] impulse purchases of tobacco products,[35] and youth experimentation with tobacco products.[36] While tobacco advertising restrictions at the point of sale are difficult to pass in the US, states and localities can restrict tobacco advertising at the point of sale through licensing laws, zoning laws, or other laws/ordinances.[37] Since our measure of exposure to point of sale tobacco marketing only included exterior marketing, findings may not apply to all tobacco marketing restrictions; however, these results are still valuable since localities in the US have begun to restrict exterior point of sale tobacco marketing (e.g., New York) [37]. Future research could tease out the differences between 1) exterior marketing versus other forms of point of sale tobacco marketing and 2) tobacco outlets with and without exterior marketing to determine the extent to which marketing is a proxy for availability.

Our research also highlights the need for interventions—such as placing anti-tobacco ads at the point of sale—to target perceptions and counter the influence of tobacco advertisements and promotions. Among adults, studies have found significant associations between exposure to point of sale anti-tobacco ads and thinking about the risks of tobacco,[38] experiencing negative emotions,[39] perceiving the ads to be effective,[39] quit intentions,[40] and quit attempts.[40] However, only one study has been conducted with youth, limiting extant knowledge about the impact of how anti-tobacco ads at the point of sale could counteract the influence of advertisements and promotions from the tobacco industry. Results also suggest the importance of interventions or media campaigns to change perceptions of blunts as cannabis only product and emphasize the risks of tobacco use in relation to blunt use.



## Limitations

We acknowledge a number of limitations, including that: 1) we relied on self-reported measures of cigar use and we did not provide brand names or images of cigar products to participants, which could have led to an underestimation of cigar use; 2) we did not control for other factors that may have influenced cigar use (e.g., family history of tobacco use) and other potentially confounding associations; 3) we excluded participants with missing data, which could lead to some subgroups of participants being under-represented in the study's conclusions or conservative estimates if participants did not respond to surveys on the days in which they used cigars; the online supplementary table provides details for how participants with missing data differed from participants retained in the analysis; 4) it is possible that tobacco ads may have been counted more than once if it was near both a participant's school, neighborhood, or workplace, which means that our measure of perceived exposure to tobacco marketing may not accurately capture the total number of locations in which participants saw tobacco ads; 5) based on the data collection approach, the timing of marketing exposure and cigar use in a day are not known, leaving an important gap in our knowledge of the exposure-outcome relationship for future research; and 6) our data came from a convenience sample of youth in California and results may not generalize to other populations or locations. In addition, our study did not examine cigar-specific tobacco marketing, distinguish among different types of cigar use (e.g., cigarillo, large cigar, little cigar), and focused on one form of tobacco marketing (point of sale), leaving gaps for future research to explore how other types of cigar-specific tobacco marketing in different mediums (e.g., online, social media) are associated with different types of youth cigar use.

## Conclusions

Results suggest that it is important to assess exposure to tobacco marketing among youth considering both perceived and objective measures, since in our study both were associated with cigar use in different ways. Similarly, including blunts in the definition of cigar use changed results, which could stem from youth not perceiving blunts as a tobacco product. Building on these findings, policies and interventions to regulate tobacco marketing at the point of sale may be helpful in preventing and reducing tobacco use among youth.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## Data availability statement:

Data are available upon reasonable request to Dr. Lipperman-Kreda at skreda@prev.org. Only de-identified data can be shared. It is the policy of the IRB overseeing this project to

not share data that are personally identifiable or could lead to disclosure of the identities of individual subjects or could cause significant social or legal harm to research participants.

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### WHAT THIS PAPER ADDS

- **What is already known on this subject?** Self-reported exposure to tobacco marketing is associated with youth tobacco use.
- **What important gaps in knowledge exist on this topic?** Little is known about how tobacco marketing (especially exposure at the point of sale) is associated with cigar use among youth.
- **What does this study add?** Using time-ordered Geographic Ecological Momentary Assessments of youth, this study found that both self-reported exposure to tobacco marketing and being exposed to a greater number of tobacco outlets with outdoor marketing were positively associated with cigar use each day, but that results differed depending on whether blunts were included in the definition of cigar use.

**Table 1.**

Participant Characteristics, n=83 participants and 948 days

|  | N        | %     | Mean | SD    | Range |
|--|----------|-------|------|-------|-------|
| <b>Individual-level (n=83)</b>   |          |       |      |       |       |
| Race   |          |       |      |       |       |
| White  | 48       | 57.8% | --   | --    | --    |
| Non-White  | 35       | 42.2% | --   | --    | --    |
| Ethnicity  |          |       |      |       |       |
| Hispanic or Latino   | 18       | 21.7% | --   | --    | --    |
| Not Hispanic or Latino   | 65       | 78.3% | --   | --    | --    |
| Sex at birth   |          |       |      |       |       |
| Male   | 33       | 39.8% | --   | --    | --    |
| Female   | 50       | 60.2% | --   | --    | --    |
| Age  |          |       |      |       |       |
| 18 or older  | 50       | 60.2% | --   | --    | --    |
| Younger than 18  | 33       | 39.8% | --   | --    | --    |
| Perceived SES <sup>a</sup>   | 83       | --    | 4.27 | 1.46  | 1-7   |
| Baseline tobacco product use   |          |       |      |       |       |
| Never use  | 40       | 48.2% |      |       |       |
| Ever use but not within the past 30 days   | 15       | 18.1% |      |       |       |
| Past 30-days use   | 28       | 33.7% |      |       |       |
| Number of days used cigars, excluding blunts   | 83       |       | 0.41 | 1.41  | 0-10  |
| Number of days used cigars, including blunts   | 83       |       | 1.46 | 2.73  | 0-10  |
| Perceived exposure to tobacco marketing  | 83       |       | 0.55 | 0.72  | 0-3   |
| Number of tobacco outlets with outdoor marketing within 50m of activity space polylines per day <sup>b</sup> | 83       |       | 1.52 | 1.27  | 0-6   |
| Amount of time spent within 50m of tobacco outlets with outdoor marketing per day (in minutes) <sup>b</sup>  | 83       |       | 3.75 | 6.51  | 0-56  |
| <b>Day-level (n=948)</b>   |          |       |      |       |       |
| Cigar use, excluding blunts  |          |       |      |       |       |
| Days in which participants did not use cigars, excluding blunts  | 914 days | 96.4% | --   | --    | --    |
| Days in which participants did use cigars, excluding blunts  | 34 days  | 3.6%  | --   | --    | --    |
| Cigar use, including blunts  |          |       |      |       |       |
| Days in which participants did not use cigars, including blunts  | 827 days | 87.2% |      |       |       |
| Days in which participants did use cigars, including blunts  | 121 days | 12.8% |      |       |       |
| Perceived exposure to tobacco marketing  | 948 days | --    | 0.51 | 0.93  | 0-4   |
| Number of tobacco outlets with outdoor marketing within 50m of activity space polylines per day <sup>b</sup> | 948 days | --    | 1.55 | 2.11  | 0-11  |
| Amount of time spent within 50m of tobacco outlets with outdoor marketing per day (in minutes) <sup>b</sup>  | 948 days | --    | 3.95 | 11.25 | 0-206 |

<sup>a</sup>Higher values indicate lower SES

<sup>b</sup>Higher values indicate increasing exposure

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**Table 2.**

Descriptive results for perceived exposure to tobacco marketing, exposure to tobacco outlets with outdoor marketing, and cigar use, n=948 days

| Variable  | Cigar use, excluding blunts                                |   | Cigar use, including blunts                                |   |
|---|--|---|--|---|
|   | Days in which participants did not use cigars<br>Mean (SD) | Days in which participants used cigars<br>Mean (SD) | Days in which participants did not use cigars<br>Mean (SD) | Days in which participants used cigars<br>Mean (SD) |
| Perceived exposure to tobacco marketing   | 0.48 (0.90)  | 1.53 (1.13)   | 0.40 (0.83)  | 1.27 (1.17)   |
| Number of tobacco outlets with outdoor marketing within 50m of activity space polylines per day | 1.53 (2.09)  | 2.20 (2.48)   | 1.56 (2.12)  | 1.47 (2.04)   |
| Amount of time spent within 50m of tobacco outlets with outdoor marketing per day (in minutes)  | 3.87 (11.21)   | 6.06 (12.16)  | 4.02 (11.65)   | 3.47 (7.98)   |

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**Table 3.**

Adjusted associations among perceived exposure to tobacco marketing, number of tobacco outlets with outdoor marketing, and cigar use, n=948 days <sup>a</sup>

| Variables   | Cigar use, excluding blunts<br>aOR (95% CI) | Cigar use, including blunts<br>aOR (95% CI) |
|---|---|---|
| <b>Between-participants variables<sup>b</sup></b>   |   |   |
| Perceived exposure to tobacco marketing   | 2.69 (0.51, 14.21)                          | <b>6.91 (2.01, 23.79)</b>                   |
| Number of tobacco outlets with outdoor marketing within 50m of activity space polylines per day | 1.07 (0.40, 2.87)                           | 0.51 (0.23, 1.10)                           |
| <b>Within-participants variables<sup>c</sup></b>  |   |   |
| Perceived exposure to tobacco marketing   | <b>2.00 (1.03, 3.87)</b>                    | <b>1.87 (1.26, 2.77)</b>                    |
| Number of tobacco outlets with outdoor marketing within 50m of activity space polylines per day | <b>1.34 (1.01, 1.78)</b>                    | 1.15 (0.96, 1.36)                           |

Boldface denotes statistical significance  $p < 0.05$

<sup>a</sup>Model controls for race, ethnicity, sex at birth, age status, perceived SES, and tobacco use status at baseline

<sup>b</sup>Between-participants variables were grand mean centered

<sup>c</sup>Within-participants variables were group mean centered

**Table 4.**

Adjusted associations among perceived exposure to tobacco marketing, amount of time spent near tobacco outlets with outdoor marketing, and cigar use, n=948 days <sup>a</sup>

| Variables  | Cigar use, excluding blunts<br>aOR (95% CI) | Cigar use, including blunts<br>aOR (95% CI) |
|--|---|---|
| <b>Between-participants variables<sup>b</sup></b>  |   |   |
| Perceived exposure to tobacco marketing  | 2.47 (0.52, 11.67)                          | <b>7.32 (2.08, 25.74)</b>                   |
| Amount of time spent within 50m of tobacco outlets with outdoor marketing per day (in minutes) | 0.99 (0.82, 1.20)                           | 0.89 (0.66, 1.19)                           |
| <b>Within-participants variables<sup>c</sup></b>   |   |   |
| Perceived exposure to tobacco marketing  | <b>2.09 (1.10, 3.95)</b>                    | <b>1.85 (1.26, 2.71)</b>                    |
| Amount of time spent within 50m of tobacco outlets with outdoor marketing per day (in minutes) | 1.03 (0.98, 1.09)                           | 1.00 (0.95, 1.05)                           |

Boldface denotes statistical significance  $p < 0.05$

<sup>a</sup>Model controls for race, ethnicity, sex at birth, age status, perceived SES, and tobacco use status at baseline

<sup>b</sup>Between-participants variables were grand mean centered

<sup>c</sup>Within-participants variables were group mean centered