

Preferences, practices, and intentions of a population of U.S. adult enthusiast vapers

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Abstract

Existing surveys of e-cigarette users have provided useful information, but have been limited to convenience samples with no identifiable target population. The membership of The Consumer Advocates for Smoke-free Alternatives Association, a U.S. NGO, offers a unique opportunity for a survey of enthusiast vapers. The survey, conducted in 2015, included 20,000 adult current vapers residing in the USA, with a far higher response rate than any previous survey. The results support several pieces of conventional wisdom, also reflected in previous survey results, that enthusiast vapers prefer open systems, interesting flavors (particular sweet flavors), and have a history of failed smoking cessation attempts using most of the “officially approved” methods. Almost all subjects who quit smoking with e-cigarettes believe they would still be smoking without them. About 90% of subjects indicated an intention to flout regulatory restrictions on available products, notably including a scenario that basically describes the effects of the announced FDA regulation. This suggests that assessments of that regulation grossly understate the probability and scope of a black market and do-it-yourself manufacturing, and thus overstate the impact on actual consumption. There are clear contrasts between this population and the average e-cigarette user, which commentators frequently ignore, but these results are probably representative of half a million and perhaps a million U.S. vapers.

Introduction

There is limited systematic evidence about the preferences, experiences, and attitudes of vapers (e-cigarette users), and what is well known is often ignored. A few population representative studies [e.g., Schoenborn & Gindi, 2015; West et al., 2016] have asked simple questions about history of e-cigarette and other tobacco product usage, though nothing further, though some have been widely criticized for poor methodology [e.g., Phillips, 2014a; Rodu, 2014a]. Only governments have the means to conduct or fund population-representative surveys that are large enough to include a sufficient number of vapers, but they generally prefer to avoid generating data about vapers’ preferences. Numerous convenience sample surveys [e.g., Heavner et al., 2010; Etter & Bullen, 2011; Farsalinos et al. 2014] have asked more detailed questions about vapers’ usage and preferences. Yet most discourse about vaping, particularly policy discussions, fails to consider what we know from this research and the nonsystematic knowledge that comes from simply being familiar with vaping.

The convenience sample surveys have consistently shown several policy-relevant results that comport with the common knowledge of anyone familiar with e-cigarette use, including: Vapers who are the generally accepted “legitimate” market for e-cigarettes (adults using them to quit smoking or remain smoking abstinent) often strongly prefer interesting flavors, particularly sweet flavors, contrary to the rhetoric that those flavors primarily appeal to minors. Many smokers who repeatedly endeavored unsuccessfully to quit smoking using some or all of the government-recommended methods (NRT, other pharmaceuticals, counseling, etc.) found that switching to e-cigarettes was an easy and lasting way to become smoking-abstinent. This alone, even setting aside issues of welfare maximization [see: Phillips, forthcoming], demonstrates the disingenuity of claims that instead of trying to switch products, smokers should just stick to the “approved” methods. Moreover, many smokers who started using e-cigarettes without the intention to quit smoking became “accidental quitters” upon discovering that they preferred using e-cigarette products exclusively.

The many convenience-sample survey results are sufficiently robust to demonstrate these phenomena are common. However, due to the unknown sampling properties of the surveys, their specific quantitative results are meaningless. Most such surveys used some combination of a central social media outlet and social media snowball sampling, thereby collecting responses from an enthusiastic self-selected sample of eligible subjects (a small fraction of 1% of them), usually across numerous jurisdictions and cultures. We can conclude that the samples select for attendance to internet discussions about the products and enthusiasm (strong positive feelings) about the products, but not in any way that can be characterized. Indeed, there is no apparent way to even define what target population is represented by those samples, even allowing for biased sampling of that target. Thus, most results of those surveys can only be said to be descriptions of the sample, rather than any measure of some population’s characteristics. Despite this being obvious, those survey results have been dramatically over-interpreted. Some of those limitations could have been substantially remedied by simply analyzing results for different strata of the responses, but even simple cross-tabulations have seldom been reported.

Attempts to gather more targeted populations also tend to produce only *de facto* convenience samples. In the first published survey of e-cigarette users [Heavner et al., 2010], we invited customers of a single e-cigarette company to participate, but we conceded this was really a convenience sample due to the limited response rate from those customers and snowballing beyond them. Another survey of customers of a single company [Siegel, Tanwar, and Wood, 2011] was mischaracterized by the authors as being systematic, but is also properly characterized as a convenience sample due to the extremely low response rate and odd selection criteria.

The only survey that apparently avoids these limitations is the survey series by the UK government’s quango, Action on Smoking and Health [2016]. It is reasonably representative of

the UK population and asks several questions about preferences and attitudes of the reasonably sized subpopulation of vapers in the sample. This provides some useful information about the average vaper in the UK, though several serious problems with the study design and reporting limit its value [see: Phillips, 2016a for more].

The membership of The Consumer Advocates for Smoke-free Alternatives Association (CASAA), a U.S. NGO that advocates to protect the availability of low-risk tobacco/nicotine products, offers a unique targetable population of e-cigarettes consumers. CASAA has an email list with in the order of one hundred thousand individuals, the vast majority of whom are U.S. e-cigarette enthusiasts. A large majority of those contacts were collected in the course of the individuals taking political action in defense of vaping rights (e.g., filling out a form to contact their state representatives in advance of a hearing). Others proactively joined the organization in order to be kept apprised of U.S. regulatory actions and receive alerts when actions were being taken. CASAA defends consumer rights to use all low-risk tobacco/nicotine products, not just e-cigarettes, and non-users are welcome to be members and participate in political action; thus not all members are vapers, but the vast majority are due to the focus of recent political advocacy. Almost every CASAA member lives in the USA (others can sign up, and a few have, since CASAA is only active on in U.S. politics) and is an adult (CASAA membership is limited to adults, though there is no mechanism for preventing minors from signing up). Thus this group includes a large, reasonably well-defined population of adult e-cigarette users living in the USA, the target subset for the survey reported here. It seems safe to consider them as being representative of on the order of half a million other U.S. e-cigarette enthusiasts, perhaps as many as a million.

Methods

Survey

The survey was conducted in November and December of 2015. It was a self-administered online survey (via SurveyMonkey) that took approximately five to ten minutes to complete. A complete description of the survey instrument, including the introduction, questions, answers, and skip patterns is available at

<https://docs.google.com/document/d/1Ca8665m41nSdMmY-psHVjkXKK2kPQ8-qy6CsjuhPEZ4/edit?usp=sharing>. Preliminary results from the survey were reported in a research report [Phillips, 2016b] and CASAA testimony [Phillips, 2015a], and the present analysis is an adaptation and expansion of that work.

The survey was primarily intended to address knowledge gaps about the impacts of the predicted U.S. Food and Drug Administration (FDA) restrictions on the sale of e-cigarettes, for purposes of CASAA advocacy. A near-final draft of the survey was piloted to a small subset of the target

sample resulting in several questions being clarified and one substantial change (described below).

Sample

At the time of the survey, CASAA reported having 120,000 members, which meant having a list of that many email addresses, collected as described above. Of those, 42,000 had explicitly opted out of receiving emails, and thus 78,000 addresses could be invited to participate directly by email. It is not known how many of these email addresses were duplicates for the same person, unmonitored, or belonged to someone who did not self-identify as a CASAA member (either due to having changed her mind about such self-identification but having no easy way to leave the membership list, or due to participating in an online action and not opting out of joining, but never intending to be considered a member). Because of these factors, the number of individuals who consider themselves members of CASAA, as well as the number of people receiving the emails, are overstated. My rough estimate, based on various knowledge of the organization's membership and operations, is that the overstatement is probably at least a third the number of email addresses.

Multiple rounds of invitations to participate were sent to those addresses that receive CASAA emails. Social media (CASAA's Facebook pages, Twitter) were used to attempt to reach CASAA members who did not receive the email. The invitations made clear that the target population was CASAA members who were adult U.S. residents, but anyone were allowed to complete the survey. (The survey asked about those characteristics, but did not terminate respondents based on the answers in order to reduce the risk that someone would misrepresent their status in order to be able to complete the survey.) The email and social media invitations used two different collector links.

A total of 27,343 subjects completed the survey. Of those, 20,454 indicated they were CASAA members (they were told that if they received the email invitations, then they were CASAA members). After excluding the CASAA members who indicated they do not live in the USA and a few who indicated they were under 18, a target population of 20,162 observations remained, 18,214 of whom answered affirmatively that they received the email invitation. Of the latter, 16,562 used the emailed collector link; presumably the others opened the social media link but were aware they had received the invitation or checked their email when asked. Half (972) of those who indicated they did not receive the email also used the emailed collector link, presumably a result of other respondents posting that link on social media despite requests not to.

Of the target population, 106 identified as never having been e-cigarette users, as defined by not having spent a total of \$100 on e-cigarette products for personal use. (All CASAA members were encouraged to participate, regardless of e-cigarette use status.) No further substantive

questions were asked of this subgroup. Of those remaining, 238 indicated that they were not currently regular e-cigarette users, as defined by not having used an e-cigarette on 10 occasions in the last week. They were asked just two substantive questions. The screening questions were both pre-piloted, and it was clear that the target audience had no difficulty answering them. This left a sample of 19,823 from the target population of CASAA members who were current adult vapers living in the USA.

The response rate was of 17% of CASAA's member count and 23% of addresses receiving email invitations. The true response rates were probably in the order of one-third of the target population after accounting for the overcounting described above. This is much greater than the tiny response rates from the eligible participants of previous surveys targeted at vapers. It is, however, still low enough that we should assume there is nontrivial selection bias, associated with level of enthusiasm, as compared to the full target population.

Analysis

The data was cleaned to recode 554 open-ended responses that should have been one of the checkbox answers across the five questions where such a response error was possible, and to code other answers for analysis. In addition to that and some corrections noted below, nonsystematic review discovered a small number (in the order of tens) of open-ended responses that suggested subjects may have given incorrect answers to some other question; no corrections for these were made because of the trivial impact on the statistics from these few responses.

The data was analyzed in R [R Core Team, 2016]. The results are reported without random error statistics to reduce clutter and to avoid misleading claims of precision. Given the sample size, the confidence intervals for statistics based on all or most of the sample are obviously quite narrow (indeed, most of the comparisons in the text where it is noted results were very similar are actually statistically significantly different, a fact of no consequence). The error statistics are trivial to calculate in the unlikely event that any reader actually cares. Reporting narrow confidence intervals tends to mislead many readers into overlooking the uncertainty created by selection bias, which is undoubtedly much greater than that from random error, as well as the inevitable measurement errors.

Responses from the screen-excluded respondents are not analyzed here. The non-CASAA members comprise just another uncharacterizable convenience sample, although an analysis of them would probably still be above average, in terms of data quality, compared to most published surveys of vapers. The non-U.S. CASAA members were too few to provide useful comparisons.

Results

Descriptive statistics

Respondents were 75% male. The age distribution was 14% 18-25, 30% 26-35, 43% 36-55, and 12% over 55.

Most (87%) indicated they quit smoking (entirely) after starting to use e-cigarettes, 5% still smoked sometimes, and 3% had already quit smoking before starting to use e-cigarettes. These groups were each asked questions specific to that status. The high proportion who quit smoking entirely should be considered descriptive of the population -- a factor that makes someone more likely to be a politically-activated vaper who will take a survey -- rather than a measure that can be extrapolated to an external population, even for this unusually well-defined sample.

The remainder were 3% who indicated they had never been regular smokers (defined based on smoking an average of more than one cigarette per day on most days for at least a year, which is a stronger condition than is typically used, and is much closer to most people's interpretation of that characterization) and 3% who chose an open-ended "other" answer. Of the 595 giving an open-ended answer, almost all gave an answer that fell clearly into one of the checkbox choices, and thus some who should have been sent to one of the choice-specific branches were not, though these were disproportionately never regular smokers, whose branch contained no questions.

The open-ended option was a serendipitous mistake in retrospect; only about 1% of those choosing it actually noted a history -- of quitting and restarting -- that created genuine ambiguity about which of the other answers was accurate. However, it did create the opportunity for about 80 subjects to volunteer that they used e-cigarettes to quit smokeless tobacco, presumably driven by the widespread misperception that the former poses lower health risk than the latter. These were *non sequitur* responses to this question about smoking, but it is easy to understand those subjects balking at just answering the question as asked. This was probably also true of some who just answered they had not been a smoker, and some in the "already quit" category volunteered information about switching from smokeless tobacco in a later question. This may mean that in the USA, a substantial fraction of never-smoking adult e-cigarette adopters are still substituting tobacco products, which appears to have been largely unnoticed. While this is inconsequential from a health standpoint -- it appears that e-cigarettes probably pose only trivially more risk than the trivial risk from smokeless tobacco (notwithstanding the currently popular claim that the risk of e-cigarettes is many multiples greater than the legitimate estimate for smokeless tobacco [for more see Phillips, 2015b, 2015c] -- it might affect some discussions that focus merely on headcounts.

Respondents were overwhelmingly open system users, with 97% reporting that is what they primarily use and another 1% using them sometime in the last month. Few reported reported that

they used disposables (10%) or rechargeable cartridge systems (14%) in the last month. As with the smoking cessation distribution, this describes the sample, though it is probably reasonable to also consider it descriptive of the wider population of enthusiasts.

Response to FDA ban scenarios

A unique feature of this survey was to be able to ask about reactions to realistic scenarios about radical changes in market that were on the horizon in this jurisdiction due to the upcoming FDA regulations. The regulations have since been released [U.S. FDA 2016], and were basically as predicted. For details on the practical implications of these regulations, see Phillips [2015a].

Subjects were asked about what they would do under three different scenarios in which e-cigarettes were totally or partially banned. These were described as something that might happen in the USA, though no further details were mentioned. Most respondents presumably knew that if one of these happened, it would be due to FDA action.

For all scenarios, it was made clear that possession and use would still be legal, and the ban would only affect sales. Subjects were instructed to indicate all that applied if they believed they would respond with more than one of the actions on the list. Under the first scenario, e-cigarette sales would be completely banned. The first scenario was never a realistic possibility, but provides a useful baseline. The second scenario was a ban of all products except for a small variety of closed-system cigalikes, which would only come in tobacco and menthol flavors. It was noted that these would be more expensive than current cigalikes. The release of the FDA regulations confirms the prediction that the second scenario roughly describes the U.S. market as of 2018 if the regulations are allowed to be implemented as written. The third scenario was that all types of e-cigarette hardware would still be available (cigalikes and open systems), but all e-cigarettes and e-liquid sold could only be tobacco or menthol flavored. The third scenario described a possible move by FDA for the interim period that they had signaled they were considering, though the published regulation claims that they will not attempt to implement this. Results appear in Table 1.

Table 1 - Subjects’ expected responses to e-cigarette ban scenarios

Scenario:	Scenario 1: Complete ban	Scenario 2: One few cigalikes can be legally sold	Scenario 3: Only tobacco and menthol flavors could be sold
Subject would expect to...			

(% of subjects)			
Quit all products	5	6	5
No effect; not binding	n/a	1	4
Use the legally marketed e-cigarettes	n/a	4	10
Start smoking (if smoking abstinent)	21	21	14
Smoke more (if current smoker)	50	46	35
Start using some other smoke-free product	4	4	3
Continue to use preferred product via alternative markets and/or do-it-yourself manufacture	93	91	89

Phrasing of the quit all, smoke, and alternative smoke-free product questions were the same for each scenario (exact phrasing appears in the above-linked instrument document). The latter prompted with the options “e.g., snus / smokeless tobacco; NRT”. Subjects were asked if they only used the specific products allowed in scenarios 2 and 3, making the rule apparently non-binding for them. However, some of those subjects also indicated other answers, which may represent a response to the price increase (in scenario 2), anticipation that their *specific* preferred products would not survive the ban, anticipation of changing preferences, or an affirmative desire to flout the rules. This means that the subsequent answer, in which they were asked about intention to use only the specific allowed products, was not a superset of those currently using only those.

The stated intention to seek alternative supplies was the overwhelming response and is discussed below. This answer was originally subdivided into different supply channels (e.g., buying some e-cigarette components legally and making others oneself), but pilot subjects reported difficulty answering. We realized that subjects could reasonably anticipate they would use some alternative

supply but could not be reasonably expected to predict which of the several alternative supply chains would evolve to be most attractive. We thus collapsed the question, describing it differently for each of the three scenarios based on what components would need to be derived from alternative sources. There was substantial overlap between the alternative supply responses and other product choices. Between 10 and 20% of those indicating an intention to use alternative supplies also predicted they would smoke or smoke more. Presumably some subjects anticipated that the alternative supply would be sufficiently burdensome that they would resort to a more convenient option some of the time. It may turn out that alternative supplies are so easy to access (Phillips) that they may actually use them exclusively.

Smoking cessation with e-cigarettes

Of the 17,186 respondents who quit smoking using e-cigarettes,

- 64% indicated they switched almost immediately, within a few days of starting e-cigarettes,
- 21% used both for longer than that but quit smoking within a month,
- 11% between one and six months before quitting smoking,
- 3% more than six months.

When asked about the role e-cigarettes played in their smoking cessation,

- 64% said they started using e-cigarettes with the intention of quitting smoking,
- 25% started with the intention of merely reducing their smoking but ended up switching entirely,
- 11% started using e-cigarettes without the intention of quitting or reducing smoking, but ended up switching entirely.
- Only a handful indicated they did not credit e-cigarettes with their successful smoking cessation.

Almost all (99%) indicated they believe they would still be a smoker were it not for e-cigarettes.

It is best to interpret the switching time responses as descriptive of the study population rather than representative of some larger population. The subjects switched considerably quicker than what is generally believed to be typical, which is not surprising since those who became enthusiasts are more likely to have definitively taken to e-cigarettes. The intentions question is probably fairly representative of all e-cigarette trialers, since enthusiasm would tend to only come later, though presumably there is some association. The 11% rate of “accidental quitting” is perhaps surprisingly low given the frequent endorsement of the phenomenon in nonsystematic communications among enthusiasts, though there is no strong reason to doubt it. It still represents an impressive figure given that it exceeds estimates for the portion who quit smoking intentionally when making an *intentional* quit attempt using other cessation aids.

Current smokers

Of the 980 respondents who indicated that they still smoke, 34% reported less than one cigarette per day on average, 42% smoke one to five per day, and 23% more than 5. Half of these subjects (51%) affirmed the statement “e-cigarettes have helped me almost quit smoking”, and another 44% credited e-cigarettes with helping them smoke a lot less. Only 3% indicated they use e-cigarettes as a partial substitute but still smoke almost as much as they used to, with almost none saying they smoke fully as much as they used to. A few (1%) indicated they reduced their smoking but do not credit that to e-cigarettes. This is clearly not representative of all vapers who still smoke, but is plausibly representative of enthusiast vapers who still smoke.

Previous smoking cessation attempts

Of the 19,169 e-cigarette users who were ever regular smokers (eliminating those giving the “never smoker” response or equivalent open-ended answers), the rates of having previously unsuccessfully attempted another smoking cessation method were:

- 73% NRT,
- 42% some other pharmaceutical (e.g., Chantix),
- 24% formal counseling,
- 24% calling a quitline,
- 84% unaided quitting,
- 7% volunteered some other method they tried.

Less than 6% reported they had never attempted to quit smoking before they started using e-cigarettes.

After coding a count for the open-ended “other” response and combining it with the five listed methods, 10% had tried five or more (8% had tried all five of the listed methods), 24% had tried at least 4, and 49% had tried at least three. The results are remarkably similar for those who quit smoking and those who still smoke.

Role of flavors

Subjects were asked which flavor categories they use regularly (defined as at least sometimes in a typical month), how often they choose sweet (fruit, candy, pastry, soda) flavors, and how often they choose tobacco or menthol flavors. The results appear in Table 2, stratified by quit smoking status.

Table 2 - Subjects’ choices of e-cigarette flavors

	Quit with ecigs	Still smoke	Quit pre-ecigs
	n=17,186	n=980	n=565
Use flavor category regularly (%)			
tobacco	19	26	17
menthol/mint	18	22	19
fruit or fruit beverage	83	80	80
candy, soda, pastry	76	69	72
spice or savory	30	28	27
bitter (coffee, whiskey)	12	12	10
Choose sweet flavors (%)			
all I ever use	19	10	18
almost always	35	31	31
most of the time	25	30	26
some of the time	14	17	16
rarely	4	6	4
never	3	6	4
Choose tobacco/menthol flavors (%)			
all I ever use	3	4	2
almost always	4	6	5
most of the time	4	6	4
some of the time	14	18	13

rarely	25	30	30
never	49	35	48

Flavors that imitate cigarettes are considerably less popular than other options in the study population, and sweet flavors are particularly popular. Subjects who still smoke are substantially more likely to *ever* use tobacco/menthol flavors, but their flavor preferences do not otherwise differ much from the ex-smokers. Of those who quit smoking entirely, 72% credit interesting flavors with helping them quit. Of those who still smoke, 53% say interesting flavors are helping move them toward quitting entirely.

Only 4% indicated that they do not care much about flavors and will use anything or whatever is cheapest. 43% said they use five or fewer flavors in a typical month, while 28% said they use over twenty in a typical month.

Other results

Subjects were asked about advice they had received from a healthcare provider about e-cigarettes, excluding counselors specifically consulted about smoking cessation. Two thirds (65%) indicated that they had talked to a healthcare provider about e-cigarettes, and of those, they received the following advice (if they received different advice from different providers, they were instructed to indicate all that apply):

- a provider got the subject interested in e-cigarettes in the first place, 10%;
- a provider volunteered a recommendation to try e-cigarettes, though the subject was already using them or considering it, 10%;
- subject told a provider about his/her e-cigarette use, and the provider encouraged continuing, 66%;
- subject told a provider, who discouraged continuing, 5%;
- subject told a provider and got a neutral response, 26%;
- a provider told the subject that e-cigarettes are low-risk, 34%;
- a provider told the subject that e-cigarettes pose high risk 3%.

Of the 565 respondents who quit smoking before taking up e-cigarettes, 48% indicated they were concerned they would start smoking again and so sought a substitute and 31% did not predict they would start smoking again but missed it and started using e-cigarettes because of that. Of the 21% chose neither of these (open-ended answer), a few gave answers that implied the first checkbox answer, while most implied the second. Assuming their concern was reasonable, this suggests that in the order of half the ex-smokers who adopt vaping should be thought of the same

as established vapers who quit smoking by switching: they use e-cigarettes as an ongoing substitute for smoking.

The 238 subjects who were classified as ever-vapers but reported not using an e-cigarette 10 times in the last week were asked the questions about whether they quit smoking using e-cigarettes and previous quit attempts. Of these, 18% reported trying to quit smoking with e-cigarettes by returning to smoking, 47% reported quitting smoking with e-cigarettes, 10% had already quit smoking before trying e-cigarettes, and 15% had never been regular smokers. This subpopulation reported a substantially lower history of trying other smoking cessation attempts than the overall target population.

Discussion

These results concord with convenience sample surveys and common knowledge about enthusiast or politically engaged vapers. The subjects overwhelmingly choose open-system e-cigarettes and non-cigarette flavors, particularly sweet flavors. However, the widely-claimed disdain of this population for traditional cigarette flavors (imitation tobacco flavors and menthol/mint) seems to be overstated; a substantial minority do choose those flavors. There are small differences in flavor preferences between current smokers and nonsmokers, but no obvious value in this information (other than perhaps for marketers).

Most of this population quit smoking by switching to e-cigarettes and they overwhelmingly attribute their smoking abstinence to their use of e-cigarettes. This causal conclusion is supported by their history of trying “officially recommended” methods of smoking cessation without success.

The enthusiast vaping population is a subset of all vapers, with rather different characteristics than the majority who regularly use e-cigarettes, let alone the larger population who have merely tried e-cigarettes. Much of the discourse fails to recognize this. Notable contrasts between the study population and other e-cigarette users include the rate of having quit smoking entirely using e-cigarettes (which appears to be in the range of one-half of all vapers, depending on definitions) and product preference (e.g., cigarette-flavored cigalikes are a far larger fraction of sales among all vapers). Unlike previous surveys, the sample reported here is a substantial fraction of a defined population, and thus can be extrapolated to the wider population of enthusiasts. That wider population appears to be as many as a million Americans, certainly several hundred thousand, and a similar number in the UK, as well as many elsewhere.

Differences between the smokers and nonsmokers in the study population were small. While the data is not nearly rich enough to fully compare these subpopulations, this does suggest they are quite similar. The contrasts that are often drawn between vapers who still smoke versus those

that do not would probably be more usefully presented in as the contrast between enthusiast and other vapers. There is obvious simultaneous causation between enthusiasm and smoking cessation status, creating an association, but these should not be conflated. Treating an easily-measured correlate for an important variable as if it were that variable is sadly common practice in epidemiology, but it interferes with understanding, particularly when studying preference and choice.

Research and commentary that fails to recognize the defining heterogeneities of the vaping population is likely to produce meaningless averages across fundamentally different phenomena or to inaccurately extrapolate from one group to the other. Most discourse in this field, including almost all published research reports, fails to consider the 101-level lesson from empirical social science that one needs to consider who a sample does and does not represent.

Perhaps the most striking survey result is the near-unanimous belief of those who quit smoking using e-cigarettes that they would otherwise still be smoking. If this is true, it would mean that within this studied sample *alone*, with no extrapolation even to the rest of the CASAA membership, there are about 17,000 American adults who became non-smokers only because of e-cigarettes. This would mean that the lifetime population health benefits of this group (again, without extrapolating beyond the survey respondents) exceed the population health costs of every American non-smoker who has become a vaper. (The latter appear to be in the order of hundreds of thousands, and would need to be in the order of a million to produce that much health risk, based on the reasonable estimate that vaping poses on the order of 1/100th the risk from smoking.)

A self-assessment of a necessary cause is, of course, subject to error. It seems likely that had e-cigarettes not existed, more than 1% of subjects who switched to them would have quit smoking between the time they actually did quit smoking and the time of the survey (a period that cannot be determined from this survey, but based on other information probably averages over two years), and others would have quit over the next few years (though the delay would cause more risk than a lifetime of using e-cigarettes [Phillips, 2009]. Nevertheless, that self-perception suggests that would have been true for very few of them and reflects the perception that after trying other methods of quitting -- as almost all had done -- or having no intention of quitting, they had lacked a vision of any promising path to smoking cessation when they discovered e-cigarettes.

It is difficult to imagine a more robust method of assessing whether someone would have remained a smoker without e-cigarettes, at least for a while, than asking him. We could imagine calculating propensity scores for smoking cessation (something far more involved than the standard practice of perfunctorily throwing-in of a handful of weakly predictive covariates), but

even in the best imaginable case, that might offer an unbiased population-level estimator but still be extremely noisy. Absent that (and it seems safe to predict we will remain absent that), and even with it, self-perception is very informative. It is certainly more useful than looking population-level product usage prevalence estimates, as is often done, which is both noisy data and confounded. Even if the self-perception was hugely wrong about smoking cessation probabilities, and *half* of these enthusiast vapers would have quit smoking within a few years of when they switched to e-cigarettes, this still represents hundreds of thousands of American for whom vaping was a necessary cause of them quitting smoking. This result alone (to say nothing of similar evidence that has accumulated over the last few years) is certainly far more useful for answering the question “do e-cigarettes help many people quit smoking” than any observational association with weak controls for propensity or any artificial clinical trial experiment could ever be.

The other striking survey result is the vast majority intending to flout FDA restrictions on available products and continue to use preferred products even if those cannot be legally sold. For this population, the availability of approved “safety valve” alternatives, a few licit brands of cigalikes or a few flavors, created almost no difference for this intention. Almost the same majority of respondents indicated this intention under a total ban and under the partial bans. It is plausible that any severe market restrictions will cause almost all enthusiasts to seek alternative sources for their preferred products.

It must, of course, be recognized that answers to attitudinal or predictive questions about tobacco use behavior often give results that are aspirational, really represent second-order preferences or were trying to answer “properly” rather than accurately [Phillips, Nissen & Rodu, 2015]. Surveys notoriously produce utterly absurd results (e.g., that most smokers “want to quit” even though their actions demonstrate that they do not; claims that there is zero probability that one will smoke in the future [Phillips, 2014b], implausible estimates (e.g., enormously disparate estimates of smoking prevalence [Rodu, 2014b] with trends that are inconsistent with disappearance data), and hopes stated as prediction (e.g., far more smokers expect to quit soon than actually do). Thus in the present case, it is possible that vapers aspire to seek alternative supply chains but will give up on that when forced to make the effort. It is also reasonable to believe that some politically-engaged vapers consider the “proper” answer to the question to be that they will flout the laws, and answer on that basis. Care should be taken in interpreting intention responses from any survey of enthusiasts (which would include every convenience sample survey as well as this one).

On the other hand, there is no reason to expect that this particular aspiration will be difficult to achieve. Alternative supply chains have been predicted since FDA first proposed their regulations [Phillips, 2014c, 2015a]. Alternative supply chains -- shadow markets where

components can be sold legally and the inevitable out-and-out black markets, combined with do-it-yourself manufacture -- are trivial to operate for the same reasons there has been an explosion of small manufacturers, and the prohibition of the latter will simply lead to more of the former. Public statements from many vaping enthusiasts indicate such plans (indeed, some study subjects volunteered that they intend to *be* the black market rather than just partake of it) and a proliferation of how-to guides demonstrate their ease. This is in keeping with the observed e-cigarettes use in jurisdictions like Canada and Australia, where sales of some or all e-cigarette components are banned.

Despite this, claims by FDA and their enablers cling to the insistence that such a supply chain will be small and they will be able to effectively interfere with it, despite having only a small fraction of the enforcement resources that are (unsuccessfully) deployed against grey-market cigarettes or banned drugs. In reality, it seems that these alternative supply chains will rapidly become so robust, with active support from almost all of the hundreds of thousands of enthusiasts (a population which could plausibly double before the ban is enacted), that they will also be easily accessible by anyone with even a casual interest in obtaining the products. This suggests a rethinking about the main ramifications of the current regulations. Most criticisms of the FDA regulation focus on it eliminating an alternative to smoking, but it appears that a more plausible prediction is that it will mostly just drive that alternative underground (which will have substantial costs, just different costs [Phillips, 2015a]). It seems unlikely that anything short of seriously criminalizing possession and use -- as has been done in some totalitarian jurisdictions, but is unimaginable in free societies -- will “force vapers to return to smoking”, as is often claimed.

Nevertheless, a substantial portion of ex-smokers in this sample who expect they will start smoking again and the roughly half of current smokers who expect they will smoke more. Thus, even among enthusiast vapers who are aware of the potential alternative supplies, and mostly intend to seek them, there is an expectation of increased smoking. It would not be unreasonable for them to expect their supply chain could be temporarily unavailable and cigarettes to then be their most preferred alternative. Greater concern is often expressed about potential future switchers who might not get the chance to discover e-cigarettes. While nothing can be said about that population based on this study (and, indeed, it is difficult to imagine how to study them), there is a bit of a backhanded reassurance about them: If there is this much dedication to establishing alternative supply chains, they may get their chance after all.

The study of tobacco use behavior in general, and e-cigarette use behavior in particular, is rife with serious errors in premises and analysis. Much of this error could be addressed with a little attention to the scientific theory of preference and choice [see: Phillips, forthcoming]. The idea that people who are getting enormous consumer surplus from a product will simply obey

government diktats to forego it is absurd on its face, as is the notion that specific product choices do not reflect preferences. However, an understanding of preference and choice also tell us we might expect rather different responses by non-enthusiasts; their consumer surplus compared to the next-best alternative (e.g., just smoking) is modest. The value of the theory is limited without empirical inputs like those produced here, but making sensible use of empirical results without the benefit of the theory is almost impossible.

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References

Action on Smoking and Health (2016). Use of electronic cigarettes (vapourisers) among adults in Great Britain. http://www.ash.org.uk/files/documents/ASH_891.pdf

Etter JF, Bullen C (2011). Electronic cigarette; users profile, utilization, satisfaction and perceived efficacy. *Addiction* 106(11):2017–2028.

Farsalinos KE, et al. (2014). Characteristics, perceived side effects and benefits of electronic cigarette use: A worldwide survey of more than 19,000 consumers. *Int.J. Environ. Res. Public Health* 11:4356-73.

Heavner KH, Dunworth J, Bergen PL, Nissen CM, Phillips CV. (2010). Electronic Cigarettes (e-Cigarettes) As Potential Tobacco Harm Reduction Products: Results of an Online Survey of E-Cigarette Users. *Tobacco Harm Reduction* 2010. CV Phillips and PL Bergen, eds., pp. 257-70.

Phillips CV (2009). Debunking the claim that abstinence is usually healthier for smokers than switching to a low-risk alternative, and other observations about anti-tobacco-harm-reduction arguments. *Harm Reduction Journal* 6:29.

<https://harmreductionjournal.biomedcentral.com/articles/10.1186/1477-7517-6-29>

Phillips CV (2014a). CDC press release about e-cigarettes: blatant lying by government officials. Anti-THR Lies and Related Topics blog.

<https://antithrlies.com/2014/08/27/cdc-press-release-about-e-cigarettes-blatant-lying-by-government-officials/>.

Phillips CV (2014b). CDC refines their lies about kids and e-cigarettes. Anti-THR Lies and Related Topics blog.

<https://antithrlies.com/2014/08/26/cdc-refines-their-lies-about-kids-and-e-cigarettes/>

Phillips CV (2014c). Predicting the black market in e-cigarettes. Anti-THR Lies and Related Topics blog.

<https://antithrlies.com/2014/07/04/predicting-the-black-market-in-e-cigarettes/>.

Phillips CV (2015a). CASAA Report to OMB/OIRA regarding FDA e-cigarette deeming, December 15, 2015. Available via:

<https://antithrlies.com/2015/12/19/casaa-analysis-of-what-will-really-happen-under-ecig-deeming/>

Phillips CV (2015b). The comparative risk of e-cigarettes -- numbers, nonsense, and innumeracy. Anti-THR Lies and Related Topics blog.

<https://antithrlies.com/2015/08/29/the-comparative-risk-of-e-cigarettes-numbers-nonsense-and-innumeracy/>

Phillips CV (2015c). More on the ecig advocates' descent toward junk science. Anti-THR Lies and Related Topics blog.

<https://antithrlies.com/2015/09/01/more-on-the-ecig-advocates-descent-toward-junk-science/>

Phillips CV (2016a). Analysis of the new ASH ecig survey. Anti-THR Lies and Related Topics blog. <https://antithrlies.com/2016/05/17/analysis-of-the-new-ash-ecig-survey/>

Phillips CV (2016b). CASAA ecig survey results. Anti-THR Lies and Related Topics blog. <https://antithrlies.com/2016/01/04/casaa-ecig-survey-results>

Phillips CV (forthcoming). Understanding the basic economics of tobacco harm reduction. Institute of Economic Affairs. White paper.

Phillips CV, Nissen CM, Rodu B (2015). Smoking or quitting: choice, true preferences, tobacco harm reduction, and other neglected considerations. Working paper. <https://ep-ology.com/2014/11/24/working-paper-phillips-nissen-rodu-understanding-the-evidence-about-the-comparative-success-of-smoking-cessation-methods-choice-second-order-preferences-tobacco-harm-reduction-and-other-neglecte/>

R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>

Rodu B (2014a). In the CDC-FDA E-Cigarette Study, "probably not" is the new "yes.". Tobacco Truth blog. <http://rodutobaccotruth.blogspot.com/2014/08/in-cdc-fda-e-cigarette-study-probably.html>.

Rodu B (2014b). How Many Americans Smoke? Tobacco Truth blog. <http://rodutobaccotruth.blogspot.com/2014/07/how-many-americans-smoke.html>

Schoenborn CA, Gindi RM (2015). Electronic cigarette use among adults: United States, 2014. NCHS Data Brief No. 217. <http://www.cdc.gov/nchs/data/databriefs/db217.pdf>.

Siegel, MB, Tanwar KL, Wood KS (2011). Electronic cigarettes as a smoking-cessation tool: Results from an online survey. *American Journal of Preventative Medicine* 40:472-75.

U.S. Food and Drug Administration (2016). 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. <http://www.fda.gov/TobaccoProducts/Labeling/RulesRegulationsGuidance/ucm394909.htm>

West R, et al. (2016). Trends in electronic cigarette use in England; Smoking Toolkit Study. Available via <http://www.smokinginengland.info/latest-statistics/>.