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A new Classification System for describing concurrent use of Nicotine Vaping Products alongside Cigarettes (so-called "Dual Use"): Findings from the ITC-4 Country Smoking and Vaping Wave 1 Survey t

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Abstract

Aims: To determine whether a simple combination of level of smoking and level of vaping results in a useful typology for characterising smoking and vaping behaviours.

Methods: Cross-sectional data from adults (≥18 years) in the 2016 Wave 1 ITC Four Country Smoking and Vaping Survey in the United States (n=2291), England (n=3591), Australia (n=1376), and Canada (n=2784) were used. Participants who either smoked, vaped or concurrently used both at least monthly were included and divided into 8 groups based on use frequency of each product (daily, non-daily, no current use). This resulted in 4 concurrent use groups (predominant smokers, dual daily users, predominant vapers and concurrent non-daily users). These groups were compared with each other and with the 4 exclusive use groups, on socio-demographics, nicotine

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ETHICAL APPROVAL

The survey protocols and all materials, including the survey questionnaires, were cleared for ethics by Research Ethics Office, King's College London, UK; Office of Research Ethics, University of Waterloo, Canada; and Human Research Ethics, Cancer Council Victoria, Australia. All participants provided consent to participate.

dependence, beliefs and attitudes about both products, and quit-related measures using data weighted to reference population surveys in each country.

Results: 10.8% of the sample were concurrent users, with daily smokers vaping non-daily (predominant smokers) constituting 51.6% of this group. All 8 categories differed from other categories on at least some measures. Concurrent daily nicotine users reported higher levels of indicators of nicotine dependence, and generally more positive attitudes toward both smoking and vaping than concurrent non-daily users. Among daily nicotine users, compared with exclusive daily smokers, reports of interest in quitting were higher in all concurrent use groups. Dual daily users had the most positive attitudes about smoking overall, and saw it as the least denormalised, and at the same time were equally interested in quitting as other concurrent users and were most likely to report intending to continue vaping.

Conclusions: In Australia, Canada, England and the United States in 2016, daily nicotine users differed considerably from non-daily nicotine users. Among daily nicotine users, dual daily users (those who smoke and vape concurrently) should be treated as a distinct grouping when studying relationships between smoking and vaping. The 8 level typology characterising concurrent and exclusive use of smoking and vaping should be considered when studying both products.

Keywords

vaporised nicotine; electronic cigarettes; vaping; smoking; dual use; concurrent use

Introduction

Nicotine vaping products (NVPs), sometimes called electronic cigarettes, are products designed to deliver nicotine without tobacco smoke by heating solutions containing distilled nicotine to create an aerosol (colloquially called “vapour”) (1). NVPs should be distinguished from heated tobacco products which create an aerosol by heating volatile chemicals in tobacco. The introduction and proliferation of vaping (NVP use) is seen by some as a method of quitting smoking and/or as a possible substitute for smoking, and thus of great potential to further public health (2, 3). Others are concerned that vaping may only act as a partial substitute for smoking and/or that it might inhibit smoking cessation efforts and thus have adverse public health impacts (4–6) based on reports of high levels of dual or concurrent use (4–7). This seems to be based on the presumption that dual use involves high levels of use of both products. However, the may not be the case as definitions used for “dual use” in the literature vary from *‘any use’* of both products in the last 30 days (8), or *‘any current use’* (where frequency is not specified (9), through weekly use (10) to daily vaping in conjunction with smoking (11). This variability in definition makes it both difficult to compare results across studies and to understand what the patterns mean.

Consideration of the frequency of both vaping and smoking is important in understanding the implications of different patterns of concurrent use. A person who vapes daily and smokes a cigarette once a month is likely to be at far lower risk of adverse health effects than someone who smokes daily and vapes once a month. Yet, when ‘any current use’ of both is the grouping criterion, these are classified together. For example, Coleman et al (12) found only around one fifth of vapers vaped daily, and extent of use was related to both type of

product and smoking status. Studies defining vaping as 'any current use' have found that the majority of those vaping are "dual users" (i.e., also smoke), and that such use is not predictive of subsequent smoking cessation, or even associated with lower levels of cessation (13). By contrast, daily vaping is predictive of future smoking cessation (11, 14) and of attempts to quit smoking (15). Consistent with this, daily vaping is more predictive of subsequent abstinence from all forms of nicotine than non-daily use (3).

In this paper, we use the term "Concurrent use" to refer to any level of current use of the two products. We treat "dual use" as a subcategory, restricting it to regular (daily) use of both products).. We treat vaping as an alternative form of nicotine delivery based on the hypothesis that smokers titrate their nicotine dose, so expect comparable levels of nicotine consumption to reflect comparable levels of dependence.

The aim of this paper is to explore heterogeneity between concurrent use categories and other variables of interest to public health We propose a classification system based on the frequency of use of both cigarettes and nicotine vaping products (NVPs), which defines categories of concurrent users (see Methods for definitions of the categories developed). To assess the potential utility of the taxonomy, we utilize cross-sectional survey data to describe the prevalence of categories of smoking and vaping (exclusive or concurrent), and explore their relationships with other smoking and vaping measures of interest, including dependence, quitting interest, and a range of attitudes and beliefs.

We expect to find that associates of daily nicotine use are distinctly different to those of non-daily use. We also expect patterns of responding to differ by category of concurrent use, with responses to each concurrent use category generally closest to the most behaviourally similar exclusive use category. For example, predominant smokers (those who smoke much more than they vape) will be more similar to exclusive smokers than dual users with predominant vapers even less similar. The main likely exception is levels of dependence which may only vary by daily versus non-daily use. It is beyond the scope of this paper to systematically explore the determinants of any differences between categories of use we find.

Methods

Sample:

Data come from the International Tobacco Control (ITC) Four Country Tobacco and Vaping Wave 1 (4CV1) survey collected in 2016. We began with the core sample of 11,312 participants from four countries (Australia, Canada, England and the United States) who either currently (within the last month) smoked or did so in the last two years, and/or currently vaped and who were or had been daily smokers. We dropped the 1343 not smoking or vaping at least monthly, leaving 10,151. We also treated those vaping without nicotine as non-vapers, dropping another 149 cases that were not smoking, and reallocating the rest to the appropriate exclusive smoker category. This left us with a sample for analysis of 10,002.

Sampling procedures:

The ITC 4CV wave 1 survey (4CV1), an expansion of the 2002–2015 ITC Four-Country (ITC 4C) survey (16) conducted in 2016. The 4CV1 survey retained participants from the

original cohort who met the eligibility criteria, and recruited new participants who were current smokers or vapers or had quit nicotine within the last two years. In 3 countries (not Australia) there was over-sampling of younger respondents (aged 18–24) and/or those with experience of vaping, but done in a way that allowed us to weight the samples back to reference, representative surveys. Thus the weighted estimates are good representations of prevalence for each country (see Thompson et al (17) for more details)

Measures:

The typology we propose and plan to evaluate distinguishes between daily and non-daily current use of both products, resulting in three categories of current use: daily, non-daily (less than daily, but at least monthly use), and no current use, for each product. Cross-tabulating gives 8 categories, as those using neither were dropped from the sample (**see** Figure 1). There are four types of ***concurrent use***: 1) **Predominant smokers** (daily smokers with non- daily vaping); 2) ***Dual users*** (daily use of both products), 3) **Predominant vapers** (daily vapers and non-daily smokers), and 4) ***Non-daily concurrent users*** (non-daily use of both); plus there are 4 types of exclusive users of one product: 1) ***daily smokers***; 2) ***daily vapers***; 3) ***non-daily smokers***; and 4) ***non-daily vapers***. Divided up differently, there are 5 types of **daily nicotine** users (3 concurrent use) and 3 types of **non-daily** users (only 1 concurrent use), a distinction we theorise to be particularly important.

We have chosen daily smoking and/or vaping; that is, “daily nicotine use”, as the primary distinguishing category between levels and types of nicotine use as it is easy to operationalise and, at least for smoking, daily use, compared to non-daily use, is both of greater health concern, and more likely to persist long-term. Daily smoking is an established indicator of dependence. Compared to daily smokers, non-daily smokers find it easier to quit (18) which likely reflects a low level of nicotine dependence (19). We have not included time to first cigarettes of the day, the best single predictor of smoking cessation success (20), in our categorizing scheme as it is questionable as to whether it is a meaningful measure for non-daily smokers as it is only assessed on the days they smoke.

Comparator measures: Measures used to assess the potential utility of the typology included sociodemographics: age, gender, and socioeconomic status (SES). For SES, we combined four level indexes of education and income (Low, Medium, High, Don’t Know/ refused) by treating Don’t Knows in the Medium category, and then combining such that either or both high was coded as “high”, either or both low was coded “low”, with the remainder in the “middle” category.

Measures of *nicotine dependence*.—As a behavioural measure we extended time to first cigarette into “time to first nicotine” by including time to first vape for exclusive vapers, and substituting it for dual users if it was shorter than time to first cigarette. This should be a good measure of dependence, but it is not yet validated. We also asked about *strength of urges to smoke in the previous 24 hours*, and *how hard they rated quitting smoking*. Unfortunately we have no comparable measure of nicotine consumption because we did not ask all about cigarette consumption prior to taking up vaping, and have no validated measure of vaping consumption.

Beliefs and attitudinal measures.—These included questions about experiences and perceived effects of vaping and smoking, some attitudes and perceived societal injunctive norms for both products. These were all rated on 5-point scales with a separate "Don't Know" option; "Compared to smoking cigarettes, how addictive do you think vaping (using e-cigarettes) with nicotine is?"; "How satisfying is vaping (using e-cigarettes), compared to smoking ordinary cigarettes?"; and separately "harmful"; rated from "much more" to "much less": two questions on social norms: "What do you think the general public's attitude is towards smoking cigarettes?"; and separately "vaping/ using e-cigarettes"? rated from "strongly approves" to "strongly disapproves"; and overall attitudes: "What is your overall opinion of smoking cigarettes?, and separately "vaping" rated from "very positive" to "very negative" "Don't Know" responses were recoded into the middle, neutral category when 5 point scales were used. Where the scale was an escalation of amount or frequency (e.g., from "not to all" to "all the time"), "Don't knows" were added to the second lowest category (e.g., a little). In other cases, they were treated as missing. We also assessed type of vaping device used, reporting here on those using open tank (refillable) systems compared with all others (i.e. closed systems, either disposable or using sealed cartridges or pods).

Analytic strategy: The analysis primarily consisted of cross-tabulations using the survey weighting algorithm in STATA. We began by comparing daily versus non-daily concurrent users to explore the theorised differences. This was followed by comparing the three groups of concurrent daily nicotine users with each other and with the two exclusive daily user groups to explore whether the balance of the two behaviours influenced beliefs and behaviours in a quasi-linear fashion. Finally we compared the concurrent non-daily users with the two sole non-daily user groups. In the Tables, we report summary percentages of attitudes, beliefs and reported frequencies of events summed across multiple categories, but the significance tests were conducted using the 5-point scales. We use a p level of 0.05 throughout, but are cautious in interpreting differences with p values greater than 0.001.

Results

Characteristics of the sample of 10.002 used are found in Table 1 along with a breakdown of percentages of the 8 nicotine use groups (both weighted and unweighted). The weighted distribution of groups is 80.2% exclusive smokers (daily and non-daily) and 9.0% exclusive vapers, leaving 10.8% concurrent users: consisting of 3.3% dual daily users (called 'dual use' when not ambiguous); 1.1% concurrent non-daily; 5.6% predominant smokers; and 0.9% predominant vapers. Predominant smokers represent 51.6% of all concurrent users (weighted estimate). There was considerable variation by country in the prevalence of smoking and vaping, with rates of any vaping highest in England and lowest in Australia.

Daily vs non-daily use among concurrent users:

To test whether the distinction between daily and non-daily nicotine users is an important one, we compared daily versus non-daily nicotine users. Table 2 shows comparisons between the dual non-daily group separately with a combination of the three daily concurrent use groups (i.e., predominant smoker, dual daily, and predominant vaper), and the group of dual users alone. Older people were much more likely to be daily users as were

people of lower SES, but there were no sex differences. Perceived difficulty of quitting and reported strength of urges to smoke were both higher among the daily users. The dual non-daily nicotine users were less likely to use tank systems to vape and were less likely to plan to continue use, especially compared to the dual daily users. The dual non-daily users also had less positive attitudes towards vaping, and marginally less positive attitudes to smoking. It is notable that there were some differences in the comparisons where concurrent use rather than dual use was the daily use comparator. These typically occurred on measures where the dual users differed markedly from the predominant smokers (see below).

Comparisons within daily nicotine user groups:

We now turn to comparisons between the five daily nicotine use groups, focussing on the three concurrent daily use groups, the patterns of most concern (see Table 3). There were no strong sociodemographic effects observed. There were small but non-systematic differences in dependence as indexed by time to first nicotine, but large differences in strength of urges to smoke and perceived difficulty of quitting, with predominant vapers, and especially exclusive vapers, reporting far fewer urges to smoke and being less likely to perceive quitting as difficult. All concurrent users were more likely to have reported recent quit attempts and were more likely to be planning to quit in the next 6 months than the exclusive daily smokers.

Those currently vaping at all were much more likely to report being likely to vape in future than exclusive smokers. Among the 4 daily use groups who vape currently, reporting that vaping was less satisfying than smoking declined with increased vaping frequency. However, dual daily users, were more likely to report that they will continue to vape, especially compared to exclusive daily vapers, an unexpected finding.

Overall attitudes toward vaping became more positive with increased frequency of vaping and reduced levels of smoking, while perceived positive social norms were strongest among dual users. The pattern was also non-linear for smoking. Both attitudes and perceived societal norms were more positive, or less negative, among dual daily users, and to a lesser extent the predominant smokers, than the exclusive smokers, with predominant vapers and sole vapers much more negative.

Non-daily nicotine users:

Comparisons between the concurrent non-daily user group and the two non-daily exclusive use groups are shown in Table 4. It is notable that the concurrent non-daily users were less likely to report few or no urges to smoke in the last day, especially compared to the non-daily vapers. They were also most likely to plan to continue vaping.. Concurrent non-daily users had more positive (less negative) attitudes and normative beliefs about smoking than the two exclusive non-daily use groups, with the non-daily vapers most negative. As expected, both groups that vaped were much more positive about vaping than the non-daily smokers.

Discussion

We found concurrent daily nicotine users differ from concurrent non-daily users on a wide range of measures establishing this as an important distinction. The concurrent non-daily users also differed from the two non-daily exclusive users on many measures, in particular, they had more positive attitudes to smoking even than the occasional smokers with the exclusive non-daily vapers being most negative. They differed less from this latter group on attitudes to vaping overall, with e exclusive non-daily smokers having by far less positive views. . These differences justify treating concurrent non-daily users as a separate group in addition to the separation between daily and non-daily nicotine use.

We did not find the expected gradation across the five daily use categories. Only in the cases of overall attitudes to vaping and the belief that switching to vaping will improve health a lot was there a simple linear (monotonic) trend across the five daily nicotine use groups.

Further we found difference in the measures of dependence, somewhat unexpectedly. However, the largest differences were in reported urges to smoke, where the predominant vapers and, particularly, the daily vapers were more likely to report low levels of urges, perhaps because they now tend to crave vaping rather than smoking. Also they less likely to rate quitting smoking as very hard, probably because they had succeeded or almost succeeded. Predominant vapers were also less likely than other concurrent users to report that vaping is less satisfying than smoking and more likely to perceive benefits from quitting, although typically not as much as the exclusive vapers. These differences all support these three groups being distinct and differing formt eh exclusive user groups, at least in some areas. We now consider each of the three concurrent daily user groups in more detail.

Predominant smokers are the largest single concurrent use category and as such have the potential to swamp analyses where they are combined with other concurrent user groups. On most smoking related measures, they are more similar to exclusive smokers than to predominant or exclusive vapers; however, they report being more interested in quitting and are more positive about vaping. Predominant smokers appear to be mainly experimenting with vaping and are not using VNPs as a way that is likely to materially affect their cigarette consumption. Consistent with their infrequent vaping, they are unlikely to see vaping as a viable substitute for smoking, If our analysis is correct, they may be a group that declines in size unless there is a constant flow of innovations in VNPs to maintain continued interest. We think it is important that they be considered as a separate group, not combined with other concurrent users.

On a number of measures it was the dual users who stood out as different. They were the most likely to report intending to continue to vape, had the least negative pro-smoking attitudes and normative perceptions, and much more positive attitudes about vaping than the predominant smokers. They are by far the most pro smoking, both in terms of their personal views and their normative perceptions. However, they were more likely than exclusive smokers to be interested in quitting and to have made recent attempts. That said, we might have expected even higher rates of intending to quit if dual use is simply a transition to

smoking cessation. It may be some are stuck and thus see quitting as unlikely in the near future. It is also possible that some may see dual use as a more stable state, which would be undesirable. Research is needed to explore this seeming ambivalence. They could be more focussed on immediate gratification or positive aspects of each option, or they may come from a particularly pro-smoking social environment. It will be important to determine if their attitudes have been shaped by their period of dual use or whether they are more likely to dual use because of pre-existing beliefs, desires or social conditions. Both because of their distinctiveness and the concerns raised about regular dual use, they should be a major focus of future research.

The pattern of responses in the small group of predominant vapers lay between exclusive daily vapers and dual daily users, where dual users were notably much more likely to report cravings to smoke and less confident that switching will lead to health benefits. They were also less likely to have been vaping for more than a year compared to the exclusive vapers. This suggests predominant vaping may be a relatively transitory state for most, but confirmation is needed from longitudinal studies. If they did maintain smoking less than daily, it is likely to have a positive impact on their risk profile, although not as much as from quitting smoking altogether. Encouraging cutting down in the absence of alternative sources of nicotine has been found to be unstable and thus not a useful goal to pursue for most people (21, 22). It is an interesting question as to whether it may be more stable with alternatives like vaping available. The main concern with this group is whether they will relapse back to smoking, as they seemingly are having trouble quitting altogether..

The finding of several important exceptions to the simple expectation that attitude would become more pro vaping as vaping predominated and conversely less pro-smoking as smoking predominates, demonstrates interactive effects and thus the potential need for the taxonomy of concurrent use types. Given that on most measures concurrent users were different to exclusive users, even when focussing on the concurrent user group closest to them, and that there were also significant differences between the three concurrent daily user groups, all elements of the classification scheme are broadly supported as identifying potentially important differences. Some dual users give the impression of being torn between two behaviours which they value, presumably in different ways. They can be contrasted with the predominant smokers who appear to be largely smokers who are still experimenting with vaping, presumably because they still have doubts as to whether NVPs are good enough products to draw them away from smoking; and the predominant vapers who still experience some benefits from smoking that they don’t get from vaping, but have otherwise largely transitioned.

Overall, the analyses suggest that groups of smokers who vape at all are more interested in quitting smoking than those who don’t, and are more likely to report recent quit attempts, consistent with most previous studies (14, 23). This finding is not consistent with arguments that vaping may act as a barrier to interest in quitting. It is also notable that exclusive vapers appear more interested in eventually discontinuing vaping than dual users, with predominant vapers intermediate. Our findings suggest that at least some vaping is seen as only being needed so long as necessary to support smoking cessation. This is consistent with other

findings in this Supplement (24), where we found quitting to be a core reason for vaping and successful smoking cesatin a major reason for stopping vaping.

The study has some important limitations. It relies entirely on cross-sectional data, and all inferences about possible consequences over time are speculative. It was restricted to current nicotine users who are or have been daily smokers, so findings may not apply to occasional users who have never smoked daily, and those who do not vape with nicotine. One other important limitation is that our study defined daily nicotine use in terms of smoking and vaping. With the emergence of heated tobacco products, and in some places the importance of oral tobacco and nicotine products, the concept of nicotine use will need to extend to all forms of nicotine that are used regularly. It may also be useful to explore whether daily use is the best possible bounding condition between regular and occasional use. We chose daily use as the cut-off point between regular and occasional use because it is easily assessed, and regularly asked in population surveys, and it has been shown to be important for differentiating smoking levels. The ideal bounding condition could be lower; for example, smoking most days; averaging at least one cigarette per day (which would take in some weekly smokers); or even weekly smoking, as there is likely some regularity of pattern. Alternatively, it could be higher, for example, smoking less than five cigarettes per day as this is not associated with some indicators of dependence (25), but in this case would be better described as dependent versus non-dependent use. However, this is likely to only be an issue for fine-grained analyses, not for large scale understanding. Finally, this paper only looks at some indicators to demonstrate that enough important differences exist to justify the classification scheme. It was not designed to explore the differences found. These are tasks for subsequent papers, including use of longitudinal data from other waves of this study. The larger challenge is to work out how vaping influences smoking, both as a potential substitute and as a means for complete cessation of nicotine use.

We recommend that daily nicotine use versus non-daily use be used as the basis of both measurement and reporting, even if more sophisticated distinctions are developed for specialist purposes. We recognise that this results in 8 distinct categories of current nicotine use which can be unwieldy. One possible solution to this would be to focus on daily use of nicotine, and make dual daily use the focus for understanding concurrent use. To do this we would need to treat non-daily use of either or both products as risk factors for transitioning to or from the four possible daily use groups or states (smoking, dual use, vaping, and neither).

In conclusion, we found that categorizing concurrent nicotine users in terms of daily versus non-daily use of both revealed differences between the 8 categories of use and the 4 patterns of concurrent use, on a broad range of characteristics that are of vital interest to public health researchers and policymakers, including some indicators of nicotine dependence, quit smoking intentions, and beliefs and attitudes about smoking and vaping. Failure to distinguish between different types of concurrent user groups that are often combined together as “dual users” is likely contributing to confusion about important issues regarding the use VNPs in relation to smoking. For these reasons it is important to distinguish daily from non-daily nicotine use, and to differentiate three groups of concurrent daily users: predominant smokers, dual daily users and predominant vapers.

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Vaping Status (Frequency)	Smoking Status (Frequency)		
	No current use	**Non-Daily use**	**Daily use**
No current use	No current use of either (excluded)	Exclusive non-daily smoker	Exclusive daily smoker
Non-Daily use	Exclusive non-daily vaper	Concurrent non-daily user	Predominant smoker
Daily use	Exclusive daily vaper	Predominant vaper	Dual daily user

Figure 1.
Characterization of the 8 types of nicotine use, highlighting the 4 types of concurrent user

Table 1

Sample Characteristics by Country and Overall:

	CANADA	USA	ENGLAND	AUSTRALIA	TOTAL
N	2784	2291	3591	1376	10,002
Weighted % (unweighted %)					
% Female	40.9 (52.7)	45.9 (47.7)	46.6 (45.1)	43.3 (46.1)	44.4 (48.3)
Age 18 – 24	10.8 (20.0)	10.4 (20.4)	14.1 (20.1)	12.4 (2.6)	12.1 (17.8)
25 – 39	27.2 (25.2)	27.7 (26.6)	30.8 (24.0)	35.2 (18.6)	29.7 (24.2)
40 – 54	32.8 (29.6)	30.5 (16.9)	27.7 (27.4)	28.0 (38.7)	29.8 (27.1)
55 plus	29.3 (25.2)	31.4 (36.1)	27.4 (28.5)	24.4 (40.0)	28.4 (30.9)
SES Low	30.4 (32.7)	54.2 (39.2)	28.1 (30.6)	32.1 (30.6)	35.2 (33.1)
Medium	28.6 (28.2)	23.8 (22.1)	33.6 (27.4)	32.3 (28.0)	29.8 (26.5)
High	41.0 (39.0).	22.0 (38.7)	38.3 (42.0)	35.6 (41.4	35.0 (40.4)
USE status: Concurrent use					
Predominant Smoker	6.9 (15.7)	4.8 (16.3)	6.5 (14.0)	1.6 (6.3)	5.6 (14.0)
Dual Daily User	3.6 (8.0)	3.7 (15.7)	3.6 (9.2)	0.8 (3.9)	3.3 (9.6)
Predominant Vaper	0.9 (2.0)	0.9 (3.1)	1.2 (2.5)	0.2 (0.8)	0.9 (2.3)
Dual Non-daily User	1.6 (4.5)	0.8 (3.8)	1.1 (3.8)	0.2 (0.7)	1.1 (3.6)
Exclusive					
Daily Smoker	70.2 (56.0)	74.5 (48.8)	64.7 (57.1)	89.8 (80.8)	71.8 (58.4)
Non-daily Smoker	11.3 (8.8)	7.7 (5.2)	8.0 (6.7)	4.8 (4.1)	8.4 (6.6)
Daily Vaper	3.2 (2.6)	6.6 (5.9)	12.1 (6.7)	2.3 (3.1)	7.1 (4.4)
Non-daily Vaper	2.4 (2.3)	1.0 (1.2)	2.8 (1.5)	0.3 (0.4)	1.9 (1.5)

Table 2

Comparison of both A) daily concurrent nicotine users and C) the sub-group of daily dual users with B) non-daily dual users

	A: Concurrent daily nicotine use*	B Dual daily use	C: Concurrent non-daily use	Sig
% Female	47.5	46.1	46.3	A-C: NS B-C: NS
Age: 18–24	13.0	13.3	24.4	A-C: P<.0001 B-C: p<.0001
25–39	29.3	32.1	42.1	
40–54	32.8	32.6	20.9	
55 +	25.0	22.1	12.6	
Socioeconomic Status (SES): Low	36.2	35.0	24.1	A-C: P=.004 B-C: p=.03
Medium	28.8	27.1	31.1	
High	35.1	37.8	44.8	
Uses a tank system to vape	58.2	56.5	36.4	A-C: P<.0001 B-C: p<.0001
Reports only no or slight urges to smoke in last day	12.0	11.9	42.8	A-C: p<.0001 B-C: p<.0001
Very or extremely hard to quit completely	46.7	43.7	14.7	A-C: p<.0001 B-C: p<.0001
Plans to quit within next 6 months	46.3	49.1	53.2	A-C: NS B-C: NS
Probably or definitely plans to vape in future	67.1	74.7	43.0	A-C: p<.0001 B-C: p<.0001
Believes ECs less addictive than cigarettes	56.7	57.2	51.3	A-C: p<.0001 B-C: p<.0001
Finds vaping less satisfying than smoking	65.0	52.6	46.7	A-C: p<.0001 B-C: p=.02
Believes vaping less harmful than smoking	74.0	70.2	60.9	A-C: p<.0001 B-C: p=.002
Believes switching to vaping believed to improve health	76.5	75.7	67.0	A-C: P=.0001 B-C: p=.0001
Agrees society disapproves of smoking	74.4	65.5	63.5	A-C: P=.0002 B-C: p=.0002
Agrees society approves of vaping	35.8	39.2	31.9	A-C: p=.007 B-C: p=.002
Positive overall opinion of vaping	43.3	52.8	30.8	A-C: p=.0001 B-C: p<.0001
Positive overall opinion of smoking	14.1	18.4	10.7	A-C: NS B-C: p=.02

*Consists of the three Concurrent daily use groups

Table 3.

Associations between the 5 groups of daily nicotine users and other measures

	A: Exclusive Daily smoker	Concurrent use (% concurrent)			E: Exclusive Daily vaper	Significance
		B: Predominant Smoker 68.4%	C: Dual daily user 23.6%	D: Predominant vaper 8.0%		
Total Raw (weighted)%	65.8 (81.1)	15.8 (6.3)	10.9 (3.7)	2.6 (1.0)	5.0 (7.9)	
% Female	44.1	49.8	46.1	39.2	48.7	A-B: p<0.003 B-D: NS D-E: NS
Age: 18–24	11.5	12.3	13.3	16.1	9.7	A-B: p=0.04 B-D: NS D-E: NS
25–39	28.6	28.2	32.1	26.0	22.4	
40–54	29.9	33.8	32.6	27.0	32.1	
55 +	30.0	25.8	22.1	31.0	35.9	
Socioeconomic status (SES): Low	38.0	36.5	35.0	37.9	25.7	A-B: NS B-D: NS D-E: NS
Medium	29.9	29.8	27.1	28.3	34.1	
High	32.1	33.7	37.8	33.7	40.3	
Uses a tank system	NA	56.2	56.5	76.9	84.5	B-D: p<.0001 D-E: NS
Time to first nicotine: <= 5 minutes	19.1	21.2	23.8	15.3	30.0	A-B: p=.003 B-D: NS D-E: p=.01
Rates quitting as very or extremely hard	48.1	50.7	43.7	32.2	29.4	A-B: NS B-D: p<.0001 D-E: NS
Reports no or only slight urge to smoke in last day	14.2	8.6	11.9	33.6	93.1	A-B: p<.0001 B-D: p<.0001 D-E: p<.0001
Made a quit attempt in the previous year	47.5	60.3	63.8	73.9	N/A	A-B: p<.0001 B-D: p=.009
Plans to quit in the next 6 months	33.7	43.9	49.1	50.6	N/A	A-B: p<.0001 B-D: NS
Has vaped daily >= 1 year	N/A	N/A	36.6	41.9	63.4	C-D: NS D-E: p=.0002
Reports vaping less satisfying than smoking	N/A	76.6	52.6	38.3	26.7	B-D: p<.0001 D-E: NS
Probably or definitely plans to vape in future	15.3	63.1	74.7	64.0	58.2	A-B: p<.0001 B-D: p<.0001 D-E: NS
Believes vaping less addictive than smoking	29.5	56.6	57.2	55.3	59.1	A-B: p<.0001 B-D: NS D-E: NS
Believes vaping less harmful than smoking	52.2	74.6	70.2	83.9	94.1	A-B: p<.0001 B-D: p<.0001 D-E: p=.0009
Believe switching to vaping will improve health a lot	15.8	29.9	34.0	40.1	69.2	A-B: p<.0001 B-D: NS D-E: p<.0001
Society disapproves of smoking (agrees)	80.5	78.3	65.5	82.2	91.3	A-B: p=.0007 B-D: p<.0001

	A: Exclusive Daily smoker	Concurrent use (% concurrent)			E: Exclusive Daily vaper	Significance
		B: Pre-dominant Smoker 68.4%	C: Dual daily user 23.6%	D: Pre-dominant vaper 8.0%		
						D-E: p<.0001
Society approves of vaping (agrees)	20.2	34.1	39.2	34.0	32.5	A-B: p<.0001 B-D: p=.002 D-E: NS
Positive overall opinion of vaping	11.5	35.4	52.8	57.5	72.3	A-B: p<.0001 B-D: p<.0001 D-E: p=.002
Positive overall opinion of smoking?	9.7	13.3	18.4	3.6	2.6	A-B: p<.0001 B-D: p<.0001 D-E: NS

Table 4

Patterns of responding among non-daily nicotine users

	A: Non-daily smoker	B: Non-daily vaper	C: Concurrent non-daily	Sig
% Female	39.7	45.3	46.3	A-C: NS
Age: 18–24	15.9	15.5	24.4	A-C: NS
25–39	42.6	38.0	42.1	
40–54	24.7	27.5	20.9	
55 +	16.8	18.9	12.6	
Socioeconomic Status (SES): Low	24.0	16.9	24.1	A-C: p<.05
Medium	28.6	20.3	31.1	
High	47.4	62.8	44.8	
Uses a tank system to vape	NA	49.9	36.4	NS
No or only slight urges to smoke in the last day	60.6	82.5	42.8	A-C: p<.0001
Plans to quit in next 6 months	50.6	N/A	53.2	NS
Probably or definitely plans to vape in future	11.2	39.5	43.0	A-C: p<.0001
Believes vaping less satisfying than smoking	N/A	44.8	46.7	NS
Believes vaping less addictive than smoking	29.5	66.6	51.3	A-C: p<.0001
Believes vaping less harmful than smoking	52.8	81.3	60.9	A-C: p<.0001
Society disapproves of smoking (agrees)	80.5	88.7	63.5	A-C: p<.0001
Society approves of vaping (agrees)	18.2	37.1	31.9	A-C: p=.002
Positive overall opinion of vaping	10.9	34.1	30.8	A-C: p<.0001
Positive overall opinion of smoking	7.2	2.8	10.7	A-C: p<.0001