BMJ Open

Patterns of electronic cigarette use in current and ever users among college students in France: a cross–sectional study

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ABSTRACT

Objective: There is sparse information on electronic cigarette use and health behaviours among college student populations. Our objectives were to identify the patterns of electronic cigarette use in current and ever users among college students in France.

Design: Cross-sectional study.

Settings: A multicentre cross-sectional study was conducted on two major campuses in France. Students filled in an anonymous questionnaire on their use of electronic cigarettes and on targeted behaviours such as smoking, alcohol consumption, binge drinking, use of cannabis, practice of sport and eating disorders. Ever use of electronic cigarettes was defined as use but not during the previous 30 days, and current use of electronic cigarettes as any use in the previous 30 days. The opinions and motivations of electronic cigarette users were also sought and collected.

Participants: 1134 college students between October 2014 and February 2015.

Results: The 1134 students included had a mean age of 20.8 years. The prevalence of ever use and current use of electronic cigarettes was 23.0% (95% CI (20.5% to 25.3%)) and 5.7% (95% CI (4.4% to 7.1%)), respectively. The prevalence of the combined use of conventional cigarettes and electronic cigarettes was 14.5%. Almost half (45.8%) of the ever users of electronic cigarettes had never smoked conventional cigarettes. Behaviours associated with ever use of electronic cigarettes were current cigarette smoking (adjusted OR (AOR)=3.97, 95% CI 2.71 to 5.83), former smoking (AOR=2.56, 95% CI 1.42 to 4.61), cannabis use (AOR=2.44, 95% CI 1.70 to 3.51) and occasional binge drinking (AOR=1.83, 95% CI 1.28 to 2.64). The only behaviour associated with current use of electronic cigarettes was conventional smoking, either previously (AOR=4.85, 95% CI 1.53 to 15.34) or currently (AOR=14.53, 95% CI 6.81 to 31.02).

Conclusions: The ever users have an experimenter's profile with sensation-seeking while the current users are mostly smokers with intention to quit smoking. Our findings are crucial for the accurate targeting of student populations at risk and to implement appropriate awareness campaigns and health education programmes.

Strengths and limitations of this study

- Our findings from a large representative sample of two major campuses will help improve our understanding of patterns of electronic cigarette use among college students.
- The prevalence of electronic cigarette use among college students was estimated with a narrow CI.
- We identified two different profiles of electronic cigarette users with associated health behaviours.
- Our findings will be useful for implementing further health education and behavioural interventions.
- All data were collected by self-reporting.

BACKGROUND

The electronic cigarette (e-cigarette) is a battery-operated product designed to deliver nicotine, flavour and other chemicals (Food and Drug Administration (FDA), 2014). It is manufactured in order to resemble the conventional cigarette, but it does not burn tobacco and instead of the smoke released from a conventional cigarette, the e-cigarette delivers a vapour as a result of inhaling the product found in the cartridge. This product can contain nicotine, just flavours or both. An e-cigarette gives a sensation similar to smoking a cigarette by providing taste and inhaling sensations that are closer to smoking than those provided by the nicotine inhalator.[1] The e-cigarette is a novel device, released in 2004, with health claims and smoking cessation messages which make it particularly attractive to young adults.[2 3]

Ever use of the e-cigarette is highest among young adults in the USA (college students and those aged 20–28 years; 4.9–29.9%), then adults (0.6–30.9%) and adolescents

(<1–23.5%)[4–6] with a prevalence of use which seems to have risen since 2010.[7] Current use is also up to 14.9% higher in young adults and especially college students.[8] The prevalence of e-cigarette use varies according to different countries and their specific policies or restrictions.[9] In France, the e-cigarette was released in 2007 and the law forbids the sale of this device to underage buyers (<18 years). According to national French surveys, 26% of adults and 14% of college students have tried the e-cigarette at least once.[10]

The role of this device is controversial in a public health context, as there is little information on the effects or consequences, either beneficial or harmful, of using e-cigarettes. A meta-analysis has recently shown that e-cigarettes help conventional cigarette smokers to reduce or stop their long-term consumption compared to placebo.[11] Other studies have shown that the e-cigarette is capable of helping with tobacco withdrawal, in the same manner as nicotine replacement products (patches, chewing-gum, etc),[12] but does not enable users to quit smoking.[2 13] The mechanism by which the e-cigarette could help to reduce tobacco consumption is by reducing craving and the symptoms of tobacco withdrawal.[12] Users see the e-cigarette as an alternative to smoking or as a way of quitting smoking since it contains the nicotine necessary for the smoker's body.[14] E-cigarette use is strongly correlated with conventional cigarette use among adults or adolescents.[8 15 16] Since no tobacco is actually burnt, there are no harmful particles like tar or carbon monoxide, but the e-cigarette does contain low-level carcinogens.[16 17] A systematic review of the health effects of e-cigarettes showed that they cannot be regarded as safe, even though they are probably less harmful than conventional cigarettes.[17] McRobbie et al[11] identified no evidence that short-term e-cigarette use is associated with health risks. The belief that this device is less harmful than conventional cigarettes seems to be constantly cited in adult[18] or younger populations.[6 19] Anand et al[20] recently demonstrated an increased tendency to use the e-cigarette in the higher school grades, with a slightly higher current use of tobacco and higher current combined use. It would be interesting to find out if this trend applies to college students.

The transition to young adulthood from adolescence is an important developmental period during which young adults, especially college students, are confronted with a variety of life changes which could increase susceptibility to engaging in a variety of health-risk behaviours, most notably alcohol, tobacco and other drug use.[21 22] In emerging adulthood, young people may experience multiple life transitions which they have the time to explore and develop.[23] Instability of the transitions (eg, identity explorations, a new job) may lead to substance use, including experimentation with e-cigarettes.[24] Eating disorders is high among college students, and often associated with smoking behaviour then it could be interesting to identify an association

with the e-cigarette use.[25] Also, the perception of novel products and e-cigarette advertising may influence youth to start using the device.[6 8]

However, there is sparse information on the link between e-cigarette use and substance use in adolescents,[26–28] especially in the college student population.[8] Moreover, this subset of youth who choose to try e-cigarettes may be different from those who have not tried the device.[29 30] Furthermore, studies have shown a somewhat different pattern of e-cigarette use among young people (new e-cigarette users who had never used tobacco) versus adults (former or current tobacco users).[4] It is important to assess e-cigarette use and associated health behaviour in this college population. In order to address the research gap, the present study aimed to examine the prevalence of ever and current e-cigarette use, to identify health-risk behaviours associated with e-cigarette use according to patterns of use (ever and current use), and motivations and opinions on e-cigarettes among college students in France.

METHODS
Study design
A multicentre cross-sectional study was conducted between October 2014 and February 2015 among college students in France.

Study setting
This study including 1134 college students was conducted on multiple campuses at two universities in France: Rouen University (Normandy) and Nanterre-West Paris University (Greater Paris area).

Participants
Between October 2014 and February 2015, students were recruited as follows: for the Rouen group during their medical check-up (October to December 2014), and for the Nanterre group during compulsory lectures (January to February 2015). The study sample consisted of replies from 687/848 students in the Rouen group yielding an 81% response rate, and 447/480 students in the Nanterre group yielding a 93% response rate. The overall response rate was 85%. All students filled in an anonymous self-questionnaire on a paper support which took about 15–20 min. This observational study design was approved by the 'Commission Nationale de l'Informatique et des Libertés' (The French Electronic Data Protection Authority) and by Rouen University Hospital's Institutional Review Board without mandatory informed consent.

Socioeconomic characteristics
The anonymous and confidential questionnaire filled in by college students included sociodemographic characteristics such as age, gender, job, scholarship status, accommodation status (in rented

accommodation, living with parents or on campus), marital status and financial difficulties.

University curriculum

Students were divided into five curriculum groups: (1) the healthcare group (medicine, pharmacy, nursing, physiotherapy, midwifery and radiology technician studies); (2) the physical activities and sports group; (3) the psychology group; (4) the technology group (studies of shorter duration and technical curriculum); (5) the mixed group (literature, sciences and art). The academic year of study (1, 2, 3 or more) was also collected.

E-cigarette use

Never users were defined as students who had never tried e-cigarettes. Current users were defined as students who had used e-cigarettes once or more during the previous 30 days, and ever users as students who had tried e-cigarettes but not during the previous 30 days. For never users, there was also a question that identified whether students intended to use the e-cigarette in the future. We also sought and collected the opinion of users and never users on e-cigarettes.

The perception of danger for the user or for passive users was also recorded ('Yes', 'No', 'Do not know') for both e-cigarette never users and users.

Tobacco and cannabis use

All students reported their tobacco status as follows: current, former and never smokers. A current smoker smoked at least one cigarette a day. Current smokers were asked how many years they had been smoking. Cannabis use in the previous year was recorded with a dichotomous yes/no question and an occasional cannabis user was defined as someone who has consumed cannabis at least once in the previous 12 months.

Alcohol use

Students who reported consuming five or more alcoholic drinks (four and more for female students) on one single occasion were classified as binge drinkers.[31] Binge drinking was defined as either frequent or occasional for a frequency of more than twice a month or once a month or less, respectively.

Alcohol abuse problems were assessed using the French version of the Alcohol Use Disorders Identification Test (AUDIT) questionnaire designed to identify hazardous drinkers, harmful drinkers and those with risk of alcohol dependence. A score below 8 for males or 7 for females indicates no problems with alcohol, between 8 and 12 for males or between 7 and 11 for females indicates hazardous drinking, and above 12 for males or 11 for females indicates risk of addiction. The Cronbach α test was 0.83.[32]

Practice of sport

Students reported practice of all regular sports (at least weekly) except for brisk walking.

Eating disorders

In order to assess eating behaviours, we used the Sick, Control, One stone, Fat, Food (SCOFF) questionnaire, which is a screening tool used to identify eating disorders, including anorexia nervosa and bulimia nervosa, in young adults. The SCOFF questionnaire includes 5 dichotomous questions, and 1 point is given for every yes answer. A score of 2/5 indicates possible eating disorders.[33] The Cronbach α test was 0.76.[34]

Statistical analysis

There were no missing data for the main variables. Qualitative variables and quantitative data were compared with Pearson's χ^2 test and Student's t-test, respectively. Variables with $p<0.10$ from the univariate analysis were then introduced into a multivariate model (logistic regression) to explain the factors associated with e-cigarette use. Adjusted ORs (AOR) and their 95% CIs were calculated. Associations were considered statistically significant when $p<0.05$. The analysis was conducted using Xlstat2014.

RESULTS
Baseline characteristics of the study population

A total of 1134 college students were included in this study (687 in the Rouen group and 447 in the Nanterre group). The male/female sex ratio was 0.45 and mean age was 20.8 years (SD=2.3). Age, gender, study curriculum and year of study are described in table 1. Students' sociodemographic characteristics are described in table 2.

Table 1 Baseline characteristics of the 1134 students according to the universities: Rouen and West Paris-Nanterre (France; 2014–2015)

	Rouen (n=687)	West Paris-Nanterre (n=447)	p Value
Age years mean (SD)	20.1 (2.4)	21.1 (2.0)	<0.0001
Male gender	32.7	28.3	0.12
Curriculum			<0.0001
Healthcare	30.6	0	
Sport	6.1	17.0	
Psychology	20.2	76.3	
Mixed group*	27.6	6.7	
Technology	15.5	0	
Academic year of study			<0.0001
1	44.2	6.1	
2	16.6	9.9	
3	18.9	66.0	
>3	20.3	18.0	

*Literature, sciences, art.

Table 2   Baseline characteristics of the 1134 students according to e-cigarette use and associated sociodemographic factors (logistic regression) (France; 2014–2015)

	Never user (n=809)	Ever user (n=260)	Current user (n=65)	Total (N=1134)	p Value	Never user (Ref)	Ever user AOR (95% CI)	p Value	Current user AOR (95% CI)	p Value
Universities (%)					0.009	1		0.99		0.24
Rouen	62.3	59.6	43.1	60.6			1		1	
West Paris-Nanterre	37.7	40.4	56.9	29.4			1.00 (0.63–1.61)		1.65 (0.71 to 3.88)	
Age years mean (SD)	20.9 (3.7)	20.3 (2.5)	21.0 (5.0)	20.8 (3.6)	0.03	1	0.98 (0.92 to 1.04)	0.43	0.99 (0.92 to 1.07)	0.89
Male gender	30.0	33.5	34.9	31.0	0.45					
Student job holder (%)	27.4	33.8	40.0	29.6	0.02	1	1.39 (0.96 to 2.00)	0.08	0.69 (0,37 to 1,29)	0.25
Study grant holder (%)	44.1	41.6	30.1	42.7	0.08	1	1.10 (0.79 to 1.53)	0.55	0.69 (0.37 to 1.29)	0.25
Financial difficulties (%)	25.7	26.7	27.9	26.0	0.90					
Accommodation (%)					0.18					
At parents	47.1	52.5	60.3	49.1						
In rented accommodation	40.6	38.2	31.8	39.5						
On campus	12.3	9.3	7.9	11.4						
Living in couples (%)	25.1	27.6	28.6	25.9	0.65					
Curriculum (%)					0.01	1				
Healthcare	20.5	16.2	3.1	18.5			1		1	
Sport	9.8	13.8	4.6	10.4			1.75 (0.91 to 3.36)	0.09	2.51 (0.35 to 18.03)	0.36
Psychology	40.2	44.2	61.5	42.3			1.29 (0.66 to 1.93)	0.66	5.05 (1.04 to 25.51)	0.04
Mixed group*	20.4	16.9	16.9	19.4			0.96 (0.56 to 1.65)	0.89	4.07 (0.82 to 20.19)	0.09
Technology	9.1	8.9	13.9	9.4			0.99 (0.51 to 1.90)	0.97	9.26 (1.77 to 48.52)	0.008
Academic year of study					0.08	1				
1	27.6	35.4	33.3	29.7			2.03 (1.17 to 3.55)	0.01	1.96 (0.74 to 5.19)	0.17
2	13.8	16.3	7.9	14.0			1.80 (0.98 to 3.28)	0.06	0.69 (0.20 to 2.32)	0.55
3	38.0	33.1	38.2	36.9			1.08 (0.66 to 1.76)	0.75	0.62 (0.28 to 1.38)	0.25
>3	20.6	15.2	20.6	19.3			1		1	

*Literature, sciences, art.
Never users: never tried the e-cigarette. Current users: tried the e-cigarette during the past 30 days. Ever-users: used e-cigarettes but not during the past 30 days.
AOR, adjusted OR.

Prevalence of e-cigarette use and tobacco use

The prevalence of ever use and current use of e-cigarettes was 23.0%, 95% CI (20.5% to 25.3%) and 5.7%, 95% CI (4.4% to 7.1%), respectively. Regarding current users of e-cigarettes, 44.8% used them every day or several times a week and 55.2% once a week or less. Students who had not tried e-cigarettes declared that they did not intend to try them in the future. The prevalence of current tobacco use and previous tobacco use was 24.3% and 6.3%, respectively. Concerning the combined use of conventional cigarettes and e-cigarettes, the prevalence was 14.5% (10.4% of ever e-cigarette users and 4.1% of current e-cigarette users). Conventional cigarette smokers represented 13.6% of never users, 45.0% of ever users and 73.8% of current users of e-cigarettes (p<0.001). The number of cigarettes smoked per day was not statistically different according to the status of e-cigarette use. The intention to stop smoking conventional cigarettes involved 54.5% of cigarette smokers, 45.9% of e-cigarette never users, 61.5% of e-cigarette ever users and 56.5% of e-cigarette current users (p=0.06).

Characteristics of e-cigarette current users and ever users

The baseline characteristics according to frequency of e-cigarette use (never, ever and current) are described in table 2. E-cigarette use differed according to city of study (p=0.009), age (p=0.03), job status (p=0.02) and curriculum (p=0.01).

Concerning behaviours, in univariate analysis there was an association between e-cigarettes (current use and ever use) and smoking (p<0.001), occasional consumption of cannabis (p<0.001), binge drinking (p<0.001), alcohol abuse problems (p<0.001) and risk of eating disorders (p=0.02; table 3).

Multivariate analysis by logistic regression compared ever use and current use to never use of e-cigarettes. Ever use of e-cigarettes was significantly associated with the first year of curriculum AOR=2.03 95% CI 1.17 to 3.55, current and former smoking status (AOR=3.97 95% CI 2.71 to 5.83 and AOR=2.56 95% CI 1.42 to 4.61, respectively), occasional cannabis use (AOR=2.44 95% CI 1.70 to 3.51) and occasional binge drinking (AOR=1.83 95% CI 1.28 to 2.64). Current use of e-cigarettes was significantly associated with the psychology and technology groups, respectively AOR=5.05 (1.04 to 25.51) and AOR=9.26 (1.77 to 48.52) and current and former smoking status, AOR=14.53 (6.81 to 31.02) and AOR=4.85 (1.53 to 15.34).

Opinions, motivations and perceived danger of e-cigarettes

Opinions of e-cigarette never users

E-cigarette never users (32.3%) declared having no opinion on the device. Other students' opinions are shown in figure 1. Half of the never users thought that the e-cigarette was a good solution to stop smoking and one-quarter thought that the e-cigarette was more risky to health than conventional cigarettes.

Motivations of e-cigarette users

Stopping or limiting tobacco consumption (42.9% and 32.1%) was among the first three reasons for using e-cigarettes. The second most cited reason was the pleasant taste of e-cigarettes (39.3%) (figure 2).

Perceived danger for oneself and for others

Some students declared no opinion on the dangers of e-cigarettes for the user (28.7%) or for passive users (32.9%). Among students with an opinion, 94.2% of never users and 78.9% of users thought that the e-cigarette was harmful for the user (p<0.001), whereas 59.3% of never users and 25.7% of users thought that the e-cigarette was harmful for passive users (p<0.001). Perceived danger for the user and for passive users did not differ between ever users and current users.

DISCUSSION

Prevalence of e-cigarette use

To the best of our knowledge, this is the first study conducted in France that has looked into the behaviours of college students regarding ever and current use of e-cigarettes and the motivations and opinions of users and non-users. In our study conducted in France, there was a 23.0% prevalence of e-cigarette ever use which is consistent with ever use and current use in college students in Poland, the USA and Romania.[8] [35] [36] The prevalence of current use of e-cigarettes for college students in France was 5.7% lower than in the USA[8] and consistent with that of college students in Poland.[33] The prevalence of conventional cigarette use in our study was 24.3%, as found in other French studies in college student populations.[37] [38] In our study, the combined use of e-cigarettes and tobacco concerned 14.5% of college students, which was comparable with the results of two recent studies conducted in a German adolescent population,[39] [40] but higher than in the Li et al[2] study (4.1%) in New Zealand adults, or in the Saddleson et al[8] study (6.4%) in American college students.

E-cigarette ever users and associated behaviours

We found that cigarette smoking status (current and former) was related to ever use of e-cigarettes as also reported by Saddleson et al[8] in US students and also in larger populations.[9] Occasional cannabis use and binge drinking were identified as risk factors solely for ever use of e-cigarettes. This association was also highlighted in e-cigarette ever users in adolescent populations.[25] [27] Only one other study has evaluated behaviours associated with e-cigarette use in college students,[8] which found an association between ever use of e-cigarettes and cannabis use and between current use of e-cigarettes and binge drinking; however, the prevalence of current use (14.9%) was higher than in our study.

Table 3 Behaviour characteristics of the 1134 students according to e-cigarette use and associated risk factors (logistic regression) (France; 2014–2015)

	Never user (n=809)	Ever user (n=260)	Current user (n=65)	Total (N=1134)	p Value	Never user (Ref)	Ever user AOR (95% CI)	p Value	Current user AOR (95% CI)	p Value
Regular practice of sport (%)	59.1	61.8	53.8	59.4	0.48					
Smoker (%)					$<10^{-3}$	1				
No	81.6	45.8	18.5	69.7			1		1	
Former smoker	4.8	9.2	7.7	6.0			2.56 (1.42 to 4.61)	0.002	4.85 (1.53 to 15.34)	0.007
Yes	13.6	45.0	73.8	24.3			3.97 (2.71 to 5.83)	<0.0001	14.53 (6.81 to 31.02)	<0.0001
Cigarettes/day mean (SD)	5.2 (4.6)	5.1 (4.5)	4.6 (4.0)	4.9 (4.4)	0.76					
Smoking period (years) mean (SD)	5.0 (2.9)	5.0 (2.8)	4.7 (3.5)	4.9 (2.9)	0.89					
Occasional cannabis user (%)	22.7	56.1	67.7	32.7	<0.001	1	2.44 (1.70 to 3.51)	<0.0001	1.80 (0.91 to 3.57)	0.09
Binge drinking (%)					<0.001	1				
Never	52.4	27.7	26.1	45.2			1		1	
Occasional	43.6	63.1	60.0	49.1			1.83 (1.28 to 2.64)	0.001	1.56 (0.78 to 3.12)	0.20
Frequent	4.0	13.8	13.9	5.7			2.02 (0.92 to 4.43)	0.08	1.78 (0.53 to 5.95)	0.35
Alcohol abuse problems (AUDIT) (%)					<0.001	1				
No	85.4	73.8	63.1	81.5			1		1	
Hazardous drinking	10.5	15.8	21.5	12.3			0.75 (0.45 to 1.23)	0.25	0.98 (0.43 to 2.21)	0.96
Risk of addiction	4.1	10.4	10.4	6.2			0.85 (0.42 to 1.72)	0.65	1.23 (0.43 to 3.48)	0.70
Risk of eating disorders (%)	17.9	25.5	15.4	19.4	0.02	1	1.39 (0.95 to 2.01)	0.09	0.67 (0.30 to 1.48)	0.32

Never-users: never tried the e-cigarette. Current users: tried the e-cigarette during the past 30 days. Ever users: used e-cigarettes but not during the past 30 days.
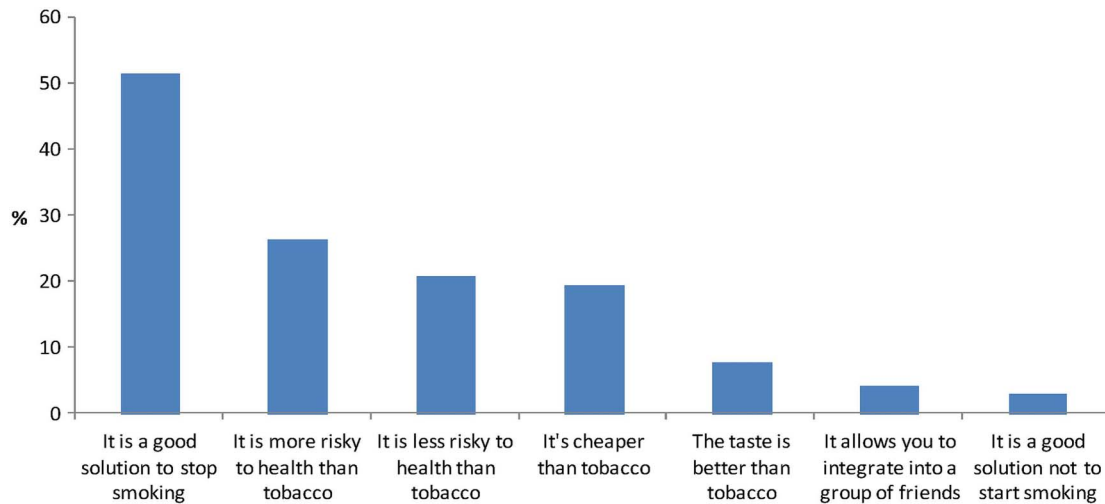AOR, adjusted OR.

Figure 1 Opinions of e-cigarette never users about the device: university students of Rouen (n=504). — France 2014–2015 (data collected only among Rouen students).

First-year college students were at greater risk of e-cigarette ever use, and this tendency of youth towards experimentation has been proven to be mostly expressed during the first year of college when students may be more susceptible to passive peer pressure associated with membership to a high-risk group. Peers are an important source of information on the acceptability and potential benefits of engaging in different types of social behaviour.[22] Emerging adults with strong social motives may develop attitudes such as e-cigarette use when they affiliate with social groups in which the behaviour is accepted and valued.

E-cigarette current users and associated behaviours

In this study, current and former cigarette smoking status was strongly related to e-cigarette use, especially among current users AOR=14.53 95% CI 6.81 to 31.02. These results are consistent with prior research among adolescents[16 41] or American college students.[5 8] In our

study, e-cigarette current users were not heavier smokers than ever users, with no difference in the mean number of cigarettes smoked per day or in their history of smoking. We report here for the first time that sport and psychology curriculum are related to current use of e-cigarettes.

While the main factor associated with e-cigarette use was a history of cigarette smoking, almost half (45.8%) of the e-cigarette ever users had never smoked conventional cigarettes, suggesting that e-cigarettes are not perceived purely as a cessation aid. The cross-sectional nature of our study did not allow us to identify whether most college students start smoking with conventional cigarettes and then move on to e-cigarettes or vice versa. However, if we look at the average smoking period (5 years), we could suppose that tobacco use started before e-cigarette use, but we do not have enough data to prove this hypothesis. Initiating e-cigarette use is reserved mainly for those who already use some kind of
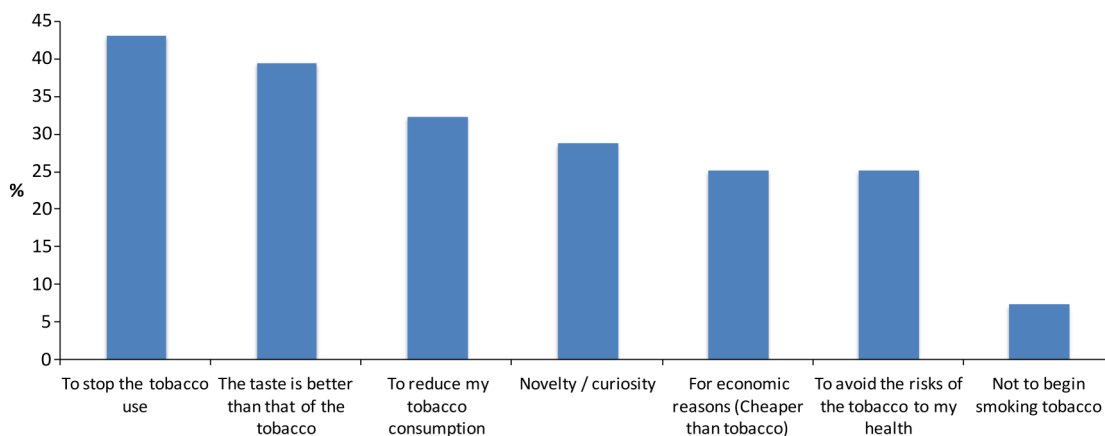
None students answer "to do the same of my friends"

Figure 2 Motivations of e-cigarette users: university students of Rouen (n=183) France 2014-2015. (Data only collected among Rouen students).

tobacco,[6 39] but the reverse is also possible and initiating e-cigarette use is viewed as a possible gateway to tobacco for young curious users[37 42] Nevertheless, there is no relation between e-cigarette use and susceptibility to smoking cigarettes.[8] Enhanced prevention efforts for youth are crucial for all forms of tobacco, including e-cigarettes. Regardless of the frequency of e-cigarette use, we found no association between gender and ever use of e-cigarettes, unlike other studies that reported that adolescent[27 43] and US male college students[8] had higher odds of using e-cigarettes than female students.

In our study, about 70% of college students were never e-cigarette users. An interesting finding was that no never users declared that they intended to start using e-cigarettes. These data contradict other findings in the literature in which college students have always shown some sort of interest in e-cigarettes and never users declare their intention to use them.[8 36] Allem et al[44] reported a curvilinear pattern that may reflect two distinct groups of emerging adults. Emerging adults managing many transitions may not have time to experiment with e-cigarettes, while emerging adults managing fewer transitions may have excess time lending to idleness and experimentation with e-cigarettes.

Our results strengthen concepts found in studies in adults and young adults that e-cigarettes may be an element of multiple product use; users of other substances (ie, cigarettes, alcohol or marijuana) have greater odds of using e-cigarettes.[5 45] Our finding could suggest that e-cigarette ever users are mostly students who are more attracted by risky behaviours. Equally likely as explanatory factors are impulsivity and sensation-seeking, which incline youth towards experimentation and risky behaviours like the use of conventional cigarettes, alcohol consumption with predrinking and cannabis use.[46 47] In this cases it would be logical to observe that youth who are sensation-seeking and/or rebellious would be inclined to try both conventional cigarettes and e-cigarettes or only e-cigarettes. Moreover, college students believe that e-cigarettes are not as addictive as conventional cigarettes,[40 48] as suggested by the existence of two theoretical models of e-cigarette users. The first model represents users concerned by healthier behaviours who do not want to consume conventional cigarettes and, therefore, use e-cigarettes, and the second model suggests that behaviours associated with e-cigarette use are a form of rebelling against conventional values and that these users are more prone to consuming alcohol, cannabis and tobacco. Our data suggest that the second model is more adapted to the reality found in college students in France and that e-cigarette ever use is associated with binge drinking, tobacco use and cannabis use. However, when we look at the data corresponding to current use, this theoretical model no longer applies and we find that e-cigarette current use is only associated with tobacco use, a fact which could suggest that current users are smokers trying to reduce or stop smoking.

Opinions and perceived dangers of e-cigarettes

Almost one-third of students answered that they had no opinion on e-cigarettes, a finding which suggests that college students lack knowledge and that there is a need to fill the knowledge gap with awareness and information campaigns. It is crucial to ensure other more impartial means of information to balance the vested interests of television advertising and publicity. Half of the student never users (smokers and non-smokers combined) thought that the e-cigarette was a good solution to stop smoking. Never users were equally divided as to whether e-cigarettes were more risky or less risky to health, showing that students have diverging opinions and there is all the more need for information, debate and awareness on campuses in France.

The main motivation of tobacco users was to stop smoking, which was slightly higher in ever and current e-cigarette users than in never e-cigarettes users, data corresponding to that found by Christensen et al[49] in adults but not adolescents for whom curiosity was the main reason for trying e-cigarettes.[27] We found no difference between the intention of ever users and current users to stop smoking, but this might be due to the small sample of current users. In addition, Hughes et al[26] found that ever use of e-cigarettes by college students was mostly because of experimentation and not for smoking cessation. Another important motivation for users was the taste factor, which was considered better for e-cigarettes than conventional cigarettes. This taste factor was also among the first to be evoked in other studies interested in reasons for using e-cigarettes.[14] The third motivation for use was to reduce tobacco consumption, a reason also found in other studies.[14 50] Pokhrel et al[51] showed that the marketing of e-cigarettes as safer alternatives to cigarettes or cessation aids is associated with increased e-cigarette use among young adults. Curiosity is also one of the reasons why users were interested in this device, and the rather high prevalence of ever use can be explained in part by the novelty of the product and also by the fact that young adults and college students are more inclined to try new products and respond to marketing and publicity campaigns[6 49] since aggressive sponsorship has been shown to induce higher alcohol awareness in children.[52]

Almost half of the respondents did not know what to answer regarding the dangers of e-cigarettes for the user or for passive users, reinforcing the idea that college students in France lack the necessary information to be able to respond. For students with an opinion, a very high percentage, even among users, thought that e-cigarettes might represent a danger for the user, and some thought that they could represent a danger for passive users. Other studies reported a lower percentage of respondents who considered e-cigarettes to be a danger for the user.[19] Nevertheless, health claims and smoking cessation messages that are unsupported by current scientific evidence are frequently used to sell and promote e-cigarettes.[3]

Limitations

Our study has several limitations; first of all, the response rate was 85%. However, the main characteristics of our sample are no different from those of a European study involving 36 000 French students.[53] Our study population was two-thirds women and one-third men (in the European study, there were 63% women and 37% men). The mean age in our sample was 20.8 years compared to 21.2 years in the European study. The National Prevention and Health Education Institute (INPES) survey conducted by Beck and Richard in 2010[35] reported that 23.2% of college students were smokers, a figure similar to ours. However, this sample enrolled students from different curriculums at only two universities, including one in the capital city of France (Paris). Relying on cross-sectional data constrains the study's ability to make causal inferences about the relationship found in the research. Students' own substance use might be under-reported, as this measure was based on self-reporting. Self-reported substance use questionnaires have, however, been shown to be reliable for the substances studied.[54]

Conclusions

This study shows that one in four college students are interested in e-cigarettes and college students are starting to use this device in high numbers. The profile of e-cigarette ever users seems to correspond to that of rebellious young adults like college students who are attracted to different kinds of experimentation (smoking, binge drinking, cannabis use), while the profile of current users seems to resemble that of a conventional cigarette smoker trying to quit. The field of e-cigarette research could benefit from these results which underline the importance of addressing the issue of e-cigarette use according to the user's profile. This corresponds to experimenters (ever users) who are more prone to trying the device and view e-cigarettes as a recreational substance and current users who are mostly conventional cigarette smokers. Our study suggests that a substantial number of college students have access to e-cigarettes, including those who have never smoked conventional tobacco products. However, those most likely to try e-cigarettes are those who engage in other substance-related risk behaviours including regular smoking, binge drinking and cannabis use, especially in freshman year. More research is needed in order to identify trends of use and to include a larger population of students. The results of this study could help to identify college student populations at risk, which could then be targeted by appropriate awareness campaigns and health education programmes.

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