

Motivations for using electronic cigarettes in young adults: A systematic review

Shérazade Kinouani, Chloé Leflot, Paul Vanderkam, Marc Auriacombe, Emmanuel Langlois & Christophe Tzourio

To cite this article: Shérazade Kinouani, Chloé Leflot, Paul Vanderkam, Marc Auriacombe, Emmanuel Langlois & Christophe Tzourio (2019): Motivations for using electronic cigarettes in young adults: A systematic review, Substance Abuse

To link to this article: <https://doi.org/10.1080/08897077.2019.1671937>

 View supplementary material 

 Published online: 22 Oct 2019.

 Submit your article to this journal 

 View related articles 

 View Crossmark data 

Motivations for using electronic cigarettes in young adults: A systematic review

Shérazade Kinouani, MD^{a,b,c} , Chloé Leflot, MD^{a,c}, Paul Vanderkam, MD^d, Marc Auriacombe, MD, PhD^{a,e,f} , Emmanuel Langlois, PhD^{a,g}, and Christophe Tzourio, MD, PhD^{a,b} 

^aUniversity Bordeaux, Bordeaux, France; ^bInserm, Bordeaux Population Health Research Center, Team HEALTHY, University Bordeaux, Bordeaux, France; ^cDepartment of General Practice, University of Bordeaux, Bordeaux, France; ^dDepartment of General Practice, Faculty of Medicine, Poitiers, France; ^eSANPSY, Bordeaux, France; ^fPôle Addictologie, Bordeaux, France; ^gCentre Émile Durkheim, University Bordeaux, Bordeaux, France

ABSTRACT

Background: The most common reasons why adults use e-cigarettes are to stop or reduce tobacco smoking. However, it is unclear if this reason is evenly distributed between young and older adults. **Objectives:** describe the motivations for e-cigarette use amongst young adults aged 18–25 and compare the reasons for using e-cigarettes of people who currently or formerly used tobacco products to those who had never smoked tobacco prior e-cigarette use. **Methods:** PubMed[®], Scopus[®], Cochrane Library[®], SocINDEX[®], PsycARTICLES[®], Psychology and Behavioral Sciences Collection[®] and PsycINFO[®] databases were used. English written articles were screened up to March 2018. Depending on study design, quality was assessed using The STROBE or RATS checklists. **Results:** Six articles were included in the review, all with a moderate quality of evidence. Independently of smoking status, curiosity was the most frequently reported reason for initiating the use of e-cigarettes in young adults. Reasons for continuing to use e-cigarettes were various. The continued use of e-cigarettes could be either a means to replicate smoking habits, or a way for a different and personalized use of nicotine by inhalation. **Conclusions:** Reasons for using e-cigarettes in young adults are varied and are not limited to stopping smoking.

KEYWORDS

Electronic nicotine delivery systems (ENDS); e-cigarettes; young adults; smoking; motivation; health risk behaviors; systematic review

Introduction

Electronic cigarettes (or e-cigarettes) are battery-powered devices containing an e-liquid that is heated to create an aerosol for inhalation. This e-liquid is mainly composed of propylene glycol, glycerin, flavor, and sometimes nicotine, in various concentrations.

Current evidence about the effectiveness of e-cigarettes in smoking cessation is inconclusive, due to the small number of controlled trials and some methodological limitations.^{1–3} Furthermore, several longitudinal studies have reported that e-cigarette use is associated with a greater risk for initiation of tobacco smoking amongst adolescents and young adults.^{4–6} Even if a recent review suggested that the benefit of smoking cessation from e-cigarette use in those who previously smoked would be greater than the risk of tobacco smoking initiation in e-cigarette users who had never smoked,⁷ the lack of data on the long-term health effects of continued use of e-cigarettes remains a concern. The use of e-cigarettes seems less harmful than tobacco smoking due to the absence of carbon monoxide and tars by combustion. Studies on animal or human cell models have shown that the e-liquids or their aerosols are less cytotoxic than cigarette smoke.^{8–10}

Despite these uncertainties, e-cigarette use has quickly spread, especially among young adults.^{11–14} For several reasons, it seemed particularly important to understand the motivations for using e-cigarettes in adults aged 18–25. First, these young adults appear to be in a specific phase of development that has been dubbed “emerging adulthood”.^{15,16} This stage is characterized by instability, and identity explorations. Second, psychoactive product use is sometimes tolerated, even promoted between young adults.¹⁶ Third, unlike minors for whom e-cigarettes are prohibited in many countries, young adults can legally obtain them. Fourth, several studies amongst young adults have focused on the use intentions^{17–20} or perceptions^{19,21–23} concerning e-cigarettes but very few have focused on the reasons for its use in this population. Finally, the most common reason for adults to use e-cigarettes is the cessation or reduction of tobacco smoking.^{13,24–26} However, some studies have compared the motivations for e-cigarette use between younger and older adults^{27–29} and reported that young adults used e-cigarettes for other reasons than to cut down or quit tobacco smoking.

The first objective of this review was to describe the motivations for initiating and pursuing e-cigarette use in

Table 1. Search Strategy.

Search equations (31th March 2018)	Filters	Number of records identified
MEDLINE		
(electronic cigarette* OR e-cigarette* OR vaping OR electronic nicotine delivery system*) AND (reason* for use OR experimentation* OR initiation* OR expectation* OR motivation* OR pattern* OR intention*)	English 19–44 years* Humans	461
(electronic cigarettes*[MeSH Major Topic] OR e-cigarette* OR electronic nicotine delivery system* [Title/Abstract]) AND (reason* [Title/Abstract] OR motivation*[Title/Abstract] OR perception*[Title/Abstract] OR pattern*[Title/Abstract] OR intention*[Title/Abstract] OR expectation*[Title/Abstract])	English 19–44 years* Humans	419
SocINDEX with Full Text, PsycARTICLES, Psychology and Behavioral Sciences Collection and PsycINFO		
AB (electronic cigarette* OR e-cigarette* OR electronic nicotine delivery system*) AND AB (reason* for use OR experimentation* OR initiation* OR motivation* OR intention* OR pattern* OR expectation*)	English 18–39 years* Humans	82
Cochrane Library		
TITLE-ABS-KEY (electronic cigarette* OR e-cigarette* OR vap* OR electronic nicotine delivery system*) AND TITLE-ABS-KEY (motivation* OR intention* OR pattern* OR reason* OR expectation*)	Title, abstract or keyword	298
Scopus		
TITLE-ABS-KEY(electronic cigarette* OR e-cigarette* OR vap* OR electronic nicotine delivery system*) AND TITLE-ABS-KEY(motivation* OR intention* OR pattern* OR expectation* OR reason* for use OR experimentation* OR initiation*)	Title, abstract or keyword English	17

AB: ABS: abstract; KEY: keyword.

*Inability to limit searches to articles about adults aged 18–25 years by using the age filter proposed by database.

young adults aged 18–25. Understanding the motivations for using e-cigarettes is an important prerequisite before evaluating its effectiveness as a tool in smoking cessation. Furthermore, the role that young adults ascribe to this nicotine-delivering device might also give us some insight into the risk of normalizing nicotine use without tobacco. The second objective was to compare motivations for using e-cigarettes in young adults who had never smoked tobacco to those who currently or formerly used tobacco products, in order to identify differences by smoking status.

Review

The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.³⁰

Eligibility criteria

All study designs were included. We focused this review on adults aged 18–25. Participants had to have used e-cigarettes at least once.

We defined motivation as a reason reported by e-cigarette users to try an e-cigarette for the first time (initiation motivation) or to continue using it (motivation for continued use). Articles that only reported the intention of use by non-e-cigarette users were excluded. We excluded articles addressing only representations on e-cigarette use, without exploring motivations. Articles were also excluded if it was not clear that the explored motivations were related to initiation or pursuit of e-cigarette use.

Only motivations referring to adults aged 18–25 were included in the review when several age groups were described in articles. Studies were excluded if there was insufficient information to appreciate participants' age.

Supplemental material reports the analysis of articles excluded from this review when young adults belonged to an age group wider than our target and when the distinction

was not clear between initiation and continued use of e-cigarettes.

Search strategy

We searched articles published in English, up to March 31, 2018 in the following electronic databases: MEDLINE, Scopus, Cochrane Library, SocINDEX, PsycArticles, Psychology and Behavioral Sciences Collection, and PsycINFO. The list of search equations is presented in [Table 1](#).

Data extraction

Articles were initially selected on the assessment of title and abstracts independently by two authors. Discrepancies were resolved by consensus examination. The full text of selected articles was read independently by two authors for final selection. An inter-judge agreement was evaluated by Cohen's unweighted Kappa coefficient, on the number of documents included/excluded which was estimated at 0.861 (95%IC:0.708–1.000): a very good agreement. In case of discrepancies, a third author read the full-text articles and decided to include them or not. Two articles were excluded by this third author. The first described intentions to use e-cigarettes, not the reasons for using them. The second explored exclusively the use of e-cigarettes by cannabis users. Details are presented in the [supplemental material](#).

Once selected, study information (publication year, location, design, recruitment strategy, strategy of data collection, participants' characteristics, definition of motivations for using e-cigarettes, results) was extracted and checked independently.

Quality assessment

The quality of the reporting of the included studies was evaluated using The STROBE checklist³¹ for quantitative

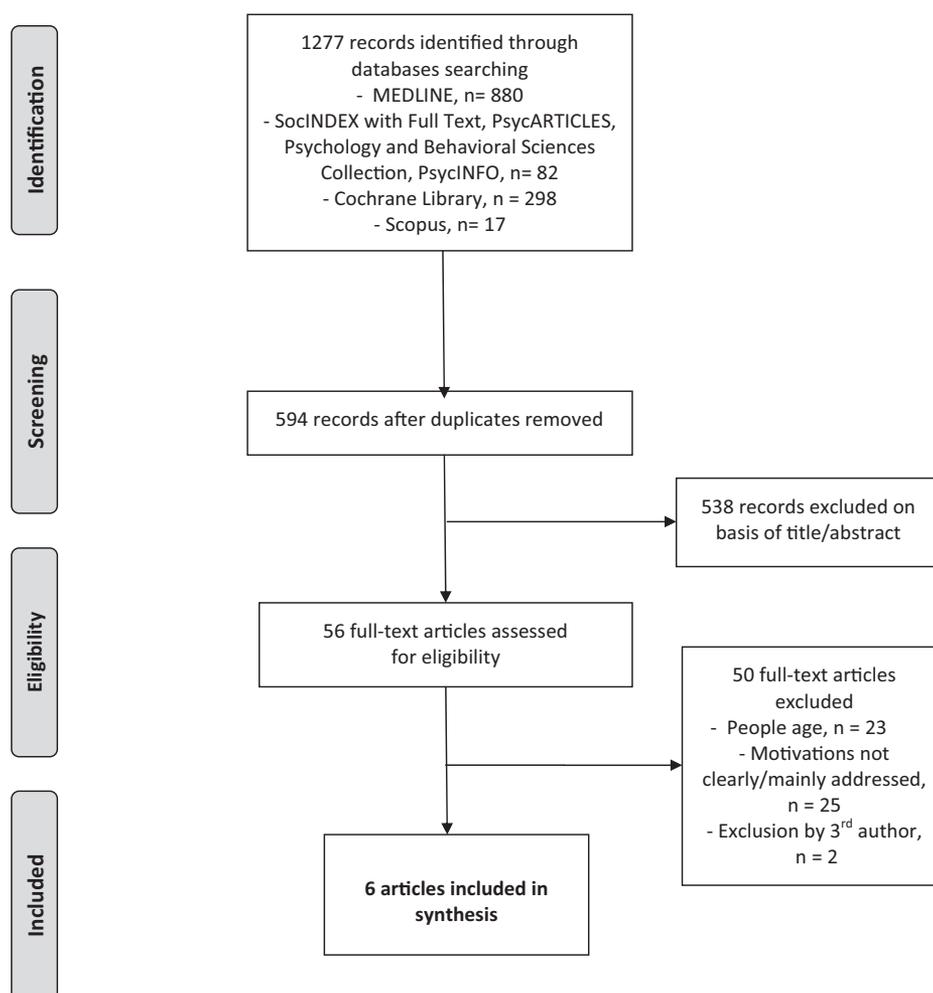


Figure 1. PRISMA flow chart.

studies and the RATS checklist³² for qualitative studies. The assessment was made according to the following three modalities: good/fair/poor. We hypothesized that the topic of motivations for using e-cigarettes amongst young adults was insufficiently explored in studies and that a small number of articles could be included in the review. Therefore, this assessment was mainly used to check the internal validity of the review and no article was excluded based on judgments about quality.

Results

We identified 594 published articles (Figure 1). Six studies were included in the review: four cross-sectional studies^{26,33–35} and two qualitative studies.^{36,37} Two studies were performed in Europe,^{34,35} two in the USA,^{26,37} one in New Zealand,³⁶ and the last one in Saudi Arabia.³³ The reporting quality of the included studies is presented in Table 2. Four studies were rated as good^{26,34,35,37} and two studies as fair.^{33,36}

Motivations for initiating e-cigarette use

As shown in Table 2, three cross-sectional studies^{33–35} and one qualitative study³⁷ focused on motivations for initiating e-cigarettes. All were conducted in student population.

In all quantitative studies, the most frequent motivation for initiating e-cigarette use was curiosity. Other reported motivations for initiating e-cigarette use were: smoking cessation, reduction of tobacco smoking,^{33–35} less harm compared to tobacco smoking,^{33–35} copying friends^{33,34} and to a lesser extent, as a substitute when tobacco smoking is banned, suggestion by someone, flavors or lower cost.³⁵

One mixed-method study was led in Connecticut (USA) between November 2012 and April 2013 to assess reasons for initiating e-cigarette use among adolescents and young adults.³⁷ Focus groups were carried out in two colleges during the qualitative stage of this study. Young adults who tried e-cigarettes reported as reasons for use curiosity and availability, regardless of tobacco smoking status. In addition, college tobacco product users said that e-cigarettes were an alternative to tobacco use because they were healthier, cleaner, cheaper and smelt better.

Motivations for the pursuit of e-cigarette use

A cross-sectional study was led in a probability-based sample of US adults in 2014.²⁶ It showed that reasons for using e-cigarettes some days or daily amongst those aged 18–24 were, in decreasing order: smoking cessation or health;

Table 2. Summary of Studies Who Reported Reasons for E-cigarettes Use in Young Adults Aged 18–25, $n = 6$.

First author, publication year and location	Study design	Materials and data collection	Participants' characteristics	Definition of motivation for using e-cigarettes	Main findings	Quality assessment
Reasons to initiating e-cigarettes use in young adults, $n = 4$ Kong 2015 USA	Qualitative study	Focus groups in 2 colleges between November 2012 and April 2013	Students who had ever tried e-cigarettes Mean age: 19.97 ± 2.03	Reasons for e-cigarette experimentation	All e-cigarettes users: curiosity, readily available, influence of friend or family, cool appearance In smokers, e-cigarette was an alternative to cigarettes because: healthier, less harsh, cheaper, smelling better, possibility to hide its use or use it indoors 25.2% have tried e-cigarettes at least once in lifetime. The reasons for use were following: curiosity (62.5%); friends also tried e-cigarettes (23.2%); to quit smoking (23.2%); e-cigarettes are less dangerous (8%); to reduce smoking (0%) 25.6% have tried e-cigarettes at least once in lifetime. The reasons for use were following: curiosity (63.4%); smoking cessation (24.3%); peers' influence (23.9%); e-cigarettes are less dangerous (7.9%); to reduce smoking (0%).	Good
Lotrean 2015 Romania	Cross-sectional study Cluster sampling	Self-questionnaire Data collection between April and May 2013	444 students aged 19–24, who have heard about e-cigarettes	Reasons for trying e-cigarettes	40% have tried e-cigarettes at least once in lifetime. The reasons for use are following: curiosity (77.4%); someone offered to try it (63.5%); For flavors (24.6%); to stop (or try to stop) smoking (11.1%); to decrease smoking without stopping (8.5%); e-cigarettes are less harmful (8.2%); e-cigarettes can be used in places where smoking is prohibited (7.7%); e-cigarettes are cheaper (7.3%)	Good
Awan 2016 Saudi Arabia	Cross-sectional study	Self-questionnaire Data collection between August and October 2014	480 students Mean age: 24.0 ± 1.3 Women: 36.7%	Reasons for trying e-cigarettes	40% have tried e-cigarettes at least once in lifetime. The reasons for use are following: curiosity (77.4%); someone offered to try it (63.5%); For flavors (24.6%); to stop (or try to stop) smoking (11.1%); to decrease smoking without stopping (8.5%); e-cigarettes are less harmful (8.2%); e-cigarettes can be used in places where smoking is prohibited (7.7%); e-cigarettes are cheaper (7.3%)	Fair: number of individuals at each study stage partially reported.
Kinouani 2017 France	Cross-sectional study	Online self-questionnaire Data collection between February and April 2016	2720 French-speaking students Median age : 21 (IQR*): 19–22 Women : 77.6%	Reasons for trying e-cigarettes	40% have tried e-cigarettes at least once in lifetime. The reasons for use are following: curiosity (77.4%); someone offered to try it (63.5%); For flavors (24.6%); to stop (or try to stop) smoking (11.1%); to decrease smoking without stopping (8.5%); e-cigarettes are less harmful (8.2%); e-cigarettes can be used in places where smoking is prohibited (7.7%); e-cigarettes are cheaper (7.3%)	Good
Reasons to pursuing e-cigarettes use in young adults, $n = 2$ Patel 2016 USA	Cross-sectional study Probability based sampling	Online self-questionnaire Data collection between April and June 2014	138 US adults aged 18–24	Reasons for currently using e-cigarettes, "some days" or "every day"	Cigarette cessation aid or health: 72.5 % Consideration of others: 64.6% E-cigarette convenience: 54.7% Curiosity: 45.4% Flavoring: 45.5% Cost: 32.1% Simulation of tobacco cigarettes: 21.6%	Good
Hoek 2017 New Zealand	Qualitative study	In-depth semi-structured interviews	16 e-cigarettes users aged 18–25 Mean age: 21.4 ± 1.9 Women: 44%	Reasons for currently using e-cigarettes	Replication: maintain of appearance and experience of smoking; preservation to a smoker identity and their social group who still smoked. Differentiation: creation of new rituals and technological abilities, cultivation of a social "pro-sumer", control on device performances	Fair: the issue did not directly explore the continued use of e-cigarettes users

*IQR: interquartile range.

consideration for others; e-cigarette convenience; curiosity; flavors; cost, and simulation of tobacco cigarettes. Using e-cigarettes regularly was less associated with smoking cessation or health but more associated with flavors amongst adults aged 18–24.

One qualitative study explored reasons for the continued use of e-cigarettes.³⁶ Sixteen adults aged 18–25 who used e-cigarettes in the past month were interviewed to investigate how they appropriated the device. Volunteers were recruited by social media and flyers distributed in e-cigarette shops. More than three quarters of them were daily or occasional tobacco product users. Reasons for the continued use of e-cigarettes were not directly explored but were spontaneously discussed by participants. Young adults described two opposing goals to currently use e-cigarettes. Some searched to quit tobacco while replicating their smoking habits with e-cigarette use. E-cigarettes – in particular, those of the first generation – allowed them to retain smoking rituals, smoker identity and connections with their social group of tobacco product users. For other young adults, e-cigarette use was a way to distinguish themselves from the tobacco product users, or even, to create a new customized use with minimal similar functions: inhalation, nicotine access and hand occupation. They were attracted by this possibility to create their bespoke devices. The personalization of e-cigarette use increased satisfaction and the feeling of control over what they consumed.

Motivations for using e-cigarettes in young adults according to smoking status

Four quantitative and qualitative studies explored reasons for initiating e-cigarette use according to smoking status. In two of them,^{33,34} authors distinguished those who used tobacco products during the last month (current tobacco product users) to those who used them in the past but not in the last month (former tobacco product users). In two other studies, current tobacco product users were defined as having smoked daily or occasionally (less than one cigarette per day).^{35,37} In these four studies, curiosity was the most reported motivation for initiating e-cigarettes, regardless of smoking status. Amongst never-tobacco product users, e-cigarette use by friends^{33,34} or suggestion by someone to try it³⁵ were the next reasons for trying e-cigarettes, after curiosity. In former or current tobacco product users, the other reasons were: less harm, smoking cessation, possibility to use in no-smoking areas,^{33–35,37} use by friends or family,^{33,34,37} suggestion by someone to try it, lower cost,^{35,37} or flavors.³⁵

One study analyzed the motivations for pursuing e-cigarette use according to smoking status. In this study, former tobacco product users reported the use of e-cigarettes to maintain social connections with their networks of tobacco or e-cigarette users.³⁶ They thought that e-cigarettes were a safer alternative that prevented them from feeling isolated when their friends went outside to smoke.

Discussion

According to our review, few studies have investigated the motivations for using e-cigarettes in adults aged 18–25, especially those for the pursuit of this use. Curiosity was the most frequent reason reported for the initiation of e-cigarette use in adults aged 18–25, whatever the smoking status. In never-tobacco product users, entourage influence (used by friends, suggested by someone to try) was the second reason, after curiosity. In current or former tobacco product users, the other reasons for initiating the use of e-cigarettes were various, without the possibility of classifying them in order of frequency. Reasons for continuing to use e-cigarettes were also various amongst young adults and not limited to the smoking cessation. The continued use of e-cigarettes was especially motivated by social reasons amongst former tobacco product users.

As described in adolescents,^{38–40} curiosity was a common reason for trying e-cigarettes in young adults aged 18–25. Smoking cessation was not the only or the main reason for trying e-cigarettes in this specific population. Two hypotheses could be raised. First, young adults usually smoke small amounts of tobacco or use tobacco products occasionally; many of them have a hedonic use of tobacco smoking (search for nicotine's pleasurable effects, smoking in pleasurable social situations); they have also made a few attempts to stop smoking and have experienced little tobacco relapse. As described in Tara Mantler's systematic review in 2013,⁴¹ young adults could be optimistic about their ability to quit smoking in those conditions and could use e-cigarettes in other ways than for stopping smoking. Second, it is possible that they try e-cigarettes for the same reasons that would have made them try tobacco. Curiosity and entourage influence are known factors in initiating smoking.^{42,43} Our results, therefore, suggested that the factors described as promoting smoking initiation could also encourage the initiation of e-cigarette use among young adults. This would corroborate Etter's Common Liability theory.⁴⁴

Some studies have reported that young adults continue to use e-cigarettes to cut down or quit tobacco smoking less than older adult users.^{27,29} However, other studies showed that young adults were more likely than older adults to quit tobacco smoking with e-cigarettes.^{13,45} One possible explanation to this contradiction could be that smoking cessation was a common reason, but not the only one, for continuing the use of e-cigarettes among young adults. For example, a US mixed-method study explored the reasons why adults used e-cigarettes in the past month.⁴⁶ It showed that people aged 18–25, more than people aged 36–45, quoted convenience, nicotine effects and social reasons as motives for using e-cigarettes. The younger age groups (18–25 and 26–35) quoted hobby more frequently than those over the age of 45. This diversity of motivations for pursuing the use of e-cigarettes amongst young adults can partly be explained by the diversity of roles to e-cigarettes that they perceive. As described by our review, e-cigarette use could be either a means to replicate their smoking habits, or a way for a different and personalized use of nicotine by inhalation. Another qualitative study led among 64 current or former

tobacco product users (mean age: 36 years) in Scotland showed similar results.⁴⁷ Nicotine replacement therapy products (NRT) were clearly identified as medical products while e-cigarettes found their place between an alternative to tobacco smoking and NRT. Thus, there is a spectrum of views about e-cigarettes in young adults, leading to a heterogeneous group of continued e-cigarette users in terms of motivations.

In our review, social reasons sometimes motivated young adults to use e-cigarettes. This is consistent with the results of previous studies, stating that social factors may influence initiation, continuation, but also cessation of e-cigarette use in young adults.^{48,49} These results even suggested that e-cigarette users perceive this use as socially more acceptable than tobacco use, at whatever age.^{46,48,50,51} This greater social acceptability may be related to the perception by tobacco product users that the use of e-cigarettes is less harmful than tobacco smoking.⁵²

Limitations

There were some limitations to the current review. The small number of included articles and the heterogeneity of definitions of e-cigarette use made it difficult to study motivations. This heterogeneity was also found by Echevarria and Sinha in their systematic review of the definitions used in studies concerning e-cigarette use in adolescents.⁵³ As shown in Figure 1 and Supplemental material, many studies were not included in our review because they explored reasons for using e-cigarettes without clearly distinguishing initiation and prolonged use. This distinction seems necessary because some studies suggest that, although many young adults try e-cigarettes, only a few continue using them.^{35,54} The heterogeneity of the studies in terms of study populations, definitions of e-cigarette use, smoking status and methods of data collection did not allow the data to be pooled for meta-analysis. Weaknesses in terms of methods for the included studies also limited the quantitative interpretation of the findings. This review is a qualitative description of the reasons for e-cigarette use in young adults.

Conclusions

Despite all these limitations, our review suggested that motivations for using e-cigarettes were various. In particular, the motivations for continuing use of e-cigarettes could be multifactorial in adults aged 18–25. Some recommendations can be formulated for further research. Studies exploring reasons for using e-cigarettes should distinguish motivations for initiation of use from motivation for the pursuit of use. Our findings also highlight the usefulness of qualitative studies in understanding reasons for using e-cigarettes.

Tobacco use and its consequences are known to be a marker of social inequalities. Prevalence of tobacco use disorders is higher in less economically advantaged individuals.^{55–57} Mortality due to tobacco use is higher when socioeconomic conditions are unfavorable.^{58,59} We do not currently know if a greater social acceptability of e-cigarette

use can influence the relationship between smoking and social status and in what direction. Does the use of e-cigarettes reinforce or reduce health within social inequalities caused by the use of tobacco products? Future studies should further explore the impact of the use of e-cigarettes on health within social inequalities. Similarly, studies on reasons for using e-cigarettes should consider national contexts of tobacco and e-cigarette use, such as tobacco control policies and the differing status of e-cigarettes from one country to another.

Reasons for using e-cigarettes in young never-tobacco product users should be the subject of specific studies to better understand what attracts young adults who have never experienced tobacco use to initiate e-cigarette use. Finally, researchers should consider the reasons for using e-cigarettes as an influential factor in evaluating the effectiveness of e-cigarettes in smoking cessation.

Acknowledgements

The authors would like to thank Ms. Aurélie Delamarre for her assistance in the choice of databases. They also thank Ms. Jacqueline Pedley and Emmanuelle Maignal for English language copyediting.

Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

Author contributions

SK and CL were responsible for screening, data extraction and quality assessment. PV read the full-text articles in case of discrepancies between SK and CL. SK produced the first draft of the paper. MA, EL and CT were responsible of interpretation of results, and revising manuscript. All authors contributed to the production of the final manuscript and approved submission.

ORCID

Shérazade Kinouani  <http://orcid.org/0000-0003-2921-008X>

Marc Auriacombe  <http://orcid.org/0000-0002-8938-8683>

Christophe Tzourio  <http://orcid.org/0000-0002-6517-2984>

References

- [1] Hartmann-Boyce J, McRobbie H, Bullen C, Begh R, Stead LF, Hajek P. Electronic cigarettes for smoking cessation. *Cochrane Database Syst Rev*. 2016;9(9):CD010216.
- [2] Kalkhoran S, Glantz SA. E-cigarettes and smoking cessation in real-world and clinical settings: a systematic review and meta-analysis. *Lancet Respir Med*. 2016;4(2):116–128.
- [3] Malas M, van der Tempel J, Schwartz R, et al. Electronic cigarettes for smoking cessation: a systematic review. *Nicotine Tob Res*. 2016;18(10):1926–1936.
- [4] Soneji S, Barrington-Trimis JL, Wills TA, et al. Association between initial use of e-cigarettes and subsequent cigarette smoking among adolescents and young adults: a systematic review and meta-analysis. *JAMA Pediatr*. 2017;171(8):788–797.
- [5] Spindle TR, Hiler MM, Cooke ME, Eissenberg T, Kendler KS, Dick DM. Electronic cigarette use and uptake of cigarette smoking: a longitudinal examination of U.S. college students. *Addict Behav*. 2017;67(Supplement C):66–72.

- [6] Chaffee BW, Watkins SL, Glantz SA. Electronic cigarette use and progression from experimentation to established smoking. *Pediatrics* 2018;141(4):e20173594.
- [7] Warner KE, Mendez D. E-cigarettes: comparing the possible risks of increasing smoking initiation with the potential benefits of increasing smoking cessation. *Nicotine Tob Res*. 2018;21(1):41–47.
- [8] Farsalinos KE, Romagna G, Alliffranchini E, et al. Comparison of the cytotoxic potential of cigarette smoke and electronic cigarette vapour extract on cultured myocardial cells. *Int J Environ Res Public Health*. 2013;10(10):5146–5162.
- [9] Husari A, Shihadeh A, Talih S, Hashem Y, El Sabban M, Zaatari G. Acute exposure to electronic and combustible cigarette aerosols: effects in an animal model and in human alveolar cells. *Nicotine Tob Res*. 2016;18(5):613–619.
- [10] Romagna G, Alliffranchini E, Bocchietto E, Todeschi S, Esposito M, Farsalinos KE. Cytotoxicity evaluation of electronic cigarette vapor extract on cultured mammalian fibroblasts (ClearStream-LIFE): comparison with tobacco cigarette smoke extract. *Inhal Toxicol*. 2013;25(6):354–361.
- [11] McMillen RC, Gottlieb MA, Shaefer RMW, Winickoff JP, Klein JD. Trends in electronic cigarette use among U.S. adults: use is increasing in both smokers and nonsmokers. *Nicotine Tob Res*. 2015;17(10):1195–1202.
- [12] Reid JL, Rynard VL, Czoli CD, Hammond D. Who is using e-cigarettes in Canada? Nationally representative data on the prevalence of e-cigarette use among Canadians. *Prev Med*. 2015;81:180–183.
- [13] Filippidis FT, Laverty AA, Gerovasili V, Vardavas CI. Two-year trends and predictors of e-cigarette use in 27 European Union member states. *Tob Control*. 2017;26(1):98–104.
- [14] Levy DT, Yuan Z, Li Y. The prevalence and characteristics of e-cigarette users in the U.S. *Int J Environ Res Public Health*. 2017;14(10):1200.
- [15] Arnett JJ. Emerging adulthood. A theory of development from the late teens through the twenties. *Am Psychol*. 2000;55(5):469–480.
- [16] Sussman S, Arnett JJ. Emerging adulthood: developmental period facilitative of the addictions. *Eval Health Prof*. 2014;37(2):147–155.
- [17] Saddleson ML, Kozlowski LT, Giovino GA, et al. Risky behaviors, e-cigarette use and susceptibility of use among college students. *Drug Alcohol Depend*. 2015;149:25–30.
- [18] Péntzes M, Foley KL, Balázs P, Urbán R. Intention to experiment with e-cigarettes in a cross-sectional survey of undergraduate university students in Hungary. *Subst Use Misuse*. 2016;51(9):1083–1092.
- [19] Trumbo CW, Harper R. Use and perception of electronic cigarettes among college students. *J Am Coll Health*. 2013;61(3):149–155.
- [20] Trumbo CW, Kim SJ. The effect of electronic cigarette advertising on intended use among college students. *Addict Behav*. 2015;46:77–81.
- [21] Brikmanis K, Petersen A, Doran N. E-cigarette use, perceptions, and cigarette smoking intentions in a community sample of young adult nondaily cigarette smokers. *Psychol Addict Behav*. 2017;31(3):336–342.
- [22] Case K, Crook B, Lazard A, Mackert M. Formative research to identify perceptions of e-cigarettes in college students: implications for future health communication campaigns. *J Am Coll Health*. 2016;64(5):380–389.
- [23] Czoli CD, Goniewicz M, Islam T, Kotnowski K, Hammond D. Consumer preferences for electronic cigarettes: results from a discrete choice experiment. *Tob Control*. 2016;25(e1):e30–6.
- [24] Rutten LJF, Blake KD, Agunwamba AA, et al. Use of e-cigarettes among current smokers: associations among reasons for use, quit intentions, and current tobacco use. *Nicotine Tob Res*. 2015;17(10):1228–1234.
- [25] Hummel K, Hoving C, Nagelhout GE, et al. Prevalence and reasons for use of electronic cigarettes among smokers: findings from the International Tobacco Control (ITC) Netherlands Survey. *Int J Drug Policy*. 2015;26(6):601–608.
- [26] Patel D, Davis KC, Cox S, et al. Reasons for current e-cigarette use among U.S. adults. *Prev Med*. 2016;93:14–20.
- [27] Dunlop S, Lyons C, Dessaix A, Currow D. How are tobacco smokers using e-cigarettes? Patterns of use, reasons for use and places of purchase in New South Wales. *Med J Aust*. 2016;204(9):355.
- [28] Schmidt L, Reidmohr A, Harwell TS, Helgersson SD. Prevalence and reasons for initiating use of electronic cigarettes among adults in Montana, 2013. *Prev Chronic Dis*. 2014;11:E204.
- [29] Cooper M, Harrell MB, Perry CL. Comparing young adults to older adults in e-cigarette perceptions and motivations for use: implications for health communication. *Health Educ Res*. 2016;31(4):429–438.
- [30] Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009;6(7):e1000097.
- [31] von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *J Clin Epidemiol*. 2008;61(4):344–349.
- [32] Clark JP. How to peer review a qualitative manuscript. In: Godlee F, Jefferson T, eds. *Peer Review in Health Sciences*. London, UK: BMJ Books; 2003:219–235.
- [33] Awan KH. Experimentation and correlates of electronic nicotine delivery system (electronic cigarettes) among university students – A cross sectional study. *Saudi Dent J*. 2016;28(2):91–95.
- [34] Lotrean LM. Use of electronic cigarettes among Romanian university students: a cross-sectional study. *BMC Public Health*. 2015;15(1):358.
- [35] Kinouani S, Pereira E, Tzourio C. Electronic cigarette use in students and its relation with tobacco-smoking: a cross-sectional analysis of the i-Share Study. *Int J Environ Res Public Health*. 2017;14(11):1345.
- [36] Hoek J, Thrul J, Ling P. Qualitative analysis of young adult END users' expectations and experiences. *BMJ Open*. 2017;7(3):e014990.
- [37] Kong G, Morean ME, Cavallo DA, Camenga DR, Krishnan-Sarin S. Reasons for electronic cigarette experimentation and discontinuation among adolescents and young adults. *Nicotine Tob Res*. 2015;17(7):847–854.
- [38] Surís JC, Berchtold A, Akre C. Reasons to use e-cigarettes and associations with other substances among adolescents in Switzerland. *Drug Alcohol Depend*. 2015;153:140–144.
- [39] Lee JA, Lee S, Cho HJ. The relation between frequency of e-cigarette use and frequency and intensity of cigarette smoking among South Korean Adolescents. *Int J Environ Res Public Health*. 2017;14(3):305.
- [40] Kinnunen JM, Ollila H, Lindfors PL, Rimpelä AH. Changes in electronic cigarette use from 2013 to 2015 and reasons for use among Finnish adolescents. *Int J Environ Res Public Health*. 2016;13(11):1114.
- [41] Mantler T. A systematic review of smoking Youths' perceptions of addiction and health risks associated with smoking: utilizing the framework of the health belief model. *Addict Res Theory*. 2013;21(4):306–317.
- [42] Sarason IG, Mankowski ES, Peterson AV, Dinh KT. Adolescents' reasons for smoking. *J Sch Health*. 1992;62(5):185–190.
- [43] Freedman KS, Nelson NM, Feldman LL. Smoking initiation among young adults in the United States and Canada, 1998–2010: a systematic review. *Prev Chronic Dis*. 2012;9:E05.
- [44] Etter JF. Gateway effects and electronic cigarettes. *Addiction*. 2018;113(10):1776–1783.
- [45] Filippidis FT, Laverty AA, Mons U, Jimenez-Ruiz C, Vardavas CI. Changes in smoking cessation assistance in the European

- Union between 2012 and 2017: pharmacotherapy versus counselling versus e-cigarettes. *Tob Control*. 2019;28(1):95–100.
- [46] Soule EK, Rosas SR, Nasim A. Reasons for electronic cigarette use beyond cigarette smoking cessation: a concept mapping approach. *Addict Behav*. 2016;56:41–50.
- [47] Rooke C, Cunningham-Burley S, Amos A. Smokers' and ex-smokers' understanding of electronic cigarettes: a qualitative study. *Tob Control*. 2016;25(e1):e60–6.
- [48] Berg CJ. Preferred flavors and reasons for e-cigarette use and discontinued use among never, current, and former smokers. *Int J Public Health*. 2016;61(2):225–236.
- [49] Yule JA, Tinson JS. Youth and the sociability of “Vaping.” *J Consumer Behav*. 2017;16(1):3–14.
- [50] McKeganey N, Barnard M, Russell C. Vapers and vaping: E-cigarette users' views of vaping and smoking. *Drugs Educ Prev Policy*. 2018;25(1):13–20.
- [51] Vandrevala T, Coyle A, Walker V, Cabrera Torres J, Ordoña I, Rahman P. A good method for quitting smoking' or 'just an alternative to smoking'? Comparative evaluations of e-cigarette and traditional cigarette usage by dual users. *Health Psychol Open*. 2017;4(1):205510291668464.
- [52] Lee C, Yong HH, Borland R, McNeill A, Hitchman SC. Acceptance and patterns of personal vaporizer use in Australia and the United Kingdom: results from the International Tobacco Control survey. *Drug Alcohol Depend*. 2018;185:142–148.
- [53] Echevarria C, Sinha IP. Heterogeneity in the measurement and reporting of outcomes in studies of electronic cigarette use in adolescents: a systematic analysis of observational studies. *Tob Control*. 2017;26(3):247–253.
- [54] Bauld L, MacKintosh AM, Eastwood B, et al. Young people's use of e-cigarettes across the United Kingdom: findings from five surveys 2015–2017. *Int J Environ Res Public Health*. 2017;14(9):973.
- [55] Chou SP, Goldstein RB, Smith SM, et al. The epidemiology of DSM-5 nicotine use disorder: results from the National Epidemiologic Survey on Alcohol and Related Conditions-III. *J Clin Psychiatry*. 2016;77(10):1404–1412.
- [56] Legleye S, Khlat M, Beck F, Peretti-Watel P. Widening inequalities in smoking initiation and cessation patterns: a cohort and gender analysis in France. *Drug Alcohol Depend*. 2011;117(2-3):233–241.
- [57] Reid JL, Hammond D, Driezen P. Socio-economic status and smoking in Canada, 1999-2006: has there been any progress on disparities in tobacco use? *Can J Public Health*. 2010;101(1):73–78.
- [58] Gregoraci G, van Lenthe FJ, Artnik B, et al. Contribution of smoking to socioeconomic inequalities in mortality: a study of 14 European countries, 1990–2004. *Tob Control*. 2017;26(3):260–268.
- [59] Siahpush M, English D, Powles J. The contribution of smoking to socioeconomic differentials in mortality: results from the Melbourne Collaborative Cohort Study, Australia. *J Epidemiol Community Health*. 2006;60(12):1077–1079.