Predictors of Vape Shops Going out of Business in Southern California

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Abstract

Objectives: Vape shops have proliferated in the United States (US) in recent years. As of May 2016, the US Food and Drug Administration (FDA) asserted its authority to regulate electronic nicotine delivery systems. It is critical to understand how these polices have affected the vape shop industry, as the rise and fall of vape shop proliferation has the potential for influencing public health.

Methods: In this longitudinal study, we examined factors associated with vape shop (N = 77) closure over a 2-1/2-year period in southern California. We assessed predictors of vape shops going out of business using a multivariate logistic regression model.

Results: Among 77 vape shops assessed at baseline, 44.2% closed over a 2-1/2-year period. The absence of a "bar type" physical environment (OR = 2.64, 95% CI = 1.12–6.20), poorer shop accessibility (OR = 7.11, 95% CI = 1.17–43.24), fewer reports of qualified personnel (OR = 2.28, 95% CI = 1.12–4.64), less average time spent in shop by customers (OR = 4.8, 95% CI = 1.18–19.60), a narrower e-liquid flavor selection (OR = 6.55, 95% CI = 1.56–27.49), and less vape device diversity (OR = 2.36, 95% C = 1.13–4.91) predicted vape shop closure.

Conclusions: The rise and subsequent decline in vape shops could potentially affect public health. However, there needs to be more research on their association with public health..

As electronic nicotine delivery systems (e-cigarettes) have surged in popularity, sales, and use in the United States (US), brick-and-mortar vape shops, ie, stores that specialize in the sale and promotion of e-cigarettes, e-liquids, and other vaping products (but not selling combustible tobacco products) have proliferated. The number of vape shops in the US increased from 3500 in 2013 to approximately 10,000 in 2017.[1,2] The estimated sales of vape products have increased from $1.7 billion in 2013 to over $2.5 billion in 2015.[3,4]

To be successful, vape shops must be responsive to consumer demand as well as to pressure from the public health community and changing federal, state, and local policies.[5] Vaping devices sold at these shops have evolved from disposable devices (ie, vape pens) to tubular or box-shaped mod devices (third-generation devices that can be programmed on voltage and wattage, to vary the amount of vapor exuded) and, as of 2020, to pod mods. Pod mods are relatively affordable, compact, and easy to use and conceal. They use e-liquid in the pod. Pod mods are popular in vape shops in southern California, with the most prevalent brand being Suorin, followed by JUUL.[6] However, in recent years, there has been an increase in vape shops closing, as federal, state, and local policies limit their operation and consumers increasingly purchase products online. The sustainability of vape shops might offer insights into the future of the industry, public health, and the effects of policies.

There is disagreement in the public health community regarding the harm reduction potential of e-cigarettes and the steep rise in adolescent e-cigarette use.[7,8] The effects of vape shops on public health remain unknown. They could cause potential harm by encouraging e-cigarette use among non-users of tobacco, including youth, or promote dual use among combustible tobacco users. However, if e-cigarettes were effective as harm reduction products, vape shop owners and employees (with appropriate training) could help adult chronic smokers quit or reduce combustible tobacco use, thereby benefiting public health. If policies force them to sell only uncontaminated, correctly labeled products from reputable manufacturers and to refuse sales to minors, adverse public health effects might lessen.

The US Food and Drug Administration (FDA) Deeming Rule classified e-cigarettes as a tobacco product as of May 2016.[9,10] This regulation banned free samples of e-cigarettes and other tobacco products and required health warnings be placed on the product package. In addition, fixing/modifying a vaping product mandates premarket review.[11] The legal minimum age to purchase tobacco products increased from 18 to 21 years old as of June 2016 (Tobacco 21).[12] Such policy changes may have reduced the customer base in vape shops. The impact of new regulations on flavors and their impact on vape shop closures is still unknown but could provide clues to potential public health strategies in the future. Currently only 2 studies have examined the predictors of shops going out of business.[13,14] These studies have shown that bar-type physical environment (ie, bar stools set in front of a long, generally wooden counter; tasting bar setups), attributions of staff being "helpful" and "respectful," the capacity to fix devices, and having a lounge area were characteristics of shops that stayed open. This indicates that opportunities to socialize enhance the vape shop experience, potentially prolonging the amount of time that customers spend in vape shops and increasing the amount of money that they spend there. A pleasant physical environment, easy shop access, availability of free and convenient parking, customer satisfaction with employee performance, effective common marketing, and wide shop variety are some other features that predict retail success in general, and therefore, might predict vape shop closures.[15]

Against a changing background of e-cigarette regulations, it is critical to obtain knowledge on how these new polices are affecting the vape shop industry, and subsequently, public health. The variables that impact vape shop survival may be a direct reflection of FDA, state, and local policy (eg, potential flavor restrictions, whether vape shop personal are "helpful" by providing counseling advice on quitting combustible cigarettes), or indirectly impact e-cigarette consumer behavior (eg, by leading consumers to seek out other difficult-to-monitor channels of e-cigarette purchases such as through the Internet, or through wider marketing in mainstream convenience outlets). The present study fills an important research gap by exploring the baseline predictors of southern California vape shops going out of business 2-1/2 years later, from before the FDA and California regulations to post-regulations.

METHODS

Shop Recruitment and Data Collection

We conducted this longitudinal study in the Greater Los Angeles area. In the summer of 2014, we identified a stratified sample of 77 vape-only shops to examine baseline characteristics predictive of vape shop staying open or closing 2-1/2 years later. We selected the shops from neighborhoods with relatively high percentages of Korean-American, Hispanic/Latino, black/African-American, and non-Hispanic white residents, based on data from the US Census, defined by zip codes and census tracts.[16–18] We identified the shops using Yelp to locate vape shops in neighborhoods with a high proportion of residents from each of the 4 racial/ethnic groups. Selected vape shops did not sell any combustible tobacco products.[16–18] The total sample of shops included 20 black/African-American location shops, 17 Hispanic/Latino location shops, 18 Korean-American location shops, and 22 non-Hispanic white location shops.

The authors' Institutional Review Board permitted trained research team members to visit sampled vape shops in pairs between the hours of 10 am to 5 pm on weekdays, asking shop owners or employees available if they would like to participate in the study. We assured each employee that the information collected would be anonymous and would not pose any personal risk, either to the employee or to the shop. After obtaining verbal consent, one research team member conducted the retailer interview, which took about 35 minutes to complete, while the other team member recorded shop characteristics with a checklist. These checklists were comprised of a store observation (which items the shop openly displayed), vape shop built-environment (characteristics of the physical environment surrounding the shop), and customer observations (number of customers that entered the shop and the ages of customers). We surveyed one employee per vape shop; to ensure that the interview would not interfere with the shop's business, the interviewer stepped aside when a customer approached the cashier. We compensated those who agreed to participate in this study with a $50 gift card. In addition to the employee interview, store observation, built environment observation, and customer observation, we collected Yelp reviews for each participating shop. Yelp is a business review site, through which customers exchange business recommendations. The company attempts to remove fake reviews (self-promotion), although fraudulent reports may still occur[19] However, previous studies of vape shops have justified the heuristic value of using Yelp data, and previous studies have shown that Yelp reviews correlate well with revenues of small businesses.[13,18,20] We coded the 20 most recent reviews for each shop. If a shop had fewer than 20 reviews, then all reviews were coded for that shop.

The baseline data collection took place from June 19, 2014 to December 6, 2014 (Wave 1). Employees at all 77 shops provided consent to participate in our study (no refusals at baseline). Then, 2-1/2 years post-baseline data collection (Wave 3: November 17, 2017-December 11, 2018) we used in-person visits to these shops to identify ones permanently closed.

Measures

This study focused on survey items that assessed baseline vape shop staff attributes, built environment, product selection, and customer characteristics. The vape shop's status (open or closed) 2-1/2 years later was the primary outcome. We used 5 sources of baseline data (ie, employee interviews, customer observations, product observations, built environment data, and Yelp customer reviews assessed at Wave 1) to identify predictors of vape shops going out of business.

Vape shop staff attributes.—We retrieved vape shop staff attributes from Yelp reviews. We developed a coding sheet based on an initial qualitative analysis of the recurring themes about vape shop characteristics in Yelp pages.[18] Endorsements of staff attributes were coded in terms of person-to-person marketing influence characteristics, such as helpful and knowledgeable/professional using open-ended coding. Helpful (yes or no) and knowledgeable (yes or no) vape shop staff attributes were then averaged in a vape shop staff quality index.

Vape shop-built environment.—We assessed vape shop-built environment with an observation checklist. We assessed vape shop accessibility with the item: *"How accessible is this vape shop from the street (eg, 2nd floor, no signage, entrance around back)?"* Response options were on a 4-point scale ranging from *"very difficult" (0)* to *"very easy" (4).* We assessed availability of free parking with the question: *"Is parking free?"* (yes or no). We assessed vape shop physical environment, in particular, bar type (ie, bar stools set in front of a long, generally wooden counter) venue via Yelp reviews using open-ended coding.[13,18]

Product selection.—We assessed the number of e-liquid (ie, flavored liquid used inside e-cigarettes that contains propylene glycol or vegetable glycerin and nicotine) flavors sold at the shop with the open-ended employee interview question: *"What is the number of flavors sold at the shop?"* We assessed availability of an e-liquid menu at the shop with the observation checklist item: *"Menu of juices available?"* (yes or no). We assessed types of vaping devices (ie, rechargeable [eg, box mod, pod mod], disposable, atomizer, and dry herb) sold at shops (yes or no) with the interview item: *"Do you have the following e-cigarette items at the shop?"* and via naturalistic observation of vape shop displays. We created a diversity of devices index by averaging these 4 types of vaping devices.

Customer characteristics.—We assessed the average customer age with the open-ended employee interview item: *"What is the average age of the customers who go to this vape shop?"* We used naturalistic customer observation to count the number of customers in the shops during data collection. We also recorded the amount of time each customer spent at the shop. The total amount of time spent by all customers within each shop was then divided by the total number of customers in each shop to create an average time spent in the vape shop index.

Inter-rater Reliability

To ensure that observational estimates were reliable, 2 data collectors coded a subsample of shops on all measures except for the employee interviews. We used a convenience sample of 18 (23.4%) shops to assess shop and customer observation reliability (at least 4 shops per ethnic community). Yelp reliability included 16 (20.8%) shops, and built environment reliability had 40 (51.9%) shops, randomly selected from a list of all vape shops stratified by ethnic community. We measured inter-rater reliability using Cohen's Kappa for nominal and ordinal (weighted) variables, and intra-class correlation (ICC) for continuous measures.[21] There were 12 comparisons, all of which indicated high inter-rater reliability: Cohen's Kappa varied from substantial agreement (.61-.80, 3 items) to almost perfect agreement (.81 or higher, 6 items), and ICC varied from 0.91 to 1.0 (3 items).

Data Analysis

The prevalence, descriptive statistics, and bivariate association of vape shop closed/open status and study variables are reported first. We used Pearson's chi-square tests for categorical study variables, and t-tests for continuous variables. Variables were retained for inclusion as predictors in the multivariate model if they were significant at $\alpha = .05$ in bivariate comparisons. Predictors (assessed at Wave 1) of vape shop going out of business at Wave 3 were assessed using a multivariate logistic regression model. This model included

vape shop closure status as the outcome. The following predictors were retained for this model: vape shop accessibility (dichotomized as 0 - easy, 1 - difficult), number of flavors sold at the shop (0 -   100 flavors, 1 - < 100 flavors), average time spent by customers (dichotomized as 0 -   10 minutes or more, 1 - < 10 minutes), vape shop staff qualification index (higher score indicating less qualified staff), "bar type" physical environment (yes or no), diversity of devices sold index (higher score indicating less device diversity), and availability of an e-liquid menu (yes or no) in the shop. We conducted all statistical analyses using Stata software (version 15.1; Stata Corp, College Station, TX). We report odds ratios (ORs) with 95% CIs with 2-tailed statistical significance at p < .05.

RESULTS

In-person visits identified that 34 out of 77 baseline shops (46%) were closed 2-1/2 years post-baseline data collection. Table 1 shows vape shop characteristics for the total sample and by closed/open status. Closed and open shops did not significantly differ in terms of ethnic composition of the neighborhood. Number of e-liquid flavors available at the shops at baseline ranged from 20 to 400 with a mean of 117.2 (SD = 73.8) flavors. Rechargeables (sold at all shops) and atomizers (sold at 98.7% shops) were the most popular types of devices, and disposables and dry herb devices were less popular (sold at 16.9% and 28.6% shops, respectively). None of the shops sold pod mod devices at baseline; these devices first appeared on the market in 2015. Most shops had "very easy" accessibility at baseline (mean = 3.68, SD = 0.66), yet the shops that were still open after 2-1/2 years had better accessibility than closed shops (3.8 vs 2.5, p = .04). Free parking was available at 80.5% of shops at baseline. On average, customers at baseline reported that they spent more time in the shops that stayed in business, compared to those that went out of business (12.0 minutes vs 6.6 minutes, p = .003).

The logistic regression model (Table 2) showed that having narrower baseline flavor selection (OR = 6.55, 95% CI = 1.56–27.49), less device diversity sold at the shop (OR = 2.36, 95% CI = 1.13–4.91), not reporting having helpful or knowledgeable staff (OR = 2.28, 95% CI = 1.12–4.64), and less average time spent by customers (OR, 4.80, 95% CI = 1.18–19.60) predicted vape shop closure in 2-1/2 years. Additionally, poorer shop accessibility (OR = 7.11, 95% CI = 1.17–43.24) and not having a "bar type" vape shop physical environment (OR = 2.64, 95% CI = 1.12–6.20) also predicted vape shops going out of business.

DISCUSSION

The present longitudinal study is among the first to examine the predictors of vape shop closure in southern California. Nearly half (44.2%) of the 77 shops surveyed in 2014 closed over a 2-1/2-year period. A narrower selection of e-liquid flavors and less vape device diversity were statistically predictive of vape shop closure. It is plausible that relatively wide e-liquid and device selection provides customers with more choices, thereby making the shop more attractive for return visits. This has implications for public health, as offering wider variety in flavor selection and vape devices may contribute to increases in electronic cigarette use as well as predicting whether vape shops stay open. Local, state, or federal

policies to restrict sales of flavored tobacco products might benefit public health by making vaping less attractive to youth, but they also might have the unintended consequence of making it more difficult for vape shops to remain profitable, thereby decreasing accessibility to vaping products among adults who want to quit cigarettes. One also might speculate that wide selection is an indicator of larger baseline capital; therefore, it is possible that vape shops with relatively large baseline capital may be more successful overcoming business challenges, such as federal and state restrictions compared to those with lower capital. Future research should examine this possibility.

Additionally, those vape shops that remained open 2-1/2 years later were more likely to have a "bar type" physical environment (ie, bar stools set in front of a long, generally wooden counter), staff who were rated as relatively more qualified (ie, they were more likely to be rated as "helpful" and "knowledgeable" about vaping products and devices), and customers spending more time in the shop. This has implications regarding the social aspects of vaping; in a bar type environment, individual vapers may feel more comfortable interacting socially with other customers and the vape shop employees. This might cause customers to spend more time there, buy more products, and potentially, form new friendships based on vaping, all of which might increase their nicotine intake. It appears that another class of vape shop characteristics that attracts customers is the ambiance of the pleasant physical environment that vape shops create for users.[15,22] This finding is consistent with Wagener et al,[23] who showed that advice, support from vape shop staff, and environment are reasons customers are going to vape shops. It is plausible that vape shop visitors come to the shops to spend time with friends and socialize. Future studies involving vape shop customers need to identify any additional attributes.

IMPLICATIONS FOR PUBLIC HEALTH AND TOBACCO REGULATION

Historically, the e-cigarette industry has differentiated itself from the tobacco industry by marketing and promoting e-cigarette use as a less harmful alternative to combustible cigarette smoking and by selling vaping devices that provide opportunities for smokers to quit.[5] However, in recent years at least 3 major tobacco companies (ie, Imperial Brands ["blu"], RJ Reynolds ["Vuse"], and Philip Morris ["Mark Ten"]) have entered the e-cigarette market, along with tobacco giant Altria, which purchased 35% of the JUUL Labs Inc company at the end of 2018.[24] It is possible that a merging of the tobacco and vape shop industries may be occurring. Future work should investigate whether or not vape shops will promote tobacco industry marketed e-cigarettes.

Vape shops with employees who are considered "knowledgeable" and "helpful" are more likely to stay open. However, researchers need to discern in which ways they are knowledgeable and helpful. It is not clear if they are "helping" individuals who want to quit smoking, ie, quit by switching to vaping, or if are they encouraging use of electronic nicotine delivery devices and related products among individuals who have never smoked. One may speculate that one of the ways that vape shop employees are helpful is by instructing consumers about e-cigarettes as a harm reduction device and suggesting that chronic combustible cigarette users switch over to e-cigarettes. However, vape shop employees may overestimate the safety and underestimate the harm of e-cigarettes,[16,25] and

they are not adequately trained to access and transmit accurate health messages to consumers of these products.[26,27] However, if vape shops were successful venues for reducing tobacco use, they could potentially be an aid to ameliorating the health effects caused by tobacco products by getting customers to switch to electronic devices. There needs to be more research on the efficacy of vape shops as a potential harm reduction setting.

The FDA and the State of California have proposed additional e-cigarette regulations, including flavor bans (on flavors other than tobacco, mint, and menthol) and a mandatory submission of a pre-market tobacco application for flavored products sold at the vape shops. [11] If such proposed policies take effect, one may speculate that more vape shops are likely to go out of business; moreover, it is possible that vape shop customers trying to wean off conventional cigarettes may return to using combustible cigarettes, which would negatively impact public health efforts.

On the other hand, underage users are attracted to flavored e-liquid (ie, candy- and fruit-flavored), in part, due to the novelty and perceived appeal of these flavors and colorful packaging.[28–31] In fact, although in 2016 California Tobacco 21 Law has raised the minimum legal age to 21 years to purchase tobacco, e-cigarettes and vaping products,[10–12] and new FDA regulations have followed suit,[32] reports demonstrate that vape shops in several states, including California, have high rates of sales to minors.[33,34] If minors are buying vape devices and e-liquid from brick-and-mortar vape shops, then closure of these shops could be a protective factor with benefit for public health.[35]

Our data indicate that vape shops with a "bar type" physical environment are more likely to stay open, which is consistent with 2 previous studies.[13,14] Some of these shops initially offered free samples to customers, but doing so is now illegal. It is possible that the shops maintained this "bar type" environment without actually offering free samples, and customers enjoyed this environment. In addition, more time spent by customers at the vape shops predicted the likelihood of the shop staying open. One may speculate that non-smoking young adults might go to vape shops seeking a bar-like environment where they can vape indoors, as well as socialize with other visitors and vape shop employees, similar to what is found at hookah bars.[36] California currently allows vaping in vape shops, although local jurisdictions have the ability to ban the practice. Additional FDA regulations, such as banning vaping inside the vape shops, may have a significant impact on consumer behavior. For instance, people may resort back to hookah bars and other bars serving alcohol due to the lack of vape shop hangout options, potentially having a negative effect on public health. There needs to be research directly involving vape shop customers and consumer behavior to evaluate whether vape shop visitors are using e-cigarettes as harm reduction devices or to initiate vaping.

Furthermore, the vape shop setting may expose vape shop customers and their non-user friends visiting the shop together to secondhand vapor. Lerner et al[37] revealed that exposure to e-cigarette vapor induces oxidative and inflammatory responses in lung cells and tissues, which may lead to adverse health effects. Future research should examine the impact of secondhand vapor on vape shop customers.

Limitations

There are several study limitations to consider. First, we only observed vape shops in southern California, which might limit generalizability to other geographic areas. To enhance generalizability, future research should compare observations across different US regions, and perhaps, different countries. Second, we completed customer observations between 10 am and 5 pm Monday through Friday, a period which varied by shop. The vape shops may have been open on weekends; however, the team mainly utilized weekday data collection because shop employees had more time for interviews during the week. We continued weekday collection for consistency purposes for all waves of collection. Thus, we may have missed some customer activity.[38] Third, we collected the average age of the customers through employee interviews, and such estimation could be biased; nonetheless, previous studies involving vape shops customers showed comparable results.[35] Furthermore, some businesses may choose to close for reasons other than listed in this study; therefore, future research should conduct interviews with the employees of the closed shops to identify actual reasons for shop closure. Finally, even though previous studies involving vape shops has justified the heuristic value of using Yelp data,[13,18] social desirability bias and fraudulent reviews may have affected the results.[19] The fact that not all shops had 20 recent Yelp reviews and that some shops had old reviews may have affected the comparability of coded reviews.

Conclusions and Future Directions

Local vape shop closures are dependent on factors, such as physical environment, product flavor and device diversity and employee knowledge of products and helpfulness. Additional regulations (eg, a flavor ban) may affect the ability of the vape shops to stay in business, which in turn, may cause unintended public health effects (eg, e-cigarette users trying to quit conventional cigarettes may return to the use of combustible cigarettes). Future research should examine intentions to return to combustible use as restrictions on flavors and/or devices become a reality.

Acknowledgements

References

1. Dai H, Hao J. Geographic density and proximity of vape shops to colleges in the USA. Tob Control. 2017;26(4):379–385. [PubMed: 27302700]

2. Dai H, Hao J, Catley D. Vape shop density and socio-demographic disparities: a US census tract analysis. Nicotine Tob Res. 2017;19(11):1338–1344. [PubMed: 28371830]

3. Mangan D E-cigarette sales are smoking hot, set to hit $1.7 billion: CNBC. Available at: https://www.cnbc.com/id/100991511/. Accessed January 13, 2020.

4. Bonnie H, Scott A, Kanada P. Nielsen: tobacco "All Channel" Data Through 12/26/15. Wells Fargo Securities. 2016. Available at: http://www.akleg.gov/basis/get_documents.asp?session=29&docid=40849/. Accessed January 13, 2020.

5. Sussman S, Baezconde-Garbanati L, Garcia R, et al. Commentary: forces that drive the vape shop industry and implications for the health professions. Eval Health Prof. 2016;39(3):379–388. [PubMed: 25967071]

6. Galstyan E, Galimov A, Sussman S. Commentary: the emergence of pod mods at vape shops. Eval Health Prof. 2019;42(1):118–124. [PubMed: 30477337]

7. US Department of Health and Human Services (USDHHS). E-cigarette Use among Youth and Young Adults. A Report of the Surgeon General. Atlanta, GA: USDHHS; 2016. Available at: https://www.cdc.gov/tobacco/data_statistics/sgr/e-cigarettes/pdfs/2016_sgr_entire_report_508.pdf/. Accessed January 13, 2020.

8. Schier JG, Meiman JG, Layden J, et al. Severe pulmonary disease associated with electronic-cigarette-product use – interim guidance. MMWR Morb Mortal Wkly Rep. 2019;68(36):787–790. Available at: https://www.cdc.gov/mmwr/volumes/68/wr/mm6836e2.htm/. Accessed January 13, 2020. [PubMed: 31513561]

9. Yu S, Escobedo P, Garcia R, et al. A descriptive longitudinal study of changes in vape shop characteristics and store policies in anticipation of the 2016 FDA regulations of tobacco products, including e-cigarettes. Int J Environ Res Public Health. 2018;15(2):313.

10. US Food and Drug Administration. FDA's deeming regulations for e-cigarettes, cigars, and all other tobacco products. 2018. Available at: https://www.fda.gov/tobacco-products/rules-regulations-and-guidance/fdas-deeming-regulations-e-cigarettes-cigars-and-all-other-tobacco-products/. Accessed January 13, 2020.

11. US Food and Drug Administration. Interpretation of and compliance policy for certain label requirement; applicability of certain Federal food, drug, and cosmetic act requirements to vape shops. US Department of Health and Human Services Food and Drug Administration Center for Tobacco Products. 2019. Available at: https://www.fda.gov/TobaccoProducts/Labeling/RulesRegulationsGuidance/ucm536995.htm/. Accessed January 13, 2020.

12. Sussman S, Cruz TB, Smiley SL, et al. Tobacco regulatory compliance with STAKE Act age-of-sale signage among licensed tobacco retailers across diverse neighborhoods in Southern California. Tob Induc Dis. 2018 6;16. pii: 30. doi: 10.18332/tid/91846. [PubMed: 31321095]

13. Kong G, Unger J, Baezconde-Garbanati L, et al. The associations between Yelp online reviews and vape shops closing or remaining open one year later. Tob Prev Cessat. 2017;2(Suppl). pii: 9. doi: 10.18332/tpc/67967. Epub 2017 Feb 2. [PubMed: 29057379]

14. Lanza IH, Pittman PS. A peek past the vape clouds: vape shop decline in Long Beach, California during 2015–2018. Tob Regul Sci. 2019;5(5):447–455. [PubMed: 32879896]

15. Gibbs RJ. Principles of Urban Retail Planning and Development. New York, NY: John Wiley & Sons; 2012.

16. Allem J-P, Unger JB, Garcia R, et al. Tobacco attitudes and behaviors of vape shop retailers in Los Angeles. Am J Health Behav. 2015;39(6):794–798. [PubMed: 26450547]

17. Garcia R, Allem JP, Baezconde-Garbanati L, et al. Employee and customer handling of nicotine-containing e-liquids in vape shops. Tob Prev Cessat. 2016;2(Suppl). doi: 10.18332/tpc/67295. Epub 2017 Jan 20.

18. Sussman S, Garcia R, Cruz TB, et al. Consumers' perceptions of vape shops in Southern California: an analysis of online Yelp reviews. Tob Induc Dis. 2014;12(1):22. [PubMed: 25484852]

19. Luca M, Zervas G. Fake it till you make it: reputation, competition, and Yelp review fraud. Manage Sci. 2016;62(12):3412–3427.

20. Luca M, Reviews reputation, and revenue: the case of yelp.com. Harvard Business School NOM Unit Working Paper. 2016. Available at: https://www.hbs.edu/faculty/Publication%20Files/12-016_a7e4a5a2-03f9-490d-b093-8f951238dba2.pdf/. Accessed January 10, 2020.

21. Hallgren KA. Computing inter-rater reliability for observational data: an overview and tutorial. Tutor Quant Methods Psychol. 2012;8(1):23–34. [PubMed: 22833776]

22. Lee YO, Kim AE. 'Vape shops' and 'e-cigarette lounges' open across the USA to promote ENDS. Tob Control. 2015;24(4):410–412. [PubMed: 24727649]

23. Wagener T, Shaikh R, Meier E, et al. Examining the smoking and vaping behaviors and preferences of vape shop customers. Tob Prev Cessat. 2016;2(Suppl):5. DOI: 10.18332/tpc/65150.

24. LaVito A Tobacco giant Altria takes 35% stake in Juul, valuing e-cigarette company at $38 billion: CNBC. 2018. Available at: https://www.cnbc.com/2018/12/20/altria-takes-stake-in-juul-a-pivotal-moment-for-the-e-cigarette-maker.html/. Accessed January 13, 2020.

25. Basch CH, Kecojevic A, Menafro A. Provision of information regarding electronic cigarettes from shop employees in New York City. Public Health. 2016;136:175–177. [PubMed: 27156992]

26. Nayak P, Kemp CB, Redmon P. A qualitative study of vape shop operators' perceptions of risks and benefits of e-cigarette use and attitude toward their potential regulation by the US Food and Drug Administration, Florida, Georgia, South Carolina, or North Carolina, 2015. Prev Chronic Dis. 2016;13:E68–E68. [PubMed: 27197081]

27. Wann TF, Gowin M, Cheney MK. Vapor store owner beliefs and messages to customers. Nicotine Tob Res. 2015;18(5):694–699. [PubMed: 26113622]

28. Pepper JK, Ribisl KM, Brewer NT. Adolescents' interest in trying flavoured e-cigarettes. Tob Control. 2016;25(Suppl 2):ii62–ii66. [PubMed: 27633762]

29. Harrell MB, Weaver SR, Loukas A, et al. Flavored e-cigarette use: characterizing youth, young adult, and adult users. Prev Med Rep. 2017;5:33–40. [PubMed: 27896041]

30. Morean ME, Butler ER, Bold KW, et al. Preferring more e-cigarette flavors is associated with e-cigarette use frequency among adolescents but not adults. PLoS One. 2018;13(1):e0189015. [PubMed: 29300749]

31. McKelvey K, Baiocchi M, Halpern-Felsher B. Adolescents' and young adults' use and perceptions of pod-based electronic cigarettes. JAMA Netw Open. 2018;1(6):e183535. [PubMed: 30646249]

32. Food US and Administration Drug. Selling tobacco products in retail stores. 2019. Available at: https://www.fda.gov/tobacco-products/retail-sales-tobacco-products/selling-tobacco-products-retail-stores/. Accessed January 13, 2020.

33. Levinson AH, Ma M, Jason LA, et al. Assessment of the US Federal retailer violation rate as an estimate of the proportion of retailers that illegally sell tobacco to adolescents. JAMA Pediatr. 2018;172(10):966–972. [PubMed: 30128544]

34. Roeseler A, Vuong TD, Henriksen L, et al. Assessment of underage sales violations in tobacco stores and vape shops. JAMA Pediatr. 2019;173(8):795–797. [PubMed: 31233124]

35. Sussman S, Allem J-P, Garcia J, et al. Who walks into vape shops in Southern California? A naturalistic observation of customers. Tob Induc Dis. 2016;14(1):18. [PubMed: 27231480]

36. Soule EK, Lipato T, Eissenberg T. Waterpipe tobacco-smoking: a new smoking epidemic among the young? Curr Pulmonol Rep. 2015;4(4):163–172. [PubMed: 26756025]

37. Lerner CA, Sundar IK, Yao H, et al. Vapors produced by electronic cigarettes and e-juices with flavorings induce toxicity, oxidative stress, and inflammatory response in lung epithelial cells and in mouse lung. PLoS One. 2015;10(2):e0116732. [PubMed: 25658421]

38. Lipinski D, Nelson R. Problems in the use of naturalistic observation as a means of behavioral assessment. Behav Ther. 1974;5(3):341–351.

Table 1

Vape Shops Baseline Characteristics for the Total Sample and Stratified by Closed/Open Status [a]

Study variables	Total (N = 77)	Open shops (N = 43)	Closed shops (N = 34)	p-value
Total	100	55.8	44.2	N/A
Ethnic location				
Black/African American	20 (25.9)	14 (32.6)	6 (17.7)	
Hispanic/Latino	17 (22.1)	9 (20.9)	8 (23.5)	
Korean American	18 (23.4)	7 (16.3)	11 (32.3)	.28[c]
White	22 (28.6)	13 (30.2)	9 (26.5)	
Free parking available	62 (80.5)	36 (83.7)	26 (76.5)	.43[c]
Accessibility, mean (SD) [b]	3.7 (0.7)	3.8 (0.5)	3.5 (0.83)	.04[d]
"Bar type" physical environment, mean (SD)	0.9 (1.5)	1.4 (1.8)	0.4 (0.7)	.003[d]
Shop staff attributes				
Helpful	36 (46.8)	27 (62.8)	9 (26.5)	.002[c]
Knowledgeable	21 (27.3)	16 (37.2)	5 (14.7)	.03[c]
Average number of customers, mean (SD)	2.4 (2.1)	2.8 (2.2)	1.9 (1.9)	.07[d]
Average time spent in the shop (in min), mean (SD)	9.6 (8.0)	12.0 (8.3)	6.6 (6.6)	.003[d]
Average age of customers, mean (SD)	30.9 (7.2)	31.4 (7.2)	30.2 (7.3)	.55[d]
Number of flavors sold, mean (SD)	117.2 (73.8)	146.0 (78.3)	80.7 (47.7)	<.001[d]
Types of devices sold				
Rechargeable	77 (100.0)	43 (100.00)	34 (100.00)	.99[c]
Disposable	13 (16.9)	9 (20.9)	4 (11.8)	.37[c]
Atomizers	76 (98.7)	43 (100.0)	33 (97.1)	.44[c]
Dry Herb	22 (28.6)	17 (39.5)	5 (14.7)	.02[c]
E-liquid menu available	70 (90.9)	42 (97.7)	28 (82.4)	.04[c]

Note.

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[a] Data are expressed as number (%) unless otherwise indicated

[b] Higher scores indicate better accessibility (on a scale from 1 to 4)

[c] Calculated using the χ^2 test

[d] Calculated using the independent samples t-test

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Table 2

Logistic Regression Model Examining the Predictors of Vape Shops Going out of Business

Predictors	Vape Shop Going out of Business	
	AOR (95% CI)	**p-value**
Accessibility (ref = easy)	7.11 (1.17–43.24)	.03
Number of flavors sold (ref = more than 100)	6.55 (1.56–27.49)	.01
Vape shop staff qualification index[a]	2.28 (1.12–4.64)	.02
Average time spent in the shop (ref = more than 10 min)	4.80 (1.18–19.60)	.03
Diversity of devices index[a]	2.36 (1.13–4.91)	.02
"Bar type" physical environment (ref = yes)	2.64 (1.12–6.20)	.03
E-liquid menu available (ref = yes)	6.83 (0.59–78.85)	.12

Note.

Abbreviations: AOR, Adjusted Odds Ratio; CI, Confidence Interval; ref, reference

[a]Rescaled (mean = 0, SD = 1) such that the ORs indicate the change in odds in the outcome associated with an increase in 1 SD unit on the covariate continuous scale.