



Neighborhood distribution of availability of newer tobacco products: A US four-site study, 2021

Shyanika W. Rose^{a,b,*}, Arati Annabathula^a, Susan Westneat^{a,c}, Judy van de Venne^a,
Mary Hrywna^{d,h,i}, Christopher Ackerman^d, Joseph G.L. Lee^e, Mahdi Sesay^e,
Daniel P. Giovenco^f, Torra Spillane^f, Shawna V. Hudson^{g,i}, Cristine D. Delnevo^{d,h,i}

^a University of Kentucky, College of Medicine, Behavioral Science and Center for Health Equity Transformation, Lexington, KY, USA

^b University of Kentucky, Markey Cancer Center, Lexington, KY, USA

^c University of Kentucky, College of Public Health, Epidemiology and Biostatistics, Lexington, KY, USA

^d Rutgers Center for Tobacco Studies, New Brunswick, NJ, USA

^e Department of Health Education and Promotion, College of Health and Human Performance, East Carolina University, Greenville, NC, USA

^f Department of Sociomedical Sciences, Columbia University Mailman School of Public Health, New York City, NY, USA

^g Dept of Family Medicine and Community Health, Rutgers Robert Wood Johnson Medical School, Rutgers, The State University of New Jersey, New Brunswick, NJ, USA

^h Department of Health Behavior, Society, and Policy, Rutgers School of Public Health, New Brunswick, NJ, USA

ⁱ Rutgers Cancer Institute of New Jersey, New Brunswick, NJ, USA

ARTICLE INFO

Keywords:

Tobacco control
Marketing
Retail
Tobacco products

ABSTRACT

Audits of tobacco retailers can identify marketing patterns as newer tobacco products are introduced in the US. Our study examined store and neighborhood correlates of availability of nicotine pouches and disposable e-cigarettes in four US sites. We conducted standardized store audits of $n = 242$ tobacco retailers in 2021 in different states: New Jersey, Kentucky, North Carolina, and New York. We geocoded stores linking them with census tract demographics. We conducted unadjusted and adjusted Poisson regression of availability of each product with correlates of the proportion of Non-Hispanic White residents, households under poverty, proximity to schools, site, and store type. Nicotine pouches and disposable e-cigarettes were each available in around half the stores overall, but availability differed across sites (range: 76 %–32 %). In adjusted analyses, nicotine pouches were less likely to be available in each store type vs chain convenience (IRR range 0.2–0.6) and more likely in stores in census tracts with a greater percentage of non-Hispanic White residents (IRR range 1.8–2.3). In contrast, disposable e-cigarettes were more likely to be available in tobacco/vape shops (IRR 1.9 (1.4–2.5) than convenience stores and less likely in non-specialty store types like groceries (IRR 0.2 (0.1–0.4)). Newer tobacco products like nicotine pouches and disposable e-cigarettes were widely available in stores across sites, but retail marketing patterns appear to differ. As these product types become subject to increased regulation as they go through the FDA pre-market authorization process, understanding patterns and changes in the retail environment is critical to inform potential policies regulating their sale and marketing.

1. Introduction

Retail outlets are one of the main avenues for marketing and promotion of tobacco products in the US. In 2020, cigarette manufacturers spent \$7.84 billion to advertise and promote tobacco – almost 80 % for discounts and other promotions at the point-of-sale (Federal Trade Commission, 2021). Exposure to point-of-sale marketing of tobacco products has been linked with youth and adult tobacco use and

unsuccessful quit attempts among those who smoke (Robertson et al., 2015; Siahpush et al., 2016). There is also clear evidence of tobacco manufacturer targeting of products and marketing by neighborhood demographics with substantial consequences for health equity (Lee et al., 2015). A higher density of tobacco retailers has been found in neighborhoods with higher proportions of Black and low-income residents, potentially contributing to disparities in tobacco product use (Lee et al., 2017). Additionally, different products have been

Abbreviations: TFNP, Tobacco-Free Nicotine Pouch.

* Corresponding author.

E-mail address: s.rose@uky.edu (S.W. Rose).

<https://doi.org/10.1016/j.pmedr.2022.102028>

Received 5 June 2022; Received in revised form 15 September 2022; Accepted 18 October 2022

Available online 19 October 2022

2211-3355/© 2022 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

disproportionately marketed in different communities. For instance, more retail menthol cigarette and cigarillo marketing is found in neighborhoods with more Black residents (Mills et al., 2018; Rose et al., 2022); however, smokeless tobacco marketing is generally found to be lower in neighborhoods with more non-White residents (Giovenco et al., 2018). Prior research on retail availability has shown that e-cigarettes were not initially marketed in neighborhoods with more residents from racial/ethnic minority backgrounds but became more prevalent in such neighborhoods over time (D'Angelo et al., 2020).

Retail surveillance of the tobacco product landscape can help identify early trends in newer tobacco product availability and marketing in communities. Several non-combustible product types including disposable e-cigarettes and smokeless nicotine pouch products have emerged on the US market, but little is known about retail availability of these products. In 2021, disposable e-cigarettes such as Puffbar were used by 54 % of youth who use e-cigarettes after these products were exempted from flavor restrictions imposed on cartridge/pod-based e-cigarettes such as JUUL (Park-Lee et al., 2021). Nicotine pouches, often marketed as 'tobacco-free' or 'tobacco-leaf free' nicotine, are newer smokeless tobacco products that come in pouches like moist snuff or snus but contain a nicotine powder concentration instead of tobacco leaf. Market leaders like Zyn and On! are sold by major tobacco manufacturers (Marynak et al., 2021). Sales of such products have greatly increased since their introduction to the market in 2016 (Marynak et al., 2021).

Understanding the retail availability of these products can help to determine to whom and where these products are marketed. However, to date, little is known about the retail availability and neighborhood and store correlates of recently introduced products. Thus, we sought to assess neighborhood differences in the availability of nicotine pouches and disposable e-cigarette devices as part of a four-state study investigating tobacco product availability and health inequity.

2. Methods

2.1. Parent study site selection

As part of a larger study on the impact of Tobacco 21 laws, sites were selected purposively. We conducted standardized audits in sites in four states with different histories around Tobacco 21 laws. Two sites, in New York (NY) and New Jersey (NJ) had state-level Tobacco 21 laws prior to the passage of a Federal law in December 2019. Two sites, Kentucky (KY) and North Carolina (NC) did not have Tobacco 21 until the federal law. Availability audits for this study were conducted prior to conducting underage purchase attempts in these sites.

2.2. Data source

Each site randomly sampled stores from tobacco retailer lists. Sites in NJ and NY used tobacco retailer license lists. In KY and NC, which lack tobacco retailer licensing, this came from compliance check lists used by the state for Synar compliance in KY and from a list of probable tobacco retailers created using a validated method in NC (D'Angelo et al., 2014). In NC and KY, vape shops were identified using a validated search of Google Maps and Yelp (Lee et al., 2016). In NJ, vape shops were also added through Google search as these store types were not included on tobacco retailer license lists.

2.3. Sample

NJ included 65 stores selling tobacco, which were visited in prior rounds of data collection from stores in a 25-mile radius around Rutgers University campus center in New Brunswick, NJ and 10 additional vape stores. In sites selecting a new sample, each site randomly selected 50 tobacco retailers and up to 10 vape shops or as many as available in the jurisdiction. This number of retailers per site was selected to balance inclusion of a diverse sample of retailers, while ensuring feasibility of

the later multiple purchase attempts. Thus, in these jurisdictions, stores were randomly selected from retailers in Fayette County, KY, (in the Lexington metro area) and Pitt County, NC, around Greenville, and the Borough of Manhattan in New York City, NY. Thus, the full sample set was comprised of KY (n = 60), NC (n = 56), NY (n = 56), and NJ (n = 74), bringing the total number of stores where audits were attempted to 246. During audits, we found 4 stores did not carry any tobacco and were thus ineligible and dropped from the analytic sample (n = 242).

2.4. Store audits

Following standard store audit practices,⁴ trained data collectors at each site visited stores to record the different types of products sold and store characteristics. A Qualtrics survey was created with standardized questions used across sites. Each data collector used a smartphone to access this survey either while inside the store or while in the parking lot immediately after the store visit. The Qualtrics survey included a geolocator which identified the data collector's latitude/longitude based on the phone location when completing the survey. Store auditors were trained to conduct audits covertly and not interact with store staff unless necessary. If the tobacco product type was not visible, auditors were trained to ask the clerk if that type was sold, but did not ask about brand availability. If the store did sell tobacco but was not safe or closed at the time of visit, the data collector returned to complete the audit at a later time. No products were purchased as part of the audit, but occasionally in smaller stores auditors would make small purchases to make the visit appear more natural and avoid suspicion. We did not audit advertising, promotions, or prices. Audits were completed between April 2021 and September 2021.

2.5. Measures

We assessed availability (yes/no) of cigarettes, e-cigarettes (pod and disposable), cigars, smokeless tobacco (e.g., chew, dip, snuff), and tobacco-free nicotine pouches (TFNP). Where data collectors responded yes to e-cigarettes, we followed up with "Which e-cigarette brands are available?" and gave visual examples and yes/no options for Puff Bar Disposable, Hype bar disposable, Posh Plus disposable, Fruyt disposable, Flair disposable, Pop disposable, Eon smoke disposable, and a free-text response for other disposable e-cigarette brands. Auditors were not expected to collect all brands in the store but focused on these specific brands, being among the most common brands sold nationwide. A yes to any of these items was coded that disposable e-cigarettes were available. Availability of JUUL or VUSE Alto tobacco or menthol pods was coded as pod e-cigarette availability. We coded store types into 10 categories (convenience store, drug store, gas kiosk only, dollar store, grocery/supermarket, mass merchandiser, chain convenience, vape shop, tobacco store, other store type).

2.6. Geocoding

After collecting product availability (see Table 1), ArcMap and ArcGIS Pro were utilized to geocode store locations based on address and cross-checked with the geolocation position collected in the field. If the points did not match, we would search coordinates on Google map to update the store address if needed. This verified geocoded position was used to identify the census tract of the store and merge stores with the most recent publicly available American Community Survey 5-year estimates (2015–2019) census tract data as well as the National Center for Educational Statistics' public school (2020–2021) dataset. We performed a closest facility analysis to determine whether the store was within a half mile of a school. We picked this buffer to account for reasonable walking distance from schools in the areas that were less urban in our sample. We linked tract demographics (percent non-Hispanic White residents, percent households under federal poverty level) to stores based on their census tract.

Table 1
Tobacco product availability and store characteristics in a four-site sample of tobacco retailers by site and overall, 2021, n = 242, USA.

| | KY n = 59 | NC n = 56 | NJ n = 71 | NY n = 56 | Overall n = 242 | p-value |
|---|------------------|--------------|--------------|--------------|--------------------|---------|
| Product Availability | n (%) | | | | | |
| Cigarettes | 49 (83%) | 51 (91%) | 62 (87%) | 49 (88%) | 211 (87%) | 0.64 |
| Pod e-cigarettes | 33 (56%) | 19 (34%) | 30 (42%) | 37 (66%) | 119 (49%) | 0.003 |
| Disposable e-cigarettes | 27 (46%) | 18 (32%) | 35 (49%) | 35 (63%) | 115 (47%) | 0.015 |
| Cigars | 48 (81%) | 52 (93%) | 65 (92%) | 36 (64%) | 201 (83%) | <0.001 |
| Smokeless tobacco | 43 (73%) | 22 (39%) | 28 (39%) | 19 (34%) | 112 (46%) | <0.001 |
| Tobacco-free nicotine pouches | 45 (76%) | 26 (46%) | 26 (37%) | 24 (43%) | 121 (50%) | <0.001 |
| Store Characteristic: Store type | <0.001 | | | | | |
| Convenience Store (non-chain) | 3 (5%) | 14 (25%) | 31 (44%) | 36 (64%) | 84 (35%) | |
| Chain Convenience | 30 (51%) | 11 (20%) | 16 (23%) | 2 (4%) | 59 (24%) | |
| Drug Store | 3 (5%) | 5 (9%) | 6 (8%) | 0 | 14 (6%) | |
| Gas Kiosk only | 3 (5%) | 2 (4%) | 5 (7%) | 1 (2%) | 11 (5%) | |
| Dollar Store | 3 (5%) | 11 (20%) | 1 (1%) | 0 | 15 (6%) | |
| Grocery store/supermarket | 4 (7%) | 5 (9%) | 2 (3%) | 0 | 11 (5%) | |
| Mass Merchandiser | 2 (3%) | 0 | 0 | 0 | 2 (0.8%) | |
| Vape Shop | 10 (17%) | 4 (7%) | 10 (14%) | 4 (7%) | 28 (12%) | |
| Tobacco Store | 1 (2%) | 4 (7%) | 0 | 13 (23%) | 18 (7%) | |
| Store Neighborhood Demographics | <0.001 | | | | | |
| Non-Hispanic White residents | | | | | | |
| Q1 (0–28%) | 2 (3%) | 15 (25%) | 27 (44%) | 17 (28%) | 61 (25%) | <0.001 |
| Q2 (28–60%) | 6 (10%) | 19 (32%) | 21 (35%) | 14 (23%) | 60 (25%) | |
| Q3 (60–74%) | 22 (37%) | 21 (35%) | 8 (13%) | 9 (15%) | 60 (25%) | |
| Q4 (74%+) | 29 (48%) | 1 (2%) | 15 (25%) | 16 (26%) | 61 (25%) | |
| Households under poverty | | | | | | |
| Q1 (0–7%) | 17 (28%) | 0 | 35 (57%) | 9 (15%) | 61 (25%) | <0.001 |
| Q2 (7–17%) | 14 (23%) | 3 (5%) | 16 (27%) | 27 (45%) | 60 (25%) | |
| Q3 (17–26%) | 15 (26%) | 22 (38%) | 10 (17%) | 11 (19%) | 58 (24%) | |
| Q4 (26%+) | | | | | 63 (26%) | |

Table 1 (continued)

| | KY n = 59 | NC n = 56 | NJ n = 71 | NY n = 56 | Overall n = 242 | p-value |
|---------------------------|--------------|--------------|--------------|--------------|--------------------|---------|
| | 13 (21%) | 31 (49%) | 10 (16%) | 9 (14%) | | |
| Within 0.5 mile of school | | | | | | <0.001 |
| Yes | 23 (39%) | 14 (25%) | 49 (69%) | 56 (100%) | 142 (59%) | |

2.7. Data analysis

We conducted descriptive statistics by site using Pearson chi-square tests to examine differences in proportions across sites. Since the availability of nicotine pouches and disposable e-cigarettes was high in our sample, we conducted Poisson regression to estimate prevalence with robust standard errors to derive risk ratios (Zou, 2004). We then used unadjusted and adjusted Poisson regression analyses to examine the prevalence of (1) nicotine pouches and (2) disposable e-cigarettes separately. Initial results including the proportions of Hispanic and Black/African-American residents and median household income and percent households under poverty did not converge due to multicollinearity as these measures were correlated at $\alpha = 0.76$. Instead, for neighborhood measures we included percent of non-Hispanic White residents and percent households under poverty as well as a proximity measure of whether the retailer was within 1/2 mile of a school. Thus, adjusted analyses included these measures along with store type collapsed into four categories (chain convenience (reference category), non-chain convenience, tobacco/vape stores, other store types [including grocery/supermarket, pharmacy, dollar stores, mass merchandisers, and gas kiosks]), and site (NJ (reference category), KY, NC, NYC). We used Stata v16 and SAS 9.4 and conducted analyses in February 2022 with reanalysis in September 2022. This research was classified as Not Human Subjects Research by the Institutional Review Board at the University of Kentucky. Data are available from the authors upon reasonable request.

3. Results

Table 1 shows the percent of retailers in each site that carried each product type as well as store type and store neighborhood demographics. Almost all retailers carried cigarettes (87%) and cigars (83%), but half or less of all retailers in each site carried other products including pod e-cigarettes (49%), disposable e-cigarettes (47%), smokeless tobacco (46%) and nicotine pouches (50%). There were significant differences in the availability of product types across sites except cigarettes.

3.1. Nicotine pouches

As shown in Table 2, in unadjusted analyses, availability of nicotine pouches was significantly lower in all store types relative to chain convenience stores, in stores in census tracts with the 3rd quartile of residents under poverty compared with the lowest quartile, and in stores near schools. Additionally, unadjusted availability of nicotine pouches was higher in Kentucky compared with New Jersey and in neighborhoods with a greater percentage of non-Hispanic White residents compared with neighborhoods with the lowest percentage of non-Hispanic White residents. In adjusted analyses, only store type vs chain convenience (non-chain convenience IRR 0.3 95%CI (0.02–0.04), tobacco/vape store IRR 0.6 95% CI (0.4–0.7), and other store types IRR 0.5 95%CI (0.3–0.7)) and the proportion of non-Hispanic White residents remained significant (IRR range from Quartile 2 2.0 (95% CI 1.2–3.5)- Quartile 4 2.3 (95% CI 1.3–4.1) vs Quartile 1).

Table 2

Correlates of availability of Nicotine Pouches and Disposable E-cigarettes in tobacco retail stores in four sites, 2021, n = 242, USA.

| | Percent Stores with TFNP % | Product Availability | | Percent of Stores with Disposable E-cigarettes | Availability of Disposable E-cig (unadjusted) IRR (95 % CI) | Availability of Disposable E-cig (adjusted) IRR (95 % CI) |
|---|----------------------------|---|---|--|---|---|
| | | Availability of TFNP (unadjusted) IRR (95 % CI) | Availability of TFNP (adjusted) IRR (95 % CI) | | | |
| Store Type | | | | | | |
| Chain Convenience Store | 93 % | ref | ref | 46 % | ref | ref |
| Non-chain Convenience Store | 21 % | 0.2 (0.2–0.4) | 0.3 (0.2–0.4) | 49 % | 0.9 (0.7–1.3) | 1.0 (0.7–1.5) |
| Tobacco Store/Vape Store | 53 % | 0.6 (0.5–0.8) | 0.6 (0.4–0.7) | 94 % | 1.9 (1.5–2.5) | 1.9 (1.4–2.5) |
| Other Store types (grocery/supermarket, pharmacy, dollar store, mass merchandiser, gas kiosk) | 41 % | 0.4 (0.3–0.6) | 0.5 (0.3–0.7) | 8 % | 0.2 (0.1–0.4) | 0.2 (0.1–0.4) |
| Site | | | | | | |
| NJ | 37 % | Ref | ref | 46 % | ref | ref |
| KY | 76 % | 2.1 (1.5–2.9) | 1.2 (0.9–1.7) | 32 % | 0.9 (0.6–1.3) | 1.0 (0.7–1.5) |
| NC | 46 % | 1.3 (0.8–1.9) | 1.3 (0.8–2.1) | 49 % | 0.7 (0.4–1.0) | 0.9 (0.5–1.5) |
| NYC | 43 % | 1.2 (0.8–1.8) | 1.5 (0.9–2.4) | 63 % | 1.3 (0.9–1.7) | 1.1 (0.7–1.4) |
| Store Neighborhood Demographics | | | | | | |
| Non-Hispanic White residents | | | | | | |
| Q1 (0–28 %) | 20 % | ref | ref | 33 % | ref | ref |
| Q2 (28–60 %) | 53 % | 2.7 (1.5–4.7) | 2.0 (1.2–3.5) | 57 % | 1.7 (1.1–2.6) | 1.6 (1.0–2.7) |
| Q3 (60–74 %) | 57 % | 2.9 (1.7–5.0) | 1.8 (1.0–3.0) | 48 % | 1.5 (0.9–2.3) | 1.4 (0.8–2.3) |
| Q4 (74 % +) | 71 % | 3.6 (2.1–6.1) | 2.3 (1.3–4.1) | 53 % | 1.6 (1.0–2.5) | 1.3 (0.7–2.2) |
| Households under poverty | | | | | | |
| Q1 (0–7 %) | 56 % | ref | ref | 59 % | ref | ref |
| Q2 (7–17 %) | 60 % | 1.1 (0.8–1.5) | 1.1 (0.8–1.4) | 57 % | 1.0 (0.7–1.3) | 0.8 (0.6–1.1) |
| Q3 (17–26 %) | 35 % | 0.6 (0.4–0.9) | 0.8 (0.5–1.2) | 34 % | 0.6 (0.4–0.9) | 0.7 (0.5–1.1) |
| Q4 (26 % +) | 49 % | 0.9 (0.6–1.2) | 1.1 (0.8–1.6) | 40 % | 0.7 (0.5–1.0) | 0.8 (0.5–1.3) |
| Within 0.5 mile of school | | | | | | |
| No | 60 % | ref | ref | 44 % | ref | ref |
| Yes | 43 % | 0.7 (0.6–0.9) | 1.0 (0.8–1.3) | 50 % | 1.1 (0.8–1.5) | 1.1 (0.8–1.5) |

3.2. Disposable E-cigarettes

In unadjusted analyses, compared with chain convenience stores, tobacco stores/vape stores were significantly more likely to carry disposable e-cigarettes, but other store types like grocery stores and pharmacies were less likely to have these products. These products were also more prevalent in NY stores compared with NJ stores and in stores in census tracts in the 2nd and 4th quartile for White residents compared with the lowest quartile. Stores in neighborhoods with the 3rd quartile of residents under poverty compared with the lowest quartile were less likely to have disposable e-cigarettes. In adjusted analyses, only store type was a significant correlate of disposable e-cigarette availability (tobacco/vape store IRR 1.9 95 %CI (1.4–2.5), other store types IRR 0.2 95 %CI (0.1–0.4) vs chain convenience store).

4. Discussion

Newer tobacco products like nicotine pouches and disposable e-cigarettes were available in roughly half the stores in our sample, in some cases exceeding the availability of more established tobacco products such as e-cigarette pods and smokeless tobacco products. Availability varied in different parts of the country and patterns of availability of these two product types also differed. Though these products share some common features such as relatively high nicotine concentrations, flavor availability, ‘tobacco-free’ claims, and relatively low prices, (Czaplicki et al., 2022; Delnevo et al., 2020; Talih et al., 2022; Lunell et al., 2020) retail marketing appears to differ. Nicotine pouches were more common in chain convenience stores, likely driven by their promotion by major tobacco companies, and in neighborhoods with a greater percentage of non-Hispanic White residents—perhaps capitalizing on marketing to those who already use smokeless tobacco, as non-Hispanic White populations use smokeless tobacco at higher rates than any other racial/ethnic group (Cornelius et al., 2020). In contrast,

disposable e-cigarettes appear to be more prevalent in tobacco/vape shops, but not other non-specialty store types like groceries and pharmacies. Encouragingly in our sample, there did not appear to be targeting of either product by neighborhood poverty or in stores near schools. Additional retail surveillance in more locations and especially outside of predominantly urban centers is needed to confirm such patterns.

This study had several strengths and limitations. This is one of the first studies on retail availability of newer nicotine products; however, as part of a large, existing study on Tobacco 21 laws, sites were purposely selected based on states’ history with Tobacco 21 and thus may not be generalizable to other US locations or to other parts of the states where the sites were located. Nonetheless, these data provide an important sentinel look at the availability of newer nicotine products. Stores within each catchment area were randomly selected from comprehensive lists, however, and thus constitute a diverse geographic sample. Data were collected by different data collectors in each site and we did not measure inter-rater reliability of audits; however, data collectors completed several hours of training on store audit methods and the training content was identical across sites. Additionally, availability measures have been shown to have good reliability across retail audit studies.⁴

5. Conclusion

Our results provide an early indication of different patterns of retail availability of nicotine pouches and disposable e-cigarettes – newer non-combustible tobacco products that have risen in popularity. As both product types potentially face increased regulation under the FDA pre-market authorization process, understanding patterns and changes in their availability in the retail environment is critical to inform potential policies regulating their sale and marketing.

6. Data availability

Data are available from the authors upon reasonable request.

Funding

Research reported in this publication was supported by the National Cancer Institute of the National Institutes of Health under Award Number [R01CA231139, MPI Delnevo/Hudson]. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

CRedit authorship contribution statement

Shyanika W. Rose: Conceptualization, Supervision, Writing – original draft, Writing – review & editing. **Arati Annabathula:** Investigation, Data curation, Writing – original draft, Writing – review & editing. **Susan Westneat:** Formal analysis. **Judy van de Venne:** Project administration, Supervision, Investigation, Writing – review & editing. **Mary Hrywna:** Conceptualization, Supervision, Writing – review & editing. **Christopher Ackerman:** Project administration, Supervision, Investigation, Writing – review & editing. **Joseph G.L. Lee:** Conceptualization, Supervision, Writing – review & editing. **Mahdi Sesay:** Project administration, Supervision, Investigation, Writing – review & editing. **Daniel P. Giovenco:** Conceptualization, Supervision, Writing – review & editing. **Torra Spillane:** Project administration, Supervision, Investigation, Writing – review & editing. **Shawna V. Hudson:** Funding acquisition. **Cristine D. Delnevo:** Funding acquisition, Conceptualization, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: JGL Lee has a royalty interest in store audit and mapping software owned and licensed by the University of North Carolina at Chapel Hill. The system was not used in this research. All other authors report no conflicts of interest.

Data availability

Data will be made available on request.

References

Cornelius, M.E., Wang, T.W., Jamal, A., Loretan, C.G., Neff, L.J., 2020. Tobacco Product Use Among Adults - United States, 2019. *MMWR Morb. Mortal. Wkly Rep.* 69 (46), 1736–1742.

- Czaplicki, L., Patel, M., Rahman, B., Yoon, S., Schillo, B., Rose, S.W., 2022. Oral nicotine marketing claims in direct-mail advertising. *Tob. Control* 31 (5), 663–666.
- D'Angelo, H., Fleischhacker, S., Rose, S.W., Ribisl, K.M., 2014. Field validation of secondary data sources for enumerating retail tobacco outlets in a state without tobacco outlet licensing. *Health Place* 28, 38–44.
- D'Angelo, H., Rose, S.W., Golden, S.D., Queen, T., Ribisl, K.M., 2020. E-cigarette availability, price promotions and marketing at the point-of sale in the contiguous United States (2014–2015): National estimates and multilevel correlates. *Prev. Med. Rep.* 19, 101152.
- Delnevo, C., Giovenco, D.P., Hrywna, M., 2020. Rapid proliferation of illegal pod-mod disposable e-cigarettes. *Tob. Control* 29 (e1), e150–e151.
- Federal Trade Commission, 2021. Federal Trade Commission Cigarette Report for 2020. FTC, Washington, DC.
- Giovenco, D.P., Ackerman, C., Hrywna, M., Delnevo, C.D., 2018. Changes in the availability and promotion of non-cigarette tobacco products near high schools in New Jersey, USA. *Tob. Control* 27 (5), 578–579.
- Lee, J., D'Angelo, H., Kuteh, J., Martin, R., 2016. Identification of Vape Shops in Two North Carolina Counties: An Approach for States without Retailer Licensing. *Int. J. Environ. Res. Public Health* 13 (11), 1050.
- Lee, J.G., Henriksen, L., Rose, S.W., Moreland-Russell, S., Ribisl, K.M., 2015. A Systematic Review of Neighborhood Disparities in Point-of-Sale Tobacco Marketing. *Am. J. Public Health* 105 (9), e8–18. <https://doi.org/10.2105/AJPH.2015.302777>, 26180986.
- Lee, J.G., Sun, D.L., Schleicher, N.M., Ribisl, K.M., Luke, D.A., Henriksen, L., 2017. Inequalities in tobacco outlet density by race, ethnicity and socioeconomic status, 2012, USA: results from the ASPIRE Study. *J. Epidemiol. Community Health* 71 (5), 487–492.
- Lunell, E., Fagerström, K., Hughes, J., Pendrill, R., 2020. Pharmacokinetic comparison of a novel non-tobacco-based nicotine pouch (ZYN) with conventional, tobacco-based Swedish snus and American moist snuff. *Nicotine Tob. Res.* 22 (10), 1757–1763.
- Marynak, K.L., Wang, X., Borowiecki, M., Kim, Y., Tynan, M.A., Emery, S., King, B.A., 2021. Nicotine Pouch Unit Sales in the US, 2016–2020. *JAMA* 326 (6), 566–568. <https://doi.org/10.1001/jama.2021.10366>, 34374729.
- Mills, S.D., Henriksen, L., Golden, S.D., Kurtzman, R., Kong, A.Y., Queen, T.L., Ribisl, K.M., 2018. Disparities in retail marketing for menthol cigarettes in the United States, 2015. *Health Place* 53, 62–70.
- Park-Lee, E., Ren, C., Sawdey, M.D., Gentzke, A.S., Cornelius, M., Jamal, A., Cullen, K.A., 2021. Notes from the Field: E-Cigarette Use Among Middle and High School Students - National Youth Tobacco Survey, United States, 2021. *MMWR Morb. Mortal. Wkly Rep.* 70 (39), 1387–1389.
- Robertson, L., McGee, R., Marsh, L., Hoek, J., 2015. A systematic review on the impact of point-of-sale tobacco promotion on smoking. *Nicotine Tob. Res.* 17 (1), 2–17.
- Rose, S.W., Anesetti-Rothermel, A., Westneat, S., van de Venne, J., Folger, S., Rahman, B., Azam, T., Zhou, Y., Debnam, C., Ribisl, K., Cohn, A.M., 2022. Inequitable distribution of FTP marketing by neighborhood characteristics: further evidence for targeted marketing. *Nicotine Tob. Res.* 24 (4), 484–492.
- Siahpush, M., Shaikh, R., Smith, D., Hyland, A., Cummings, K., Kessler, A., Dodd, M., Carlson, L., Meza, J., Wakefield, M., 2016. The Association of Exposure to Point-of-Sale Tobacco Marketing with Quit Attempt and Quit Success: Results from a Prospective Study of Smokers in the United States. *Int. J. Environ. Res. Public Health* 13 (2), 203.
- Talih, S., Salman, R., Soule, E., El-Hage, R., Karam, E., Karaoghlanian, N., El-Hellani, A., Saliba, N., Shihadeh, A., 2022. Electrical features, liquid composition and toxicant emissions from 'pod-mod'-like disposable electronic cigarettes. *Tobacco Control* 31 (5), 667–670.
- Zou, G., 2004. A modified poisson regression approach to prospective studies with binary data. *Am. J. Epidemiol.* 159 (7), 702–706.