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Content analysis of e-cigarette products, promotions, prices and claims on Internet tobacco vendor websites, 2013–2014

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Abstract

Objective—To identify the population of Internet e-cigarette vendors (IEVs) and conduct content analysis of products sold and IEVs' promotional, claims and pricing practices.

Methods—Multiple sources were used to identify IEV websites, primarily complex search algorithms scanning over 180 million websites. In 2013, 32 446 websites were manually screened, identifying 980 IEVs, with the 281 most popular selected for content analysis. This methodology yielded 31 239 websites for manual screening in 2014, identifying 3096 IEVs, with 283 selected for content analysis.

Results—While the majority of IEVs (71.9%) were US based in 2013, this dropped to 64.3% in 2014 (p<0.01), with IEVs located in at least 38 countries, and 12% providing location indicators reflecting two or more countries, complicating jurisdictional determinations. Reflecting the retail market, IEVs are transitioning from offering disposable and 'cigalike' e-cigarettes to larger tank and "mod" systems. Flavored e-cigarettes were available from 85.9% of IEVs in 2014, with fruit and candy flavors being most popular. Most vendors (76.5%) made health claims in 2013, dropping to 43.1% in 2014. Some IEVs featured conflicting claims about whether or not e-cigarettes aid in smoking cessation. There was wide variation in pricing, with e-cigarettes available as inexpensive as one dollar, well within the affordable range for adults and teens.

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Conclusions—The number of Internet e-cigarette vendors grew threefold from 2013 to 2014, far surpassing the number of Internet cigarette vendors (N=775) at the 2004 height of that industry. New and expanded regulations for online e-cigarette sales are needed, including restrictions on flavors and marketing claims.

INTRODUCTION

E-cigarettes are widely available at traditional tobacco retailers,[12] vape shops[34] and Internet E-cigarette vendors (IEVs).[5–9] The e-cigarette market was forecast to reach $10 billion by 2017, eclipsing cigarette sales by 2023.[10] *Online* sales were projected to be $1.2 billion by the end of 2015.[11] The Surgeon General has called for expanded surveillance of the e-cigarette market[12] that includes IEVs, which capture 30% of US e-cigarette sales, more than any other store-type category.[11]

A small examination of 59 e-cigarette manufacturer–retailer websites[8] showed that 95% made positive health-related claims and 64% made smoking-cessation claims, many promoting e-cigarettes' benefits over smoking, including that they are cleaner (95%) and cheaper than cigarettes and/or nicotine replacement therapies (93%). Additional claims included the modernity and social favourability of e-cigarettes. Another study of 78 manufacturer and 32 retailer websites found that most (78% and 65% respectively) featured at least one health claim, with an average of two modified risk and/or secondhand smoke-related claims per site.[6]

This study expands on previous studies of IEVs and on the Internet Tobacco Vendors (ITV) Study's[13] long-term surveillance of the Internet tobacco marketplace since 1999. With more detailed data and a substantially larger sample size, we provide a more complete picture of the online e-cigarette marketplace and the products, prices, promotions and claims featured on vendor websites, helping to inform future state and federal regulation of these companies' business practices.

Comparatively little regulatory and scientific attention has been paid to online e-cigarette sales as to retail store sales.[1314] In August 2016, the US Food and Drug Administration (FDA) issued federal regulations affecting e-cigarettes,[14] although few immediately affected Internet vendors. Baseline data about products, prices, promotions and claims featured on IEV websites are crucial to informing future FDA e-cigarette regulations and enforcement actions, particularly about IEVs' featuring of potentially restricted or prohibited products or promotions and potentially misleading health claims. This study expands on limited existing surveillance research with more comprehensive data, providing a baseline measure of the preregulated IEV industry to which to compare vendor adaptations and changes postregulation, and evaluates aspects of the IEV industry over which the government has regulatory authority.

METHODS

Website identification procedures

IEVs were identified from an ongoing study of ITVs selling all types of tobacco products. As described in figure 1's depiction of study sampling procedures and in a previous publication drawn from the same sample,[15] several sources were used to identify as close as possible the full population of ITVs followed by content analyses of the most popular IEVs. While previous studies have employed web queries on popular Internet search engines to identify potential IEV websites (a few hundred at most with at least one limited to manufacturer websites),[5–9] our methodology[15] yields a larger and more diverse population (of over 3000 vendors from multiple sources and across a wide range of popularity).

In 2013, through the use of complex automated search algorithms, we searched 180 million websites, newsgroups, message boards and spam emails for Internet e-cigarette vendors, resulting in 14 171 potential IEV links. To that we added another 17 102 URLs extracted from Twitter, 1044 links from our prior work and from promotional sites identified during screening, and another 129 identified by R.J. Reynolds.[16] We manually screened these 32 446 websites for eligibility, identifying 980 IEVs. By 2014, 36.8% of those had gone out of business, comparable with the rate of attrition for Internet cigarette vendors prior to federal regulation.[17]

Manual screening of 31 239 URLs in 2014 (15 285 from search algorithms, 15 515 from our prior research and 439 linked from promotional websites) identified 3096 IEVs, a *threefold increase* in the number of vendors over the previous year.

Inclusion criteria

An IEV was defined as an English language website selling nicotine-containing e-cigarette products for home delivery. Alexa.com traffic rankings[18] were used as a quantifiable and accurate[19] measure of popularity to identify the most visited IEVs for content analysis. The 2013 sample included the 236 most popular IEVs (including 36 that were initially excluded as not selling e-cigarettes and then re-included after deeper examination revealed that they sold e-cigarettes). Also included were 45 IEVs that were not among the most popular *e-cigarette* vendors but *were* among the 200 most popular ITVs selling *other* categories of tobacco products that *also* sold e-cigarettes, resulting in a final sample of 281 popular IEVs. In 2014, identical methodology led to selection of the 206 most visited IEVs, as well as 77 popular ITVs in other tobacco categories, resulting in a sample of 283 popular IEVs.

Coding and analysis

Every website in our study is double coded using our proprietary OnTrAC (Online Tracking, Auditing and Coding) application. Furthermore, we collect data from browsable archival copies (created during a short period of time with Wysigot V.6.1, Site-Sucker V.2.4 and Evernote V.5.0 software), allowing for a snapshot of the data from a fixed period of time. After double coding, OnTrAC flagged inter-rater discrepancies for resolution by senior staff.

Geographic location was published in a paper focusing on issues related to youth access from the same samples of IEVs.[15] Variables tracked for this paper are included in tables 1–3, and detailed definitions of all variables are included in online supplementary appendix 1.

Final records were analysed with SAS V.9.3, including frequencies, descriptive statistics and χ^2 tests to evaluate significant differences between groups and t-tests to evaluate significant differences between means from 2013 to 2014.

RESULTS

Website location and characteristics

As reported in our earlier paper,[15] Most IEVs sold online only, with a significant increase in shops with retail locations from 2013 to 2014. Most (71.9% in 2013 and 65.0% in 2014) were in the USA, although 38 countries were represented, including 12% of vendors with indicators reflecting two or more countries, like a Swiss mailing address and a US toll-free phone number, complicating determination of the business's locational jurisdiction. There was high attrition, with only 63.2% of IEVs identified in 2013 *still in business* by 2014, with only 31.0% of IEVs in the 2013 *content analysis sample* still in business *and* still popular enough to be included in the 2014 content analysis sample.

Products for sale

The types of products available from IEVs changed from 2013 to 2014, reflecting the evolution of product popularity[11] from try-it-out disposable e-cigarettes to cigarette-sized (cigalike) e-cigarettes to larger tank and mod 'open' systems, which use larger batteries and higher vaping temperatures to produce larger, more toxic vapour clouds.[12] In 2013, more than half of IEVs sold disposable e-cigarettes, dropping to 39.2% by 2014 (table 1). Similarly, e-cigarette starter kits, sold by 92.5% of vendors in 2013, were available from only 78.1% of vendors in 2014.

In 2013, we found that <2% of IEVs sold the five most popular retail store e-cigarette brands,[20] including Blu (1.8%), NJoy (1.1%), Logic (1.1%), Mistic (0.0%) or 21st Century Smoke (0.0%). Between 2013 and 2014, we conducted a study of e-cigarette-related Google Search Trends,[21] which found little overlap between the most popular retail brands and the most searched brands online. In fact, Blu, NJoy and Logic (the three most popular retail brands) were ranked second, fourth and eighth in e-cigarette brand searches on Google, and there was *no other overlap* between the 15 most popular retail store brands and the 15 most searched brands online (figure 2).

By 2014, Blu and NJoy were sold by significantly more popular IEVs than in 2013. While Nucig was the most searched for brand in 2013, it was found on only one popular IEV in 2014. The brand found on most IEV websites was Joyetech (sold at 53 sites). Ego e-cigarettes, featured on 106 sites, were originally developed by Joyetech, but over time became more broadly known as a standard style of e-cigarette made by many companies, using interchangeable parts with standard 510 threading.[22] Flavoured e-cigarettes were featured on the overwhelming majority of IEVs, with a significant increase from 80.1% to 85.9% from 2013 to 2014 ($p<0.05$). Fruit and candy flavours were most popular, followed by coffee and spices. Alcoholic beverage-flavoured e-cigarettes were available at 45.6% of vendors in 2013, with a significant increase to 54.8% of vendors the following year.

Some more unusual flavours available from IEVs included Atomic Cinnacide, Peanut Butter Jesus, Energy Cow (mimicking Red Bull energy drinks), Purple Drank (a slang term for a grape Kool-Aid flavoured illicit alcoholic mixed drink containing strong prescription cough medicine)[23] and flavours whose names did not describe their taste, instead capitalising off of popular culture, such as Unicorn Blood and The Vaping Dead.

Sale of other types of tobacco products on IEV websites varied. With e-cigarettes commonly promoted as a replacement product for cigarettes, few IEVs sold cigarettes. Vendors were more likely to sell cigarette-alternative products like roll-your-own cigarette supplies, little cigars or hookah, although most only sold e-cigarettes (76.5% in 2013 and 60.8% in 2014).

Prices

Prices for e-cigarettes varied widely across vendors, with starter kits ranging from *free* to $129.95, with a median $28.95 in 2013, decreasing significantly to $24.70 by 2014 (table 2). The median price of a disposable e-cigarette in 2013 was $8.99, but they were available for as little as $2.50, with prices rising as high as $44.95, higher than the average and median prices for reusable e-cigarette starter kits. By 2014, average and median disposable prices had not changed significantly, but the range had, with the minimum price dropping to $1.00 and the maximum price rising to $55.03. Shipping varied widely as well, with 62.3% of vendors offering free shipping at some or all purchase levels. Of the vendors that charged for shipping (n=209), the price ranged from $0.01 to $55.63, with an average of $7.55.

Promotions and claims

E-cigarette vendors featured a wide variety of promotions and claims on their websites (table 3), with about a quarter failing to include a health warning. IEVs featured conflicting claims about whether e-cigarettes do (32.7% in 2013 and 26.2% in 2014) or do not (50.2% in 2013 and 36.8% in 2014) help to quit smoking, sometimes on the same website (16.7% in 2013; 12% in 2014). In fact, some sites featured claims by the vendor that e-cigarettes are not a cessation device while prominently featuring supposed customer testimonials (that read like professional marketing copy) about how e-cigarettes helped them quit smoking, such as ‘Even if you feel that smoking is an impossible habit to quit, this tool has helped millions around the world to stop smoking once and for all’. Some sites had conflicting claims within the same statement (eg, ‘<Brand> has never been tested or proven to be a cessation device, although many have used it as such’.). Claims about the advantages of e-cigarettes over traditional cigarettes, such as health (69.4%) and price (53.4%) advantages, the ability to circumvent smoke-free laws (59.4%) and that e-cigarettes are safer for others than secondhand smoke (47.7%), were common; 76.5% of vendors made one or more health-related claims.

In 2013, 31 IEVs (11.0%) and 17 in 2014 (6.0%) featured celebrity endorsements (eg, a celebrity vaping on a TV show). Six of the IEVs featuring celebrity endorsements in 2013 were also in the 2014 sample and featured celebrity endorsements. One vendor from the 2013 sample *added* celebrity endorsements by 2014. Sixty-eight videos and images of celebrities using e-cigarettes were featured in 2013, with 46 in 2014, including popular recording artists like Snoop Dogg, actors such as Katherine Heigl and Leonardo DiCaprio, and even endorsements from TV news programmes and supposed physicians were featured. Other popular promotions included loyalty programmes, discounts, free tobacco products, free mobile phone minutes, military discounts and a contest to win a free car.

DISCUSSION

With at least 3096 unique ITVs selling e-cigarettes for home delivery identified in 2014, the number of Internet e-cigarette vendors has far surpassed the number of Internet *cigarette* vendors (n=775) at the preregulation height of that industry in 2004.[24] With over a quarter of popular e-cigarette vendors located outside the USA (and with over 10% indicating more than one country location, further complicating determination of legal jurisdiction),[15] the FDA and US Customs departments will need to foresee and address challenges posed by these international and multinational sales. Merely identifying the incoming packages as containing tobacco products can be a major challenge. In our study of e-cigarette sales to minors online,[25,26] 11 of 98 packages were received from other countries. Of those, only three bore customs declarations or return addresses that identified the products as e-cigarettes. The rest had false declarations (eg, that they were ‘lipstick’ or ‘gift pen sets’), making identifying them as e-cigarettes challenging.[25]

Products

Reductions in vendors featuring disposable and cigalike starter kit e-cigarettes (and increases in their prices) may be indicative of the move towards open e-cigarette systems involving buying separate parts (or mods) to customise one’s personal and reusable e-cigarette system. This reduction is consistent with the findings of our youth e-cigarette purchase study, where only 6 of the 98 most popular IEVs sold disposable e-cigarettes.[26] As their popularity grows, more research and regulatory attention needs to be paid to these products.

Online sales represents 30% of e-cigarette sales.[11] There is relatively little crossover between brands popular in retail and online sales. While some brick and mortar retailers have IEV websites, the overwhelming majority (74.7%) of popular Internet e-cigarette stores are online only and appear to sell different brands than are popularly found in retail stores. The fact that there is little crossover between popular retail store brands and brands frequently sought on Google underscores the importance of studying *both* markets, with the implication that the online and retail markets for e-cigarettes may be reaching different customer bases with different products and/or that people seeking e-cigarettes online may be exposed to (or searching for) different products than they are finding in retail stores. It also implies that the online and retail store markets (and customers) are different enough to necessitate further study comparing the two markets.

The broad availability of flavoured e-cigarettes is of substantial concern, adding to a growing foundation of evidence indicating that e-cigarette flavours are common and wide ranging.[9,27] Chemicals approved for flavouring foods are commonly used for flavouring tobacco products, but are not necessarily safe for vaporising and inhaling,[12] such as diacetyl (which imparts buttery or creamy flavours), and cinnamaldehyde (cinnamon flavour), both of which cause lung tissue death when vaporised.[28,29]

The vast array of e-flavours has the potential to attract a large customer base, enticing current smokers who miss the availability of flavoured cigarettes, or who would like to experiment with flavours, and attracting new users who see familiar flavours as an enticing reason to experiment. The plentiful assortment of fruit, candy, dessert and alcohol flavours is of particular concern for the same reason that flavoured cigarettes were concerning enough to be banned under the Family Smoking Tobacco Prevention Control Act[30]: their high youth-appeal and the intentional or unintentional marketing to minors. Some flavours seem intentionally designed to appeal to youth tastes with names after popular kids' sweetened drinks and cereals, with edgy or amusing names like Peanut Butter Jesus, or profiting on the popularity of TV shows like *The Walking Dead* with The Vaping Dead. The e-cigarette industry has even co-opted youth slang for an illegal drug concoction (Purple Drank) to draw in young people whose social currency improves by association with seeking an illicit high.[31,32] With 40% of teen e-cigarette users having never smoked cigarettes,[33] and 99% of teen e-cigarette users having *started* with flavoured e-cigarettes,[34] the availability of flavours is a primary reason that teens are starting to use e-cigarettes,[35] and a primary reason that flavours in e-cigarettes should be restricted (and why some areas, such as San Francisco, have already passed legislation to ban them[36]).

Prices

While nearly all vendors sold e-cigarette starter kits and over half sold disposable e-cigarettes, starter kits were often less expensive. Vendors often group disposables together in multipacks or price them higher than their starter kits perhaps to encourage people to become regular users right away by making it less expensive to buy a starter kit than a 'try it and throw it away' disposable e-cigarette. The commonality of cheap or free shipping on these products further underscores the notion of online sellers trying to reduce barriers to their buyers becoming regular customers. Furthermore, e-cigarettes were inexpensive, priced well within the affordable range for adults and teens alike (our research has shown that teens can easily buy e-cigarettes from IEVs[26]).

Promotions and claims

Featured on 89.3% of IEV websites, promotions are widely used to garner consumer interest. Seeing popular news programmes promoting e-cigarette use and/or popular actors like Katherine Heigl, Leonardo DiCaprio and Johnny Depp on IEV websites using e-cigarettes on popular TV shows could have impact on consumer perception of social norms and e-cigarette safety. Also concerning, 14.6% of vendors featured endorsements from supposed medical professionals (without scientific evidence supporting the products' safety).

Another concern among promotions were the giveaways of tobacco products and high-value items, most notably a new car. These types of promotions have been identified in similar numbers by other researchers.[7] Offering grand incentives such as this may be an effective way to draw in new customers that were on the fence about trying the vendor's products.

Although the FDA's 2016 Deeming regulations[14] now prohibit the offering of free product samples, they do not prohibit offering free gifts or entries into giveaway contests (eg, a new car).

Even more concerning was the multitude of claims made on IEV websites about the advantages of e-cigarettes over traditional cigarettes. With well over half touting health advantages, price advantages and the ability to circumvent smoke-free laws—and nearly half claiming they are safer than secondhand smoke, more fire safe (in direct contradiction to the growing reports of e-cigarette explosions[37–41]), and carry more social advantages than combustible cigarettes—IEVs are giving customers unproven claims about their products, potentially to the detriment of their health. While we found fewer instances of these claims (77.6%) than Grana *et al*[8] (95%), this is likely due to sampling differences (that study was limited to single-brand manufacturer retailers). Furthermore, while it is likely that e-cigarettes pose lower health risks than combustible cigarettes, these claims are not yet supported by adequate scientific evidence; in fact, the Surgeon General has called them 'a major public health concern'.[12] But the claims made on IEV websites give users the impression that they are safe (not merely safer than cigarettes), potentially drawing customers who are not current combustible cigarette users into an addictive nicotine habit.

Our finding that half of vendors claimed e-cigarettes are not smoking-cessation devices is consistent with previous research.[8] However, the incidence of conflicting claims about e-cigarettes and smoking cessation is particularly troubling. Featuring disclaimers about e-cigarettes not being cessation devices is disingenuous when accompanied by featured statements to the contrary via customer 'testimonials' that appear to be marketing copywriting. These conflicting claims may confuse customers and mislead smokers who are desperate to quit, when there is conflicting scientific evidence about whether e-cigarettes are an effective cessation device.[42] In fact, there is mounting evidence that e-cigarettes are more likely to undermine cessation efforts[43–45] and more likely to be used as a bridging device (creating dual users)[46] than to help smokers successfully quit tobacco products.

LIMITATIONS

This study has several limitations, First, we tried to identify as close as possible the population of Internet e-cigarette vendors, but we acknowledge that our methodology likely missed some less popular vendors. Second, we limited our content analyses to the most popular vendors because it is impractical to fully code all vendor websites, and the most popular ones get the bulk of visitor traffic and are most likely to be found by consumers. Third, due to the extensive time required to collect, audit, analyse and publish our findings, the data are now several years old, but a longitudinal analysis of data through 2016 is forthcoming.

CONCLUSIONS

The preregulatory online e-cigarette sales industry bears much resemblance to the online cigarette sales industry preregulation. Lessons learnt from our team's research on Internet cigarette vendors indicate that regulating online sales of restricted products is difficult and further complicated by issues of jurisdiction, the challenges of enforcing regulations and vendors' adaptability to regulatory change.[17244748] Furthermore, in the absence of regulation *and* enforcement, tobacco product vendors will take little action to comply with regulations. Despite support submitted to the FDA by various public health experts and tobacco control organisations, the 2016 regulations issued by the FDA[14] have done little to regulate the *online* sale of e-cigarettes. While the regulations set the stage for the regulation of both online and offline e-cigarette sales, until the FDA issues additional regulations directly affecting online e-cigarette vendors' sales practices and the claims they make, e-cigarette sales will continue to grow unfettered in the online retail environment. New, adapted and expanded regulations and enforcement plans are needed to address online e-cigarette sales, requiring—among other things—restrictions on marketing claims and use of potentially unsafe flavouring chemicals in e-cigarette products and accessories.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Rose SW, Barker DC, D'Angelo H, et al. The availability of electronic cigarettes in U.S. retail outlets, 2012: results of two national studies. Tob Control. 2014; 23(Suppl 3):iii10–16. [PubMed: 24935892]
2. Hsu R, Myers AE, Ribisl KM, et al. An observational study of retail availability and in-store marketing of e-cigarettes in London: potential to undermine recent tobacco control gains? BMJ Open. 2013; 3:e004085.
3. Lee YO, Kim AE. 'Vape shops' and 'E-Cigarette lounges' open across the USA to promote ENDS. Tob Control. 2015; 24:410–2. [PubMed: 24727649]
4. 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; 12:22. [PubMed: 25484852]
5. Cuomo RE, Miner A, Mackey TK. Pricing and sales tax collection policies for e-cigarette starter kits and disposable products sold online. Drug Alcohol Rev. 2015 (Epub ahead of print: 23 Oct 2015).
6. Klein EG, Berman M, Hemmerich N, et al. Online E-cigarette marketing claims: a systematic content and legal analysis. Tob Regul Sci. 2016; 2:252–62. [PubMed: 27446984]
7. Mackey TK, Miner A, Cuomo RE. Exploring the e-cigarette e-commerce marketplace: Identifying internet e-cigarette marketing characteristics and regulatory gaps. Drug Alcohol Depend. 2015; 156:97–103. [PubMed: 26431794]
8. Grana RA, Ling PM. "Smoking revolution": a content analysis of electronic cigarette retail websites. Am J Prev Med. 2014; 46:395–403. [PubMed: 24650842]
9. Zhu SH, Sun JY, Bonnevie E, et al. Four hundred and sixty brands of e-cigarettes and counting: implications for product regulation. Tob Control. 2014; 23(Suppl 3):iii3–9. [PubMed: 24935895]
10. HerzogB, , GerberiJ. E-cigs revolutionizing the tobacco industry. Secondary E-cigs revolutionizing the tobacco industry2013http://www.smallcapfinancialwire.com/wp-content/uploads/2013/11/E-Cigs-Revolutionizing-the-Tobacco-Industry-Interactive-Model.pdf
11. HerzogB. Tobacco Talk: Independent Vapor Mfr. SurveyNew York: Wells Fargo Securities; 2015
12. Surgeon General US. Surgeon General's Report: E-cigarette Use Among Youth and Young Adults. Secondary 2016 Surgeon General's Report: E-cigarette Use Among Youth and Young Adults2016https://www.cdc.gov/tobacco/data_statistics/sgr/e-cigarettes/index.htm

13. WilliamsRS, , DerrickJ, , JohnsonA. Internet Tobacco Vendors Study Website. Secondary Internet Tobacco Vendors Study Website2017http:/InternetTobaccoVendorsStudy.com

14. Food and Drug Administration, HHS. Deeming tobacco products to be subject to the federal food, drug, and cosmetic act, as amended by the family smoking prevention and tobacco control act; restrictions on the sale and distribution of tobacco products and required warning statements for tobacco products. secondary deeming tobacco products to be subject to the federal food, drug, and cosmetic act, as amended by the family smoking prevention and tobacco control act; restrictions on the sale and distribution of tobacco products and required warning statements for tobacco products. 2016; 81:28973–9106. https://www.federalregister.gov/articles/2016/05/10/2016-10685/deeming-tobacco-products-to-be-subject-to-the-federal-food-drug-and-cosmetic-act-as-amended-by-the.

15. Williams RS, Derrick J, Liebman AK, et al. Content analysis of age verification, purchase and delivery methods of internet e-cigarette vendors, 2013 and 2014. Tob Control. 2017 tobaccocontrol-2016-053616 (Epub ahead of print: 08 May 2017).

16. R. J. Reynolds Tobacco Company. A list of 129 tobacco related websites identified by R.J. Reynolds Corporate Security and offered to author R.W. following a discussion ondetecting counterfeit RJR cigarettes. 2013

17. Ribisl KM, Williams RS, Gizlice Z, et al. Effectiveness of state and federal government agreements with major credit card and shipping companies to block illegal Internet cigarette sales. PLoS One. 2011; 6:e16754. [PubMed: 21340032]

18. Alexa Traffic Rankings. Secondary Alexa Traffic Rankings2016http://www.alexa.com/

19. FishkenR. The Traffic Prediction Accuracy of 12 Metrics from Compete, Alexa, SimilarWeb, & More. Secondary The Traffic Prediction Accuracy of 12 Metrics from Compete, Alexa, SimilarWeb, & More2015https://moz.com/rand/traffic-prediction-accuracy-12-metrics-compete-alexa-similarweb/

20. HuangJ, , ChaloupkaFJ, , EmeryS. Rapid rise of electronic cigarettes: Public health and policy implications. Boston. Presented at American Public Health Association Annual Meeting; 2013

21. Ayers JW, Althouse BM, Allem JP, et al. Revisiting the rise of electronic nicotine delivery systems using search query surveillance. Am J Prev Med. 2016; 50:e173–e181. [PubMed: 26876772]

22. Phillips CV. Serious ethical concerns about public health research conduct; the case of vape convention air quality measurement. Secondary Serious ethical concerns about public health research conduct; the case of vape convention air quality measurement. 2016; 2016 https://antithrlies.com/2016/02/19/serious-ethical-concerns-about-public-health-research-the-case-of-vape-convention-air-quality-measurement/.

23. [10 Sep 2015] Purple drank. Wikipedia: The Free Encyclopedia2015https://en.wikipedia.org/wiki/Purple_drank

24. RibislKM, , KimAE, , WilliamsRS. Sales and Marketing of Cigarettes on the Internet: Emerging Threats to Tobacco Control and Promising Policy Solutions. In: BonnieRJ, StrattonK, , WallaceRB, editorsEnding the Tobacco Problem: A Blueprint for the NationWashington, DC: The National Academies Press; 2007M127

25. Kong AY, Derrick JC, Abrantes AS, et al. What is included with your online e-cigarette order? An analysis of e-cigarette shipping, product and packaging features. Tob Control. 2016 (Epub ahead of print: 29 Jun 2016).

26. Williams RS, Derrick J, Ribisl KM. Electronic cigarette sales to minors via the internet. JAMA Pediatr. 2015; 169:e1563. [PubMed: 25730697]

27. Singh T, Kennedy S, Marynak K, et al. Characteristics of electronic cigarette use among middle and high school students - United States, 2015. MMWR Morb Mortal Wkly Rep. 2016; 65:1425–9. [PubMed: 28033310]

28. Rowell TR, Lee S, Tarran R. Select E-Cigarette Flavors Alter Calcium Signaling, CellViability And Proliferation In Lung Epithelia. Am J Respir Crit Care Med. 2015; 191:A2896.

29. Rowell TR, Sizer S, Tarran R. Flavored E-Liquids alter cell proliferation and calcium signaling. Am J Respir Crit Care Med. 2016; 193:A5862.

30. USCFamily Smoking Prevention and Tobacco Control ActUnited States of America: USC; 20091799

31. SandersB. Drugs, Clubs, and Young People: Sociological and Public HealthPerspectivesUK: Routledge; 2016
32. The National Center on Addiction and Substance Abuse at Columbia UniversityNational survey of American attitudes on substance abuse XIII: teens and parentsNew York: The National center on addiction and substance abuse at Columbia University; 2008
33. Barrington-Trimis JL, Berhane K, Unger JB, et al. Psychosocial factors associated with adolescent electronic cigarette and cigarette use. Pediatrics. 2015; 136:308–17. [PubMed: 26216326]
34. 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]
35. Kong G, Morean ME, Cavallo DA, et al. Reasons for electronic cigarette experimentation and discontinuation among adolescents and young adults. Nicotine Tob Res. 2015; 17:847–54. [PubMed: 25481917]
36. San Francisco Board of Supervisors. Health code - banning the sale of flavored tobacco products. secondary health code - banning the sale of flavored tobacco products. 2017https://sfgov.legistar.com/View.ashx?M=F&ID=5274235&GUID=86C18253-BA63-4C0F-A6A0-E881211D2CB7
37. Rogér JM, Abayon M, Elad S, et al. Oral Trauma and Tooth Avulsion Following Explosion of E-Cigarette. J Oral Maxillofac Surg. 2016; 74:1181–5. [PubMed: 26850869]
38. Nicoll KJ, Rose AM, Khan MA, et al. Thigh burns from exploding e-cigarette lithium ion batteries: first case series. Burns. 2016; 42:e42–6. [PubMed: 27118069]
39. Colaianni CA, Tapias LF, Cauley R, et al. Injuries caused by explosion of electronic cigarette devices. Eplasty. 2016; 16:ic9. [PubMed: 26966477]
40. Kumetz EA, Hurst ND, Cudnik RJ, et al. Electronic cigarette explosion injuries. Am J Emerg Med. 2016; 34:2252.e1–2252.e3.
41. Brooks JK, Kleinman JW, Brooks JB, et al. Electronic cigarette explosion associated with extensive intraoral injuries. Dent Traumatol. 2017; 33:149–52. [PubMed: 27397137]
42. McRobbie H, Bullen C, Hartmann-Boyce J, et al. Electronic cigarettes for smoking cessation and reduction. Cochrane Database of Systematic Reviews. 2014; 12:CD010216.
43. Grana R, Benowitz N, Glantz SA. E-cigarettes: a scientific review. Circulation. 2014; 129:1972–86. [PubMed: 24821826]
44. Callahan-Lyon P. Electronic cigarettes: human health effects. Tob Control. 2014; 23(Suppl 2):ii36–40. [PubMed: 24732161]
45. Franck C, Budlovsky T, Windle SB, et al. Electronic cigarettes in North America: history, use, and implications for smoking cessation. Circulation. 2014; 129:1945–52. [PubMed: 24821825]
46. Biener L, Hargraves JL. A longitudinal study of electronic cigarette use among a population-based sample of adult smokers: association with smoking cessation and motivation to quit. Nicotine Tob Res. 2015; 17:127–33. [PubMed: 25301815]
47. Williams RS, Derrick J, Phillips KJ. Cigarette sales to minors via the internet: how the story has changed in the wake of federal regulation. Tob Control. 2017; 26:415–20. [PubMed: 27413060]
48. WilliamsRS, , RibislKM. Vendor Compliance with Bans on Credit Card Payments and Commercial Shipping for Online Cigarette Sales; Washington, DC. American public health association annual meeting; 2011

What this paper adds

- Three small-sampled studies had assessed Internet e-cigarette vendor sales practices.
- Prior studies showed that as many as 95% of Internet e-cigarette vendors made positive health-related claims.
- Prior research found that Internet e-cigarette vendor websites featured an average of two modified risk and/or secondhand smoke-related claims.
- No other studies have attempted to identify the population of e-cigarette vendors using advanced search and identification strategies.
- The scientific literature lacks in-depth examination of Internet e-cigarette vendor sales practices prior to the beginning of federal regulation, including products sold or their promotion, claims and pricing practices.
- The population of Internet e-cigarette vendors increased threefold from 2013 to 2014, to more than 3000 vendors.
- There is a wide range of products, brands and e-liquid flavours offered for Internet e-cigarette vendors, and they make a wide range of health and social claims, including conflicting claims within the same website. The Internet e-cigarette industry is in a similar state to the Internet cigarette vendor industry prior to federal regulation.

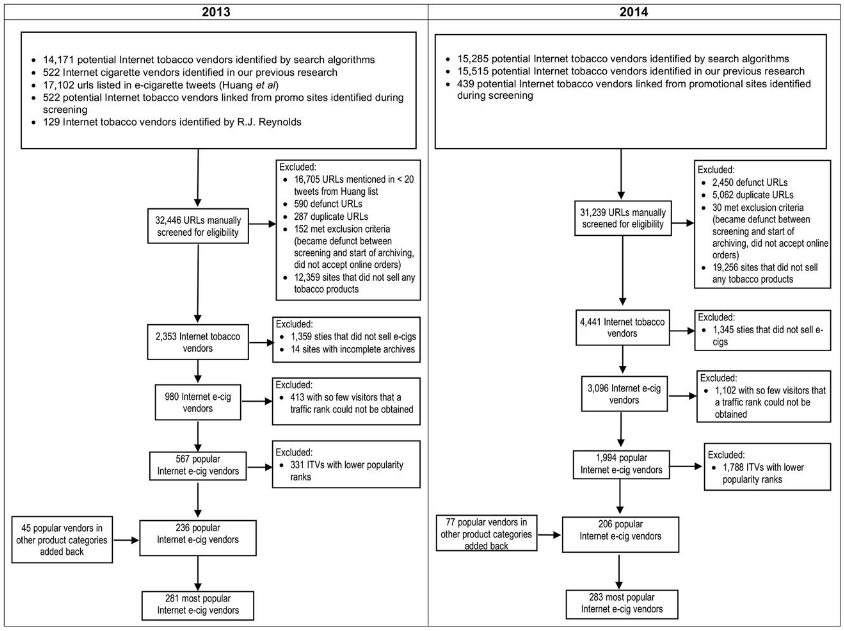

Figure 1.

Sampling for Internet e-cigarette vendor content analysis. ITV, Internet tobacco vendors.

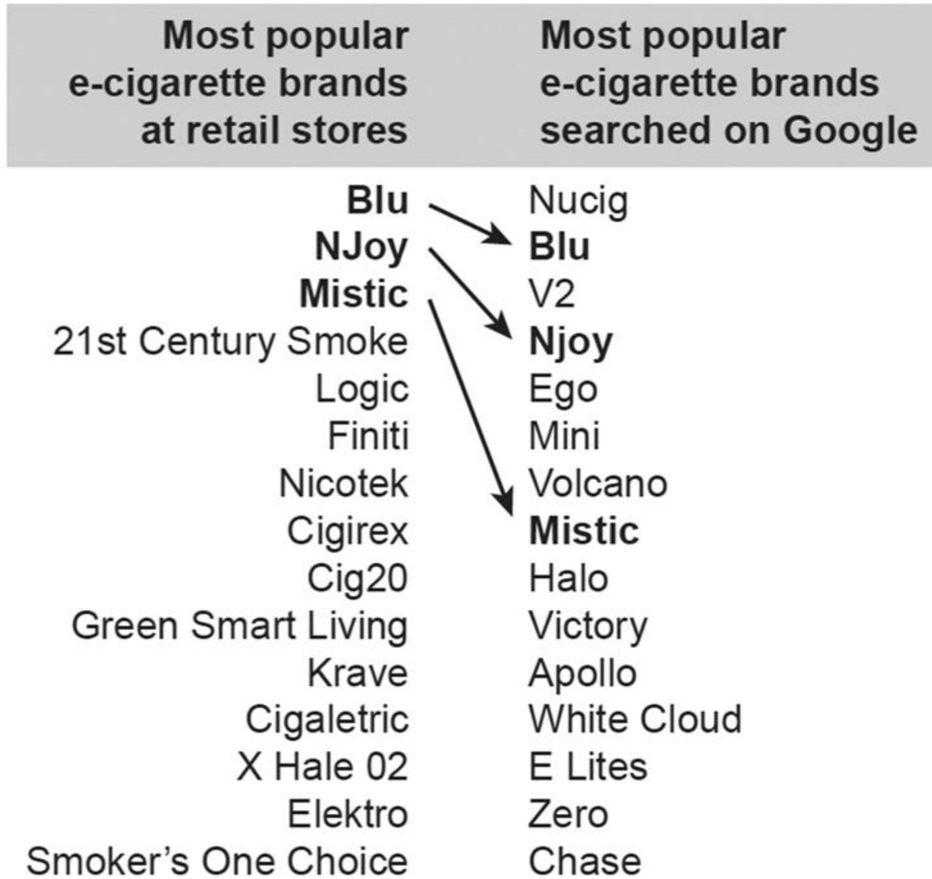

Figure 2.
Comparison of most popular retail store e-cigarette brands and most searched e-cigarette brands on Google, 2013.

Table 1

Products sold by Internet tobacco vendors selling e-cigarettes: 2013 and 2014

	2013 (n=281)	2014 (n=283)
Product	**IEV sites, n(%)**	**IEV sites, n(%)**
Disposable e-cigarettes **	155 **(55.2)**	111 **(39.2)**
E-cigarette starter kit **	260 **(92.5)**	221 **(78.1)**
Electronic cigars (e-cigars)	55 (19.6)	48 (17.0)
Disposable e-cigars	–	36 (12.7)
Most popular e-cigarette brands †		
Blu **	5 **(1.8)**	17 **(6.0)**
Njoy **	3 **(1.1)**	15 **(5.3)**
Mistic	0 (0.0)	–
21st Century Smoke	0 (0.0)	–
Logic	3 (1.1)	7 (2.5)
Joyetech	–	53 (18.7)
Ego ‡	–	106 (37.5)
Nucig	–	1 (0.4)
V2	–	10 (3.5)
E-cigarette/e-liquid flavours *	225 **(80.1)**	243 **(85.9)**
Fruit	223 (79.4)	233 (82.3)
Candy	211 (75.1)	216 (76.3)
Coffee	191 (68.0)	187 (66.1)
Spice	124 (44.1)	124 (43.8)
Alcohol *	128 **(45.6)**	155 **(54.8)**
Non-e-cigarette products		
Cigarette products		
Cigarettes	21 (7.5)	27 (9.5)
Flavoured cigarettes	12 (4.3)	12 (4.2)
Roll-your-own tobacco supplies	48 (17.1)	58 (20.5)
Herbal cigarettes	5 (1.8)	5 (1.8)
Cigar products		
Little cigars or cigarillos **	49 **(17.4)**	74 **(26.2)**
Flavoured little cigars or cigarillos *	40 **(14.2)**	60 **(21.2)**
Large cigars *	55 **(19.6)**	75 **(26.5)**
Other products		
Loose tobacco **	49 **(17.4)**	74 **(26.2)**
Hookah or hookah supplies **	23 **(8.2)**	44 **(15.6)**

	2013 (n=281)	2014 (n=283)
Product	**IEV sites, n(%)**	**IEV sites, n(%)**
Electronic hookah (e-hookah)	–	69 (24.4)
Smokeless/plug/chew/snuff tobacco	11 (3.9)	18 (6.4)
Snus	3 (1.1)	5 (1.8)
Alcohol *	6 **(2.1)**	14 **(5.0)**

*p<0.05 (data reflecting statistically significant differences between 2013 and 2014 are boldfaced).

**p<0.01 (data reflecting statistically significant differences between 2013 and 2014 are boldfaced).

†The e-cigarette brands tracked in 2013 were the most popular brands sold at retail stores at the time of data collection.[20] In 2014, Mistic and 21st Century Smoke were dropped because they were not found at all at Internet tobacco vendors in our 2013 sample, and other brands found popular in our study of Google Search Trends[21] were added to our 2014 measures for tracking purposes.

‡Ego e-cigarettes were originally developed by the Joyetech brand, but over time became more broadly known as a style of e-cigarette made by many companies, but with interchangeably compatible parts using a standard 510 threading for attaching the battery to the tank or cartomiser.[22]

Appearances of a dash (−) in the table indicate variables that were not collected in that year. For example, the two brands we tracked in 2013 because they were the most popular retail store brands at the time that were not found at all in the Content Analysis sample (Mistic and 21st Century Smoke) were dropped, and other brands found to be popular in Google Search Trends were tracked starting in 2014.

IEV, Internet e-cigarette vendor.

Table 2

Product pricing and shipping costs for cheapest products sold by Internet e-cigarette vendors: 2013 and 2014

Product or shipping	Mean		Median		Minimum		Maximum		SD	
Year	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
E-cigarette starter kit										
2013: n=249	$33.87	$29.59*	$28.95	$24.70**	$0.00	$2.21	$129.95	$109.67	19.64	18.03
2014: n=221										
Disposable e-cigarette										
2013: n=139	$9.69	$8.57	$8.99	$7.95	$2.50	$1.00	$44.95	$55.03†	6.02	6.89
2014: n=109										
Shipping										
2013: n=209‡	$7.55	$8.23	$5.80	$5.95	$0.01	$1.48	$55.63	$40.02	6.68	7.26
2014: n=208‡										

* $p<0.05$ (data reflecting statistically significant differences between 2013 and 2014 are boldfaced).

** $p<0.01$ (data reflecting statistically significant differences between 2013 and 2014 are boldfaced).

† Sites offering free shipping (2013: n=51, 2014: n=40) were excluded from the analysis.

‡ A site offering a disposable e-cigarette variety pack for $95.40 was excluded from the analysis as it contained multiple products.

Table 3

Promotions offered and claims made by Internet tobacco vendors selling e-cigarettes: 2013 and 2014

	2013 n=281	2014 n=283
Promotion or claim	**IEV sites n (%)**	**IEV sites n (%)**
Features health warning	201 (71.5)	217 (76.7)
Vendor promotions[**†]	251 **(89.3)**	232 **(82.0)**
Vendor offers free shipping[*,‡]	175 **(62.3)**	154 **(54.4)**
Celebrity endorsements (W1: n=68, W2: n=46)[* §]	31 **(11.0)**	17 **(6.0)**
Actor/actress endorsement[§]	41 (60.3)	32 (66.7)
Katherine Heigl[*§]	12 **(17.6)**	3 **(6.3)**
Leonardo DiCaprio[§]	7 (10.3)	3 (6.3)
Johnny Depp[§]	6 (8.8)	2 (4.2)
Recording artist endorsement[§]	12 (17.6)	5 (10.4)
Other celebrity endorsement[§]	15 (22.1)	9 (18.8)
Branded celebrity endorsement	13 (4.6)	6 (2.1)
Unbranded celebrity endorsement	18 (6.4)	10 (3.5)
Multiple TV news programme endorsements	1 (0.4)[††]	0 (0.0)
Doctor/health professional endorsement[**]	41 **(14.6)**	21 **(7.4)**
Other promotion[**]	78 **(27.8)**	22 **(7.8)**
Loyalty/referral programme[**]	36 **(12.8)**	5 **(1.8)**
Discounts[**]	21 **(7.5)**	4 **(1.4)**
Free tobacco products[**]	21 **(7.5)**	7 **(2.5)**
Incentives for engaging with social media[**]	11 **(3.9)**	1 **(0.4)**
Free other items	10 (3.6)	4 (1.4)
Military discount[*]	7 **(2.5)**	1 **(0.4)**
Links to social media sites[**]	196 **(69.8)**	222 **(78.5)**
Vendor claims comparing e-cigarettes with cigarettes[†]	241 **(85.8)**	198 **(70.5)**
Any health-related claim[**, ¶]	215 **(76.5)**	165 **(43.1)**
Health advantages[**]	195 **(69.4)**	148 **(52.3)**
Price advantages[**]	150 **(53.4)**	103 **(36.4)**
Smoke anywhere/circumvent smoke-free laws[**]	167 **(59.4)**	115 **(40.6)**
Product *helps* to quit smoking[*]	92 **(32.7)**	74 **(26.2)**
Product *does not help* to quit smoking[**]	141 **(50.2)**	104 **(36.8)**
Safer for other people (than secondhand smoke)[**]	134 **(47.7)**	87 **(30.7)**

Promotion or claim	2013 n=281 IEV sites n (%)	2014 n=283 IEV sites n (%)
Modern/revolutionary **	128 **(45.6)**	72 **(25.4)**
Fire safety **	117 **(41.6)**	28 **(9.9)**
Social advantages **	132 **(47.0)**	88 **(31.1)**

* p<0.05 (data reflecting statistically significant differences between 2013 and 2014 are boldfaced).

** p<0.01 (data reflecting statistically significant differences between 2013 and 2014 are boldfaced).

† Listed promotions/claims are not mutually exclusive and thus, results will sum to more than 100%.

‡ Some vendors offer free shipping for *all purchases,* whereas others offer free shipping at a *minimum purchase level.*

§ Celebrity endorsements (2013: n=68, 2014: n=46) reflect the total number of celebrity endorsements featured, rather than the total number of sites featuring those endorsements. In 2013, 31 websites (11.0%), and in 2014 17 websites (6.0%), featured celebrity endorsements with a range of one to five celebrity endorsements per site. The percentages for all marked subcategories are out of the (2013: n=68, 2014: n=46) celebrity endorsements.

¶ Any health-related claim includes health advantages, helps quit smoking, safer for other people and fire safety.

†† One vendor featured graphics indicating they were endorsed by four TV news programmes.