

# Rates of Age Verification for Cigarette and E-cigarette Purchases as a Function of State T21 Laws Before and After Implementation of the Federal T21 Law in the United States

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## Abstract

**Introduction:** In the US, having a 21 minimum legal sales age for tobacco (T21) at the state level may have impacted age verification of cigarette and e-cigarette purchases among U.S. young adults (ages 18–26), before and/or after federal T21 implementation.

**Aims and Methods:** This study examined this by analyzing data from cigarette and/or e-cigarette users ( $n = 618$  and  $n = 864$ ) in six metropolitan areas in six states. Participants reported frequency of being age verified (“almost always” vs. less frequently) for cigarette and/or e-cigarette purchases across 3 timepoints (ie, wave 1 [w1]: September–December 2018, w2: September–December 2019, and w3: September–December 2020). Multilevel modeling examined time-varying state T21 status and time (reflecting federal T21 implementation) in relation to age verification of cigarette and e-cigarette purchases, respectively.

**Results:** The proportions almost always age verified for cigarette purchases in states with T21 versus without were: W1: 38.5% versus 37.7%, w2: 33.0% versus 39.1%, and w3: 45.4% versus 30.6%. For e-cigarettes, the proportions were: W1: 30.6% versus 40.3%, w2: 42.3% versus 50.5%, and w3: 56.0% versus 58.3%. In multilevel modeling, state T21 status was associated with greater likelihood of age verification for e-cigarettes (aOR = 1.67, CI = 1.13 to 2.45), but not for cigarettes. Age verification increased over time for e-cigarettes—both accounting for and not accounting for state T21 status. There were no changes for cigarettes.

**Conclusions:** State T21 status and time correlated with age verification for e-cigarettes, but not cigarettes. These self-reported age verification data contribute to evidence from compliance checks, indicating that retailers require additional prompts and enforcement to enhance compliance with T21 laws.

**Implications:** Current findings suggest that variations in regulations and gaps in enforcement may hinder the potential impact of increasing the minimum legal sales age, which ultimately may undermine the promise of such policies, specifically with regard to preventing tobacco use among the underage. Therefore, it is crucial to monitor retailer compliance with T21 laws and evaluate their efficacy to increase ID checks, minimize illegal sales, and curb underage use of tobacco. Relatedly, particular attention to enforcement efforts that may promote compliance is warranted.

## Introduction

Laws increasing the minimum legal sales age for tobacco from 18 to 21 (ie, “T21”) are presumed to decrease youth and young adult tobacco use, both directly, and indirectly (eg, via social norms). In the United States, prior to the federal T21 being implemented in December 2019, state and local jurisdictions generally had authority to implement such policies, and many had done so. There is some evidence that state and/or local T21 laws lead to decreases in sales

to minors,<sup>1</sup> tobacco use among youth<sup>2</sup> and young adults,<sup>3</sup> sales of cigarettes popular with youth,<sup>4</sup> and overall tobacco sales.<sup>5</sup> However, other evaluations of T21 laws report null findings.<sup>6,7</sup> One California-based study of young adults (ages 18–20) found no association between T21 laws and ever and current smoking<sup>7</sup> and that—despite the T21 law—most were not refused cigarette (65.4%) or e-cigarette purchases (82.0%), although half reported greater difficulty purchasing these products.<sup>6</sup> The efficacy of state/local T21 laws depends

Received: October 20, 2022. Revised: March 8, 2023. Accepted: March 17 2023.

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**Table 1.** State and Federal T21 Law Status at Waves 1–3 (Fall 2018–2020)

	Wave 1	Wave 2	Wave 3
Survey dates	September–December 2018	September–December 2019	September–December 2020
<b>State T21</b>			
<i>California</i>	Yes Enacted 4 May, 2016 Effective 9 June, 2016	Yes	Yes
<i>Massachusetts</i>	No	Yes Enacted 27, July 2018 Effective 31 December, 2018	Yes
<i>Washington</i>	No	No	Yes Enacted 5 April, 2019 Effective 1 January, 2020
<i>Minnesota</i>	No	No	Yes Enacted 16 May, 2020 Effective 1 August, 2021
<i>Oklahoma</i>	No	No	Yes Enacted 19 May, 2020 Effective 19 May, 2020
<i>Georgia</i>	No	No	No
<b>Federal T21</b>		Effective 20 December, 2020	
	Wave 1–2: Before implementation	Waves 2–3: After implementation	

on robust enforcement and retail compliance, which vary. For example, sales to minors are influenced by the nature of enforcement protocols,<sup>8</sup> as well as store location<sup>1,9</sup> and type.<sup>10–12</sup>

When the U.S. federal government raised the minimum legal sales age from 18 to 21 in 2019,<sup>13</sup> it closed gaps in coverage of state/local T21 laws.<sup>14</sup> Comparing data from the National Youth Tobacco Survey before and after federal T21, one evaluation found that the proportion of middle and high school students who perceived it was easy to buy tobacco products decreased for brick-and-mortar stores, but not online retailers.<sup>15</sup> Notably, only 17% of students who attempted to purchase cigarettes were refused because of age.<sup>15</sup> Furthermore, some evidence suggests that FDA enforcement of penalties to stores with repeated sales-to-minor violations is unnecessarily lenient.<sup>16</sup> Although federal law requires retailers to check ID for tobacco purchasers who appear to be under age 27, the extent to which this regulatory mechanism has been successfully implemented and variations across states with historically different minimum legal sales age laws warrant investigation.

This study analyzed survey data from young adults in six metropolitan statistical areas (MSAs; a geographical region with a relatively high core population density and close economic ties throughout the area) in six states. The aim was to assess whether the presence of a state T21 law was associated with higher odds of age verification among recent cigarette and/or e-cigarette purchasers under age 27. Additionally, we examined the extent to which time, representing federal T21 implementation, was associated with increased odds of age verification for cigarette and e-cigarette purchases.

## Methods

### Study Design

We analyzed data from a 2-year longitudinal study of young adults from six MSAs (Atlanta-Sandy Springs-Roswell, Georgia; Boston-Cambridge-Newton, Massachusetts; Minneapolis-St. Paul-Bloomington, Minnesota; Oklahoma City, Oklahoma; San Diego-Carlsbad, California; and Seattle-Tacoma-Bellevue, Washington) with varied tobacco legislative contexts (see *Measures* and [Table 1](#)).<sup>17</sup> This study, described elsewhere,<sup>18</sup> was approved by the Emory University Institutional Review Board.

In fall of 2018, ads posted on Facebook and Reddit targeted individuals by using indicators reflecting those eligible (ie, ages 18–34, residing in one of the six MSAs, English speaking). After clicking ads, individuals were directed to a webpage with a consent form and eligibility screener, completed the online wave 1 (w1) survey, and were asked to confirm their participation in the study a week later. Purposive, quota-based sampling ensured that sufficient proportions of the sample represented e-cigarette and cigarette users, each sex, and racial or ethnic minorities. Of the 10 433 individuals who clicked ads, 9847 consented, of which 2751 (27.9%) were excluded because of ineligibility ( $n = 1472$ ) and/or their subgroup target being met ( $n = 1279$ ). Among the remaining 7096 individuals, 48.8% ( $n = 3460$ ) provided complete data, and 86.9% ( $n = 3006$ ) confirmed participation.<sup>18</sup>

This study analyzed data from w1 to w3 (w1 [2018]:  $n = 3006$ , w2 [2019]:  $n = 2375$ , 79.0%, and w3 [2020]:  $n = 2476$ , 82.4%); analyses were restricted to participants under age 27 (coinciding with age verification requirements of the federal T21 law) who reported current cigarette and/or e-cigarette use, respectively. Current use was defined as past 30-day use at w1 but expanded to past 6-month use at

**Table 2.** Multilevel Regression Models Predicting “Almost Always” (vs. <Almost Always) Being Age Verified for Cigarette and E-cigarette Purchases From Wave 1 (Fall 2018) to Wave 3 (Fall 2020)

Variable	Cigarettes			E-cigarettes		
	aOR	CI	<i>p</i>	aOR	CI	<i>p</i>
<i>Policy factors</i>						
State T21	1.12	0.68, 1.85	.644	1.67	1.13, 2.46	.010
<i>Sociodemographic factors</i>						
Age	0.83	0.74, 0.92	.001	0.95	0.87, 1.03	.196
Female (ref = male)*	1.60	0.92, 2.77	.097	0.89	0.59, 1.35	.588
Sexual minority (ref = heterosexual)	1.33	0.76, 2.32	.314	1.54	1.00, 2.37	.052
<i>Race (ref = white)</i>						
Black	0.33	0.05, 2.05	.236	0.49	0.13, 1.83	.291
Asian	1.22	0.52, 2.86	.650	1.12	0.59, 2.12	.726
Other	0.88	0.40, 1.90	.740	1.06	0.56, 1.98	.864
Hispanic (ref = non-Hispanic)	1.74	0.81, 3.75	.154	0.88	0.49, 2.46	.668

\*aOR adjusted for other variables in the table.

w2 and w3 to capture use characteristics among less frequent users. If participants turned 27 during the study period, only data from prior waves of data collection were included.

## Measures

### Primary Predictors

State T21 law status was based on participant self-reported home address at each wave. State law was treated as a time-varying predictor, coded as 0 (no state T21) or 1 (state T21) at each wave (Table 1). California had a state T21 law at all waves, Massachusetts at w2–w3, and Washington, Minnesota, and Oklahoma at w3 only. Participants in Georgia were not exposed to state T21 at any wave. Participants who moved out of the six states were coded to their respective state T21 status and included in analyses. The potential impact of federal T21 law was assessed by examining the magnitude of change in age verification outcomes from w1 to w2 (before federal T21 implementation) and from w2 to w3 (after).

### Primary Outcomes

Age verification was assessed in three waves, two prior to the federal T21 law and one after (Table 1). At each wave, current cigarette and e-cigarette users, respectively, were asked, “When you buy [cigarettes; e-cigarettes], how frequently are you asked to provide an ID to verify your age? never; rarely; sometimes; often; or almost always.” Responses were dichotomized as “almost always” versus other responses, separately for cigarettes and e-cigarettes.

### Exploratory Variable

At each wave, e-cigarette users were asked, “Where do you most commonly purchase e-cigarettes and e-liquids? gas stations/convenience stores, online, vape shops, other tobacco specialty stores (eg, smoke shop), pharmacy, liquor store, or other.” Given the small numbers reporting pharmacies, liquor stores, or other,” analyses excluded these responses.

### Covariates

Participants reported their age, sex, sexual orientation, race, and ethnicity.

## Data Analysis

Multilevel logistic regression examined state T21 law in relation to age verification “almost always” (vs. <almost always [referent group]) for cigarette and e-cigarette purchases, respectively, controlling for sociodemographics and accounting for the data’s hierarchical structure (repeated measures nested within individuals nested in six states/MSAs). Additional multilevel models examined changes in age verification over time, accounting for state T21 law. To assess impact of federal T21, we compared age verification rates from w1 to w2 (before federal T21 implementation) to w2 to w3 (after). Exploratory analyses (using Chi-square tests) examined age verification for e-cigarettes by purchase location at each cross-section to determine if certain retailer types exhibited changes in age verification rates over time and by state T21 status. Descriptive analyses were conducted using SPSS v26; multilevel regression analyses were conducted using Stata v17.0; and maximum likelihood in Stata was used to account for missing data among those who provided eligible data at any wave.

## Results

Among participants reporting cigarette use at any wave ( $n = 618$ ;  $M_{age} = 21.79$ , 50.3% male, 43.0% sexual minority, 73.9% white, 2.8% black, 10.0% Asian, 13.4% Hispanic), the proportions residing in MSAs with state T21 laws at w1–w3 were 13.8%, 32.6%, and 87.1%, respectively (Supplementary Table 1). At w1, the proportion of cigarette users residing in each MSA ranged from 8.3% (Oklahoma City) to 24.6% (Minneapolis). Among those reporting e-cigarette use at any wave ( $n = 864$ ;  $M_{age} = 21.28$ , 45.7% male, 38.1% sexual minority, 74.5% white, 2.7% black, 10.8% Asian, 13.5% Hispanic), 15.2%, 34.5%, and 86.3% resided in MSAs with state T21 laws at w1–w3 (Table 2). At w1, the proportion of e-cigarette users residing in each MSA ranged from 10.1% (Minneapolis, Oklahoma City) to 21.2% (Seattle).

The proportions reporting being almost always asked for age verification for cigarettes in states with T21 versus without were: W1: 38.5% versus 37.7%, w2: 33.0% versus 39.1%, and w3: 45.4% versus 30.6%. For e-cigarettes, the proportions were: W1: 30.6% versus 40.3%, w2: 42.3%

versus 50.5%, and w3: 56.0% versus 58.3% (Supplementary Table 2 and Figure 1).

In multilevel regression (Table 2), the time-varying state T21 law variable correlated with greater likelihood of age verification for e-cigarettes (aOR = 1.67, CI = 1.13, 2.45,  $p = .010$ ), but not cigarettes. Models exploring time trends (reflecting federal T21 impact) indicated significant increases in age verification over time for e-cigarettes—both accounting for state T21 status (OR = 2.10, CI = 1.61, 2.74,  $p < .001$ ) and not (OR = 1.76, CI = 1.45, 2.14,  $p < .001$ ; data not presented in tables); however, there were no significant differences between w1–w2 and w2–w3 in either case. Additionally, there were no significant changes in age verification over time for cigarettes—both accounting for state T21 status (OR = 1.25, CI = 0.90, 1.74) and not (OR = 1.16, CI = 0.91, 1.47; data not presented in tables).

Age verification rates among states with and without T21 laws also varied by purchase locations (from 7.3% at gas stations/convenience stores with state T21 at w1 to 57.2% at vape shops with state T21 at w3; Supplementary Figure 2 and Table 2). Among those almost always age verified at w1, there was a smaller proportion of age-verified purchases at gas stations/convenience stores in states with T21 (7.3% vs. 17.9% without state T21) but a larger proportion online (31.7% vs. 17.3%); no other differences were found.

Regarding sociodemographics, being younger correlated with greater likelihood of age verification for cigarettes (aOR = 0.83, CI = 0.74, 0.92,  $p = .001$ ). No other sociodemographics were related to age verification (Table 2).

## Discussion

This study examined whether state and federal T21 laws were associated with higher odds of “almost always” being asked for age verification among young adult cigarette and e-cigarette purchasers. For e-cigarette purchases, time trends indicated greater age verification over time, suggesting the potential impact of the federal T21 law; moreover, state T21 predicted greater age verification over time. However, for cigarette purchases, results indicated no significant change in age verification rates over time and no relationship between state T21 laws and age verification rates. Additionally, the results suggest suboptimal age verification rates, regardless of timepoint, state T21 status, or e-cigarette purchase location. These findings are somewhat consistent with evidence of non-compliance from other surveys, such as national surveillance data indicating that underage individuals were highly likely to purchase cigarettes after the federal T21 implementation<sup>15</sup> and California surveys indicating little impact of state T21 on cigarette or e-cigarette purchasing.<sup>6,7</sup>

Other factors, such as variations in state T21 implementation and enforcement,<sup>1</sup> may have impacted current findings. Participants reported age verification both before (w1, w2) and during the coronavirus disease 2019 pandemic (w3). State masking laws in stores, changes in tobacco control funds, and reallocation of personnel to track-and-trace or other activities may have been associated with decreases in state T21 compliance. Additionally, state T21 laws vary in terms of guidance on the minimum age for verifying ID.<sup>19</sup> For instance, the minimum age ranges from 21 to 30 years across states, and multiple states (eg, California, Georgia, Oklahoma, Washington) do not require age verification for purchasers who appear older than 21 years.<sup>20</sup> Current findings also indicate that

those who were younger were more likely to be asked for age verification for cigarette purchases, which may reflect more universal guidance regarding age verification for the younger segment of the young-adult population.

## Limitations

This study analyzed data from a non-probability sample of U.S. young adults in six MSAs, limiting the generalizability to these MSAs and others in the United States. Additionally, small sample/cell sizes limited statistical power and precluded certain analyses (eg, by e-cigarette purchase location). Other limitations pertain to measures, including self-reported age verification (ie, subject to bias) and inconsistency in measures used to classify current cigarette users and e-cigarette users over time (ie, past 30 days vs. past 6 months). Finally, this study focused on federal and state T21, but did not control for exposure to local policies because there are 692 local jurisdictions in the six MSAs. This study also did not account for implications of other laws (eg, flavored product restrictions).

## Conclusions

Current findings highlight the importance of monitoring retailer compliance with T21 laws and suggest that gaps in enforcement may undermine the potential impact of these laws on preventing tobacco use among those underage. Therefore, continued surveillance of T21 enforcement and compliance is critical to future research examining the efficacy of these laws to minimize illegal sales and curb underage tobacco use. Additionally, such research is timely given the potential for compliance to increase as enforcement becomes more normative—or decrease if attention to such policies diminishes.

## Supplementary Material

A Contributorship Form detailing each author’s specific involvement with this content, as well as any supplementary data, are available online at <https://academic.oup.com/ntr>.

## Funding

This work was supported by the US National Cancer Institute (R01CA215155-01A1; PI: Berg). Dr. Romm is supported by Oklahoma Tobacco Settlement Endowment Trust (TSET) contract #R22-03, the National Cancer Institute grant awarded to the Stephenson Cancer Center (P30CA225520), and the National Institute on Drug Abuse (R25DA054015; MPIs: Obasi, Reitzel). Dr. Berg is also supported by other US National Institutes of Health funding, including the National Cancer Institute (R01CA239178-01A1; MPIs: Berg, Levine; R01CA179422-01; PI: Berg; R21 CA261884-01A1; MPIs: Berg, Arem), the Fogarty International Center (R01TW010664-01; MPIs: Berg, Kegler), the National Institute of Environmental Health Sciences/Fogarty (D43ES030927-01; MPIs: Berg, Caudle, Sturua), and the National Institute on Drug Abuse (R01DA054751-01A1; MPIs: Berg, Cavazos-Rehg).

## Acknowledgments

This study was approved by the Emory University Institutional Review Board (IRB00097895).

## Declaration of Interests

The authors declare no conflicts of interest.

## Data Availability

Data not publicly available (available upon request).

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