



OPEN ACCESS

# Associations between living in localities with e-cigarette sales restrictions and e-cigarette use change among young adults in Los Angeles County

Julia Chen-Sankey <sup>1,2</sup>, Raul Cruz-Cano,<sup>3</sup> Sheila Pakdaman,<sup>4</sup> Nicholas Wong,<sup>4</sup> Jennifer B Unger <sup>4</sup>, Jessica Barrington-Trimis <sup>4</sup>, Mary Ann Pentz<sup>4,5</sup>

► Additional supplemental material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/tc-2022-057478>).

<sup>1</sup>Center for Tobacco Studies, Rutgers Biomedical and Health Sciences, New Brunswick, New Jersey, USA

<sup>2</sup>School of Public Health, Rutgers University, Piscataway, New Jersey, USA

<sup>3</sup>School of Public Health, University of Maryland at College Park, College Park, Maryland, USA

<sup>4</sup>Keck School of Medicine, University of Southern California, Los Angeles, California, USA

<sup>5</sup>Institute for Health Promotion and Disease Prevention Research, University of Southern California, Los Angeles, California, USA

## Correspondence to

Dr Julia Chen-Sankey, Rutgers Center for Tobacco Studies, New Brunswick, NJ 08901, USA; [jc.sankey@rutgers.edu](mailto:jc.sankey@rutgers.edu)

Received 19 April 2022

Accepted 28 June 2022

## ABSTRACT

**Introduction** Local e-cigarette sales restrictions (ESRs) may impact e-cigarette use. This study examined the associations between living in localities with various ESR policies and changes in e-cigarette use among young adults in Los Angeles (LA) County, California, USA.

**Methods** Data were from a cohort of LA County young adults (18–21 years; n=2100) who completed two waves of surveys (Fall 2018–Summer 2019 and Summer–Fall 2020). Local flavoured (n=9) and comprehensive (n=2) ESRs in LA County implemented between June 2019 and May 2020 were identified, coded and merged with the baseline data. Multivariable logistic regressions were used to examine the associations between living in ESR localities and e-cigarette use at follow-up, controlling for covariates and stratified by cigarette smoking at baseline.

**Results** Overall, 20.9% and 14.3% of participants lived in localities with flavoured and comprehensive ESRs, respectively. Participants who were non-Hispanic, had higher socioeconomic statuses and were currently using e-cigarettes were generally more likely to live in ESR localities than their counterparts. The associations between living in ESR localities and e-cigarette use at follow-up were not found among baseline non-e-cigarette users regardless of their cigarette smoking status; a positive relationship was found among baseline e-cigarette users who also smoked cigarettes but not among non-smokers.

**Discussion** Participants who lived in localities with various ESR policies were different in their baseline e-cigarette use and socioeconomic backgrounds. Future research examining the potential impact of ESRs on e-cigarette use change should consider the localities' overall sociodemographic and tobacco-using characteristics and individuals' cigarette smoking histories.

## INTRODUCTION

Since the early 2010s, many local jurisdictions in California, Massachusetts, Illinois and Minnesota enacted policies to restrict the sale of flavoured tobacco products, including flavoured e-cigarettes.<sup>1,2</sup> Starting in September 2019, as a result of e-cigarette or vaping use-associated lung injury (EVALI)<sup>3</sup> outbreaks and rising youth e-cigarette use across the country,<sup>4</sup> many more local jurisdictions in southern California, specifically those in Los Angeles (LA) County, took immediate action to enact e-cigarette sales restrictions (ESRs), including flavoured ESRs.<sup>5</sup> The goal of these policies was to reduce the availability of e-cigarette products in the

## WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Local flavoured e-cigarette sales restrictions may reduce e-cigarette sales in the area.

## WHAT THIS STUDY ADDS

- ⇒ This study used two waves of data from a cohort of young adults living in Los Angeles County, California to assess the associations between living in localities with e-cigarette sales restrictions (ESRs), including flavoured ESRs and subsequent e-cigarette use behaviour change at follow-up, controlling for participants' baseline sociodemographic characteristics and tobacco use history.
- ⇒ Young adults who were non-Hispanic, had higher socioeconomic statuses and were currently using e-cigarettes were more likely to live in localities with ESRs, including flavoured ESRs, than their counterparts.
- ⇒ The associations between living in ESR localities and e-cigarette use behaviour change may depend on young adults' cigarette smoking history.

## HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ Research that examines the impact of local ESRs, including flavoured ESRs, on e-cigarette use behaviour change may need to consider community characteristics related to sociodemographic backgrounds and tobacco-using norms during the pre-policy implementation period.

corresponding LA County localities and minimise e-cigarette use among young people who might develop EVALIs,<sup>3</sup> nicotine addiction<sup>6,7</sup> or progress to more harmful forms of tobacco use.<sup>6,8</sup>

To assess the potential impact of ESRs, especially flavoured ESRs, among localities and states, an increased number of research studies were conducted. These studies mainly examined the retail sales data for e-cigarette products<sup>9–12</sup> in the localities of interest (or in comparison with similar or adjacent localities) or assessed individuals' tobacco use behaviour data to examine the change of current or recent e-cigarette use cross-sectionally at one or multiple points in time.<sup>13–16</sup> Specifically, studies using e-cigarette retail sales data most consistently found an impact of flavoured ESRs on reducing retail sales of e-cigarette products.<sup>9–12</sup>



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

**To cite:** Chen-Sankey J, Cruz-Cano R, Pakdaman S, et al. *Tob Control* 2022;**31**:s187–s196.

Much less research, however, has leveraged longitudinal data to examine e-cigarette use behaviour change among individuals over time in relation to living in localities with various ESR characteristics. Such investigation may be especially needed for the young adult population, a priority population for research on e-cigarette use and prevention strategies.<sup>17</sup>

Additionally, the impact ESRs and flavoured ESRs among users and non-users of e-cigarettes may depend on their cigarette smoking history. Previous research has shown that ESR's hypothetical impact on adults' e-cigarette use behaviour change may largely depend on their cigarette smoking behaviour.<sup>18 19</sup> Specifically, adult e-cigarette users who also smoke cigarettes may be less likely to be influenced by ESR policies than e-cigarette users who are non-smokers.<sup>18 19</sup> Lastly, almost all previous research examining the impact of ESRs or flavoured ESRs was conducted before the COVID-19 pandemic.<sup>9–15</sup> Evidence has shown that the pandemic may disrupt local public health policy enforcement<sup>20 21</sup> and retailer compliance with local tobacco control measures<sup>22 23</sup> as well as change individuals' tobacco-related consumption and purchasing behaviours.<sup>24–26</sup> Given the pandemic's significant socioeconomic and public health impact, more research is needed to evaluate ESR policies during the era of the global pandemic.

Using two waves of data (Fall 2018–Fall 2020) from a cohort of young adults (age range: 18–21 years) living in LA County, the goals of this research were to (1) examine the sociodemographic and tobacco-using characteristics of the participants who lived in LA County localities with various ESRs; and (2) examine the associations between e-cigarette use behaviour change (current use to current use vs current use to non-current use; and non-current use to current use vs non-current use to non-current use) and living in localities with ESRs, stratified by participants' cigarette smoking status at baseline.

## METHODS

### Identifying and categorising ESRs

To obtain a comprehensive list of localities that have passed ESRs, we used multiple databases of local tobacco control policies from several sources, including the Campaign for Tobacco-free Kids,<sup>27</sup> Truth Initiative<sup>5</sup> and American Nonsmokers' Rights Foundation's Policy Evaluation Tracking System.<sup>28</sup> Using those databases, we selected 11 ESRs that were passed and came into enforcement by LA County localities (including incorporated and unincorporated areas) between June 2019 and May 2020 (see LA County localities in online supplemental figure 1). This timeline was set to match the data collection of recent waves (ie, surveys of baseline and follow-up waves collected Fall 2018–Summer 2019 and Summer–Fall 2020) of the cohort study. To confirm the search result, we also searched online news articles and relevant websites using combinations of keywords, including (1) locality name and (2) e-cigarette sales restriction, e-cigarette ban or e-cigarette flavor ban. Using these databases and sources, the final list of ESRs in LA County we obtained only resulted in a few discrepancies, which were further resolved by group discussion and contacting local health departments or legislature offices to further validate the policies. Afterward, we obtained the documents of ESR ordinances from the websites of local health departments or legislature offices.

Three trained coders independently coded the ordinances to examine whether the ESR policies restricted the sale of all types of e-cigarettes (comprehensive ESRs) or just flavoured e-cigarettes (flavoured ESRs), which were often defined as e-cigarettes having a taste or aroma other than tobacco.<sup>5 27</sup> After

resolving any coding disagreements, we found that among the 11 ESR localities, three were comprehensive ESRs and eight were flavoured ESRs. We then prepared a policy database that categorised all LA County localities into three groups: (1) those without any ESRs, (2) those with flavoured ESRs and (3) those with comprehensive ESRs.

### Analytical sample

Data of two waves of surveys from a cohort<sup>8</sup> of young adults living in southern California were used for statistical analysis. All self-report surveys were collected and managed online using web-based REDCap electronic data capture tools.<sup>29</sup> During the baseline wave, 2526 participants completed the survey; and during the follow-up wave, 2415 participants completed the survey. A published study using the cohort data presented detailed information about the cohort and its study design.<sup>8</sup> We first obtained the sample from participants who completed both waves and reported living in any localities in LA County at the baseline wave (n=2127). We further removed the participants who lived in LA County localities that enacted an ESR before the baseline wave data collection in September 2018 or after the follow-up wave data collection in June 2020 (n=27, including 17 men, 8 current e-cigarette users). Finally, we merged the participants' residential addresses in the dataset with the policy dataset (linked by locality name) to obtain a final sample of participants (n=2100) for statistical analysis.

### Measures

#### ESR policy status

We created two ESR policy variables (ESR policy categories 1 and 2) for statistical analysis. ESR policy category 1 has two groups: without ESRs and with any ESRs (including flavoured or comprehensive ESRs); ESR policy category 2 has three groups: without ESRs, with flavoured ESR and with comprehensive ESRs.

#### Sociodemographic and tobacco-using characteristics

Specific sociodemographic variables at baseline (age, gender, sexual identity, race/ethnicity, education level and subjective financial status) and their categories can be found in [table 1](#). Past 30-day use of cigarette and e-cigarette products at baseline were used to measure current cigarette and e-cigarette use behaviour. Those who used an e-cigarette product (including e-cigarettes with nicotine, e-cigarettes without nicotine or hash oil, and other electronic vaping devices) in the past 30 days were considered current users. Current e-cigarette use at follow-up followed the same criteria. To minimise missing values during statistical analysis, a label of 'undetermined' was applied to categories when the corresponding variables were missing greater than 5% of the sample.

#### Current e-cigarette use frequency and dependence

Current e-cigarette use frequency at baseline was defined by the highest frequency (1–2 days, 3–9 days and 10–30 days) of different e-cigarette types used in the past 30 days. Current e-cigarette dependence at baseline was measured using the Hooked on Nicotine Checklist specifically adapted for e-cigarette dependence.<sup>7 30</sup> Participants reported whether they had ever experienced each of 10 e-cigarette dependence symptoms. Self-reporting one or more symptoms indicated that the participant had e-cigarette dependence.<sup>7 30</sup>

**Table 1** Participant characteristics at baseline by e-cigarette sales restriction (ESR) policy categories (18–21 years; N=2100)

	All participants N=2100	ESR policy category 1*		P value‡§	ESR policy category 2†		P value‡§
		Without ESRs N=1360	With any ESRs N=740		With flavoured ESRs N=438	With comprehensive ESRs N=302	
<b>Total</b>		<b>64.8%</b>	<b>35.2%</b>		<b>20.9%</b>	<b>14.3%</b>	
Age				0.682			<b>0.020</b>
18 and 19	75.4%	65.0%	35.0%		21.9%	15.7%	
20 and 21	24.6%	64.0%	36.0%		20.4%	13.7%	
Gender				0.176			0.431
Female	54.8%	66.0%	34.0%		20.4%	13.7%	
Male	39.2%	62.5%	37.5%		21.9%	15.7%	
Other§	6.0%	68.5%	31.5%		19.7%	11.8%	
Sexual orientation				<b>0.034</b>			0.085
Heterosexual	81.7%	64.6%	36.5%		21.9%	14.6%	
Other orientations¶	18.3%	69.3%	30.7%		17.1%	13.5%	
Race and ethnicity				<b>0.000</b>			<b>0.000</b>
Hispanic	54.4%	79.8%	20.2%		16.0%	4.2%	
Non-Hispanic white	12.4%	39.2%	60.8%		54.2%	6.5%	
Non-Hispanic Asian	17.2%	41.9%	58.1%		11.3%	46.8%	
Non-Hispanic other††	16.0%	58.2%	41.8%		22.1%	19.7%	
Education level				<b>0.033</b>			<b>0.029</b>
≤High school	39.2%	67.6%	32.4%		17.7%	14.7%	
≥Some college	55.0%	62.3%	37.5%		23.4%	14.1%	
Undetermined	5.8%	68.9%	31.2%		18.0%	13.1%	
Subjective financial status				<b>0.001</b>			<b>0.000</b>
<Living comfortably‡‡	50.1%	67.9%	32.1%		20.9%	11.2%	
Living comfortably	43.5%	62.3%	37.5%		23.4%	14.1%	
Undetermined	6.4%	70.2%	29.9%		17.9%	11.9%	
Current e-cigarette use				<b>0.035</b>			<b>0.020</b>
Yes	20.7%	50.2%	39.5%		25.8%	13.8%	
No	79.3%	65.7%	34.1%		19.6%	14.5%	
Current cigarette smoking				0.192			0.071
Yes	6.1%	59.4%	40.6%		28.9%	11.7%	
No	93.9%	65.1%	34.9%		20.5%	14.5%	

\*ESR policy category 1 has two groups: without ESRs and with any ESRs (including flavoured or comprehensive ESRs).

†ESR policy category 2 has three groups: without ESRs, with flavoured ESR and with comprehensive ESRs.

‡Bolded text indicates statistical significance ( $p < 0.05$ ).

§Post-hoc analysis was conducted to examine within-group differences if between-group difference was significant.

¶'Other' category for gender includes those who did not report a gender or gender other than female or male.

\*\*'Other' category for sexual orientation includes asexual, bisexual, gay, lesbian, pansexual, queer, questioning or unsure, and other identities.

††'Other' category for race/ethnicity includes American Indian or Alaska Native, Native Hawaiian or Pacific Islanders.

‡‡<Living comfortably category includes met needs with a little left, just meet basic expenses and do not meet basic expenses.

### E-cigarette use behaviour change

To examine the associations between e-cigarette use change and living in areas with ESRs over two waves, we created two samples for analysis: current e-cigarette users at baseline ( $n=435$ ) and non-current e-cigarette users at baseline ( $n=1665$ ). Current e-cigarette use behaviour at follow-up was further assessed for both samples to measure whether the participants continued or started to use e-cigarettes at follow-up, respectively.

### Statistical analyses

For data analysis, we first estimated the baseline sociodemographic and tobacco-using characteristics of the overall sample by the ESR policy under which the participants resided. We employed  $\chi^2$  tests to examine the differences between participant characteristics and their ESR policy status, followed by a post-hoc comparison analysis to examine within-group

differences. Second, we conducted the same set of analyses among current e-cigarette users and non-users, separately. Third, we used multivariable logistic regression models to examine the associations between living in various types of ESRs and current e-cigarette use at follow-up. Specifically, the first set of analyses was applied to current e-cigarette users at baseline, and the second set was applied to non-e-cigarette users at baseline. We further controlled for baseline e-cigarette use frequency and dependence for the models of baseline e-cigarette users. Additionally, we used stratified analyses to examine these associations among current cigarette smokers and non-smokers at the baseline. Listwise deletion was used for analysis since the number of participants missing at least one variable was minimal compared with the overall sample ( $< 2\%$ ). Statistical significance was set to 0.05 (two-tailed). Data were analysed using Stata V.17.

## RESULTS

**Characteristics of participants living in localities with various ESRs**

Table 1 shows the sociodemographic and tobacco-using characteristics of the participants who lived in localities with different types of ESRs. Overall, 35.2% of participants lived in localities with any ESRs; 20.9% and 14.3% lived in localities with flavoured ESRs or comprehensive ESRs, respectively.  $X^2$  tests and post-hoc analysis for identifying within-group differences revealed that participants who were non-Hispanic Asian, non-Hispanic white or non-Hispanic other were more likely to live in localities with any ESRs or comprehensive ESRs compared with those who were Hispanic. Those who were non-Hispanic white or non-Hispanic other were more likely to live in localities with flavoured ESRs than those who were Hispanic. Participants who had education of some college or above were more likely to live in localities with any ESR or flavoured ESRs compared with those who had a high school degree or less. Participants who reported living comfortably were more likely to live in localities with any ESRs or comprehensive ESRs than those who reported worse financial situations. Additionally, those who currently used e-cigarettes were more likely to live in localities with any ESRs and flavoured ESRs than non-e-cigarette users. Cigarette smoking status did not differ among participants who lived in various ESR localities.

When examining the characteristics of participants who currently used e-cigarettes at the baseline (table 2), the results reveal that those who were non-Hispanic white, non-Hispanic Asian and non-Hispanic other were more likely to live in localities with any ESRs than those who were Hispanic; those who were non-Hispanic white or non-Hispanic Asian were more likely to live in localities with flavoured ESRs and comprehensive ESRs, respectively, than those who were Hispanic. Among baseline non-e-cigarette users (table 3), a similar pattern of racial/ethnic differences was observed for those who lived in any, flavoured or comprehensive ESRs. Additionally, compared with those who reported living less than comfortable financially, those who reported living comfortably were more likely to live in localities with any ESRs or comprehensive ESRs.

**Associations between continued e-cigarette use and locality ESR policy characteristics**

Table 4 shows the associations between continued e-cigarette use and ESR locality characteristics among baseline e-cigarette users, stratified by cigarette smoking status. Participants who lived in localities with any ESRs had higher odds of continuing to use e-cigarettes at follow-up (adjusted OR (AOR)=1.69, 95% CI=1.09 to 2.65) compared with those who did not live in those localities. Additionally, those who used e-cigarettes for 3–9 days or 10–30 days within the past 30 days (AOR=1.75, 95% CI=1.02 to 3.01; AOR=2.79, 95% CI=1.63 to 4.77) and reported e-cigarette dependence (AOR=1.86, 95% CI=1.15 to 3.02) at baseline had higher odds of continuing to use e-cigarettes at follow-up compared with those who used e-cigarettes for 1–2 days and did not report e-cigarette dependence. In stratified analyses and among those who smoked cigarettes at baseline, only living in localities with any ESRs was associated with continued e-cigarette use at follow-up (AOR=5.65, 95% CI=1.62 to 19.64) compared with those who were not covered by ESRs. Similarly, those who lived in localities with flavoured ESRs (AOR=1.71, 95% CI=1.02 to 2.87) had higher odds of continuing e-cigarette use over time compared with those who did not live in those localities. However, this association

was only found for those who smoked cigarettes at baseline (AOR=6.40, 95% CI=1.53 to 26.74), not those who did not smoke cigarettes.

Table 5 shows the associations between e-cigarette use at follow-up and ESR locality characteristics among those who did not use e-cigarettes at baseline, stratified by cigarette smoking status. The results show that there were no associations between living in localities of any types of ESRs and e-cigarette use at follow-up among baseline non-e-cigarette users. Cigarette smoking at baseline was positively associated with e-cigarette use at follow-up among overall non-e-cigarette users. Due to the small sample size (n=39), results from the stratified analysis for those who smoked cigarettes at baseline were omitted and not reported in table 5.

## DISCUSSION

Using a cohort study of young adults living in LA County, California, our results revealed that current e-cigarette users were more likely to be residents of communities with ESRs or flavoured ESRs than non-e-cigarette users in the county. This is encouraging, given that communities with high e-cigarette use prevalence may greatly benefit from having ESRs to reduce the availability and harm of e-cigarette products among young people. The study also revealed that the ESRs (including flavoured and comprehensive ESRs) in LA County were disproportionately less likely to cover individuals who were Hispanic or from lower socioeconomic statuses. The flavoured ESR coverage and the differential demographic and tobacco-use patterns identified in this study were consistent with a recent study examining the same coverage and patterns among all cities in California.<sup>31</sup> Those findings suggest that communities with or without ESRs in LA County have distinct sociodemographic and e-cigarette use characteristics that were present even before ESRs were implemented. Historically, those community characteristics may shape how the residents change tobacco-using behaviours in response to tobacco control measures and policies.<sup>32–34</sup> Therefore, research examining the potential impact of local ESRs may need to first examine those community characteristics and consider the unique patterns and trends of tobacco product use in the communities.

Those results further emphasised that other localities in LA County or the country as a whole, especially those with high concentrations of historically minoritised groups and low socioeconomic populations, may further consider implementing ESRs to reduce e-cigarette use and its associated health disparities within communities. Recent research has shown that frequent flavoured e-cigarette use in the USA has been on the rise among youth who self-reported as Hispanic.<sup>35</sup> This is concerning given that Hispanic individuals constituted almost half of the LA County population<sup>36</sup> but were less covered by ESRs or flavoured ESRs than non-Hispanic groups, according to our study and the study examining all cities in California.<sup>31</sup> The finding that lower socioeconomic individuals were less likely to be covered by LA County ESRs was also troubling given that this group has been historically targeted by flavoured tobacco marketing<sup>37–39</sup> and is disproportionately affected by tobacco use-related health and economic outcomes.<sup>40</sup> Those discrepancies in ESR policy coverage may further exacerbate disparity outcomes of tobacco product use and tobacco marketing targeting among vulnerable community members. The referendum for restricting the sale of flavoured tobacco products in California, including flavoured e-cigarettes and cigar products, is pending approval in November 2022.<sup>41</sup> This state-wide restriction may greatly increase the

**Table 2** Participant characteristics at baseline by e-cigarette sales restriction (ESR) policy categories among baseline e-cigarette users (18–21 years; N=435)

	ESR policy category 1*			ESR policy category 2†			
	All participants	Without ESRs	With any ESRs	P value‡§	With flavoured ESRs	With comprehensive ESRs	P value‡§
		N=435	N=263		N=172	N=112	
		60.5%	39.5%		25.7%	13.8%	
Age				0.504			0.032
18 and 19	77.2%	61.1%	38.7%		23.2%	15.5%	
20 and 21	22.8%	57.6%	42.4%		34.3%	8.1%	
Gender				0.685			0.550
Female	48.4%	60.2%	39.8%		24.6%	15.2%	
Male	45.8%	61.8%	38.2%		26.6%	11.6%	
Other¶	5.8%	52.0%	48.0%		26.6%	11.6%	
Sexual orientation				0.029			0.150
Heterosexual	78.0%	58.4%	41.6%		28.4%	13.1%	
Other orientations**	22.0%	70.0%	30.0%		15.6%	14.4%	
Race and ethnicity				0.000			0.000
Hispanic	49.2%	73.8%	26.2%		21.0%	5.1%	
Non-Hispanic white	15.6%	38.2%	61.8%		55.9%	5.9%	
Non-Hispanic Asian	18.2%	53.2%	46.8%		12.7%	34.2%	
Non-Hispanic other††	17.0%	50.0%	50.0%		25.7%	24.3%	
Education level				0.227			0.100
≤High school	38.8%	64.5%	35.5%		20.1%	15.4%	
≥Some college	55.7%	58.6%	41.4%		29.3%	12.1%	
Undetermined	5.5%	54.2%	45.8%		25.0%	20.8%	
Subjective financial status				0.252			0.248
<Living comfortably‡‡	48.5%	64.5%	36.5%		25.6%	16.4%	
Living comfortably	44.8%	57.9%	42.1%		25.6%	10.9%	
Undetermined	6.7%	55.2%	44.8%		27.6%	17.2%	
Current e-cigarette dependence				0.918			0.977
Yes	34.4%	61.2%	38.8%		25.2%	13.6%	
No	65.6%	60.7%	39.3%		26.1%	13.2%	
Current e-cigarette use frequency				0.332			0.317
1–2 days	35.6%	60.0%	40.0%		29.0%	11.0%	
3–9 days	26.9%	65.8%	34.2%		16.9%	11.3%	
10–30 days	37.5%	57.1%	42.9%		28.3%	15.2%	
Current cigarette smoking				0.180			0.186
Yes	20.7%	54.4%	45.6%		33.3%	12.2%	
No	79.3%	62.2%	37.8%		23.8%	14.0%	
Continued e-cigarette use				0.018			0.005
Yes	43.5%	52.9%	47.1%		30.2%	16.9%	
No	56.5%	66.3%	33.7%		22.4%	11.4%	

\*ESR policy category 1 has two groups: without ESRs and with any ESRs (including flavoured or comprehensive ESRs).

†ESR policy category 2 has three groups: without ESRs, with flavoured ESR and with comprehensive ESRs.

‡Bolded text indicates statistical significance ( $p < 0.05$ ).

§Post-hoc analysis was conducted to examine within-group differences if between-group difference was significant.

¶'Other' category for gender includes those who did not report or gender other than female or male.

\*\*'Other' category for sexual orientation includes asexual, bisexual, gay, lesbian, pansexual, queer, questioning or unsure, and other identities.

††'Other' category for race/ethnicity includes American Indian or Alaska Native, Native Hawaiian or Pacific Islanders.

‡‡<Living comfortably category includes met needs with a little left, just meet basic expenses and do not meet basic expenses.

policy coverage among the vulnerable population groups who otherwise may not be covered by such policies at the local level.

Using the cohort data from the pre-policy and post-policy implementation periods, our study showed that living in localities with any, flavoured or comprehensive ESRs may not be associated with reduced e-cigarette use at follow-up among e-cigarette users or non-users. Although previous research using e-cigarette retail sales data most consistently showed the impact

of flavoured ESRs on reducing retail sales of e-cigarettes,<sup>9–12</sup> less research was available that used longitudinal cohort data focusing on e-cigarette use change, especially those collected during the COVID-19 pandemic. Multifaceted factors may shape how individuals, regardless of currently using e-cigarettes or not, respond to ESR policy change. For example, individuals may stockpile e-cigarette products, borrow from social sources such as friends and family members, and purchase from online retailers or

**Table 3** Participant characteristics at baseline by e-cigarette sales restriction (ESR) policy categories among baseline non-e-cigarette users (18–21 years; N=1665)

	ESR policy category 1*			ESR policy category 2†			
	All participants	Without ESRs	With any ESRs	P value‡§	With flavoured ESRs	With comprehensive ESRs	P value‡§
	N=1665	N=1097	N=568		N=327	N=241	
		65.9%	34.1%		19.6%	14.5%	
Age				0.861			0.064
18 and 19	74.8%	66.0%	34.0%		18.6%	15.5%	
20 and 21	25.2%	65.6%	34.5%		22.7%	11.7%	
Gender				0.057			0.112
Female	56.4%	67.3%	32.7%		19.4%	13.3%	
Male	37.5%	62.7%	37.3%		20.4%	17.0%	
Other¶	6.1%	72.6%	27.5%		17.7%	9.8%	
Sexual orientation				0.084			0.226
Heterosexual	22.3%	64.8%	35.2%		20.3%	14.9%	
Other orientations**	77.7%	69.6%	30.4%		17.5%	12.9%	
Race and ethnicity				<b>0.000</b>			<b>0.000</b>
Hispanic	55.7%	81.1%	18.9%		14.9%	4.0%	
Non-Hispanic white	11.5%	39.6%	60.4%		53.7%	6.8%	
Non-Hispanic Asian	17.1%	38.7%	61.3%		10.9%	50.4%	
Non-Hispanic other††	15.7%	60.5%	39.5%		21.1%	18.4%	
Education level				0.098			0.098
≤High school	39.3%	68.4%	31.6%		17.1%	14.0%	
≥Some college	54.8%	63.4%	36.6%		21.8%	14.8%	
Undetermined	5.9%	72.5%	27.5%		16.3%	11.2%	
Subjective financial status				<b>0.000</b>			<b>0.001</b>
<Living comfortably‡‡	50.5%	69.0%	31.0%		19.7%	11.3%	
Living comfortably	43.2%	61.1%	38.9%		20.2%	18.8%	
Undetermined	6.3%	74.3%	25.7%		15.2%	10.5%	
Current cigarette smoking				0.490			0.735
Yes	2.3%	71.1%	28.9%		18.4%	10.5%	
No	97.7%	65.7%	34.3%		19.8%	14.6%	

\*ESR policy category 1 has two groups: without ESRs and with any ESRs (including flavoured or comprehensive ESRs).

†ESR policy category 2 has three groups: without ESRs, with flavoured ESR and with comprehensive ESRs.

‡Bolded text indicates statistical significance ( $p < 0.05$ ).

§Post-hoc analysis was conducted to examine within-group differences if between-group difference was significant.

¶'Other' category for gender includes those who did not report or gender other than female or male.

\*\*'Other' category for sexual orientation includes asexual, bisexual, gay, lesbian, pansexual, queer, questioning or unsure, and other identities.

††'Other' category for race/ethnicity includes American Indian or Alaska Native, Native Hawaiian or Pacific Islanders.

‡‡<Living comfortably category includes met needs with a little left, just meet basic expenses and do not meet basic expenses.

neighbouring localities without ESR policies.<sup>15 42 43</sup> Localities with ESRs may also traditionally have more tobacco control policies in place, which may have influenced participants' long-term e-cigarette use history and eventually their e-cigarette use behaviour change given the recently enacted ESRs. The global pandemic may have further held back local policy enforcement efforts, resulting in delayed or halted retailer inspections.<sup>20 21</sup> All of these factors may undermine the effects of local ESRs in LA County and need to be taken into account for future studies when evaluating the impact of ESR policies in the USA or other parts of the world.

The main associations examined in the study also found that dual users of cigarettes and e-cigarettes may be more likely to continue their e-cigarette use if they lived in localities with any or flavoured ESRs. This finding echoed some previous research that showed the impact of ESRs, especially flavoured ESRs, among e-cigarette users may be reduced or different if e-cigarette users also smoked cigarettes.<sup>18 19</sup> We suspect that dual users may use e-cigarettes as a replacement for cigarette smoking and/or

reinforcement of nicotine consumption from cigarette smoking, and therefore, may be more likely to continue their e-cigarette use over time compared with e-cigarette-only users. Additionally, the fact that ESRs had a higher coverage among e-cigarette users before policy implementation suggests that the communities with ESRs might have a stronger vaping norm or culture to begin with compared with communities without ESRs. Such a pro-vaping environment might further sustain consumers' e-cigarette use over time, regardless of e-cigarette-related policy change. More research is needed to explain how local ESRs might have impacted the use of e-cigarettes among individuals with varying e-cigarette use and cigarette smoking histories and how community norms and culture of e-cigarette use may alter the impact of ESR policies among community members.

### Study limitations

This study has the following limitations. First, the sample size of e-cigarette users who lived in localities with ESRs was limited,

**Table 4** Associations between living in e-cigarette sales restriction (ESR) localities at baseline and e-cigarette use at follow-up, stratified by cigarette smoking at baseline, among e-cigarette users (18–21 years; N=435)

	E-cigarette use at follow-up*					
	All participants	Cigarette smokers	Non-cigarette smokers	All participants	Cigarette smokers	Non-cigarette smokers
	N=435	N=90	N=345	N=435	N=90	N=345
ESR policy category 1						
Without ESRs	Reference	Reference	Reference	Not applicable		
With any ESRs	<b>1.69 (1.09 to 2.65)</b>	<b>5.65 (1.62 to 19.64)</b>	1.49 (0.90 to 2.48)			
ESR policy category 2						
Without ESR	Not applicable			Reference	Reference	Reference
With flavoured ESRs				<b>1.71 (1.02 to 2.87)</b>	<b>6.40 (1.53 to 26.74)</b>	1.51 (0.83 to 2.74)
With comprehensive ESRs				1.65 (0.85 to 3.20)	4.25 (0.62 to 29.08)	1.47 (0.69 to 3.11)
Age						
18 and 19	Reference	Reference	Reference	Reference	Reference	Reference
20 and 21	0.86 (0.56 to 1.45)	2.10 (0.53 to 8.35)	0.72 (0.40 to 1.31)	0.86 (0.51 to 1.45)	2.09 (0.52 to 8.35)	0.72 (0.40 to 1.31)
Gender†						
Female	Reference	Reference	Reference	Reference	Reference	Reference
Male	1.16 (0.74 to 2.12)	1.50 (0.41 to 5.45)	1.02 (0.61 to 1.71)	1.15 (0.73 to 1.82)	1.42 (0.38 to 5.29)	1.02 (0.61 to 1.71)
Sexual orientation						
Heterosexual	Reference	Reference	Reference	Reference	Reference	Reference
Other‡	1.24 (0.73 to 2.12)	2.83 (0.72 to 11.05)	1.10 (0.60 to 2.04)	1.25 (0.74 to 2.14)	4.45 (0.97 to 20.41)	1.11 (0.60 to 2.05)
Race and ethnicity						
Hispanic	0.72 (0.39 to 1.36)	0.41 (0.11 to 1.53)	1.01 (0.48 to 2.23)	0.73 (0.39 to 1.36)	0.41 (0.11 to 1.54)	1.02 (0.47 to 2.21)
Non-Hispanic white	Reference	Reference	Reference	Reference	Reference	Reference
Non-Hispanic Asian	0.94 (0.45 to 1.96)	0.60 (0.07 to 5.03)	1.28 (0.56 to 2.98)	0.96 (0.44 to 2.04)	0.63 (0.07 to 5.28)	1.30 (0.54 to 3.13)
Non-Hispanic other§	1.16 (0.52 to 2.57)	0.49 (0.07 to 3.47)	1.54 (0.62 to 3.89)	1.17 (0.52 to 2.64)	0.46 (0.06 to 3.39)	1.56 (0.60 to 4.07)
Education level†						
≤High school	Reference	Reference	Reference	Reference	Reference	Reference
≥Some college	0.91 (0.58 to 1.41)	0.67 (0.21 to 2.09)	0.86 (0.52 to 1.44)	0.91 (0.58 to 1.41)	0.64 (0.20 to 2.05)	0.85 (0.52 to 1.41)
Subjective financial status¶						
<Living comfortably¶	Reference	Reference	Reference	Reference	Reference	Reference
Living comfortably	0.89 (0.58 to 1.36)	1.08 (0.37 to 3.18)	0.83 (0.51 to 1.36)	0.89 (0.58 to 1.37)	1.07 (0.36 to 3.15)	0.84 (0.51 to 1.37)
Current e-cigarette use frequency						
1–2 days	Reference	Reference	Reference	Reference	Reference	Reference
3–9 days	<b>1.75 (1.02 to 3.01)</b>	2.56 (0.56 to 11.69)	1.68 (0.92 to 3.07)	<b>1.76 (1.02 to 3.02)</b>	2.55 (0.56 to 11.58)	1.68 (0.92 to 3.07)
10–30 days	<b>2.79 (1.63 to 4.77)</b>	1.62 (0.48 to 7.15)	<b>3.28 (1.79 to 5.98)</b>	<b>2.80 (1.64 to 4.78)</b>	1.53 (0.34 to 6.70)	<b>3.28 (1.79 to 6.02)</b>
Current e-cigarette dependence						
Yes	<b>1.86 (1.15 to 3.02)</b>	1.44 (0.46 to 4.46)	<b>2.17 (1.23 to 3.81)</b>	<b>1.87 (1.15 to 3.02)</b>	1.50 (0.47 to 4.78)	<b>2.17 (1.23 to 3.81)</b>
No	Reference	Reference	Reference	Reference	Reference	Reference
Current cigarette smoking						
Yes	1.46 (0.84 to 2.53)	Not applicable		1.46 (0.83 to 2.52)	Not applicable	
No	Reference					

\*Bolded text indicates statistical significance ( $p < 0.05$ ).

†'Other' or 'undetermined' categories for gender, education level and subjective financial status were omitted due to small cells and wide CIs.

‡'Other' category for sexual orientation includes asexual, bisexual, gay, lesbian, pansexual, queer, questioning or unsure, and other identities.

§'Other' category for race/ethnicity includes American Indian or Alaska Native, Native Hawaiian or Pacific Islanders.

¶<Living comfortably category includes met needs with a little left, just meet basic expenses and do not meet basic expenses.

**Table 5** Associations between living in e-cigarette sales restriction (ESR) localities at baseline and e-cigarette use at follow-up, stratified by cigarette smoking at baseline, among non-e-cigarette users (18–21 years; N=1665)

	E-cigarette use at follow-up*†			
	All participants	Non-cigarette smokers	All participants	Non-cigarette smokers
	N=1665	N=1626	N=1665	N=1626
ESR policy category 1				
Without ESRs	Reference	Reference	Not applicable	
With any ESRs	0.84 (0.56 to 1.26)	0.92 (0.60 to 1.39)		
ESR policy category 2				
Without ESR	Not applicable		Reference	Reference
With flavoured ESRs			0.71 (0.43 to 1.17)	0.74 (0.44 to 1.23)
With comprehensive ESRs			1.08 (0.61 to 1.94)	1.31 (0.72 to 2.35)
Age				
18 and 19	Reference	Reference	Reference	Reference
20 and 21	0.91 (0.59 to 1.37)	0.93 (0.60 to 1.43)	0.91 (0.60 to 1.38)	0.94 (0.61 to 1.45)
Gender‡				
Female	Reference	Reference	Reference	Reference
Male	1.29 (0.89 to 1.83)	1.32 (0.91 to 1.67)	1.28 (0.89 to 1.85)	1.33 (0.92 to 1.93)
Sexual orientation				
Heterosexual	Reference	Reference	Reference	Reference
Other§	1.16 (0.74 to 1.82)	1.03 (0.64 to 1.67)	1.15 (0.74 to 1.82)	1.04 (0.64 to 1.67)
Race and ethnicity				
Hispanic	1.16 (0.93 to 1.98)	1.24 (0.67 to 2.35)	1.10 (0.60 to 2.00)	1.18 (0.53 to 2.22)
Non-Hispanic white	Reference	Reference	Reference	Reference
Non-Hispanic Asian	0.71 (0.33 to 1.49)	0.70 (0.32 to 1.53)	0.59 (0.27 to 1.32)	0.55 (0.24 to 1.27)
Non-Hispanic other¶	1.58 (0.78 to 3.20)	1.63 (0.78 to 3.41)	1.44 (0.70 to 2.96)	1.44 (0.68 to 3.07)
Education level‡				
≤High school	Reference	Reference	Reference	Reference
≥Some college	1.36 (0.94 to 1.98)	1.39 (0.94 to 2.05)	1.35 (0.93 to 1.97)	1.38 (0.94 to 2.04)
Subjective financial status‡				
<Living comfortably**	Reference	Reference	Reference	Reference
Living comfortably	1.08 (0.75 to 1.54)	1.00 (0.70 to 1.45)	0.89 (0.58 to 1.37)	0.84 (0.51 to 1.37)
Current cigarette smoking				
Yes	<b>4.27 (2.03 to 9.02)</b>	Not applicable	<b>4.18 (1.97 to 8.84)</b>	Not applicable
No	Reference		Reference	

\*Bolded text indicates statistical significance ( $p < 0.05$ ).

†Cigarette smoker group was omitted from statistical analysis due to small sample size ( $n=39$ ).

‡'Other' or 'undetermined' categories for gender, education level and subjective financial status were omitted due to small cells and wide CIs.

§'Other' category for sexual orientation includes asexual, bisexual, gay, lesbian, pansexual, queer, questioning or unsure, and other identities.

¶'Other' category for race/ethnicity includes American Indian or Alaska Native, Native Hawaiian or Pacific Islanders.

\*\*'Other' category for subjective financial situation includes met needs with a little left, just meet basic expenses and do not meet basic expenses.

resulting in unstable estimates of CIs during multivariable regression modelling. We also could not examine the change of flavoured e-cigarette use over time or the sources of access to e-cigarettes among e-cigarette users due to the small sample size. Second, we did not further categorise flavoured ESR policies by their comprehensiveness,<sup>44 45</sup> such as exempting adult-only retailers. More nuanced categorisation of flavoured ESR types may provide in-depth insights into the policy's potential impact on e-cigarette use. Third, this study only included one follow-up time point shortly after the ESR policies were implemented. Research using multiple rounds of follow-up data collection is critically needed to provide robust data on ESRs' long-term impact.

### Implications for US and global tobacco policy research

This study has several implications for research examining the potential impact of (flavoured and comprehensive) ESRs in local

jurisdictions in the USA and across the globe. First, such research needs to consider the community characteristics related to socio-demographic backgrounds and tobacco-using norms during the pre-policy implementation period. If using individual behaviour data, such research may need to further consider individual consumers' use of and dependence on e-cigarettes and other tobacco products (especially combustible cigarettes). Second, research evaluating such policies may need to consider the complexity of human behaviour adaptation in response to policy change. Data collected on local law enforcement efforts and retailer compliance of newly enacted policies are also needed to triangulate with consumer behaviour data. Third, research examining policy effectiveness after March 2020 needs to consider the impact of the COVID-19 pandemic on law enforcement efforts, retailer compliance and consumers' tobacco-using behaviour change.

## CONCLUSION

Using a cohort sample of young adults living in LA County, California, this study highlights the sociodemographic and tobacco-using differences among individuals living in localities with various ESR policies or without such policies. The associations between living in localities with any ESRs and different types of ESRs at baseline (pre-policy implementation) and e-cigarette use at follow-up (post-policy implementation) were found for dual users of e-cigarettes and cigarettes at baseline. Specifically, those who were using both e-cigarettes and cigarettes at baseline were more likely to continue using e-cigarettes at follow-up if they lived in localities with any or flavoured ESRs than those who did not live in those localities. Multiple considerations are highlighted in this paper for conducting tobacco policy evaluation research using consumer behaviour data from local communities and within the context of the global pandemic.

**Contributors** Concept and design—JC-S, MAP, JB-T and JBU. Acquisition, analysis or interpretation of data—all authors. Drafting of the manuscript—JC-S and SP. Critical revision of the manuscript for important intellectual content—all authors. Statistical analysis—JC-S and RC-C. Obtained funding—MAP. Administrative, technical or material support—JC-S, MAP, JB-T and JBU. Supervision and guarantor—JC-S and MAP.

**Funding** This study was funded by the USC TCORS from National Institutes of Health/US Food and Drug Administration (NIH/FDA) (U54CA180905). JC-S is supported by the Pathway to Independence Award from National Cancer Institute (NCI)/FDA (R00CA242589), Penn/Rutgers TCORS (U54CA229973) and Rutgers Cancer Institute of New Jersey Cancer Center Support Grant (P30CA072720).

**Disclaimer** Comments and opinions expressed belong to the authors and do not necessarily represent the views of the US Government, NIH, NCI or the US FDA.

**Competing interests** None declared.

**Patient consent for publication** Not required.

**Ethics approval** This study involves human participants and the University of Southern California Institutional Review Board (IRB) approved the cohort study (IRB identification number: HS-12-00180). Participants gave informed consent to participate in the study before taking part.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data are available upon reasonable request.

**Supplemental material** This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

**Open access** This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

## ORCID iDs

Julia Chen-Sankey <http://orcid.org/0000-0002-1797-5248>

Jennifer B Unger <http://orcid.org/0000-0001-9064-6603>

Jessica Barrington-Trimis <http://orcid.org/0000-0002-3331-0326>

## REFERENCES

- Chen JC, Green KM, Chen J, *et al*. Restricting the sale of flavored e-cigarettes in the US: an examination of local regulations. *Tob Regul Sci* 2018;4:32–40.
- Rose SW, Amato MS, Anesetti-Rothermel A, *et al*. Characteristics and reach equity of policies restricting flavored tobacco product sales in the United States. *Health Promot Pract* 2020;21:445–53.
- CDC Office on Smoking and Health. Outbreak of lung injury associated with the use of e-cigarette, or Vaping, products. *Centers for Disease Control and Prevention* 2020 [https://www.cdc.gov/tobacco/basic\\_information/e-cigarettes/severe-lung-disease.html](https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html)
- U.S. Department of Health and Human Services. Surgeon General releases advisory on e-cigarette epidemic among youth, 2018. Available: <https://www.hhs.gov/about/news/2018/12/18/surgeon-general-releases-advisory-e-cigarette-epidemic-among-youth.html> [Accessed 18 Mar 2019].
- Truth Initiative. Local restrictions on flavored tobacco and e-cigarette products. Available: <https://truthinitiative.org/research-resources/emerging-tobacco-products/local-restrictions-flavored-tobacco-and-e-cigarette> [Accessed 27 Jan 2022].
- Surgeon General USMurthy VM. E-Cigarette use among youth and young adults a major public health concern, 2016. Available: <http://jamanetwork.com/data/Journals/PEDS/0/pvp160037.pdf> [Accessed 02 Jan 2017].
- Vogel EA, Cho J, McConnell RS, *et al*. Prevalence of electronic cigarette dependence among youth and its association with future use. *JAMA Netw Open* 2020;3:e1921513.
- Leventhal AM, Strong DR, Kirkpatrick MG, *et al*. Association of electronic cigarette use with initiation of combustible tobacco product smoking in early adolescence. *JAMA* 2015;314:700–7.
- Andersen-Rodgers E, Zhang X, Vuong TD, *et al*. Are California's local flavored tobacco sales restrictions effective in reducing the retail availability of flavored tobacco products? A multicomponent evaluation. *Eval Rev* 2021;45:134–65.
- Gammon DG, Rogers T, Gaber J, *et al*. Implementation of a comprehensive flavoured tobacco product sales restriction and retail tobacco sales. *Tob Control* 2021. doi:10.1136/tobaccocontrol-2021-056494. [Epub ahead of print: 04 Jun 2021].
- Kephart L, Setodji C, Pane J. Evaluating tobacco retailer experience and compliance with a flavoured tobacco product restriction in Boston, Massachusetts: impact on product availability, advertisement and consumer demand. *Tobacco Control* 2020;29:e71–7.
- Pearlman DN, Arnold JA, Guardino GA, *et al*. Advancing tobacco control through point of sale policies, Providence, Rhode Island. *Prev Chronic Dis* 2019;16.
- Farley SM, Sisti J, Jasek J, *et al*. Flavored tobacco sales prohibition (2009) and noncigarette tobacco products in retail stores (2017), New York City. *Am J Public Health* 2020;110:725–30.
- Kingsley M, Setodji CM, Pane JD, *et al*. Longer-term impact of the flavored tobacco restriction in two Massachusetts communities: a mixed-methods study. *Nicotine and Tobacco Research* 2021;23:1928–35.
- Yang Y, Lindblom EN, Salloum RG, *et al*. The impact of a comprehensive tobacco product flavor ban in San Francisco among young adults. *Addict Behav Rep* 2020;11:100273.
- Hawkins SS, Kruzik C, O'Brien M, O'Brien M, *et al*. Flavoured tobacco product restrictions in Massachusetts associated with reductions in adolescent cigarette and e-cigarette use. *Tob Control* 2022;31:576–9. doi:10.1136/tobaccocontrol-2020-056159
- Centers for Disease Control and Prevention. E-Cigarette use among youth and young adults. A report of the Surgeon General, 2016. Available: [https://e-cigarettes.surgeongeneral.gov/documents/2016\\_sgr\\_full\\_report\\_non-508.pdf](https://e-cigarettes.surgeongeneral.gov/documents/2016_sgr_full_report_non-508.pdf) [Accessed 01 Nov 2017].
- Posner H, Romm KF, Henriksen L. Reactions to sales restrictions on flavored Vape products or all Vape products among young adults in the United States. *Nicotine & Tobacco Research* 2021.
- Huh J, Yu S, Galimov A, *et al*. Hypothetical flavour ban and intention to vape among vape shop customers: the role of flavour preference and e-cigarette dependence. *Tob Control* 2021. doi:10.1136/tobaccocontrol-2020-056321. [Epub ahead of print: 10 Jun 2021].
- DeSalvo K, Hughes B, Bassett M, *et al*. Public health COVID-19 impact assessment: lessons learned and compelling needs. *NAM Perspect* 2021;2021.
- Jennings WG, Perez NM. The immediate impact of COVID-19 on law enforcement in the United States. *American Journal of Criminal Justice* 2020;45:690–701.
- Berg CJ, Callanan R, Johnson TO, *et al*. Vape shop and consumer activity during COVID-19 non-essential business closures in the USA. *Tob Control* 2021;30:e41–4.
- Medel D, Galimov A, Meza L, *et al*. Longitudinal tracking of Vape shop compliance with state business regulations within southern California ethnic neighborhoods during the COVID-19 pandemic. *Eval Health Prof* 2021;44:87–92.
- Chen-Sankey JC, Broun A, Duarte DA, *et al*. Exploring changes in cigar smoking patterns and motivations to quit cigars among black young adults in the time of COVID-19. *Addictive Behaviors Reports* 2020;12:100317.
- White AM, Li D, Snell LM, *et al*. Perceptions of tobacco product-specific COVID-19 risk and changes in tobacco use behaviors among smokers, e-cigarette users, and dual users. *Nicotine Tob Res* 2021;23:1617–22.
- Kalkhoran SM, Levy DE, Rigotti NA. Smoking and e-cigarette use among U.S. adults during the COVID-19 pandemic. *Am J Prev Med* 2022;62:341–349.
- Campaign for Tobacco-free Kids. Flavored tobacco sales restrictions: promising evidence for reducing youth access and tobacco use. Available: <https://www.tobaccofreekids.org/assets/factsheets/0409.pdf> [Accessed 27 Jan 2022].
- California Tobacco Control Program. Tobacco control funding opportunities and resources. Available: <https://tcfcr.catcp.org/index.cfm?fuseaction=websites.home> [Accessed 03 Feb 2022].
- Harris PA, Taylor R, Thielke R, *et al*. Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377–81.

- 30 Tackett AP, Hébert ET, Smith CE, *et al.* Youth use of e-cigarettes: does dependence vary by device type? *Addict Behav* 2021;119:106918.
- 31 Dove M, Zheng S, Pakdaman S, *et al.* Demographics, tobacco use, and tobacco control measures of California cities with flavored tobacco sales restrictions. Poster presented at the 2022 Society for Nicotine and Tobacco Research Conference. Baltimore, MD.
- 32 Hafez AY, Gonzalez M, Kulik MC, *et al.* Uneven access to smoke-free laws and policies and its effect on health equity in the United States: 2000-2019. *Am J Public Health* 2019;109:1568–75.
- 33 Golden SD, Farrelly MC, Luke DA, *et al.* Comparing projected impacts of cigarette floor price and excise tax policies on socioeconomic disparities in smoking. *Tob Control* 2016;25:i60–6.
- 34 Grube JW, Lipperman-Kreda S, García-Ramírez G, *et al.* California's tobacco 21 minimum sales age law and adolescents' tobacco and nicotine use: differential associations among racial and ethnic groups. *Tob Control* 2021. doi:10.1136/tobaccocontrol-2020-056219. [Epub ahead of print: 30 Jun 2021].
- 35 Dai H, Ramos AK, Faseru B, *et al.* Racial disparities of e-cigarette use among US youths: 2014–2019. *Am J Public Health* 2021;111:2050–8.
- 36 U.S. Census Bureau. *QuickFacts*. California: Los Angeles County, 2022. <https://www.census.gov/quickfacts/losangelescountycalifornia>
- 37 Chen-Sankey JC, van de Venne J, Westneat S. Real-Time context of tobacco marketing exposure and community vulnerability—An ecological Momentary assessment among young adults. *Annals of Behavioral Medicine* 2021.
- 38 Villanti AC, Richardson A, Vallone DM, *et al.* Flavored tobacco product use among U.S. young adults. *Am J Prev Med* 2013;44:388–91.
- 39 Feirman SP, Lock D, Cohen JE, *et al.* Flavored tobacco products in the United States: a systematic review assessing use and attitudes. *Nicotine Tob Res* 2016;18:ntv176.
- 40 U.S. Department of Health and Human Services. *The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General*, 2014. <https://www.surgeongeneral.gov/library/reports/50-years-of-progress/index.html>
- 41 Ballotpedia. California flavored tobacco products ban referendum, 2022. Available: [https://ballotpedia.org/California\\_Flavored\\_Tobacco\\_Products\\_Ban\\_Referendum\\_](https://ballotpedia.org/California_Flavored_Tobacco_Products_Ban_Referendum_) [Accessed 27 Jan 2022].
- 42 Gaiha SM, Henriksen L, Halpern-Felsher B, *et al.* Sources of flavoured e-cigarettes among California youth and young adults: associations with local flavoured tobacco sales restrictions. *Tob Control* 2022;31:659–62.
- 43 Nguyen HV. Association of Canada's provincial bans on electronic cigarette sales to minors with electronic cigarette use among Youths. *JAMA Pediatr* 2020;174:e193912.
- 44 Donovan E, Folger S, Akbar M, *et al.* Classifying the comprehensiveness of flavoured tobacco sales restrictions: development and application of a tool to examine us state and local tobacco policies. *Tob Control* 2021. doi:10.1136/tobaccocontrol-2021-057042. [Epub ahead of print: 17 Dec 2021].
- 45 Chaiton MO, Cunningham R, Hagen L, *et al.* Taking global leadership in banning menthol and other flavours in tobacco: Canada's experience. *Tob Control* 2022;31:202–11.