Limiting tobacco accessibility by transitioning tobacco sales to state alcohol stores: estimated increases in travel time and changes in associated disparities

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► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/tc-2024-059033).

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Received 23 September 2024
Accepted 3 March 2025

ABSTRACT

Background Transitioning tobacco sales (TTSs) to state-controlled stores would reduce tobacco retailer density, making tobacco less accessible while also providing infrastructure to support retailer licensing, raise prices and restrict marketing. Using 10 US states with an alcohol retail monopoly as an example, this study estimated population average increases in driving time associated with implementing TTS, reporting changes overall and by race, ethnicity and poverty status.

Methods This cross-sectional study combined 2020 licensing data, business records and American Community Survey 5-year estimates. Network (road-based) driving times to the nearest tobacco retailer were calculated at the census tract level for the status quo (existing tobacco retailers) and TTS counterfactual (state alcohol stores) in 2020. Travel times were weighted by subpopulations to assess equity reach of decreases in tobacco retailer accessibility.

Results On average, TTS would more than double travel times to the nearest tobacco retailer, resulting in a mean 119% increase in driving time (range: 30%–232%). The average per cent increase in travel time was slightly greater for black (127%) and Hispanic or Latino people (126%) than for white people (117%), and travel times increased more for black and/or Hispanic or Latino people in all states except Alabama, New Hampshire and Utah. There were larger increases in travel time for persons with incomes below the federal poverty line (vs above) in 7 of the 10 states.

Conclusions The TTS policy would make tobacco less accessible and reduce racial, ethnic and socioeconomic disparities in tobacco retail accessibility in most of the states examined.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Modelling studies conclude that large-scale reductions in tobacco retailer density can reduce tobacco use prevalence and associated harms, although no studies have modelled the potential effects of transitioning tobacco sales to government-controlled stores, such as state alcohol stores.

⇒ No jurisdictions have implemented a tobacco retail monopoly, although retail monopolies exist for alcohol and cannabis.

WHAT THIS STUDY ADDS

⇒ On average, transitioning tobacco sales to government-controlled stores would more than double the amount of time required to drive to a tobacco retailer.

⇒ In 7 of 10 states, the increases in driving time would be larger for minoritised groups that are overexposed to tobacco retailers.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study suggests that leveraging existing monopolies and/or establishing a tobacco retail monopoly could help states and countries achieve tobacco control objectives via established mechanisms: limiting tobacco retailer density and reducing convenience of tobacco purchases.

⇒ Findings from this study may inform equity-focused research, practice, and policy discussions by suggesting that transitioning tobacco sales to state alcohol stores could help mitigate long-standing disparities in tobacco use and related harms by race, ethnicity and socioeconomic status.

INTRODUCTION

Tobacco retailer density and proximity are structural drivers of tobacco use.[1] As tobacco retailers proliferate, the average customer does not need to travel as far to buy tobacco,[2] thereby increasing consumption by making the product more accessible and convenient to purchase.[3] Consequently, each unit increase in proximity to a tobacco retailer is associated with 2.4% lower risk of tobacco use.[1] In addition, people for whom tobacco is highly accessible may also have less success when attempting to quit[4] because the retailers (and their tobacco marketing) serve as visual reminders that may trigger tobacco cravings and spur impulsive purchases.[5] Finally, the potential harms associated with high tobacco retailer density extend beyond those who use tobacco; exposure to second-hand smoke is greater in neighbourhoods that have more tobacco retailers.[6 7]

There were 356 000 presumed tobacco retailers in the USA) in 2017,[8] suggesting retailer reduction strategies hold substantial potential for reducing and preventing tobacco use and related harms. An understudied tobacco retailer reduction approach is transitioning tobacco sales (TTS) to state-controlled stores.[9] A TTS approach could establish a new tobacco retail monopoly, but it may be more feasible if the first TTS states leveraged the existing infrastructure, such as that in

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To cite: Trangenstein PJ, Patterson DM, Karriker-Jaffe KJ, *et al*. *Tob Control* Epub ahead of print: [*please include* Day Month Year]. doi:10.1136/tc-2024-059033

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states with a spirits retail monopoly. State alcohol stores tend to be few in number, have higher prices, shorter hours of sale, less marketing, fewer risky products and higher compliance rates than other alcohol outlets, the net effect of which can lower demand and consumption.[10 11] Thus, a TTS policy could provide states with greater oversight of tobacco sales, potentially supporting other endgame strategies, such as the US Surgeon General's recommended bans on some classes of tobacco products.[12] A New Zealand study estimated that a policy similar to TTS—one that would transition tobacco sales to 50% of alcohol outlets—would reduce the prevalence of tobacco use and save US$1.23 billion in health system costs.[13] However, to our knowledge, there has been no modelling work evaluating the impact of TTS strategies in the USA, preventing informed consideration of such approaches.

Internal tobacco industry documents show efforts to target industry retail strategies by race, ethnicity and income, overexposing some marginalised communities to tobacco retailers, high-risk products and promotional marketing.[14 15] As a result, studies consistently document that black, Hispanic or Latino and lower-income communities have disproportionately high availability of tobacco retailers, and this systematic overexposure may drive disparities in tobacco use.[16] Consequently, there is a pressing need for tobacco prevention strategies that may realise larger gains among historically marginalised populations that have been targeted by the tobacco industry.

Within this context, we estimated population average increases in driving travel times associated with implementing a TTS policy limiting tobacco sales to state-controlled alcohol stores in 10 US states. This study used census block groups (CBGs) to approximate neighbourhoods. We then calculated travel times from CBG centroids to the nearest tobacco retailer or state alcohol store, with the centroids weighted by population to more closely reflect where the majority of residents lived. In addition, we investigated how status quo (baseline) and TTS (counterfactual) travel times would differ among key population subgroups, defined by race and ethnicity, and poverty status (separately). We also examined age to assess potential impacts for underage youth in supplemental analyses, considering that tobacco endgame strategies maintain a key focus on preventing tobacco initiation and creating a 'tobacco-free generation'.[17]

METHODS

Policy scenarios and context

This cross-sectional study compared travel times to the nearest tobacco retailer under two policy scenarios: (1) status quo and (2) legislatively TTS to state alcohol control stores. Under the status quo option, states and localities would continue as they existed in 2020. By contrast, the TTS option modelled travel times to state alcohol stores (rather than tobacco retailers) in 2020. In this scenario, state alcohol stores served as a proxy for the location of potential state tobacco stores. A key benefit of limiting tobacco sales to state-controlled stores would be a rapid decrease in tobacco retailer density, and these comparisons quantify the accompanying potential rise in travel time.

Because state alcohol stores only exist in states with alcohol control systems, we limited the analysis to the 10 states with these stores. We included those with government-operated stores (ie, New Hampshire (NH), Pennsylvania (PA) and Virginia (VA)), both government-operated stores and agency/contract stores (ie, Alabama (AL), Idaho (ID) and Utah (UT)), only agency/contract stores (ie, Montana (MT), Oregon (OR) and Vermont (VT)) and stores operated by local alcohol beverage control boards (ie, North Carolina (NC); table 1). Unlike the other nine states in this sample, MT allows bars to sell alcohol for off-site consumption. To yield comparable estimates across states, the TTS policy modelled here assumed that bars would not be permitted to sell tobacco. There were 32 061 CBGs in these 10 states.

Tobacco retailer accessibility

Tobacco retailer data were obtained from state retailer licensing records if the state has a tobacco licensing system. Otherwise, tobacco retailer data were obtained from Reference USA (now Data Axle). We followed previously reported procedures to process the tobacco business records data.[18] Briefly, we limited the business categories for likely tobacco retailers to those categorised as: beer, wine and liquor stores; convenience stores; department stores (which include chains known to sell tobacco); gas stations with convenience stores and other gas stations; general merchandise stores (which include chains known to sell tobacco); pharmacies (top 50 tobacco-selling chains), supermarkets and other grocery stores; tobacco retailers; and warehouse clubs and supercentres (which include chains known to sell

Table 1 State demographics, 2020

	State mean or total			Census block group-level means						
	Tobacco retailers per square mile	State alcohol stores per 1000 square miles	Total population	Black	Hispanic/Latino	White	Below the federal poverty line	At or above the federal poverty line	Youth aged 15–20 years	Adults 21+ years
State	Number			Percentage (%)						
AL*	1.26	3.38	4 876 250	31.17	3.97	61.57	19.15	80.85	7.63	74.69
ID*	1.26	2.03	1 717 750	0.54	12.39	82.22	14.70	85.30	8.23	71.96
MT†	1.45	0.65	1 050 649	0.44	3.70	85.82	13.92	86.08	7.18	75.58
NC‡	2.32	9.34	10 248 631	21.93	8.76	63.64	16.42	83.58	7.61	74.88
NH	1.43	8.71	1 298 307	1.34	3.91	90.18	8.45	91.55	7.20	77.64
OR†	2.90	3.04	4 129 803	1.66	11.98	77.68	13.69	86.31	6.92	76.71
PA	6.56	13.86	12 791 530	12.20	7.13	75.51	13.76	86.24	5.78	76.69
UT*	1.97	0.57	3 096 848	1.13	13.80	78.63	10.90	89.10	9.34	67.49
VA	1.19	9.95	8 454 463	19.37	8.38	63.46	11.76	88.24	7.37	75.20
VT†	2.39	8.14	624 313	1.10	1.87	93.21	11.36	88.64	7.62	77.60

*Both state-run stores and contract (agency) stores.
†Contract (agency) stores.
‡Stores owned by local Alcohol Beverage Control boards.
AL, Alabama; ID, Idaho; MT, Montana; NC, North Carolina; NH, New Hampshire; OR, Oregon; PA, Pennsylvania; UT, Utah; VA, Virginia; VT, Vermont.

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Table 2 Travel time in minutes to the nearest tobacco retailer at baseline and under transitioning tobacco sales policy counterfactual for the general population

			Transitioning tobacco sales policy			
	Baseline		Total travel time		Per cent change	
State	Travel time	95% CI	Travel time	95% CI	%	95% CI
AL	4.68	4.50, 4.87	12.93	12.49, 13.37	176.28	174.54, 177.56
ID	10.30	6.54, 14.06	13.35	9.47, 17.24	29.61	22.62, 44.80
MT	9.13	8.13, 10.13	16.56	15.06, 18.06	81.38	78.28, 85.24
NC	3.89	3.77, 4.01	8.75	8.51, 8.99	124.94	124.19, 125.73
NH	4.05	3.58, 4.51	9.89	8.93, 10.86	144.20	140.80, 149.44
OR	4.22	3.90, 4.54	6.60	6.21, 6.99	56.40	53.96, 59.23
PA	2.75	2.67, 2.83	6.30	6.15, 6.45	129.09	127.92, 130.34
UT	4.19	3.74, 4.63	13.89	12.69, 15.09	231.50	225.92, 239.30
VA	3.63	3.42, 3.84	7.85	7.53, 8.17	116.25	112.76, 120.18
VT	4.67	4.27, 5.06	9.28	8.58, 9.97	98.72	97.04, 100.94

AL, Alabama; ID, Idaho; MT, Montana; NC, North Carolina; NH, New Hampshire; OR, Oregon; PA, Pennsylvania; UT, Utah; VA, Virginia; VT, Vermont.

tobacco). Reference USA data do not include online retailers. We then deduplicated the list and excluded chains confirmed as not selling tobacco products. State alcohol control store licensing lists for 2020 were provided by the National Alcohol Beverage Control Association.

We calculated the network (road-based) travel time in minutes and distance in miles (presented in the online supplemental appendix) from population-weighted CBG centroids to the nearest tobacco retailer and nearest state alcohol control store. Driving travel times and distances were calculated using ArcGIS Pro Network Analyst. ArcGIS computes travel times assuming travel is conducted by car and the driver follows all applicable laws, including speed limits.

Sociodemographic characteristics

To investigate whether the TTS policy could mitigate or would exacerbate disparities, we weighted the tobacco retailer access measures by CBG-level sociodemographic characteristics of race, ethnicity, poverty and age. In doing so, we conceptualised race and ethnicity as social constructs resulting from racialisation and discrimination that result in unequal levels of power across groups.[19 20] Places can become racialised,[19] resulting in subgroups with less power having disproportionate exposure to undesirable land uses, such as tobacco retailing.

We obtained sociodemographic data for the total population and subpopulations defined by race, ethnicity, poverty status and age from the US Census Bureau's 2015–2019 American Community Survey estimates.[21] The total population included all people who lived in the CBG. The three race and ethnicity measures included the number of residents in the CBG who identified as: (1) black or African American and non-Hispanic or Latino (hereafter 'black'); (2) Hispanic or Latino (of any race) and (3) white and non-Hispanic or Latino (hereafter 'white'). Poverty status was measured using two variables: (1) the number of residents with incomes below the federal poverty line and (2) the number of residents with incomes at or above this threshold. Poverty status was only available at the census tract level, so we assigned the census tract value to all CBGs located in the tract. Age was also measured using two variables: (1) the number of youth aged 15–20 years and (2) the number of adults aged 21+ years.

We limited our analyses to those aged 15+ years old to include only people for whom changes in tobacco retailer travel times might be relevant. We did this by multiplying the total population and the number of people in each racial, ethnic and poverty category by the percentage aged 15+ years in each respective CBG.

Analysis

We calculated a weighted average of the tobacco retailer drive times and distances under the status quo and TTS policy options for persons aged 15+ overall and in each sociodemographic group. The weight was calculated as the number of people from a given sociodemographic group in a given CBG ($subpop_{CBG}$) divided by the total population for that sociodemographic group at the state level ($subpop_{state}$). The weight was then multiplied by the travel time t for the specific policy condition (ie, status quo or TTS; $time_{policy}$). The product of the weight and the driving time was then summed for all CBGs in a state from 1 to n to calculate the total population-weighted average travel time. We repeated this process for five sociodemographic groups: (1) Overall (ie, adults aged 15+), (2) black people, (3) Hispanic or Latino people, (4) white people and (5) people with incomes below the federal poverty line.

$$\sum_{1}^{n} \frac{subpop_{CBG}}{subpop_{state}} time_{policy}$$

We present travel times for the general population and by race, ethnicity and poverty status in the manuscript. For each type of travel time or per cent change within a given state, 95% CIs that do not overlap between the population subgroup and reference group are bolded. The online supplemental appendix provides travel times by age, as well as the results for driving distances for all subgroups.

RESULTS

Tobacco retailer and alcohol state store densities (retailers per square mile) were highest in PA, a tobacco-producing and populous state (table 1). The average per cent of residents in a CBG who were black ranged from 0.44% in MT to 31.17% in AL. CBGs in six states—ID, MT, NH, OR, UT and VT—had on average less than 2% of the population who was black. There was also a wide range in the average CBG-level per cent Hispanic or Latino across states, ranging from 1.87% in VT to 13.80% in UT. On average, 8.45% (NH) to 19.15% (AL) of the CBG populations had incomes below the federal poverty line.

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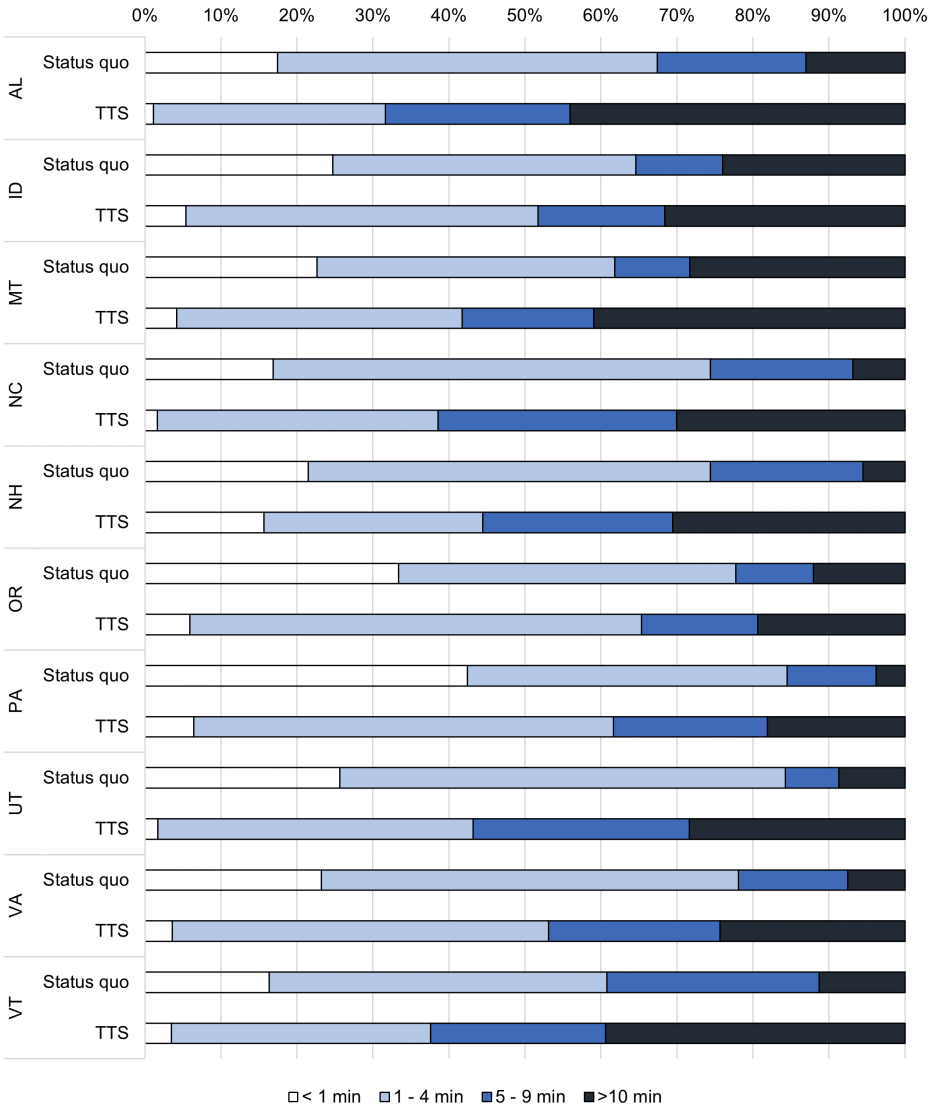

Figure 1 Distribution of travel times to the nearest tobacco retailer in status quo and the transitioning tobacco sales policy counterfactual. Figure 1 is a stacked bar chart that shows the per cent of census block groups that, on average, have travel times less than 1 min, 1–4 min, 5–9 min and 10 min or more travel to the nearest tobacco retailer. There are two bars for each state: The top bar, labelled 'status quo', summarises the current distribution of travel times, and the bottom bar, labelled 'TTS', displays the travel times that would exist if tobacco sales were transitioned to state alcohol stores. In general, more census block groups have shorter travel times under the status quo, indicated by longer white (<1 min) and light blue (1–4 min) bars, while more census block groups have longer travel times under the TTS scenario, indicated by longer dark blue (5–9 min) and dark navy (10+ min) bars. AL, Alabama; ID, Idaho; MT, Montana; NC, North Carolina; NH, New Hampshire; OR, Oregon; PA, Pennsylvania; TTS, transitioning tobacco sales; UT, Utah; VA, Virginia; VT, Vermont.

Travel times for the general population

Under the status quo in 2020, population-weighted travel times to the nearest tobacco retailer for all persons aged 15+ years ranged from 2.75 min in PA to 10.30 min in ID (table 2). Implementing the TTS policy would lengthen travel times by anywhere between 2.38 min in PA to 9.70 min in UT. When accounting for the baseline travel time and the difference after implementing the TTS policy, travel times would increase between 29.61% (ID) and 231.50% (UT).

Under the status quo, more than three out of every five persons aged 15+ years lived less than 5 min from the nearest tobacco retailer (figure 1). Three-quarters of this population lived within 5 min of the nearest tobacco retailer in four states: OR, PA, UT and VA. If the TTS policy were implemented, the proportion of adults aged 15+ who live less than 5 min from the nearest tobacco retailer would fall to less than 50% in five states: AL, MT, NC, UT and VT. Across the 10 states, 13.1 million fewer adults aged 15+ would live within 1 min of the closest tobacco retailer if the TTS policy were implemented.

Travel times by race and ethnicity

Under the status quo, there was a disparity in travel times such that black people lived closer to the nearest tobacco retailer than white people in every state except MT, which had a small percentage of the population who was black at the CBG level (table 3). This was evidenced by 95% CIs that did not overlap under the status quo, showing travel times were longer for historically marginalised racial groups than for white people. The per cent change in travel times was greater for black people

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Table 3 Change in travel time (in minutes) to the nearest tobacco retailer between status quo and the transitioning tobacco sales policy counterfactual by race and ethnicity

				Transitioning tobacco sales policy			
		Baseline		Total travel time		Per cent change	
State	Racial or ethnic group*	Time	95% CI	Time	95% CI	%	95% CI
AL	Black	**3.80**	**3.55, 4.04**	**9.71**	**9.16, 10.25**	**155.53**	**153.71, 158.03**
	Hispanic or Latino	**3.76**	**3.37, 4.15**	**10.15**	**9.28, 11.01**	**169.95**	**165.30, 175.37**
	White	5.12	4.90, 5.35	14.46	13.88, 15.04	182.42	181.12, 183.27
ID	Black	**4.72**	**3.22, 6.21**	**7.14**	**5.13, 9.15**	**51.27**	**47.34, 59.32**
	Hispanic or Latino	8.07	5.59, 10.55	11.49	8.47, 14.50	42.38	37.44, 51.52
	White	10.81	6.39, 15.23	13.82	9.30, 18.35	27.84	20.49, 45.54
MT	Black	7.60	2.77, 12.43	12.35	6.96, 17.75	62.50	42.80, 151.26
	Hispanic or Latino	7.36	6.06, 8.65	14.03	11.95, 16.11	**90.63**	**86.24, 97.19**
	White	9.26	8.28, 10.23	16.43	14.89, 17.97	77.43	75.66, 78.74
NC	Black	**3.06**	**2.93, 3.19**	**7.00**	**6.73, 7.27**	**128.76**	**127.90, 129.69**
	Hispanic or Latino	**3.23**	**3.07, 3.38**	**7.59**	**7.25, 7.92**	**134.98**	**134.32, 136.16**
	White	4.30	4.15, 4.46	9.57	9.25, 9.90	122.56	121.97, 122.89
NH	Black	**2.21**	**1.67, 2.75**	**5.87**	**4.87, 6.88**	165.61	150.18, 191.62
	Hispanic or Latino	**2.48**	**1.96, 3.00**	**6.31**	**5.30, 7.31**	154.44	143.67, 170.41
	White	4.25	3.46, 5.03	10.05	9.08, 11.02	136.47	119.09, 162.43
OR	Black	**2.32**	**1.78, 2.86**	**4.16**	**3.33, 4.99**	**79.31**	**74.48, 87.08**
	Hispanic or Latino	**2.97**	**2.64, 3.30**	**5.17**	**4.71, 5.62**	**74.07**	**70.30, 78.41**
	White	4.59	4.24, 4.95	7.06	6.63, 7.48	53.81	51.11, 56.37
PA	Black	**1.16**	**1.04, 1.28**	**3.19**	**3.00, 3.37**	**175.00**	**163.28, 188.46**
	Hispanic or Latino	**1.55**	**1.45, 1.64**	**4.04**	**3.85, 4.23**	**160.65**	**157.93, 165.52**
	White	3.13	3.04, 3.23	7.06	6.88, 7.24	125.56	124.15, 126.32
UT	Black	**2.68**	**2.11, 3.24**	**7.93**	**6.44, 9.43**	**195.90**	**191.05, 205.21**
	Hispanic or Latino	**3.04**	**2.67, 3.42**	**9.90**	**8.75, 11.05**	225.66	223.10, 227.72
	White	4.42	3.93, 4.92	14.67	13.37, 15.97	231.90	224.59, 238.42
VA	Black	**2.72**	**2.56, 2.88**	**6.33**	**6.01, 6.64**	**132.72**	**130.56, 134.77**
	Hispanic or Latino	**2.36**	**2.22, 2.51**	**5.11**	**4.86, 5.36**	116.53	113.55, 118.92
	White	4.26	3.97, 4.55	9.13	8.68, 9.59	114.32	110.77, 118.64
VT	Black	**2.64**	**2.09, 3.19**	**5.89**	**4.50, 7.27**	**123.11**	**115.31, 127.90**
	Hispanic or Latino	3.98	3.34, 4.63	7.66	6.61, 8.70	92.46	87.90, 97.90
	White	4.73	4.33, 5.13	9.40	8.69, 10.11	98.73	97.08, 100.69

Bolding indicates that the 95% CIs in the population subgroup do not overlap with the reference group (white people). Race and ethnicity were measured as the per cent of residents in a census block group who identified as a given racial or ethnic group.
*White people are the reference group.
AL, Alabama; ID, Idaho; MT, Montana; NC, North Carolina; NH, New Hampshire; OR, Oregon; PA, Pennsylvania; UT, Utah; VA, Virginia; VT, Vermont.

(vs white people) in six of the eight states that had such a disparity: ID, NC, OR, PA, VA and VT. However, these pro-equity impacts were insufficient to eliminate the disparity in the travel times between black and white populations under the TTS counterfactual, as black populations still had shorter average travel times and the 95% CIs did not overlap. In other words, the larger percentage increases narrowed the gap in black-white accessibility to tobacco retailers, but it did not eliminate it. The per cent change was smaller for black people (vs white) in AL and UT; there was no difference in this per cent change in NH. Travel times were similar for black and white populations in MT under the status quo, and there was no difference in the per cent change in travel times under the TTS counterfactual in that state.

On average and compared with white people, Hispanic or Latino people had shorter travel times under the status quo in seven states: AL, NC, NH, OR, PA, UT and VA. The per cent change in travel time to the nearest tobacco retailer was greater for Hispanic or Latino (vs white) people in four states: MT, NC, OR and PA. This per cent change was smaller in AL. Similar to the results for black people, the larger percentage increases in travel time under the TTS counterfactual for Hispanic or Latino people were insufficient to eliminate the disparities.

Travel times by poverty status

People who have incomes below the federal poverty line had shorter status quo travel times than those with incomes at/above the federal poverty line in NC, PA and VT (table 4). However, the per cent increase in travel times was larger for those with incomes below (vs at/above) the federal poverty line in seven states (all states except ID, NH and OR).

Supplemental analyses

The travel times to the nearest tobacco retailer were similar for youth and adults under the status quo and TTS counterfactual in all states except AL (online supplemental table S-1). In AL, youth ages 15–20 lived closer to tobacco retailers, on average, than adults during the status quo. The percentage increase in travel time was greater for youth than adults in four states (NC, NH, UT and VT). Results for driving distance mirrored those for

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Table 4 Change in the travel time to the nearest tobacco retailer between status quo and the transitioning tobacco sales policy counterfactual by poverty status

				Transitioning tobacco sales policy			
		Baseline		Total travel time		Per cent change	
State	Poverty level	Time	95% CI	Time	95% CI	%	95% CI
AL	Below	4.38	4.17, 4.59	12.63	12.09, 13.18	**188.36**	**187.15, 189.93**
	At/above	4.77	4.58, 4.97	13.11	12.64, 13.58	174.84	173.24, 175.11
ID	Below	8.67	6.64, 10.70	11.20	9.05, 13.36	29.18	24.86, 36.30
	At/above	10.51	6.37, 14.66	13.67	9.40, 17.95	30.07	22.44, 47.57
MT	Below	8.26	7.14, 9.38	16.64	14.39, 18.88	**101.45**	**101.28, 101.54**
	At/above	9.33	8.31, 10.26	16.71	15.21, 18.21	79.10	77.49, 83.03
NC	Below	**3.57**	**3.44, 3.70**	**8.27**	**8.00, 8.53**	**131.65**	**130.54, 132.56**
	At/above	3.96	3.84, 4.09	8.87	8.61, 9.12	123.99	122.98, 124.22
NH	Below	3.53	2.84, 4.23	8.68	7.69, 9.67	145.89	128.61, 170.77
	At/above	4.14	3.67, 4.61	10.07	9.05, 11.08	143.24	140.35, 146.59
OR	Below	3.68	3.38, 3.98	5.93	5.56, 6.30	61.14	58.29, 64.50
	At/above	4.22	3.92, 4.52	6.60	6.25, 6.96	56.40	53.98, 59.44
PA	Below	**1.97**	**1.90, 2.04**	**5.13**	**4.98, 5.27**	**160.41**	**158.33, 162.11**
	At/above	2.85	2.77, 2.93	6.47	6.32, 6.63	127.02	126.28, 128.16
UT	Below	3.76	3.17, 4.34	15.16	12.73, 17.59	**303.19**	**301.58, 305.30**
	At/above	4.12	3.71, 4.53	13.65	12.53, 14.77	231.31	226.05, 236.93
VA	Below	3.43	3.20, 3.67	8.26	7.78, 8.74	**140.82**	**138.15, 143.13**
	At/above	3.66	3.44, 3.88	7.81	7.49, 8.14	113.39	109.79, 117.73
VT	Below	**3.93**	**3.52, 4.33**	**8.00**	**7.22, 8.79**	**103.56**	**103.00, 105.11**
	At/above	4.83	4.41, 5.25	9.60	8.86, 10.34	98.76	96.95, 100.91

Bolding indicates that the 95% CIs do not overlap for those with incomes below versus above the federal poverty level. Poverty status measured as the per cent of families in a census block group who were below or at/above the federal poverty line. The federal poverty line is consistent across all US states.
AL, Alabama; ID, Idaho; MT, Montana; NC, North Carolina; NH, New Hampshire; OR, Oregon; PA, Pennsylvania; UT, Utah; VA, Virginia; VT, Vermont.

driving times (online supplemental tables S-2–S-5). On average, implementing a TTS policy in the 10 states would increase the driving distance to the nearest tobacco retailer by 3.0 miles.

DISCUSSION

We estimated increases in driving time associated with a TTS approach using 10 states with an alcohol retail monopoly as an example, characterising changes overall and by race, ethnicity, poverty status and age. On average, TTS would more than double the travel time to the nearest tobacco retailer, resulting in a mean 119% increase in driving time. This translated to an average of 5.4 more min between residents' homes and the nearest tobacco retailer. In most states, the increases in travel time were larger for populations who have been historically targeted by the tobacco industry, namely black people and those with incomes below the federal poverty line.

We found pro-equity effects for at least one historically marginalised racial, ethnic or socioeconomic group in all states. There were larger increases in travel times for black, Hispanic and/or Latino people (vs white people) in eight states and greater percentage increases for those with incomes below (vs at/above) the federal poverty line in seven states. This patterning suggests TTS may be a first step in counteracting the overexposure of historically marginalised populations to tobacco retailers.[22 23] However, these increases were insufficient to offset existing disparities. Ultimately, the ability of a TTS strategy to eliminate disparities in the tobacco retail environment hinges on the spatial distribution of the state-controlled stores. States ought to ensure such stores are not disproportionately located in disinvested communities or communities of colour. Evaluating potential quantitative impacts across subpopulations was a focal point and strength of the current analysis. However, we encourage jurisdictions that may consider implementing TTS to conduct a complementary qualitative racial equity impact assessment to examine whether there are aspects of the TTS policy that could have unintended consequences for historically marginalised or disinvested communities and ways to mitigate any such effects.

By estimating changes in travel time associated with a TTS approach, this study builds on a growing literature that prospectively evaluates the potential effects of tobacco retail policies. These studies allow stakeholders to begin to compare potential effects of retailer reduction policies, such as establishing maximum density thresholds for the number of tobacco retailers or minimum distance requirements between tobacco retailers. The effectiveness of maximum density thresholds depends on not only limiting new stores from opening but also on a natural decline in the number of stores each year as stores that were grandfathered by the policy (ie, those allowed to stay despite contributing to densities in excess of the new limit) close. Approximately 7% of US tobacco retailers close annually,[8] a relatively small change each year that would accrue over time. A New Zealand modelling study found moderate reductions in the number of tobacco retailers associated with establishing a 150 m, 300 m and 450 m distance requirement (reductions of 35%, 49% and 58%, respectively, in the number of retailers).[24] A US-based study found a slightly smaller effect size, concluding a 500 ft (152 m) distance requirement was associated with a 22% decrease in tobacco retailers.[25] Comparatively, the TTS strategy presented here would achieve a dramatic 95% reduction in the number of tobacco retailers. This type of substantial decrease in tobacco retailers may achieve a 5% reduction in smoking prevalence 3 years earlier than maintaining the status quo, while

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narrowing disparities in the process.[26] Such declines could reduce the tobacco burden, as models of an NZ policy similar to TTS showed it would preserve 129 000 quality-adjusted life-years and avert NZ$1.8 billion (US$1.1 billion) in healthcare costs.[13]

The TTS approach offers strengths in addition to its potential effectiveness and equity impacts. Reducing tobacco accessibility raises the indirect (convenience) costs of tobacco purchases and, consequently, the total price. A New Zealand study that modelled a policy similar to TTS estimated it would raise pack prices from NZ$15 to NZ$51 (rural) and NZ$23 (urban).[13] Combining our results and the US Internal Revenue Service standard mileage rate (US$0.655/mile) suggests the TTS policy would add, on average, a US$2.00 convenience cost to each tobacco purchase. Finally, TTS would provide policy proportionality for tobacco. Currently, 17 states have an alcohol monopoly, and several states are considering a similar structure to regulate cannabis sales. Selling tobacco in state-controlled stores would send the message that tobacco is a dangerous product.[27]

Still, the TTS strategy may yield unanticipated negative consequences and face feasibility challenges and resistance. Specifically, the TTS strategy implemented in state alcohol stores may result in a potential increased risk of relapse to drinking among people with a history of alcohol problems who smoke, as they would be unable to purchase tobacco products without entering an alcohol retailer.[9] Implementing TTS would be most feasible in states with an existing alcohol (or perhaps newly adopted cannabis) monopoly, which would limit this approach to 17 states as of 2025. Integrating a new product into an established monopoly presents hurdles for regulators, such as the need for additional storage space. Designing and implementing a tobacco monopoly would require a broad coalition of well-organised supporters because such efforts would likely face substantial industry interference, as indicated by alcohol industry pressures to privatise the existing alcohol monopolies.[28 29]

Limitations

Our tobacco retailer lists comprised businesses likely to sell tobacco and may have included some retailers that did not sell tobacco or missed other retailers that sold tobacco. It was not possible to validate each retailer's tobacco sales policy given that our analysis included 10 states. Driving time estimates only account for travel by private car; they do not estimate travel times by walking or public transit. However, our travel time calculations more directly model convenience by accounting for travel speed and address a key gap, as such measures are scarce in the tobacco retail literature.[30] In addition, we provided results using travel distances, allowing consideration for other travel modalities. There are also disparities in tobacco use rates[31] and exposure to tobacco retailers[32] by sexual orientation and gender identity. However, population data for these subgroups were unavailable for the present analysis, so we were unfortunately unable to assess impacts for sexual and gender minority populations.

CONCLUSIONS

This study aimed to determine how a TTS approach could affect driving travel times to tobacco retailers, overall and for key subpopulations. Our findings suggest a TTS policy would have considerable effects on tobacco accessibility, increasing travel times to tobacco retailers by over 100% on average. Black and Hispanic or Latino populations, as well as those living below the federal poverty line, would face more substantial increases in travel times compared with white and higher-income groups, potentially narrowing, but not eliminating, existing disparities. The TTS strategy could be a powerful tool in reducing tobacco availability, but its equity impacts will depend heavily on the existing distribution of state-controlled stores.

Contributors LH, WK, KJK-J and NS made substantial contributions to the conception and design of the study and secured grant funding. NS and DP acquired and managed the data. PJT conducted the analysis, drafted the manuscript and revised it critically for important intellectual content. PJT is the guarantor. All authors contributed to the interpretation of the data, reviewed the manuscript and provided substantive revisions. All authors approved the final version and agree to be accountable for all aspects of the work.

Funding This work was supported by R01CA229238 (PI Malone) from the National Cancer Institute. The content is solely the responsibility of the authors and does not necessarily represent the official view of the National Cancer Institute or the National Institutes of Health.

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Competing interests PJT, DP and WK have received research and/or travel support from the National Alcohol Beverage Control Association for work unrelated to this manuscript.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available.

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