BRIEF REPORT

A Practical Way to Estimate Retail Tobacco Sales Violation Rates More Accurately

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ABSTRACT

Purpose: U.S. states annually estimate retailer propensity to sell adolescents cigarettes, a violation of law, by staging a single purchase attempt among a random sample of tobacco businesses. The accuracy of single-visit estimates is unknown. We examined this question using a novel test–retest protocol.

Method: Supervised minors attempted to purchase cigarettes at all retail tobacco businesses located in 3 Colorado counties. The attempts observed federal standards: Minors were aged 15–16, nonsmokers, and free of visible tattoos and piercings; and were allowed to enter stores alone or in pairs, to purchase a small item while asking for cigarettes and to show or not show genuine identification (ID, e.g., driver’s license). Unlike federal standards, stores received a second purchase attempt within a few days unless minors were firmly told not to return. Separate violation rates were calculated for first visits, second visits, and either visit.

Results: Eleven minors attempted to purchase cigarettes 1,079 times from 671 retail businesses. One sixth of first visits (16.8%) resulted in a violation; the rate was similar for second visits (15.7%). Considering either visit, 25.3% of businesses failed the test. Factors predictive of violation were whether clerks asked for ID, how closely they examined IDs, and whether minors included snacks or soft drinks in cigarette purchase attempts.

Conclusion: A test–retest protocol for estimating underage cigarette sales detected half again as many businesses in violation as the federally approved one-test protocol. Federal policy makers should consider using the test–retest protocol to increase accuracy and awareness of widespread adolescent access to cigarettes through retail businesses.

INTRODUCTION

Many countries, including the United States, prohibit tobacco product sales to children and adolescents. U.S. federal law requires states to estimate the proportion of retailers who sell tobacco to minors by having underage pseudocustomers attempt to purchase cigarettes from random samples of retail tobacco businesses (State law, 1992). The annual estimate produced by these compliance checks is known as the retailer violation rate (RVR) and triggers fiscal penalties to the state if it exceeds 20% of tested businesses (Department of Health and Human Services, 1996). Since the law was implemented in 1996, estimated RVRs have fallen from an average of 40.1% in 1997 to 8.5% in 2011 (Substance Abuse and Mental Health Services Administration, 2012). Adolescents report a different picture, however. In 2008, for example, the officially estimated RVR for Colorado was 11.0%, but in a statewide survey, 60.6% of high school minors who tried buy cigarettes at a retail business said their most recent attempt resulted in being sold cigarettes (Tobacco Program Evaluation Group, 2010). A simple explanation for the nearly fivefold discrepancy is that the two statistics represent different components of the underage cigarette sales problem: The RVR estimates the proportion of stores that will violate the law, while students report how often purchase attempts result in a violation (Levinson, 2004). Adolescent smokers can figure out and regularly patronize only those stores that will sell them cigarettes. The improved official RVR may indicate that fewer businesses violate cigarette sales laws, but the student reports indicate that retail access to cigarettes remains a major gateway to tobacco dependence.

The RVR has also been challenged as an inaccurate measure of what it purports to measure, that is, the proportion of retail businesses that sell tobacco to minors (DiFranza Savageau, & Bouchard, 2001). Concerns generally reflect the failure of the federally sanctioned compliance check protocol to simulate the appearance and behaviors of genuine underage cigarette customers (DiFranza et al., 2001; Klonoff & Landrine, 2004; Landrine & Klonoff, 2003; Levinson, 2004; Levinson, 2004).

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A practical way to estimate retail tobacco sales violation rates

Hendershott, & Byers, 2002); insufficient compliance check frequency to induce a deterrent effect (Jason, Billows, Schnopp-Wyatt, & King, 1996) and an absence of standards for age–sex distribution of youth who conduct compliance checks (DiPraenza & Dussault, 2005). With the exception of the last concern, these weaknesses point to underestimation bias: The standard protocol is too insensitive to detect all or most “regular” retail cigarette suppliers of underage smokers, yielding a high rate of false negatives and leading to excessive Type II error in the RVR. This study examines a way to reduce the likelihood of underage sales underestimation and discusses potential uses and limitations of the RVR.

A simple way to correct for test insensitivity is to conduct two tests, an approach often used in medical screening to avoid doing harm by acting on a false first result. Federal standards preclude the use of two different compliance check methods. However, conducting two standard compliance checks per business would improve RVR accuracy, even though each measurement has the same sensitivity on its own. We explored the use of this test–retest approach among a census sample of tobacco retailers in three Colorado counties.

METHODS

One urban, one suburban, and one resort county were selected for convenient travel distances, local prosecutors’ approval of the research, and sufficient numbers of businesses to provide acceptable margins of error (several hundred retailers). The counties represent 23.5% of Colorado’s population (Census Bureau, 2001). Retail tobacco businesses were identified from the list that Colorado investigators use to conduct federally required tobacco sales inspections; coverage studies have found the list contains 85% of all tobacco-selling businesses that are accessible to minors (Annual Synar Report, 2012). Business types include grocery chains and stores, gas stations, convenience stores, pharmacies, liquor stores, and tobacco specialty stores. For this study, research inspectors were also instructed to include any tobacco-selling business they found that was not already on the list.

The institution’s Institutional Review Board waived review of this type of research. Data were collected during 2011–2012. In two of the counties, a former deputy sheriff trained and supervised minors, whom she recruited through her church. In the third county, local police supervised the compliance checks. In all counties, participating minors were approved for the study by their parents, aged 15½ to 16 years old, good students (mostly “A” and “B” grades in school), nonsmokers, not perceived susceptible to smoking (no previous experimentation or other known risk factors, family and social support), free of tattoos and facial piercings, clean shaven (males) with minimal or no facial makeup (females), and dressed modestly but casually during study activities. Training included didactic discussion of study purposes, rules of participation, role-playing, and purchase attempt rehearsal. Minors were instructed not to claim a false age but had discretion over other behaviors: They could enter the business alone or with another minor on the team; answer the age question evasively (e.g., “I’m old enough”); bring a small snack or drink item to the counter to purchase along with cigarettes; visit a store a couple of times before attempting to buy cigarettes, and decide whether or not to show state-issued identification (ID) bearing their correct birth date. Minors asked for cigarettes by specific brand and style, such as Marlboro Reds.

Purchase attempts were conducted at all listed stores plus unlisted stores found while in the field. Most stores received two compliance check visits; reasons for not conducting a second visit included unequivocal rejection by the clerk (e.g., “Leave the store and never come back”), and sale of cigarettes on the first attempt under an earlier version of the protocol that required a second visit only to first-visit non-selling businesses. Multiple visits to a store were separated by at least a day and occurred at different times of day to increase the chance of being served by different clerks. Adult supervisors could choose to enter the store or remain outside during the purchase attempt. The purchase attempt was aborted if the supervisor decided the environment was unsafe, or if the minor felt uncomfortable or wanted to establish familiarity with the store before attempting to buy cigarettes. Violators were neither informed nor cited, to prevent communication within or between stores that could alert other clerks ahead of study visits.

Supervisors entered compliance check results immediately after each check, using a Microsoft® Excel spreadsheet formatted for the purpose. If a clerk asked a minor to leave the store before cigarette purchase was attempted, the visit was coded as a nonsale. When an ID was presented, the minor described how the clerk inspected it and the supervisor coded the description (“looked briefly,” “looked carefully,” “compared with an age calendar,” “electronic scan,” “other”). Data were cleaned and analyzed using SAS v.9.3 (SAS Institute). An RVR was calculated for first visits, second visits, and either visit. Multivariate logistic regression was used to identify transaction characteristics that significantly predicted tobacco sale as the outcome; 1.6% of compliance checks were excluded from the final model due to missing explanatory variables. Adjusted odds ratios were calculated taking into account clustered visits within businesses.

RESULTS

Between June 2011 and January 2012, four female and seven male minors attempted to purchase tobacco a total of 1,079 times from 671 retail businesses, an average of 1.61 attempts per business. Businesses had one (39.2%) or two (60.8%) compliance checks. On average, two visits to the same business were separated by 22.5 days (median = 20, SD= 19.6, inter-quartile range = 8–30). About two thirds of visits (65.1%) were conducted by a 16-year old, the others by a 15-year old.

The RVR for first visits was 16.8% and similar (15.7%) for second visits. Considering either visit, 25.3% of stores were in violation. The RVRs were similar by county, age, and gender of minor, and minor-estimated age and gender of clerk. In multiple logistic regression (Table 1), significant predictors of violation were buying a snack item when asking for cigarettes; clerk Hispanic ethnicity; not being asked for ID, and two ID-inspection behaviors (brief look, comparison with an age calendar).

DISCUSSION

In a pilot study of back-to-back compliance checks, 25.3% of businesses sold tobacco to minors. This RVR exceeds the U.S. standard for such inspections and was 51% higher than...
the first-visit rate (16.8%) that conformed to standard federal protocols. The finding casts new doubt on the meaning and validity of RVRs, which are used to determine eligibility for federal substance abuse prevention and treatment block grants, as well as to indicate the extent of underage tobacco access. Other results match those in previous studies: The odds of violation increased as minors gained experience with purchase attempts (DiFranza & Librett, 1999) and when clerks didn’t ask for ID (Glanz, Jarrette, Wilson, O’Riordan, & Jacob Wagenaar, & Hennrikus, 1998; Hinds, 1992; Jason, Ji, Anes, & Adams, 2008) and reduced tobacco supplies among youth (Levinson & Mickiewicz, 2006; Dent & Biglan, 2004; Forster, Murray, Wolfson, Blaine, Wagenaar, & Hennrikus, 1998; Hinds, 1992; Jason, Ji, Anes, & Birkhead, 1991; Jason, Pokorny, & Adams, 2008) and reduced tobacco supplies among youth (Levinson & Mickiewicz, 2007). These similarities support the possibility that the new findings may generalize, but replication studies are needed.

RVRs serve regulatory, research, and policy-making purposes. The first two purposes are somewhat obvious: Federal authorities use RVRs to qualify states for federal drug and alcohol prevention and treatment funding, and researchers use them to study youth smoking behaviors in relation to youth access to cigarettes. Less obvious but no less important is the role of RVRs in state and local policy debates. When tobacco sales legislation is proposed, tobacco lobbyists often publicize RVRs as “official proof” that cigarette sales to minors are not a problem, leaving tobacco control advocates to come up with contradictory evidence, or to bring up methodological limitations of RVRs that are too nuanced for public policy debate at state and local levels. Even if single-visit RVRs were good enough for federal funding decisions and research—and we do not believe they are—their “official” origin and systematic underestimation of the problem leave them open for abuse and unintended consequences.

In this study, sales violations were common after clerks inspected IDs briefly or appeared to compare them with age calendars. We suspect these results reflect pseudocompliant clerk behavior. Colorado law requires that clerks inspect a government-issued document with a photograph before selling cigarettes to a customer who looks younger than 30. Some clerks may merely go through the motions of diligence without reading the actual age on the ID. Such behavior lets them serve the customers while security cameras that typically monitor retail counters will show they “inspected” the ID.

A leading youth access researcher has identified a need to “determine the most efficient approach to using state and federal resources for enforcement” to prevent retail tobacco sales to minors (DiFranza, 2012). As far as we know, our study is the first to use sequential compliance checks for estimating the RVR, and it may improve RVR accuracy. Whether this approach is efficient and economical depends on how it is used. First, a two-visit protocol might seem to require doubling of resources, but time spent on compliance checks represents only a portion of the process; considerable time is devoted to writing tickets for violators and to traveling from offices to communities selected for inspection. Second, a multivisit protocol can help identify stores that make a habit of underage sales, enabling efficient concentration of resources on regular violators. Third, policies that allow penalty fines to be applied toward enforcement costs can help multivisit protocols pay for themselves. Taken together, these points also call into question the use of two visits rather than three or more. In a follow-up study, we are currently conducting up to six visits per store to learn how results affect the RVR and whether a point of diminishing information is reached.

The current findings are subject to limitations. Research was confined to a convenience sample of counties in a single state. The study design focused on detecting all businesses that violate tobacco sales law on either of two visits; the data could not be used to determine how consistently individual businesses do or do not comply with tobacco sales law. As previously mentioned, we are currently studying this question.

Many experimental and observational studies have found that reducing retail availability of tobacco is associated with lower smoking prevalence among youth (Chen & Forster, 2006; Dent & Biglan, 2004; Forster, Murray, Wolfson, Blaine, Wagenaar, & Hennrikus, 1998; Hinds, 1992; Jason, Ji, Anes, & Birkhead, 1991; Jason, Pokorny, & Adams, 2008) and reduced tobacco supplies among youth (Levinson & Mickiewicz, 2007). Some authors have argued that stricter youth tobacco

### Table 1. Multivariate Logistic Odds of an Underage Tobacco Sale, by Transaction Characteristics

<table>
<thead>
<tr>
<th>Purchase attempt n (%)</th>
<th>Adjusted odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total 1,079 (100%)</td>
<td>n/a</td>
</tr>
<tr>
<td>Clerk ethnicity</td>
<td></td>
</tr>
<tr>
<td>Asian 150 (14.0%)</td>
<td>0.84 (0.36–1.98)</td>
</tr>
<tr>
<td>Black 64 (6.0%)</td>
<td>1.24 (0.42–3.60)</td>
</tr>
<tr>
<td>Hispanic 87 (8.1%)</td>
<td>0.37 (0.16–0.84)</td>
</tr>
<tr>
<td>White 672 (62.6%)</td>
<td>Ref.</td>
</tr>
<tr>
<td>Other 100 (9.3%)</td>
<td>0.40 (0.15–1.07)</td>
</tr>
<tr>
<td>Snack purchased?</td>
<td></td>
</tr>
<tr>
<td>No 306 (28.5%)</td>
<td>2.50 (1.13–5.54)</td>
</tr>
<tr>
<td>Yes 768 (71.5%)</td>
<td>Ref.</td>
</tr>
<tr>
<td>ID presentation and examination</td>
<td></td>
</tr>
<tr>
<td>Not asked for ID 120 (11.2%)</td>
<td>555 (195–1576)</td>
</tr>
<tr>
<td>Asked, not shown 280 (26.2%)</td>
<td>2.30 (0.73–7.27)</td>
</tr>
<tr>
<td>Asked, examined briefly 96 (9.0%)</td>
<td>68.5 (25.1–187)</td>
</tr>
<tr>
<td>Asked, compared with age calendar 27 (2.5%)</td>
<td>8.01 (1.62–39.5)</td>
</tr>
<tr>
<td>Asked, examined carefully 393 (36.8%)</td>
<td>Ref.</td>
</tr>
<tr>
<td>Asked, other clerk behavior 151 (14.2%)</td>
<td>4.44 (1.41–14.0)</td>
</tr>
</tbody>
</table>

Note. CI = confidence interval; ID = identification.
*Adjusted for other variables shown in table.
access regulation and enforcement are needed (Chen & Forster, 2006; DiFranza & Dussault, 2005; Forster et al., 1998; Gemson et al., 1998). Our pilot evaluation of the test–retest protocol suggests that better surveillance is feasible.

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**DECLARATION OF INTERESTS**

None declared.

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**REFERENCES**


