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The knowledge, concerns and healthcare practices among physicians regarding electronic cigarettes

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ABSTRACT

Background: Electronic cigarettes (e-cigarettes) are battery-powered devices that deliver aerosolized nicotine. With easy access and over-the-counter availability, many patients consider using electronic cigarettes for smoking cessation. Few studies have looked at long-term safety/efficacy and physician knowledge/attitudes toward e-cigarettes. Physicians have insufficient guidelines for advising their patients about e-cigarettes.

Objective: 1) To identify knowledge and attitude of health care practitioners toward electronic cigarettes. 2) To identify the effect of level of training, experience and speciality on knowledge and practice of electronic cigarettes. 3) To identify factors influencing electronic cigarettes advise/prescribing practice.

Methods: An anonymous online questionnaire was sent to residents, fellows, and faculty in pre-selected specialties at Saint Louis University (SLU) Hospital.

Results: We received 115 responses. Nine percent reported being 'very familiar' with e-cigarettes, while 25% reported no familiarity; 18% of physicians would advise e-cigarettes as nicotine-replacement therapy if asked by patients; 91% were aware of the nicotine content of e-cigarettes, but only 20% and 39%, respectively, were aware of the presence of carcinogens and polyethylene glycol. Only 63% of respondents knew what 'vape' meant. Lack of evidence regarding long-term safety (76%), e-cigarettes as starter products for nonsmokers (50%), absence of Food and Drug Administration (FDA) regulations (51%) and marketing to youth (42%) were major concerns. Stricter regulations (54%), warning labels similar to tobacco products (53%), restricting advertising (36%), banning sales to minors (34%), and banning use in public spaces (25%) were favored as regulatory measures. More than 50% of physicians see a role for e-cigarettes as part of 'harm-reduction strategy'.

Conclusions: Further research is needed to assess whether e- cigarettes could be an effective smoking-cessation tool. There is an apparent knowledge deficit among physicians and an urgent need for evidence-based guidelines to aid with advising patients enquiring about e-cigarettes.

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1. Introduction

Electronic cigarettes (hereafter, e-cigarettes) are battery-powered devices that generate an aerosol by heating a liquid that is typically composed of a solvent (usually propylene glycol or glycerol), nicotine, and flavorings [1]. E-cigarette use is on the rise in the United States [2–4], and many of the users report various reasons for their use, including helping them quit smoking [5]. More than half (59%) of the current smokers in the United States consider them less harmful than tobacco cigarettes [6]. In 2010, a total of 1.8% of US adults described having used e-cigarettes, a rate that surged to 13% by 2014. In 2015, 16% of US high-school students and 5.3% of middle-school students reported using them in the last 30 days. In the United States, exposure of young people to advertisements for e-cigarettes expanded by 256% between 2011 and 2013, with as many as 24 million minors exposed to these advertisements in 2013 alone [2–4].

Notwithstanding the growing popularity, the evidence is lacking and conflicting to advocate e-cigarettes for either smoking cessation or reduction [7]. Hence there are no current evidence-based guidelines for providers to follow on the use of e-cigarettes. The US Preventive services task force and American College of Physicians recommended against the use of them as smoking cessation tool given the conflicting and limited evidence [8,9]. However, in previously published studies the percentage of physicians who prescribed them to help quit smoking ranged from 3.7% to 46%, implying a significant variation in the clinical practice [10–17] (Table 1).

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Table 1. A summary of all the previous studies by year of publication.

Study	Location	Year	Population	Results
Pepper, J. K., et al. [18] (2013)	Minnesota USA	2013	Family medicine physicians, pediatricians, and nurse practitioners who treat adolescents	Response rate 28%. 83% reported that they knew 'a little or nothing at all' about e-cigs. 62% of the respondents heard about e-cigs from patients.
Kandra, K. L., et al. [10] (2014)	North Carolina, USA	2014	A random sample of North Carolina physicians treating adults	Response rate 31%. 48.4% reported being asked about e-cigs by patients. 67.2% said e-cigs are a helpful for smoking cessation. 35.2% recommended to their patients.
Hiscock et al. [19] (2014)	UK	2011–2013	An online survey of UK smoking-cessation practitioners	Response rate 20% Patients asking about e-cigs increased from 64% to 91% between 2011 and 2013. Patients using e-cigs increased from 2% to 24% within the 2 years (2011–2013). Practitioner's opinion of e-cigs being good increased significantly over the 2 years (2011–2013) from 15% to 26%.
Lazuras, L., et al. [20] (2015)	Italy	2014	Healthcare professionals in public smoking-cessation clinics	79.3% agreed that e-cigs are equally effective as smoking-cessation medication. 62.6% agreed that e-cigs are safe to use. More smokers made inquiries about e-cigs in 2014 than in 2013.
Gorzkowski, J. A., et al. [21] (2016)	USA	2014	Pediatricians attending the AAP meeting	Total participants were 37. 27% believed in e-cigs as a form of harm reduction. 35% reported clinical encounters involving e-cigs. >50% of the participants reported 'not at all confident' in addressing e-cigs.
Cummins, S., et al. [11] (2016)	USA and Canada	2014	An online cross-sectional survey with quitline counselors	The response rate was 90.1%. Nearly all reported being asked about e-cigs. Only 4% recommended e-cigs. 86.7% believed that e-cigs are highly addictive yet nearly all believe e-cigs to be less harmful than standard cigarettes.
Sherratt, F. C., et al. [15] (2016)	UK	2015	An online survey of members of The British Thoracic Oncology Group	Response rate 7.7%. 81% reported being asked about e-cigs by patients. Only 21% of participants felt confident advising patients regarding e-cigs. Practitioners advised that e-cigarettes were likely to be less harmful than regular cigarettes (23.7%) and there is a paucity of research (21%). Only 3.7% recommended e-cigs.
Van Gucht, D., et al. [22] (2016)	Belgium	2014	An online survey of family doctors and tobacco counselors	Response rate 25%. 50% supported patients who spontaneously told them that they want to start using e-cigs, but none advised patients to use e-cigs. 63% said e-cigs are harmful.
Moysidou, A., et al. [14] (2016)	Greece	2014–2015	An online survey of physicians and nurses in Greece	Response rate 30.3%. 33% recommended e-cigs. 56% said they would recommend e-cigs to smokers who refuse to take medication to quit. 7.3% of respondents thought e-cigs contained tobacco and 35% thought that it involved combustion. >70% said e-cigs are less harmful than cigarettes.
El-Shahawy, O., et al. [12] (2016)	Virginia, USA	2014	Interviews with 15 primary-care physicians	13 physicians (86%) reported talking about e-cigs with their patients. 6 (46%) recommended e-cigs. All reported lack of knowledge regarding e-cigs.
Shin, D. W., et al. [17] (2017)	South Korea	2015	An online survey of all lung-cancer specialists	Response rate 48.3%. 83% of the respondents reported being uncomfortable discussing e-cigs. 12% would recommend e-cigs. Most believed that e-cigs are not safer than conventional tobacco products.
Egnot, E., et al. [13] (2016)	Ohio, USA	2015	An online survey of resident physicians at three teaching hospitals within the Ohio healthcare system.	Response rate 42% 17.7% recommended e-cigs. More years in training, exposure to peer-reviewed literature on the topic, and belief that electronic cigarettes are less addictive than traditional cigarettes increase the likelihood of recommending e-cigs.
Nickels, A. S., et al. [16] (2017)	USA	2015	National postal survey of primary-care physicians, pulmonologists, and surgeons	Response rate 44% 70% of the respondents were asked about e-cigs by their patients. 37.9% recommended e-cigs for smoking cessation and pulmonologists were more likely to recommend than surgeons and primary-care physicians. 71% believe e-cigarettes can decrease the number of cigarettes smoked and 54.5% believe e-cigarettes can help patients quit smoking. >50% reported that they are not confident about their level of knowledge about e-cigarettes and ability to answer patients' questions about e-cigarettes.

Considering the exponential growth in awareness and use of e-cigarettes coupled with aggressive marketing by tobacco companies, physicians are increasingly engaging patients who smoke cigarettes in conversations relating to the use of e-cigarettes [10–18] (Table 1). Many of the physicians lack the required knowledge and familiarity to provide informed and consistent advice for patients and their families [12,15–18,21] (Table 1). Hence, we sought to determine the attitudes/beliefs, concerns, and practices among physicians at Saint Louis University Hospital (SLU) regarding e-cigarettes. The results of our study could be essential in facilitating the identification of training needs and for generating clinical guidelines about e-cigarettes.

2. Materials and methods

This study was an SLU IRB approved cross-sectional survey consisting of a convenience sample of a cohort of physicians at SLU School of Medicine, who received an anonymous online survey between July and September 2015, consisting of multiple-choice questions regarding e-cigarettes.

An IRB approved recruitment statement was sent by the research team via email inviting residents, fellows, and attendings in pre-selected departments at SLU School of Medicine to participate in the study with a link to the survey at the bottom. Qualtrics survey software provided by the university was used to create the survey.

The study consisted of a series of 12 open and closed questions with multiple choices. Survey questions addressed participant demographics including the level of training and specialty. It also questioned participants about e-cigarettes including patient interest, physician prescription, and advocacy trends, the degree of familiarity among physicians with e-cigarettes and their contents, and concerns and measures supported by physicians to regulate e-cigarettes. This questionnaire was not validated in any prior studies (for details, see the Supplementary Appendix).

All statistical analyses were performed using IBM SPSS Statistics for Windows Version 23.0. Bivariate analyses of categorical data were conducted using Chi-square or Fisher's exact test. Multivariate logistic regression analysis was performed to explore the association between the likelihood of participants recommending e-cigarettes to patients and various characteristics of the study participants: level of training, degree of familiarity, physicians who were asked about e-cigarettes, physicians who viewed e-cigarettes as a harm-reduction tool and knew the meaning of the term 'vape'. Only statistically significant predictors are reported. P values of $\leq .05$ were considered significant.

The level of training was categorized into residents, fellows, and attendings. For the descriptive statistics, specialties were reported as described in the survey. However, during data analysis, internal medicine, geriatrics, and family medicine were defined as primary care; surgery, neurology, and psychiatry were described as 'other'; cardiology, gastroenterology, rheumatology and allergy & immunology were described as IM sub-specialties and pulmonary was reported as a separate specialty. The response of physicians when asked about e-cigarettes, concerns of the physicians about e-cigarettes, and measures advocated by doctors to regulate e-cigarettes were all tabulated and reported as percentages. Respondents were allowed to choose more than one option when answering questions. The degree of familiarity of participants was categorized as 'not at all familiar', 'somewhat familiar', and 'very familiar'. During statistical analysis, familiarity was divided into very familiar and not very familiar. Respondent's ability to correctly identify the meaning of the term 'vape' and contents of e-cigarettes was reported as the 'correct' vs. 'incorrect' answer.

3. Results

A total of 115 participants responded to the survey (40% response rate). Out of these 115 respondents, 45 (39%) were residents, 43 (37.4%) were attending physicians, and 27 (23.5%) were fellows. The majority of the respondents were from internal medicine (35%), internal medicine sub-specialties (27.8%), followed by pulmonary service (12%).

Only 11 (9%) respondents reported being 'very familiar', whereas 29 (25%) reported as being 'not at all familiar' with e-cigarettes (Table 2). Twenty-one (18.2%) participants had recommended patients to use e-cigarettes, and 58 (51%) of participants see e-cigarettes as a harm-reduction tool (Table 2). The majority (93%) of the interviewees reported being asked about smoking cessation by patients

Table 2. Baseline characteristics of the participants.

	N (%)
Provider level of training	
Resident	45 (39)
Fellow	27 (23.5)
Attending	43 (37.4)
Provider specialty	
Internal medicine	40 (35)
Internal medicine sub-specialties	32 (27.8)
Family medicine	10 (9)
Neurology	5 (4)
Psychiatry	7 (6)
Pulmonary	14 (12)
Surgery	7 (6)
Degree of familiarity	
Not at all familiar	29 (25.3)
Somewhat familiar	75 (65.2)
Very familiar	11 (9.5)
Advised e-cigs to patients	
Yes	21 (18.2)
No	94 (81.8)
See e-cigs as a tobacco-harm-reduction tool	
Yes	58 (50)
No	47 (41)
Don't know	11 (9)

and of these 53% of respondents were asked about e-cigarettes. The results illustrated inconsistencies concerning the guidance provided to patients by practitioners when asked about e-cigarettes (Table 3). Most frequently, practitioners replied 'I do not know much about the long-term safety and efficacy of e-cigarettes, and I would not advise you to use them' (n = 54, 48%) and 'I would recommend FDA-approved and better-studied methods' (n = 46, 41%). A minority of the physicians (n = 12, 11%) said: 'I do not know much about them and will leave the decision to you.'

Only 63% of the respondents knew the meaning of the term 'vape'. Even amongst respondents who reported being either 'very familiar' or 'somewhat familiar', 28% were not able to correctly recognize the meaning of the term 'vape' (Table 3). The majority (91%) of respondents were aware of the nicotine content of e-cigarettes, but only 39% were aware of the propylene glycol content, and 26% were aware of the diethylene glycol content (Table 3).

The majority of the respondents advocated regulations by the FDA like other tobacco products and having warning labels like other tobacco products (Table 4). Lack of evidence regarding the long-term safety of the product, a virtual absence of regulatory controls by the FDA, and their function as attractive starter products for young non-smokers and as a gateway to smoking for adolescents were the major concerns among the respondents (Table 4).

Table 3. Practitioners' responses to questions regarding advice provided, contents of e-cigarettes, and meaning of the term 'vape'.

Participant responses	*N* (%)
What was your response when a patient asked you about e-cigarettes?	
No, I do not know much about the long-term safety and efficacy of the e- cigarettes, and I would not advise you to use them	54 (48)
No, I would recommend FDA-approved and better-studied methods, such as gums, inhalers, or patches	46 (41)
Yes, you can use them as this is also a form NRT (nicotine-replacement therapy) and may help you quit	17 (15)
I do not know much about them and will leave the decision to you	12 (11)
Other	8 (7)
I have never heard of E-cigarettes	0
What are the contents of e-cigarettes?	
Nicotine	105 (91)
Propylene glycol	45 (39)
Tobacco-specific nitrosamines(carcinogens)	23 (20)
Diethylene glycol (toxin)	30 (25)
Tobacco	17 (14)
None	3 (2.5)
Other*	7 (6)
What does the term 'vape' mean?	
Correct response**	77 (63%)
Incorrect response	37 (32%)
Don't know	1 (1%)

*Other: formaldehyde, glycerin, propylene glycol, flavor, flavoring, water, other chemicals are available such as THC, I'm not sure about the other listed.

**To inhale vapor from e-cigarettes, a term used to refer to an electronic cigarette, the action of 'smoking' an electronic cigarette.

Table 4. Practitioners' responses to questions regarding concerns and regulations regarding e-cigarettes.

Participant responses	*N* (%)
What should the FDA do with regard to e-cigarettes?	
Regulate them like other NRT products: gums/inhalers/ patches.	62 (53)
Have warning labels like other tobacco products	61 (52.5)
Regulate them like other tobacco products.	60 (51.7)
Restrictions on advertising, promotion and sponsorship	42 (36.2)
A ban on sales to minors only.	39 (33.6)
Ban e-cigarette use in public places	28 (24.1)
Ban flavors that appeal to kids	27 (23.2)
Ban them altogether from the marketplace.	5 (4.3)
Not sure	11 (9.5)
Maintain status quo until further research is available.	9 (7.8)
What are your concerns regarding e-cigarettes?	
Lack of evidence regarding the long-term safety of the product	88 (76.5)
Virtual absence of regulatory controls by the FDA	59 (51.3)
Function as attractive starter products for young non-smokers and a gateway to smoking for adolescents	57 (49.5)
The long-term impact of repeated propylene glycol (major component of some e-cigarettes) inhalation is unknown	52 (45.2)
Marketing and advertising of e-cigarettes, especially to children and youth	48 (41.7)
Become 'bridge product' for use in places where smoking is prohibited: schools/offices/airports	41 (35.65)
E-cigarette advertising and photos of celebrities vaping will make cigarette smoking glamorous again and 'renormalize' smoking	40 (34.7)
Their use may instead perpetuate smokers' addiction	37 (32.1)
FDA may ban or restrict them from the marketplace, resulting in lack of less-harmful alternatives to smoking	6 (5.2)

Respondents' degree of familiarity and the rate of patients asking about e-cigarettes did not vary by level of training or specialty. Knowledge about 'vaping' and views of e-cigarettes as a harm-reduction tool did not vary by level of training, provider specialty, or familiarity with e-cigarettes (Table 5). As seen in Table 5, providers who viewed e-cigarettes as a harm-reduction tool were more likely to advise patients. Physician's advice about e-cigarettes did not vary based on the level of training, the degree of familiarity, or provider specialty.

In multivariate analysis, providers who viewed e-cigarettes as a harm-reduction tool and were asked about e-cigarettes are more likely to prescribe e-cigarettes (OR of 4.45 and 3.8 respectively; Table 5).

4. Discussion

E-cigarettes are growing in popularity in the US, particularly among young non-smokers and adolescents. In 2015, more than 3 million middle- and high-school students were current users of e-cigarettes, making e-cigarettes the most commonly used tobacco product among youth.

In this cross-sectional survey consisting of physicians at SLU School of Medicine, we sought to determine the attitudes/beliefs, concerns, and practices among physicians regarding e-cigarettes. The results indicate that more than half see a role for e-cigarettes as part of 'harm-reduction strategy' and that an increasing number of physicians may be called on to engage in discussions with their patients about

Table 5. Results of bivariate analysis of categorical variables to derive the *P* value and multivariate analysis.

	P value	Odds ratio
Respondents reported degree of familiarity		
The level of training	.91	
Provider specialty	.48	
Respondents who see e-cigs as a tobacco-harm-reduction tool		
The level of training	.09	
Provider specialty	.72	
Degree of familiarity	.145	
Respondents who knew the meaning of the term 'vaping'		
The level of training	.86	
Provider specialty	.99	
Degree of familiarity	.55	
Respondents who recommended e-cigs to patients		
The level of training	.770	
Provider specialty	.25	
Degree of familiarity	.265	
See e-cigs as a tobacco-harm-reduction tool	**.001**	
Respondents who were asked about e-cigs by patients		
The level of training	.97	
Provider specialty	.56	
Significant predictors of recommending e-cigarettes by multivariate analysis*		
See e-cigs as a tobacco-harm-reduction tool	.015	4.45
Respondents who were asked about e- cigarettes by patients	.029	3.8

*Multivariate analysis was performed to explore the association between the likelihood of participants recommending e-cigs and various characteristics of the study participants.

the safety and efficacy of e-cigarettes, with some providers prescribing them for smoking cessation despite lacking familiarity and having concerns about their safety.

There are several important findings in our study. The first key finding is that 53% of the practitioners reported being questioned about e-cigarettes by their patients who wanted to quit smoking, irrespective of their level of training and specialty (Table 5). Despite the frequent patient queries about e-cigarettes, our survey revealed low levels of practitioner familiarity regarding e-cigarettes. Only 9% of the respondents described being very familiar, while 25% of the interviewees stated they were not at all familiar with e-cigarettes (Table 2). This degree of familiarity was irrespective of the level of training or specialty, suggesting that there is a dearth of knowledge and awareness across all training levels and specialties (Table 5). In our study, even amongst the respondents who reported being 'very familiar' or 'somewhat familiar', 28% were not aware of the contents of e-cigarettes or the meaning of the term 'vape', indicating a gap between stated or perceived knowledge and actual knowledge about e-cigarettes. Our findings are consistent with those from previously published studies indicating that patients seek out physicians as their source of knowledge and advice regarding e-cigarettes [10–18] (Table 1), but includes several new observations, such as the observed gap between the perceived knowledge and the actual knowledge among the physicians.

A second significant finding is that 51% of respondents regard e-cigarettes as a method of harm reduction, like the methadone use or needle-exchange programs practiced in combating drug addiction. This perception among physicians was not found to be significantly associated with the level of training, the specialty of providers, or the degree of familiarity with e-cigarettes (Table 5). The harm-minimization concept for tobacco must include the following three aspects: supply reduction, demand reduction, and harm reduction [23,24]. Even if they are less harmful than conventional cigarettes [1], advocating their use explicitly for harm reduction without addressing the exponential growth in marketing and advertisements for e-cigarettes and use among US minors and adults may do more harm than good [2–4]. To the best of our knowledge, our study is the first to evaluate physicians' perception of e-cigarettes as a harm-reduction tool.

A third key finding is that despite the evidence being conflicting and limited for advocating e-cigarettes for smoking cessation or reduction [7], in our study 18% (n = 21) of the respondents recommended e-cigarettes for stopping smoking. The level of training, the degree of familiarity, and the specialty did not affect the likelihood of recommending e-cigarettes. In the earlier studies the percentage of physicians who prescribed e-cigarettes to help quit smoking ranged from 3.7% to 46%, consistent with findings from our study [10–17] (Table 1). Physicians who were asked about e-cigarettes were 3.8 times more inclined to advise their patients as compared to those who were not asked about e-cigarettes, which is consistent with two previous studies [10,22]. But the providers who viewed e-cigarettes as a form of harm reduction were 4.45 times more likely to recommend e-cigarettes as compared to physicians who did not see them as a harm-reduction tool. We suggest several reasons for the above findings. First, the physicians who perceive e-cigarettes as a harm-reduction tool are likely to have more positive views about e-cigarettes, thereby increasing the likelihood of recommending e-cigarettes. Second, patient interaction, news stories, and advertisements rather than evidence-based guidelines serve more frequently as sources of information about e-cigarettes for physicians [17,18]. Hence, physicians who are asked about e-cigarettes by patients may be more inclined to prescribe them.

Finally, the majority of the respondents (91%) reported that e-cigarettes contained nicotine (Table 2). However, only 39% of the interviewees knew e-cigarettes contained propylene glycol and 14% of the respondents stated that they contained tobacco. Analyses of the available e-cigarette liquids and aerosols displayed potentially toxic elements

other than the noted ingredients, including formaldehyde, diethylene glycol, ethylene glycol, and tobacco alkaloids, although these compounds are detected at considerably lower concentrations than in traditional cigarettes [25–28]. Only 20–25% of the respondents in our study were aware of the presence of these compounds in e-cigarettes, and 6/115 (5.2%) respondents were aware of all the contents in e-cigarettes.

Despite the above important findings, our study has some shortcomings. Our study is limited by the small sample size of a cohort of physicians at a university hospital. Generalizing our findings to a broader base of healthcare professionals would need the use of discretion. Another limitation of the study is the 40% response rate, which seems to be low, and since the findings of this study are based on participant self-report, they are subject to possible response bias. Nonetheless, they are concordant and comparable to other physician surveys (Table 5). Although our survey was developed by adoption of elements used in prior studies, with inputs from other clinicians, it has not been validated. Finally, as a relatively new phenomenon, literature about electronic cigarettes continues to be published. Given the cross-sectional nature of the survey, the ability to measure future changes in physicians' attitudes regarding electronic cigarettes that might occur based on evolving literature is limited.

5. Conclusions

In summary, our study illustrates that more than half of the surveyed physicians see a role for e-cigarettes as part of 'harm-reduction strategy' and that an increasing number of physicians may be called on to engage in discussions with their patients about the safety and efficacy of e-cigarettes, with some providers prescribing them for smoking cessation despite lacking familiarity and having concerns about their safety. These findings have significant implications for practitioner training, as well as for future research and policy. Our study highlights a critical need for increasing awareness, educational tools, and evidence-based guidelines to aid in directing patients appropriately. As more than half the respondents were asked about e-cigarettes by their patients, it is imperative to include screening and counseling about e-cigarette use in routine clinical evaluation.

In April 2015, the American College of Physicians (ACP) released a position paper recommending that the FDA extend its regulatory authority to cover electronic nicotine delivery systems (ENDS) [8]. In November 2015, the American Academy of Pediatrics (AAP) also released a position paper calling for stricter regulation of ENDS and advising pediatricians against recommending e-cigarettes as a treatment product for tobacco dependence [29]. Considering that 81% of current youth e-cigarette users cited the availability of appealing flavors as the primary reason for use, the ACP and the AAP both called for banning flavors from all ENDS. They also recommended taxing ENDS at the same rate as conventional cigarettes to decrease youth access. The AAP also called for reducing youth access to ENDS by calling for several bans, including the sale of e-cigarettes to people younger than 21 years of age, internet sales of ENDS, and advertising of ENDS in media. All these recommendations align with the concerns that we elicited among our cohort of surveyed physicians.

In 2016, the FDA [30] extended its regulatory authority to cover all tobacco products, including vaporizers, vape pens, hookah pens, e-cigarettes, e-pipes, and all other ENDS, including the manufacture, import, packaging, labeling, advertising, promotion, sale, and distribution of ENDS. During our survey, 59% of physicians had reported the lack of FDA regulation of e-cigarettes as a major concern, an issue that has now been resolved.

Currently, it's hard to reach an agreement on the safety of e-cigarettes other than to state that they may be safer than conventional cigarettes. Given the limited knowledge of the long-term consequences of e-cigarette use on public health and smoking cessation, standardized survey methods at national and international levels, as well as continued monitoring of evolving utilization patterns of e-cigarettes, and randomized controlled head-to-head trials comparing e-cigarettes with standard therapies are crucial for public health policymaking and patient advocacy. Even as this research is under way, regulations that make e-cigarettes unavailable to children and restrict marketing and advertising, as currently instituted by the FDA, are warranted, as are public health initiatives that dissuade non-smokers from smoking conventional tobacco using e-cigarettes.

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No potential conflict of interest was reported by the authors.

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