The availability of electronic cigarettes in US retail outlets, 2012: results of two national studies

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ABSTRACT

Background Since their introduction in 2007, electronic cigarette ('e-cigarette') awareness and use has grown rapidly. Little is known about variation in e-cigarette availability across areas with different levels of tobacco taxes and smoke-free air policies. This paper looks at US retail availability of e-cigarettes and factors at the store, neighbourhood and policy levels associated with it.

Methods In-person store audit data collected in 2012 came from two national samples of tobacco retailers in the contiguous US. Study 1 collected data from a nationally representative sample of tobacco retailers (n=2165). Study 2 collected data from tobacco retailers located in school enrolment zones for nationally representative samples of 8th, 10th and 12th grade public school students (n=2526).

Results In 2012, e-cigarette retail availability was 34% in study 1 and 31% in study 2. Tobacco, pharmacy and gas/convenience stores were more likely to sell e-cigarettes than beer/wine/liquor stores. Retail availability of e-cigarettes was more likely in neighbourhoods with higher median household income (study 1), and lower percent of African–American (studies 1 and 2) and Hispanic residents (study 2). Price of traditional cigarettes was inversely related to e-cigarette availability. Stores in states with an American Lung Association Smoke-Free Air grade of F (study 1) or D (study 2) compared with A had increased likelihood of having e-cigarettes.

Conclusions Currently, e-cigarette availability appears more likely in areas with weak tax and smoke-free air policies. Given the substantial availability of e-cigarettes at tobacco retailers nationwide, states and localities should monitor the sales and marketing of e-cigarettes at point of sale (POS).

INTRODUCTION

Electronic cigarettes ('e-cigarettes') are nicotine delivery devices that heat a nicotine cartridge and allow users to inhale the vaporised liquid.[1] Consumer awareness and use of these products are increasing rapidly.[2 3] However, information on the availability and marketing of e-cigarettes in US retail stores is limited. When the product was introduced to the US market in 2007, many brands were sold over the internet, at mall kiosks and other small venues.[4] A 2010 survey of e-cigarette users found 96% bought e-cigarettes over the internet.[1] Currently, *tobacco retail outlets* are primed to become a leading venue for e-cigarette sales. We found that in prior years of Bridging the Gap (study 2 in this paper), retail e-cigarette availability more than doubled from 3% in 2010 to 7% in

2011.[5] Industry estimates indicate that over 50% of sales will be through retail rather than online outlets by 2014.[6] With the acquisition of major e-cigarette manufacturers by tobacco companies, such as the purchase of blu ecigs by Lorillard, and the introduction of new e-cigarette lines, such as Vuse by RJ Reynolds, sales and marketing of e-cigarettes are growing and could reach $3 billion by 2015.[6]

Several factors may influence the availability of e-cigarettes in retail stores nationwide. Different store types have varied revenue from tobacco product sales; supermarkets and pharmacies have only 1–2%, and tobacco stores (cigar, cigarette stores) 87% from sales of tobacco products.[7] At the store level, retailers that sell more tobacco products may sell e-cigarettes as a booming product.[6]

At the neighbourhood level, sales and marketing of traditional tobacco products show disparities in low-income and minority neighbourhoods. There is increased tobacco retailer density in minority and low-income communities, increased advertising and marketing in such communities, and lower cigarette prices in minority communities.[8] However, marketing of e-cigarettes may follow an opposite pattern. African-American smokers are less likely to have heard about,[3 9] or used,[9] e-cigarettes than white smokers. Use of e-cigarettes also increases with education level.[9] Tobacco retailer density and advertising near schools is associated with higher smoking rates at those schools.[8] Use of e-cigarettes among middle and high school students doubled between 2011 and 2012,[2] warranting examination of the availability of e-cigarettes near schools.

Tobacco control policies may also play a role in retail availability of e-cigarettes. e-cigarette marketing promotes benefits of e-cigarettes over cigarettes and for use in places where traditional cigarettes are banned.[10] Users report using e-cigarettes in places where smoking is banned and for smoking cessation.[11] Currently, unlike cigarettes, e-cigarettes are not subject to the US federal cigarette excise tax and only Minnesota imposes a state excise tax.[12] Partly resulting from that tax imbalance, e-cigarettes are promoted as cheaper alternatives to traditional cigarettes.[13] Additionally, e-cigarette users cite lower cost compared with cigarettes as a reason for use[11]; daily e-cigarette users report spending $33 vs $150–200 per month for a pack-a-day cigarette smoker.[1]

We conducted this analysis to identify retail availability of e-cigarettes and to determine factors at the store, neighbourhood and policy levels associated with availability across the USA. We hypothesise retail availability of electronic cigarettes to at least double from 2011 estimates to 14%.[5]

We expect more e-cigarette availability in store types that rely on tobacco product revenue and less availability in low-income and minority communities. We expect more availability in areas with stronger smoke-free air policies and higher tobacco taxes/cigarette prices. As a non-directional hypothesis, we expect a significant difference in odds of e-cigarette availability at stores near schools compared with stores further away from schools but cannot project whether e-cigarette availability will be higher or lower near schools.

METHODS
Data sources and sampling
Study 1
Study 1 collected data from a nationally representative sample of retailers in the 48 contiguous US. We employed a two-stage probability proportionate to population size (PPS) sampling design. First, we randomly selected 100 counties with replacement, resulting in 97 unique counties.

Second, we randomly selected tobacco retailers within each county. A PPS sample is an equal probability sampling method in which the first stage of sampling selects counties with PPS. The second stage of sampling selects stores with probability inversely proportionate to size by selecting a fixed number of establishments out of a variable number. This yields probabilities of selecting establishments in initially selected urban counties substantially lower than in rural counties. The probabilities offset yielding equal probability of selection at the store level, thus resulting in a nationally representative sample of retailers. To obtain comparable lists across counties, we purchased lists from two commercial sources, ReferenceUSA and Dun & Bradstreet (D&B). We selected the 10 establishment types representing 98% of tobacco sales in the USA.[7] After cleaning and de-duplication, we phone-verified up to 55 randomly sampled stores in each county, or all stores in small counties. Research assistants called stores to ask whether cigarettes were sold. We selected the first 24 eligible stores, or all eligible stores if fewer, for in-person audits. Our final sample had 2346 stores.

Study 2
The sampling frame for study 2 derived from retail food stores in the Bridging the Gap Community Obesity Measures Project (BTG-COMP). School enrolment zones surrounding nationally representative samples of 8th, 10th and 12th grade public high schools in the contiguous US participating in the Monitoring the Future study[14] provided a national sample of communities. We identified tobacco retailers in these communities by purchasing InfoUSA and D&B lists associated with SIC codes for food, liquor/wine/beer and tobacco-only retail stores, and stores with 'dollar' or '99¢' in their name. We supplemented these lists with retail stores 'discovered' in the field, based on the expected number of stores for each of our sampling strata.[15] Research assistants called each food store from the list and confirmed eligibility. Beer/wine/liquor stores also were called to verify cigarette sales, and as with tobacco-only stores, to confirm location and hours. From this phone-verified list, we used a half-interval sampling approach[16] to calculate an expected sampling frame, splitting the sample by store type into a business list group and a field discovery group. We randomly selected the appropriate number of stores from the business list. For field discovery, while travelling around the community, field staff audited a specific number of stores of each type not on the list but that met eligibility criteria. For this analysis, food stores selling tobacco products were identified and classified as tobacco retail stores.

Field staff attempted to observe 2492 food stores and 196 tobacco stores, for a total of 2688 tobacco retailers.

Data collection
In both studies, we trained data collectors using didactic and field experience in conducting the assessment. Data collectors conducted all audits in person in retail stores. For study 1, data collection occurred from June to October, and April to July 2012 for study 2. We completed interior and exterior audits for 2165 retailers out of 2346 sampled stores in study 1. Reasons for the 181 incomplete audits included 109 ineligible stores (outside of study county, not found or not at address listed, did not sell tobacco, out of business, duplicate of another store on the list or misclassified as a store) and 72 that were not started (refused, temporarily closed or under construction).

In study 2, data collectors completed 2603 observations at 2688 retailers known to sell tobacco products. For the 85 incomplete audits, 63 were ineligible (permanently closed, did not exist, outside the community boundaries, misclassified as an eligible store type), and 22 were not started (temporary inaccessible/outside business hours; not safe; asked to leave).

For study 1, store auditors did not introduce themselves unless asked by a store employee. They conducted the audit using an iPad with an iSurvey application with real-time data collection. Auditors did not ask store employees about e-cigarette availability. To count as available, e-cigarettes needed to be clearly visible in the store. Auditors had discretion to ask about Marlboro Red prices if they were not clearly advertised in the store. Audits took 13 min on average. These measures had been developed following an analysis of reliability based on repeated visits to a subset of 165 stores conducted within 1 month of the initial visit. We found that the e-cigarette availability had per cent agreement of 83.9%, with a κ score of .59, considered 'moderate agreement'.[17] The ICC for advertised price of Marlboro Red cigarettes was .72, indicating 'strong agreement'.[17]

For study 2, store auditors introduced themselves at their discretion, often depending on the size, and thus, their visibility, within the store. If e-cigarettes or Marlboro Red prices were not clearly visible in the store, auditors were instructed to ask a store employee. Auditors used a paper and pencil instrument, and took an average of 10 min to complete the tobacco observations. Both measures had been previously tested in a reliability study in November 2009 in Chicago. e-cigarette availability had a κ score of 1.0, and the ICC for the advertised price of Marlboro Red cigarettes was .97, indicating near perfect agreement.

Measures
Both studies collected information on e-cigarette availability, cigarette price and store location. We linked store location with neighbourhood or community demographics and tobacco control policy variables. We used comparable measures across the two studies except as noted.

e-cigarette availability
Store auditors determined whether or not e-cigarettes were available in the store (y/n).

Store measures
Both studies collected information on store types, grouped in six or seven categories: (1) groceries/supermarkets; (2) gas, gas convenience and other gas stations; (3) pharmacy and drug stores; (4) tobacco stores; (5) beer, wine and liquor stores; (6)

warehouse clubs and supercenters (study 1 only); and (7) other store types (including discount department stores, newsstands and general merchandise stores).

For study 1, we created a binary measure to code retailers as more than 1000 feet from or within 1000 feet of a K-12 public school based on a straight-line distance from the school centroid position from the National Center for Education Statistics 2009–2010. In study 2, by design, all retailers were within the school enrolment zone of the selected high school. In study 2, data were unavailable for store distance from all K-12 public schools, therefore distance from school is only included in multivariate analysis for study 1.

Retailer neighbourhood demographics

We examined retailer neighbourhood or community characteristics of per cent of non-Hispanic Black residents, per cent of Hispanic residents and median household income. In study 1, we used census tract as the retailer neighbourhood while study 2 mapped all the census block groups in the school enrolment zone to determine retailer neighbourhood. Both studies linked race/ethnicity variables and median household income from the American Community Survey 5-year estimates, 2007–2011. Given county sampling, study 1 found minimal clustering of stores by census tract; over 80% of census tracts had only one store. Study 2 aggregated block group data to determine neighbourhood demographics.

Policy measures
Tax/price

Both studies collected data on advertised price of Marlboro Red cigarettes at each store. This is both a measure of traditional cigarette price and a proxy for state and local tax variability. On average, 44% of cigarette price is accounted for by taxes.[18]

Smoke-free air

Both studies examined variation in smoke-free air policy by applying the 2012 American Lung Association (ALA) state smoke-free air grade[19] to the county level (study 1) or store level (study 2). ALA assigns annual grades of A to F to states based on the overall level of clean air restrictions in government workplaces, private workplaces, schools, child care facilities, restaurants, retail stores and recreational/cultural facilities, taking into account level of penalties and enforcement.

Analysis
Study 1

For study 1, to account for clustering of stores within counties, we used weighted multilevel logistic regression models with full maximum likelihood estimation and adaptive quadrature (HLM 7) to estimate e-cigarette availability. In the null model, we found that 6% of the variance in the underlying availability of e-cigarettes at the store level was accounted for by county-level variance (intraclass correlation=.06). We entered store-level variables and then added county-level variables in successive models.

Study 2

For study 2, because of the complex sampling design and the need to account for the probability of selection of the school enrolment zone and the store, we ran logistic regression models in STATA V.12.1, applying appropriate cluster, stratum and weight variables to estimate maximum likelihood.

RESULTS

Study 1 included 2165 stores with interior audit data from 97 counties in 40 states. Study 2 included 2526 stores in 160 communities in 38 states. Table 1 shows the sample characteristics for stores in studies 1 and 2. Store-type composition was generally similar across the two study samples. In both studies, convenience stores with and without gas stations comprised over 50% of the sample. Beer, wine and liquor stores (the reference category in multivariate analyses) comprised 10% of the sample for both studies. Average advertised price for Marlboro Red cigarettes was comparable ($6.25 in study 1 vs $6.15 in study 2). In study 1, prices ranged from $3.39 to $15.00 and in study 2 from $3.29 to $13.00. In both studies, we found the highest average priced cigarettes in New York State. In study 1, almost 13% of stores were within 1000 feet of a public K-12 school; in study 2, all stores were within the sampled school's enrolment zone.

Stores in studies 1 and 2 were in neighbourhoods with fewer African–American residents than the USA as a whole; 12.1% and 11.6%, respectively, compared with 13.1% of the US population in 2012.[20] However, store neighbourhoods were comparable with US population estimates for Hispanic populations (16.9%)[20] in study 1 (16.7%) while slightly less in study 2 (15.4%). Median household income of store neighbourhoods was higher than in the USA ($56 294 in study 1 and $58 968 in study 2 compared with $52 763 in the USA).[20]

Over 50% of study 1 counties and 54% of stores were in states with a 2012 ALA smoke-free air 'A' grade. Almost a quarter of the study 1 counties and stores were in states with an 'F' grade, indicating the weakest smoke-free air regulations. In study 2, a similar proportion of stores were in states with a

Table 1 Study 1 and study 2 sample characteristics of tobacco retailers, by store-level and county-level factors

Sample characteristics Store	Study 1 unweighted n=2165	Study 2 unweighted n=2526
Store type	n (%) or mean (SD)	n (%) or mean (SD)
Beer, wine and liquor store	208 (9.6)	257 (10.2)
Gas and convenience store	1179 (54.5)	1453 (57.5)
Other establishment type	15 (0.7)	72 (2.6)
Pharmacy and drug stores	234 (10.8)	213 (8.4)
Supermarket and other grocery	390 (18.0)	407 (16.1)
Tobacco store	83 (3.8)	124 (4.9)
Warehouse clubs and supercenters	55 (2.5)	–
Average advertised price (SD)	$6.25 (1.48)	$6.15 (1.59)
Near schools		–
Within 1000 ft of school	1891 (87.3)	–
Over 1000 ft of school	274 (12.7)	–
Retailer neighbourhood characteristics	Mean (SD)	Mean (SD)
Average per cent Black, non-Hispanic	12.1 (18.7)	11.6 (17.6)
Average per cent Hispanic	16.7 (22.3)	15.4 (18.9)
Average median household income	$56 294 (26 329)	$58 968 (21 895)
ALA smoke-free air grade, 2012	n (%)	n (%)
A	1170 (54.0)	1196 (47.4)
B	245 (11.3)	497 (19.7)
C	214 (9.9)	341 (13.5)
D	23 (1.1)	48 (1.9)
F	513 (23.7)	444 (17.6)

Study 1: n=2165; data collected June–Oct 2012; study 2: n=2526 Apr–July 2012.
ALA, American Lung Association.

smoke-free air A grade (47%), while a smaller per cent (18%) were in states with an F grade. In the USA as a whole, 24 states received an A grade while 12 received an F in 2012.[19]

In study 1, we found retail e-cigarette availability of 34.1% (95% CI 32.0 to 36.3). Study 2 identified e-cigarettes in 31% of retail stores (95% CI 26.7 to 35.1). In study 1, e-cigarettes were significantly more available in tobacco, warehouse and supercenters, pharmacy/drug, and gas/convenience than in beer, wine and liquor stores (table 2, models 1 and 2). Similarly, in study 2, we found higher odds of availability of e-cigarettes in tobacco, pharmacy/drug, and convenience compared with beer, wine and liquor stores (table 3, models 1 and 2). In both studies, odds of availability of e-cigarette sales in tobacco stores was substantially higher than in other store types; in study 1, 79% of tobacco stores sold e-cigarettes and 73% sold in study 2. Only 10% (study 1) or 12% (study 2) of beer, wine or liquor stores sold e-cigarettes. In study 1, 31% of stores near schools had e-cigarettes, but availability did not significantly differ compared with stores further away from schools (35%) (table 2, model 2) (adjusted OR (AOR) 0.94, 95% CI 0.69 to 1.28).

In study 1, the odds of a store having e-cigarettes available was 1.5 times greater for every one unit increase in *log* median household income (95% CI 1.15 to 2.04) (table 2, model 2). In relation to the raw scale, for example, this corresponds to 34% greater odds of e-cigarette availability (OR=1.34) for stores in neighbourhoods with a median household income of $20 000 compared with $10 000. Whereas at the higher end of income, this same OR (1.34) is found for stores in neighbourhoods of median household income of $100 000 compared with $50 000. Study 2 did not find this association. In final models,

both studies found that odds of e-cigarette availability were 1% less, for every percentage point increase in the proportion of African–American residents in store neighbourhoods (AOR 0.99, 95% CI 0.98 to 1.00) (tables 2 and 3, model 2). Study 2, but not study 1, found a similar inverse relationship for Hispanic residents (AOR 0.98, 95% CI 0.97 to 0.99) (table 3, model 2).

Both studies found significant results regarding the relationship of e-cigarette availability and tobacco policy variables. In studies 1 and 2, in models that did not account for smoke-free air policy (tables 2 and 3, model 1), we found a significant inverse relationship between advertised cigarette price as a proxy for tax and e-cigarette availability. For every one unit increase in the *log* price of Marlboro Red cigarettes, we found almost a 50% decrease in the odds of e-cigarette availability (tables 2 and 3, model 1). For comparison in dollars, in study 2, a store with a $4 Marlboro Red pack compared with a store with a $3 pack has an 18% decrease in the odds of e-cigarette availability (OR=0.82). At a higher pack price, this same OR (0.82) corresponds to a store with a $12 pack compared with a store with a $9 pack. Once smoke-free air policy was included in the model, this effect diminished to non-significance in study 1 (table 2, model 2), but remained significant in study 2 (table 3, model 2).

We also found in study 1 that stores in states with a smoke-free air grade of F were 1.6 times (95% CI 1.18 to 2.27) more likely to have e-cigarettes available than those in states with an A grade (41% compared with 33%) (table 2, model 2). We also note a rough gradient in odds of availability across smoke-free air grades in study 1. This effect of higher availability with weaker

Table 2 Study 1 adjusted ORs of multilevel logistic model of factors influencing availability of e-cigarettes at tobacco retail stores (n=2096)

Study 1	Model 1	Model 2
Variable	AOR (95% CI)	AOR (95% CI)
Intercept	0.12*** (0.08 to 0.19)	0.11*** (0.07 to 0.17)
Level 1. Store		
Store type		
Beer, wine and liquor store	ref	ref
Gas and convenience store	4.80*** (6.72 to 19.57)	4.75*** (2.96 to 7.63)
Other establishment type	3.59 (0.95 to 13.60)	3.45 (0.92 to 12.99)
Pharmacy and drug stores	11.47*** (6.72 to 19.57)	11.77*** (6.91 to 20.05)
Tobacco store	40.20*** (18.91 to 85.46)	39.78*** (18.77 to 84.31)
Warehouse clubs and supercenters	15.65*** (6.93 to 35.36)	14.81*** (6.58 to 33.34)
Supermarket and other grocery	1.19 (0.69 to 2.07)	1.18 (0.68 to 2.05)
Advertised price (log)	0.51* (0.27 to 0.95)	0.80 (0.42 to 1.54)
Near schools		
Within 1000 ft of school	0.95 (0.69 to 1.30)	0.94 (0.69 to 1.28)
Over 1000 ft of school	ref	ref
Store neighbourhood characteristics		
Average per cent Black	0.99 (0.99 to 1.00)	0.99* (0.98 to 1.00)
Average per cent Hispanic	1.00 (0.99 to 1.00)	1.00 (0.99 to 1.00)
Average median household income (log)	1.53** (1.15 to 2.05)	1.53** (1.15 to 2.04)
Level 2 county (n=97)		
ALA smoke-free air grade, 2012		
A		ref
B		1.03 (0.70 to 1.54)
C		1.25 (0.81 to 1.93)
D		1.25 (0.41 to 3.84)
F		1.63** (1.18 to 2.27)

*p<0.05, **p<0.01, ***p<0.001.
ALA, American Lung Association.

Table 3 Study 2 adjusted ORs (AORs) of logistic model of factors influencing availability of e-cigarettes at tobacco retail stores (n=2415)

Study 2 Variable	Model 1 AOR (95% CI)	Model 2 AOR (95% CI)
Intercept	2.77 (0.00 to 1936.61)	0.33 (0.00 to 291.81)
Store type		
Beer, wine and liquor store	ref	ref
Gas and convenience store	2.96*** (1.93 to 4.54)	2.87*** (1.86 to 4.42)
Other establishment type	0.96 (0.36 to 2.52)	0.95 (0.36 to 2.52)
Pharmacy and drug stores	6.33*** (3.29 to 12.18)	6.31*** (3.29 to 12.10)
Tobacco store	32.30*** (15.14 to 68.87)	32.85*** (15.28 to 70.64)
Supermarket and other grocery	1.32 (0.67 to 2.59)	1.28 (0.65 to 2.50)
Advertised price (log)	0.43*** (0.23 to 0.81)	0.50** (0.26 to 0.96)
Store neighbourhood characteristics		
Average per cent non-Hispanic Black	0.98*** (0.98 to 0.99)	0.99*** (0.98 to 1.00)
Average per cent Hispanic	0.98** (0.97 to 0.99)	0.98*** (0.97 to 0.99)
Average median household income (log)	0.92 (0.51 to 1.67)	1.08 (0.59 to 1.99)
ALA smoke-free air grade, 2012		
A		ref
B		1.31 (0.76 to 2.25)
C		1.03 (0.54 to 1.99)
D		3.68*** (2.41 to 5.60)
F		1.27 (0.84 to 1.92)

*p<0.05, **p<0.01, ***p<0.001.
ALA, American Lung Association.

regulations was replicated in study 2, which found stores with D grades were 3.7 times (95% CI 2.41 to 5.60) more likely to have e-cigarettes than stores in A grade states (table 3, model 2).

DISCUSSION

These two studies represent the first published US national data on the availability of e-cigarettes in retail stores. We only found one other published study of e-cigarette availability; a study of London retailers in 2013 found 57% availability.[21] In our paper, both studies found e-cigarettes available at approximately one-third of US tobacco retailers in 2012 (31% in Study 2 and 34% in Study 1). This finding may simply reflect differences in sampling frame between the two studies.

A second possibility is that the slightly higher estimate in Study 1 (34%) compared with Study 2 (31%) may reflect increased national availability from the later time of data collection in Study 1 (June–October) versus Study 2 (April–July). Prior years of the BTG Study (Study 2) found that e-cigarette availability increased from 3% in 2010 to 7% in 2011 to 31% in 2012.[5] Additionally, there is evidence to suggest rapid growth of the number of outlets selling e-cigarettes during the time period covered by the two studies. For example, Lorillard purchased blu e-cigarettes in April 2012 at the beginning of Study 2 data collection. Then, news reports indicated the number of outlets carrying blu was 13 000.[22] At the end of the third quarter 2013, Lorillard reported the number of outlets was 127 000.[23] Additional years of data collection will be needed to assess time trends.

Consistent with expectations, e-cigarettes are generally more available in stores that derive a higher proportion of their revenue from tobacco product sales: tobacco stores, warehouse/supercenters, and convenience/gas stations.[7] One exception to this pattern is the high level of availability in pharmacy and drug stores. Pharmacy/drug stores derive less than 2% of sales from tobacco products.[7] However, nicotine replacement products are highly available in pharmacies,[24] perhaps sparking

availability of e-cigarettes as cessation devices or as products for more health-conscious smokers.

Neighbourhood demographic effects were consistent with our hypotheses based on current use patterns among consumers. e-cigarettes were slightly less available in stores in African–American (studies 1 and 2) and Hispanic neighbourhoods (study 2). We also found greater availability with higher median household income (study 1).

These two studies generally indicate that areas with weaker tobacco control policies in both tax and smoke-free air are associated with greater availability of e-cigarettes. This may be consistent with findings that Google searches for e-cigarettes were higher than in states with strong, rather than weak, policies.[25] In areas with weak tobacco control policies, e-cigarettes may be easily available in local retail stores and consumers would have no need to search online. Whereas in areas with strong tobacco control policies, individuals may not have e-cigarettes available in stores, so may search Google to buy them online. In some models, both studies found that e-cigarettes were more likely to be available in stores with lower-priced cigarettes. In both studies, we found stores in areas with weaker state smoke-free air grades had higher odds of availability of e-cigarettes compared with stores in areas with the highest grade. This finding is consistent with results from another study in this supplement that sales of e-cigarettes from Nielson scanner data are also associated with weaker smoke-free air policies.[26]

States with stronger tax and smoke-free air policies are associated with greater declines in smoking rates than states with weaker policies.[27] Tobacco retailers are likely selling e-cigarettes where there is a demand for them (ie, where there are more smokers, in part, due to weaker tobacco control regulations). Our findings suggest that stronger tobacco control policies are not the predominant or most direct factors driving retail availability of e-cigarettes.

Strengths and limitations

The strength of this paper is that it is the first to show national retail estimates of e-cigarette availability from two national

studies with different, but complementary, sampling approaches. We found comparable results across both samples increasing confidence in the results. We address regional variation in e-cigarette availability by accounting for clustering of stores according to the complex sampling design of both studies. Both studies had large sample sizes and high response rates for in-person data collection using store audit procedures tested in prior studies.[28]

We also identify a number of limitations. First, study 1 included only traditional tobacco product retailers; the sampling frame of study 2 was built upon a frame for retail food outlets, supplemented by tobacco-only stores. e-cigarettes may be sold in other store types not captured in these frames. In study 2, we added stores in the field to improve our sampling frame; however, non-random 'discovery' stores may have differed from the business list sample. In both studies, we measured only e-cigarettes availability; future waves of study 1will collect data on e-cigarette promotions, placement and price. Finally, other factors influencing e-cigarette availability, such as proprietary contracts between stores and e-cigarette or tobacco distributors, were not measured. These industry practices may be the most proximal influence on patterns of e-cigarette distribution seen in this study.

As a final limitation, both studies are cross-sectional, corresponding to rapid increase in the use of e-cigarettes in the USA. Given both potential increases in marketing of e-cigarettes with tobacco industry promotion and for regulation of these products by the FDA,[6] we expect fluctuation in trends in retail e-cigarette availability. In the future, we can provide longitudinal data about retail availability and how correlates of availability change over time.

CONCLUSIONS

We found sizable retail availability of e-cigarettes only 6 years after their introduction to the US market. e-cigarette availability is generally higher in store types with a higher market share of tobacco products. Encouragingly, unlike traditional cigarettes, we did not find retail e-cigarettes sales targeted to minority racial/ethnic communities, low-income neighbourhoods or near schools. We found more e-cigarette availability in areas with weak tax and smoke-free air policies, perhaps suggesting supply to smokers. We anticipate the impact of tobacco control policies, neighbourhood characteristics and store factors on availability will change over time given the rapidly shifting marketing and regulatory landscape for these products. Given these changes, states and localities should monitor the sales and marketing of e-cigarettes at POS.

What this paper adds

▶ The current study, with findings from two national studies of tobacco retailers, demonstrates substantial retail availability of electronic cigarettes in the USA.

▶ Retail availability of e-cigarettes, unlike cigarettes, does not show targeting to minority and low-income communities, or near schools.

▶ E-cigarette availability correlates with weaker tobacco control tax and smoke-free air policies, suggesting supply to smokers.

▶ These findings provide future directions for states and localities to monitor e-cigarettes at point of sale.

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