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Assessment of the US Federal Retailer Violation Rate as an Estimate of the Proportion of Retailers That Illegally Sell Tobacco to Adolescents

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Key Points

Question

Are retailers that sell tobacco to adolescents as uncommon as government surveys find?

Findings

In this survey study of 201 retailers, repeated tests of a population-level retail sample found that most retailers sold tobacco to minors at least once, while a mean of 18% of retailers sold in a single round of tests. Faulty examination of identification contributed to most violations.

Meaning

Government surveys underestimate the proportion of retailers that sell tobacco to minors, and improved survey methods can reduce this bias.

Abstract

Importance

Despite progress against tobacco sales to minors, retailers continue to violate state and federal laws and supply adolescent smokers with tobacco products. Government-sanctioned surveys underestimate the extent of the problem, and retailer associations use these data to block stricter enforcement policies.

Objectives

To assess the validity of the US federal retailer violation rate (RVR) as an estimate of the proportion of retailers that sell tobacco to minors and to investigate what proportion always or almost always sells vs refuses to sell cigarettes to minors.

Design, Setting, and Participants

This survey study was conducted October 6, 2012, to September 8, 2013; data were analyzed between September 28, 2017, and March 21, 2018. The setting was a suburban county adjacent to Denver, Colorado. Participants were a systematically selected, population-based cluster sample of retailers that stock cigarettes for sale. Retailers were masked to the survey.

Main Outcomes and Measures

Each retailer was visited 6 times by supervised minors who attempted to purchase cigarettes at each visit. The main outcome was whether cigarettes were sold. Other measures included whether government-issued photo identification (ID) was requested as required by law, how ID was examined, and what the demographic characteristics of study minors and clerks were.

Results

The sample of 201 retailers (44.8% of the 449 listed population) included convenience stores (n = 77), liquor stores (n = 63), grocery stores/supermarkets (n = 33), pharmacies (n = 17), tobacco stores (n = 7), and stand-alone gas stations (n = 4). Bars, clubs, and adult establishments were excluded. A total of 1181 purchase attempts were analyzed; 25 (2.1%) were excluded for missing data. The mean RVR across 6 rounds of checks was 18.0% (95% CI, 14.7%-21.2%) and ranged from 13.7% to 28.0% per round. Most retailers (54.7% [110 of 201]) violated at least once in 6 visits, 26.4% (53 of 201) violated at least twice, and 11.9% (24 of 201) violated half or more times. How retailers examined proof of age largely determined whether violations occurred.

Conclusions and Relevance

The proportion of retailers that sold cigarettes to a minor at least once in 6 attempts was 3 times higher than the mean RVR based on a single inspection per retailer. Larger replication studies are needed. Enforcement protocols should reflect the fact that each retailer does not respond consistently when adolescents try to buy tobacco products, and many retailers are not properly validating ID that shows proof of age.

Introduction

United States retailers cannot legally sell tobacco products to customers younger than 18 years¹ (19 years or 21 years in some jurisdictions^{2,3}). States monitor retailer compliance using federally defined “annual, random unannounced inspections” (compliance checks)⁴ at which supervised minors try to buy cigarettes from a sample of stores. The rate of sales is known as the retailer violation rate (RVR); an RVR exceeding 20% jeopardizes the state’s federal block grant funds for substance abuse prevention and treatment.

When RVR measurement began in the mid-1990s,⁵ the national rate was 40.1%; earlier studies^{6,7,8,9} found even higher violation rates of 60% to 80%. Pioneering local efforts in the 1980s showed that underage tobacco sales could be reduced through enforcement^{10,11,12} and led to legislation requiring states to reduce illegal sales of tobacco to minors. Since 2006, the national RVR has held steady at a mean of 9.8% (range, 8.5%-10.9%).¹³ A recent national study¹⁴ found state-level decreases in the RVR associated with declines in adolescent smoking prevalence. Three decades of research, policy, and enforcement have helped reduce retail tobacco sales to adolescents and decreased teen smoking.

Capitalizing on this progress, retailer associations have recently invoked RVRs in legislative debates to claim that more than 90% of retailers comply with the law, arguing that underage tobacco sales are adequately controlled and that licensing of tobacco retailers is unnecessary.^{15,16} This interpretation of the RVR—that it estimates the prevalence of stores that sell tobacco to minors—is unevaluated and requires the strong assumption that each tobacco retailer handles underage attempts to buy tobacco consistently. However, 2 studies^{17,18} found retailers responding inconsistently to repeated compliance checks. In one study,¹⁷ minors requested cigarettes from the same stores at 2 separate visits; in the other study,¹⁸ minors asked for cigarettes once and vaping products once at the same stores. In each study, RVRs were similar in each single round of checks but were roughly 50% higher when counting a violation in either of the 2 checks per retailer.

Considerable evidence suggests that the RVR underrepresents underage retail tobacco access. Compliance check outcomes depend on characteristics of the minor and retail clerk, circumstances surrounding the transaction, socioeconomic and racial/ethnic composition of the neighborhood, and the degree to which minors look and act like genuine underage smokers.¹⁹ A consistent balance of males and females can help reduce RVR variability between years, and underestimation bias can be reduced by relying on older minors.²⁰ Frequency of enforcement also matters. In a 1996 study,²¹ bimonthly enforcement reduced violations from 86% to 19%, while enforcement every 6 months reduced violations from 87% to only 42%.

However, realistic teen smoker behaviors increase the likelihood of an underage tobacco sale^{18,22,23,24} and are usually disallowed in compliance checks. These behaviors include trying to look older, claiming that the cigarettes are for a parent, lying about age, becoming a “familiar customer” through visits to buy other items before attempting to buy cigarettes, buying another item (eg, soda) as a “foot in the tobacco door,”²⁵ or suggesting legal age by flashing real photo identification (ID) and hoping that it will not be carefully examined. Research has found that these manipulative behaviors, other than presenting ID, are effective only when stores fail to ask for ID.²⁵

Presentation and examination of ID have major roles in the outcome of an underage tobacco purchase attempt. In a 1996 study,²¹ underage cigarette sales were zero when merchants asked for ID but were 100% when they did not. In a 2002 study,²⁶ age and ID questions were the most significant deterrents of illegal tobacco sales to minors. In studies^{20,21,22} in which minors are allowed to show ID when asked, sales violations are 4 to 6 times more likely than when no ID is shown even though the ID reveals that the customer is too young to be sold cigarettes.

To further examine RVR underestimation and within-retailer reliability of underage tobacco sales, we conducted repeated compliance checks on a sample of tobacco retailers. The objective was to estimate the proportion of retailers that always or almost always sells cigarettes to adolescents and the proportion that always or almost always refuses to sell. We sought to investigate whether the RVR based on a single compliance check validly estimates the prevalence of retailers that sell tobacco to minors.

Methods

Study Design

Colorado's list frame for federally required compliance checks was sorted by zip code and systematically cluster-sampled in a suburban county (Jefferson County) adjacent to Denver, Colorado (4 retailers per cluster). The sample (N = 201) included retailers in 9 cities and towns, comprised 44.8% of the 449 listed population of the county's tobacco retailers, and was composed of the following: convenience stores with or without gasoline (n = 77), liquor stores (n = 63), grocery stores/supermarkets (n = 33), pharmacies (n = 17), tobacco stores (n = 7), and stand-alone gas stations (n = 4). Bars, clubs, and adult establishments were excluded. The institutional review board waived review and informed consent because no individual participant information was collected.

A former deputy sheriff recruited minors from her church, trained them in study protocols, drove them to retailers, managed cash and cigarettes, and recorded data. Minors (n = 17) included 7 boys and 10 girls aged 15 to 16 years, all of non-Hispanic white race/ethnicity. Each provided written parental approval, and all were good students (mostly A and B grades), nonsmokers perceived as not susceptible to smoking, and free of visible tattoos and piercings. These behavioral and appearance criteria match the government compliance check standards that trigger the legal requirement of requiring ID from underage-looking tobacco customers. Minors entered retailers in pairs and could bring a snack or beverage to the counter, where 1 minor asked for a package of cigarettes by brand name of their choice. If a clerk asked for age or ID, the minors could choose between answering honestly, responding evasively or lying, or showing valid ID with their correct date of birth. Transaction data included (1) whether the clerk requested age and/or ID, (2) what the minor's response was, (3) how the clerk handled ID if presented (verified electronically, compared with age calendar, looked at briefly, looked at carefully, or other), and (4) outcome (sale or refusal). Data were collected October 6, 2012, to September 8, 2013; data were analyzed between September 28, 2017, and March 21, 2018.

Retailers were visited on 6 occasions, each time by a different minor unless schedules and availability necessitated having the same minor revisit a retailer. To maintain retailer masking to the survey, no notification or summons was issued for violations. Checks were aborted for a retailer if a minor was warned not to come back or if the clerk threatened to call police or confiscate the minor's ID (occurring at 9 liquor stores and 3 tobacco stores [21 visits]). Missing outcomes for these visits were coded as nonviolations and included in the analysis. An additional 25 compliance checks were not attempted for various reasons (eg, a police officer was on the premises or the minor's familiar brand was unavailable) and were excluded from analysis. The analytic data set included 1181 observations (97.9% of 1206 planned).

Statistical Analysis

Analysis used statistical software (Stata, version 13.1; StataCorp LP). We calculated separate RVRs for each round of visits, the incremental increase in the RVR at each round, and the proportions of new and repeat violators between each proximal pair of visits. We also calculated an overall mean RVR and 95% CI for all visits combined using the `svy` command in Stata, which calculates a robust estimate of variance (first-order Taylor series linearization method²⁷) to account for correlated visits within a retailer.

We fitted a generalized multivariable linear model with a logit link function using the 6 repeated binary measurements of visits as the outcome, coded as 1 if a violation occurred and as 0 otherwise. We treated retailers as independent variables and assumed equal variance between retailers and equal correlation within retailers. This is a compound symmetric variance structure, equivalent to using retailer as a random effect. We individually assessed correlation of the following predictors of sale: (1) minor sex, age, and coded identity to represent unmeasured characteristics, such as appearance, presentation style, and self-confidence; (2) clerk sex, age range (<30, 30-50, or >50 years), and race/ethnicity and whether the minor was asked to show ID,

whether the minor showed ID, and how the clerk looked at the ID (verified electronically, compared with age calendar, looked at briefly, looked at carefully, or other); (3) type of retailer; (4) visit number; (5) multiple visits to a retailer by the same minor; and (6) the day of the week and month and the time (in weeks) between visits. Significantly correlated variables were included as predictors in the generalized multivariable linear model. Based on modeling results, we further analyzed clerk behaviors that were strongly associated with sales violations. We also reran the model with the exclusion of second visits to a retailer by the same minor (145 of 1181 nonmissing visits [12.3%]) to assess the sensitivity of the results to data that violated an assumption of independent minors within retailers. The results were essentially unchanged, and we report the findings based on the complete data.

Finally, we used Monte Carlo approximate bootstrap resampling²⁸ (10 000 replications) in a software program (SAS, version 9.4; SAS Institute Inc) and a “confidence picture” approach by Hall²⁹ to compare graphic distributions of uncertainty around RVR estimates based on 1 to 5 visits per retailer. The bootstrapping approach is informative when the theoretical distribution of a variable is unknown (in the present case, retailer-level RVR for genuine underage tobacco purchase attempts). Visits with missing outcome data (25 of 1206 [2.1%]) were coded as 0 (no sale) to keep the number of retailers constant across resampling replicates. A 2-sided nonparametric 95% CI was computed for each panel of the confidence picture.

Results

The mean RVR across 6 rounds of checks was 18.0% (95% CI, 14.7%-21.2%); RVRs ranged from 13.7% to 28.0% per round. The first-round RVR was significantly higher than each other RVR and the others combined (28.0% vs 15.9%, $P < .001$); RVRs for rounds 2 through 6 were statistically indistinguishable. Most retailers (54.7% [110 of 201]) violated at least 1 compliance check in 6 visits. More than one-fourth (26.4% [53 of 201]) of retailers violated at least twice, and 11.9% (24 of 201) violated half or more times ([Table 1](#)).

After the first round of compliance checks, each sequential round identified a mean 5.5% (range, 3.1%-8.6%) of newly violating retailers. Between each proximal pair of visits, initial compliance was followed by a violation 11.0% (range, 9.7%-12.4%) of the time, and initial violation was followed by another violation 36.8% (range, 31.0%-44.4%) of the time.

Clerks asked for ID in 1094 (92.6%) of completed visits, and minors showed ID in all but 2 visits. Three-fourths (150 [74.6%]) of retailers requested IDs at every visit ([Table 1](#)); 3 of 201 (1.5%) retailers failed to request ID in two-thirds or more visits. Electronic systems were the most common method of examining IDs ([Table 2](#)); a brief look or a glance was second most common. Among 100 retailers that ever used an electronic system, 66 used it at least two-thirds of the time, and 21 used it every time. In almost two-thirds (133 [66.2%]) of all retailers, including 55 (55.0%) retailers that ever used electronic systems, clerks sometimes gave the ID only a brief look. Almost one-fifth (39 [19.4%]) of retailers relied on brief looks half or more times.

In regression modeling, nonsignificant bivariate factors included minor sex, age, and coded identity; clerk sex, age, and races/ethnicities except Asian; type of retailer; and day, month, and time between visits. The final model included first visit vs all others, same minor and same retailer visits, clerk of Asian race/ethnicity, whether the clerk asked for ID, and how ID was examined ([Table 3](#)).

Bootstrap-derived confidence pictures show 95% CIs shrinking as a progressively larger number of each retailer’s compliance check results is used to estimate the RVR. These results are shown in the [Figure](#).

Discussion

Our study of retailer compliance with age restrictions on cigarette sales found that more than half of stores sold at least once during the study to an underage customer. The results according to 6 checks per store show that RVRs based on single tests of retailers do not measure the prevalence of stores that sell tobacco to minors. A 10% RVR clearly does not mean that 90% of tobacco retailers obey the law, not even most of the time.

Only 24 retailers (11.9%) violated half the time or more often, and enforcement strategies might profitably focus on such persistently negligent retailers. Adolescent retail access to tobacco products remains a problem. While underage smoker reliance on retail tobacco sales from 2001 to 2015 declined slightly,³⁰ a mean of 16.1% (range, 12.6%-19.1%) of US high school current smokers reported retailers as their usual sources.

As in previous studies,^{20,21,22,26} the most decisive factor in unlawful sales was how retailers handled requirements for proof of age. Minors were challenged to show ID in 92.6% (1094 of 1181) of compliance checks, a vast improvement from 2 decades ago when, for example, a large California study³¹ found that minors were asked for age or ID only 17% of the time. In the present study, retailers that did not ask for ID were much more likely to break the law: almost three-fourths (64 of 87 [73.6%]) of visits at which ID was not requested resulted in a violation, accounting for almost one-third (64 of 212 [30.2%]) of all violations in the study. Based solely on transactions in which no ID was requested, the resultant RVR of 5.7% herein would align with Colorado's official RVR for the year in which study data were collected (8.3%; 95% CI, 5.7%-10.8%).³²

In the more than 90% (1094 of 1181) of compliance checks at which retailers requested ID in our study, minors responded by presenting an ID almost every time they were asked. Showing ID led to cigarettes being sold 13.5% (148 of 1094) of the time, usually after clerks just glanced at the IDs (approximately one-fourth of all ID presentation checks). Violations were more than 50 times more likely after glances than when clerks scanned IDs electronically.

Since 2010, the US Food and Drug Administration regulations require clerks to examine IDs of tobacco customers younger than 27 years,³³ and at least 21 states and the District of Columbia have similar laws.³⁴ Our study found high compliance with this requirement but observed a high rate of failure to examine IDs properly. Remedies seem straightforward. Tobacco retailers could be legally required to use electronic age verification for young-looking tobacco customers, although the present study and previous research³⁵ clearly show that the presence of an electronic age verification system does not ensure that it will be used consistently. Retailers must also train clerks on, require, and strictly enforce the use of such systems. Government-sponsored compliance checks, which usually do not let minors carry ID, should adapt to a retail environment in which young-looking tobacco customers are now usually asked for ID.

An unstudied question is how often genuine adolescent tobacco customers show ID when asked. In the present study, few retailers (12 of 201 [6.0%]) refused a purchase attempt sternly enough to dissuade the minors and supervisor from further purchase attempts. Casual examination of IDs happened nearly 23 times more often than stern refusals. For genuine underage customers, these results suggest that showing ID and trying a retailer more than once may be low-risk ways to obtain cigarettes. In 2015, retail-reliant underage smokers bought more than 27 million packs of cigarettes (A.H.L.; unpublished analysis of data from the Centers for Disease Control and Prevention at Adolescent and School Health: Youth Risk Behavior Surveillance System Data & Documentation; downloaded August 24, 2017). With an estimated 375 000 US tobacco retailers,³⁶ a 10% RVR means that 1 in 10 sells cigarettes to minors an average of twice a day. If a more realistic RVR is 20%, each retailer that violates does so daily and can hardly claim to be committing an occasional lapse. However, from a revenue perspective, these violations represent only 1% to 2% of the average retailer's cigarette sales; coming into compliance with tobacco sales laws would be virtually invisible to a retailer's bottom line.

Limitations

This study has some limitations. Our study was limited to retailers in a single US county, and larger replication studies are needed. The results may underestimate violation rates that occur when minors are not tattoo free, young looking, good students, nonsmokers, or of nonwhite race/ethnicity. Compliance checks were limited to cigarette sales; an earlier study²⁴ found similar RVRs for cigarettes and vaping products, but replication research is needed. New national guidelines are required for the product mix in RVR estimation given that smoking prevalence among adolescents has been declining, while vaping prevalence has increased.^{37,38,39}

Conclusions

The proportion of retailers that sold cigarettes to a minor at least once in 6 attempts was 3 times higher than the mean RVR based on a single inspection per retailer. The RVR clearly does not represent the proportion of retailers that sell cigarettes to minors. Requiring at least 2 visits per retailer would improve the reliability of the RVR as a store-level prevalence estimate. Compliance check protocols should be testing all elements of laws against selling tobacco to minors (ie, requesting ID from young-looking customers, determining age from ID, and not selling to underage adolescents). State and federal agencies need to recognize and address the fact that the proportion of retailers selling tobacco to minors is much higher than official estimates suggest. Teen cigarette smoking is dramatically lower today than 20 years ago, but the vaping epidemic has reversed much of the gain.⁴⁰ Adaptive enforcement protocols are urgently needed.

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Figures and Tables

Table 1.

How Many Retailers Committed Violations and How Often Retailers Requested Government-Issued Photo Identification (ID) in 6 Compliance Checks

Variable	Retailers, No. (%) (N = 201)
No. of Violations	
0	91 (45.3)
1	57 (28.4)
2	29 (14.4)
3	10 (5.0)
4	6 (3.0)
5	5 (2.5)
6	3 (1.5)
≥2	53 (26.4)
≥3	24 (11.9)
No. of ID Requests	
0	1 (0.5)
1	1 (0.5)
2	1 (0.5)
3	7 (3.5)
4	13 (6.5)
5	28 (13.9)
6	150 (74.6)

Table 2.

How the Age of Minors Was Determined From Government-Issued Photo Identification (ID)

ID Method	% (95% CI) of Purchase Attempts ^a	No. (%) of 201 Retailers Using ID Method 0-6 Times						
		0	1	2	3	4	5	6
Verified electronically	34.5 (29.3-40.1)	101 (50.2)	7 (3.5)	11 (5.5)	16 (8.0)	21 (10.4)	24 (11.9)	21 (10.4)
Looked at briefly	23.0 (19.9-26.3)	68 (33.8)	56 (27.9)	38 (18.9)	21 (10.4)	13 (6.5)	3 (1.5)	2 (1.0)
Other	17.6 (14.4-21.4)	100 (49.8)	45 (22.4)	22 (10.9)	17 (8.5)	6 (3.0)	7 (3.5)	4 (2.0)
Looked at carefully	15.8 (13.2-18.9)	104 (51.7)	44 (21.9)	29 (14.4)	14 (7.0)	7 (3.5)	3 (1.5)	0
Compared with age calendar	9.1 (7.1-11.7)	135 (67.2)	42 (20.9)	11 (5.5)	10 (5.0)	2 (1.0)	0	1 (0.5)

^aThe 95% CI uses a robust variance estimator for repeated measures within retailers.

Table 3.

Adjusted Odds Ratios (aORs) of Cigarette Sales to Minors

Variable	aOR (95% CI) ^a	P Value
Fixed Effects		
First visit vs all others		
First visit	2.50 (1.46-4.29)	.001
Other visit	1 [Reference]	NA
Same minor and same retailer visits		
Same minor checked retailer twice	2.00 (1.22-3.29)	.006
Different minor checked retailer each time	1 [Reference]	NA
Clerk of Asian race/ethnicity		
Asian race/ethnicity as reported by minor	0.17 (0.05-0.54)	.003
All other races/ethnicities	1 [Reference]	NA
Whether the clerk asked for ID		
Clerk did not ask for ID	130.63 (37.27-457.83)	<.001
Clerk asked for ID	1 [Reference]	NA
ID method		
Compared with age calendar	3.51 (1.05-11.68)	.04
Looked at briefly	51.54 (22.04-120.50)	<.001
Looked at carefully	2.49 (0.95-6.51)	.06
Other	2.28 (0.69-7.55)	.18
Verified electronically	1 [Reference]	NA
Random Effect for 201 Retailers and 1181 Observations^b Variance (95% CI)		
Variance of intercept	1.85 (0.99-3.46)	<.001 ^c

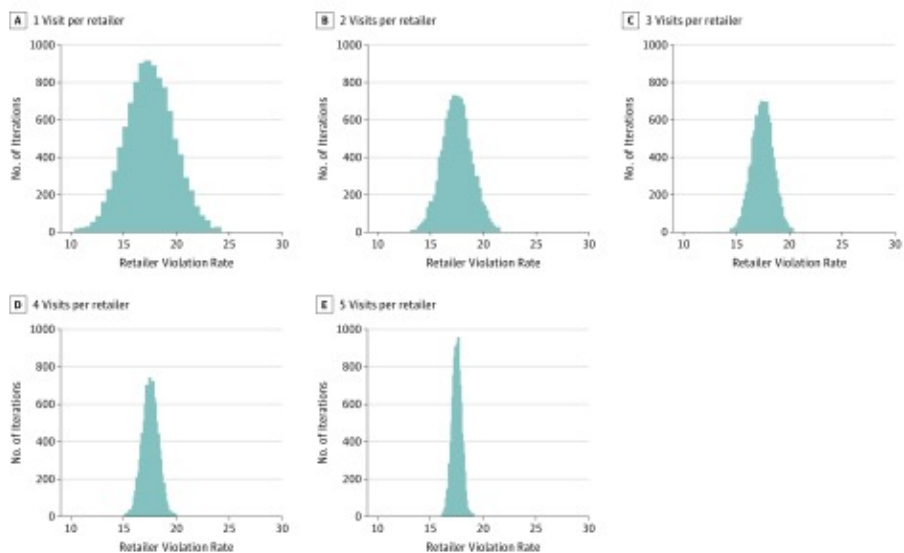
Abbreviations: ID, government-issued photo identification; NA, not applicable.

^aAdjusted for tabled covariates.

^bThe intraclass correlation coefficient was 0.36 (95% CI, 0.23-0.51).

^cLikelihood ratio test compared with ordinary logistic regression.

Figure.



Confidence Picture of Retailer Violation Rates Based on Resampling 1 to 5 Visits per Retailer

The retailer violation rates are 17.6 (95% CI, 13.4-21.9) (A), 17.6 (95% CI, 14.9-20.4) (B), 17.6 (95% CI, 15.8-19.4) (C), 17.6 (95% CI, 16.3-18.9) (D), and 17.6 (95% CI, 16.7-18.4) (E).