HEALTH PROMOTION

Comparing vape use and perceptions among pharmacy and non-pharmacy students from two universities in the US and UK

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Keywords

Vape • E-Cigarette • Electronic Nicotine Delivery System • University Students, Pharmacy

Summary

Introduction. *Little research exists regarding pharmacy student vaping habits or differences among students from different countries.*
Methods. *A novel 19-item questionnaire was distributed in November 2023 to students at The University of Bath (United Kingdom) and The University of Texas at Austin (United States) to compare vape use and perceptions among pharmacy and non-pharmacy students from the two universities. All pharmacy students at both institutions were invited to complete the survey. A non-pharmacy student control group was identified through snowball sampling (i.e., the survey was distributed to a convenience sample of non-pharmacy students at each school, asking them to complete and distribute to peers). To incentivize participation, one respondent received a $100 reward. Data was analyzed using descriptive statistics. Chi-square and Wilcoxon Rank Sum tests were used to compare answers between pharmacy and non-pharmacy and UK and US participants. A p-value < 0.05 was deemed significant.*
Results. *Overall, 372 students completed the survey (25% pharmacy student response rate). Vape use significantly differed between pharmacy and non-pharmacy students ($p = 0.03$). Among 212 pharmacy students, 49% reported vape ever-use versus 59% of the 158 non-pharmacy students. Significant differences were found in harm perceptions; more pharmacy students believed vapes are cancer-causing, affect the health of others nearby, should be banned in public, and are ineffective for quitting cigarettes. Few differences were observed between UK and US students.*
Conclusion. *Pharmacy students were less likely to vape and exhibited heightened awareness of associated risks than non-pharmacy students. Few differences were observed between UK and US students surveyed.*

Introduction

Vapes, also commonly referred to as vape pens, electronic cigarettes or e-cigarettes, were introduced around 2005, and originally marketed as a safer alternative to help smokers reduce or quit smoking traditional tobacco cigarettes and decrease smoking-related health consequences [1]. Smoking tobacco cigarettes continues to be the largest avoidable cause of death and serious disability in most developed countries, including the United States of America (US) and United Kingdom (UK) [2, 3]. Vapes do not contain tobacco nor do they produce smoke from combustion, the source of the majority of toxic, cancer-causing chemicals, and therefore are believed to be less harmful than regular tobacco cigarettes. However, this does not mean that they are harmless [4]. Vapes contain a variety of chemicals (*e.g.,* preservatives, flavorings, and heavy metals) that may be carcinogenic and contribute to lung disease, and typically contain nicotine, which confers considerable addiction potential, increases the risk of cardiovascular disease and may cause fetal harm when used during pregnancy [1, 4, 5]. There is also concern that vaping among adolescents and young adults may have negative impacts on the developing brain, confer seizure risk, and serve as a gateway to future cigarette smoking and reverse decades of progress in reducing national tobacco use rates [4, 6, 7]. It is unlikely that all of the long-term risks and health consequences have been established, since they have been around for less than 20 years [8].

Vape popularity has surged in the past decade, particularly in adolescents and young adults [9, 10]. In 2021, people between ages 18-24 years were the most likely US adults to vape, with a current use rate of 11% [11]. While there has been increasing research into vape use among teenagers, university students and young adults, research focusing specifically on healthcare students is limited, particularly pharmacy students. Franks and colleagues identified that 44% of healthcare professional students believed vapes to be less harmful than traditional cigarettes [12], while Sahr and colleagues found pharmacy students to have a more negative perception regarding vapes than other health care students, with less pharmacy students willing to recommend vapes as a smoking cessation tool [13]. Furthermore, the few studies assessing pharmacy student vape use and perceptions have been small studies in

single locations. Surveying students across multiple universities and countries allows results to be more generalizable to a wider population and explore whether cultural differences may affect vape use and perceptions. This study was conducted to compare vape use and perceptions among pharmacy and non-pharmacy students from two universities; one in the United Kingdom (UK) and the other in United States (US). Given the important role pharmacists play in tobacco use disorder treatment and the potential harms of e-cigarettes, understanding pharmacy students' vape use and perceptions regarding their benefits and harms is important for public health. This information can help guide pharmacy educators' efforts to ensure pharmacy students are well-informed regarding their own health decisions and prepared to educate patients regarding vaping.

Methods

Instrument

A novel, literature informed [12, 13], 19-item survey regarding vape use and perceptions was created by a pharmacy student from the University of Bath (UK) and faculty member from The University of Texas at Austin College of Pharmacy, as part of a study abroad program. The survey was disseminated electronically using Qualtrics® (Provo, UT) to pharmacy and non-pharmacy students from both universities. Prior to distribution, pilot testing was conducted with students across different courses at both universities, with revisions made to improve the clarity, based on student feedback. The study was ethically approved by both The University of Bath and The University of Texas at Austin's institutional review boards.

In addition to demographics, the survey consisted of: multiple choice questions regarding personal use history of vapes, tobacco, alcohol and cannabis; select all that apply questions (with optional free response) regarding perceived or personal motivations and deterrents for vaping (vape ever users were asked what their main motivation to vape was and vape never users were asked what they believed were the most common motivations for other people to vape; vape non-users were also asked what had deterred them from vaping); 'Yes, no, or unsure' questions regarding perceived harms (*e.g.,* whether they believe vapes contain cancer-causing ingredients, whether exhaled vapor can negatively impact the health of other people, and whether they believe that vaping should be banned in public places) and whether they perceive vapes to be an effective smoking cessation method; and Likert scale questions comparing the harm, addictive potential, and ease of quitting vapes versus traditional cigarettes. Display logic was incorporated to variably ask follow-up questions depending on student's responses to previous questions (*e.g.,* only those who currently vape were asked about their vaping frequency). The survey took approximately 5-10 minutes to complete.

Distribution

In November 2023, the anonymous, voluntary survey was distributed via email to all pharmacy students currently enrolled at The University of Bath in the UK and The University of Texas at Austin in the US. The survey included an information sheet and consent form for participants to read and confirm acceptance prior to beginning. Recruitment differed for non-pharmacy students because the investigators did not have a means to feasibly distribute the survey to all non-pharmacy students at each university. Snowball sampling methodology was implemented to obtain the non-pharmacy student sample, with the lead investigator disseminating the survey to personal contacts at both universities, asking participants to complete the survey and share it with peers from their university. Additionally, QR codes linking to the survey were distributed to students around campus at The University of Texas at Austin, and an email invitation was sent to all students studying within the Life Sciences department at The University of Bath. Finally, the lead investigator posted a link on social media, directing students studying at either university to fill out the questionnaire. The questionnaire was open for three full weeks and closed in December 2023.

To incentivize participation, students completing the survey could enter a drawing for a single $100 gift card. Participation in the prize draw was optional and required students to complete a separate form after the survey, which was not linked to their responses, guaranteeing anonymity. Engagement in the prize draw was optional.

Statistical Analysis

Data was analyzed using descriptive statistics. Counts and percentages were used for categorical data and median and interquartile range for numerical data because they were not normally distributed, as determined by the Shapiro-Wilk and Anderson-Darling tests. Chi-square and Wilcoxon Rank Sum tests were used to compare answers between pharmacy and non-pharmacy students, as well as UK and US participants. A p-value of < 0.05 was deemed a statistically significant difference.

Results

Pharmacy student response rates were 27% (110/411) at The University of Bath and 24% (101/420) at The University of Texas at Austin. One additional pharmacy student completed the survey but did not indicate which school they attended so they were included in pharmacy vs non pharmacy comparisons but not country comparisons. Given the various methods employed to recruit non-pharmacy students, an unknown number of individuals were approached, and the response rate could not be calculated. In total, 372 students completed the survey; 30% (n = 114/372) were male, 68% (n = 258/372) were female and 2% (n = 6/372) were non-binary. Median age was 21 years. There was a relatively even distribution among groups, with a small majority from the UK (58%)

Tab. I. Demographics and vaping and substance use habits.

Characteristic	Pharmacy n (%)	Non-pharmacy n (%)	P value	UK n (%)	US n (%)	P value
Age (years)			**< 0.01**			**< 0.01**
Median	22	21		20	24	
IQ range	19-25	19-22		19-21	22-25	
Gender			0.17			0.22
Female	152/212(72)	99/158(63)		145/216(67)	109/156(70)	
Male	57/212(27)	57/158(36)		67/216(31)	47/156(30)	
Non-binary/Third gender	3/212(1)	2/158(1)		4/216(2)	0/156(0)	
Have you ever used traditional cigarettes or other forms of tobacco?			**< 0.01**			0.79
Never used	151/209(72)	74/157(47)		130/215(61)	97/152(64)	
Occasional use in the past	39/209(19)	45/157(29)		51/215(24)	33/152(22)	
Regular use in the past	8/209(4)	9/157 (6)		12/215(6)	5/152(3)	
Occasional use currently	8/209(4)	26/157(17)		18/215(8)	15/152(10)	
Regular use currently	3/209(1)	3/157(2)		4/215(2)	2/152(1)	
Have you ever drunk alcohol?			**< 0.01**			0.06
Never	19/209(9)	12/157(8)		25/215(12)	5/152(3)	
Less than once a month	50/209(24)	12/157(8)		34/215(16)	29/152(19)	
Once a month	44/209(21)	29/157(18)		39/215(18)	35/152(23)	
Once a week	61/209(29)	60/157(38)		75/215(35)	46/152(30)	
Several times a week	34/209(16)	43/157(27)		41/215(19)	36/152(24)	
Daily	1/209(1)	1/157(1)		1/215(<1)	1/152(1)	
Have you ever used cannabis?			**0.01**			**< 0.01**
Never	126/208(61)	75/157(48)		131/214(61)	71/152(47)	
Occasional use in the past	63/208(30)	47/157(30)		61/214(29)	49/152(32)	
Regular use in the past	4/208(2)	11/157(7)		10/214(5)	5/152(3)	
Occasional use currently	12/208(6)	21/157(13)		11/214(5)	22/152(14)	
Regular use currently	3/208(1)	3/157(2)		1/214(1)	5/152(3)	
Do you vape?			**0.03**			0.07
Never	107/209(51)	65/157(41)		103/215(48)	71/152(47)	
Occasional use in the past	67/209(32)	44/157 (28)		64/215(30)	46/152(30)	
Regular use in the past	10/209(5)	17/157 (11)		21/215(10)	6/152(4)	
Occasional use currently	16/209(8)	18/157 (12)		19/215(9)	15/152(10)	
Regular use currently	9/209(4)	13/157 (8)		8/215(3)	14/152(9)	
If you vape currently, how often do you vape?			**0.90**			0.81
Less than once a month	0/25(0)	1/31(3)		1/27(3)	0/29(0)	
Once a month	3/25(12)	4/31(13)		4/27(15)	3/29(10)	
Once a week	8/25(32)	8/31(26)		8/27(30)	8/29(28)	
Several times a week	5/25(20)	7/31(23)		5/27(19)	7/29(24)	
Daily	9/25(36)	11/31(35)		9/27(33)	11/29(38)	

Demographics and substance use history by area of study and university location. US: United States of America; UK: United Kingdom; IQ: interquartile.

and studying pharmacy (57%). Among non-pharmacy participants, 40% were enrolled in other healthcare-related disciplines. Some students did not answer every question, and several questions were displayed only if a particular response was provided to a previous question, resulting in different numbers of responses for some questions. Table I provides additional details.

Vape Use

Just over half the participants (53%; n = 194/368) reported ever vaping in their life, though of the 194 vape ever-users, 71% (n = 138/194), had used them in the past but do not currently. In total, 15% (n = 56/368) of the complete survey sample reported they were currently vaping. Of the 56 who currently vaped, vaping frequency was reported as: less than once a month (2%); once a month (13%); once a week (29%); several times a week (21%); and daily (36%). In contrast 38% (n = 141/368) of all participants reported having ever used tobacco but only 11% were current users (n = 39/368). Among those that currently vaped, 13% (n = 7/56) reported using vapes for smoking cessation.

Vape use differed significantly for pharmacy and non-pharmacy students (p = 0.03); pharmacy students reported never (51%), occasional use in the past but no current use (32%), regular use in the past but no current

Tab. II. Motivations to vape or abstain from vaping.

Motivations regarding vaping or abstaining	Pharmacy n(%)	Non-pharmacy n(%)	P-value	UK n(%)	US n(%)	P-value
Motivations for vaping among those who vape currently						
Positive image	0/25(0)	3/31(10)	0.25	1/27(4)	2/29(7)	1.00
Peer pressure	3/25(12)	3/31(10)	1.00	2/27(7)	4/29(14)	0.67
Pleasurable feelings / "buzz"	19/25(76)	21/31(68)	0.50	19/27(70)	21/29(72)	0.87
Relaxation / stress relief	17/25(68)	14/31(45)	0.09	18/27(67)	13/29(45)	0.10
Nice taste	7/25(28)	14/31(45)	0.19	12/27(44)	9/29(31)	0.30
To help quit smoking	2/25(8)	5/31(16)	0.44	3/27(11)	4/29(14)	1.00
Perceived motivations why others vape among those who do not vape currently						
Positive image	104/182(57)	63/126(50)	0.22	103/186(55)	64/123(52)	0.56
Peer pressure	122/182(67)	83/126(66)	0.83	135/186(73)	70/123(57)	**0.01**
Pleasurable feelings / "buzz"	112/182(62)	75/126(60)	0.72	98/186(53)	89/123(72)	**<0.01**
Relaxation / stress relief	124/182(68)	67/126(53)	**0.01**	105/186(56)	86/123(70)	**0.02**
Nice taste	69/182(38)	53/126(42)	0.46	81/186(44)	40/123(33)	0.05
To help quit smoking	81/182(45)	59/126(47)	0.69	93/186(50)	47/123(38)	**0.04**
Motivations for abstaining from vaping among those who do not vape currently						
Negative image	57/182(31)	47/126(37)	0.28	62/186(33)	43/123(35)	0.77
Peer pressure not to vape	7/182(4)	5/126(4)	1.00	6/186(3)	6/123(5)	0.55
Bad smell or taste	45/182(25)	27/126(21)	0.50	45/186(24)	28/123(23)	0.77
Cost	79/182(43)	52/126(41)	0.71	86/186(46)	45/123(37)	0.11
Health consequences	169/182(93)	103/126(82)	**<0.01**	169/186(91)	105/123(85)	0.14
Risk of addiction	129/182(71)	70/126(56)	**0.01**	124/186(67)	76/123(62)	0.38
Not interested in vaping	127/182(70)	79/126(63)	0.19	122/186(66)	85/123(69)	0.52

Motivations and deterrents to use by area of study and university location; students who currently vape were asked about their personal motivations while students who did not vape were asked about what they perceived to be the motivations for others to vape and were also asked what motivated them to abstain from vaping. US: United States of America; UK: United Kingdom.

use (5%), current use occasionally (8%), and current use regularly (4%), while non-pharmacy students reported never (41%), occasional use in the past but no current use (28%), regular use in the past but no current use (11%), current use occasionally (12%) and current use regularly (8%).

Vape use between UK and US students surveyed did not differ significantly (p = 0.07); UK students reported never (48%), occasional use in the past but no current use (30%), regular use in the past but no current use (10%), current use occasionally (9%) and current use regularly (3%), while US students reported never (47%), occasional use in the past but no current use (30%), regular use in the past but no current use (4%), current use occasionally (10%) and current use regularly (9%).

Vaping frequency did not differ significantly based on degree or location.

Motivations for Use

The most commonly cited motivations for use among current vape users was pleasurable feelings (*e.g.,* "get a buzz") followed by relaxation/stress relief, and nice taste. Among non-vape users, the perceived motivations contained much more varied responses, with little difference in response rates among answer choices. Pharmacy students were significantly more likely to cite health consequences (93% *vs.* 82%; p < 0.01) and addiction risk (71% *vs.* 56%; p = 0.01) as deterrents than non-pharmacy students, respectively. There were no differences between UK and US students with regards to motivations for abstaining from vapes. See Table II for additional information.

Perceived Harms

Pharmacy and non-pharmacy students demonstrated significant differences regarding their perceived risk of vaping-related harm. Pharmacy students were more likely than non-pharmacy students to believe that: vapes contain cancer-causing chemicals (83% vs 73%, p = 0.05); exhaled vapor can negatively affect the health of other people (65% vs 53%, p = 0.02); and that vaping should be banned in public places (66% vs 55%, p < 0.01). Both groups expressed similar views regarding the relative risk of vapes versus traditional cigarettes, with the most common response in both groups being that vapes are 'slightly less harmful'. However, more pharmacy students believed that vapes are equally or more addictive than traditional cigarettes (88% vs 78% p < 0.01), and less pharmacy students believed that vaping is an effective method to help someone quit smoking traditional cigarettes (21% vs 35%, p = 0.01).

There were again, few significant differences between US and UK students with regards to perceived harms. However, significantly fewer US students believed

Tab. III. Perceived harms and addiction potential of vaping and perceived efficacy as a smoking cessation tool.

Item	Answer	Pharmacy n (%)	Non-pharmacy n (%)	P - value	UK n (%)	USA n (%)	P -value
Do vapes contain cancer-causing ingredients?	Yes	173/208(83)	115/157(73)	**0.05**	166/214(78)	123/152(81)	0.1
	No	6/208(3)	11/157(7)		7/214(3)	10/152(7)	
	Unsure	29/208(14)	31/157(20)		41/214(19)	19/152(13)	
Does exhaled vapor from a vape negatively affect the health of other people?	Yes	135/208(65)	83/157(53)	**0.02**	133/214(62)	85/152(56)	0.48
	No	21/208(10)	31/157(20)		29/214(14)	23/152(15)	
	Unsure	52/208(25)	43/157(27)		52/214(24)	44/152(29)	
Is vaping an effective method to help someone quit smoking traditional cigarettes?	Yes	44/205(21)	55/156(35)	**0.01**	70/210(33)	29/152(19)	**<0.01**
	No	101/205(49)	67/156(43)		75/210(36)	93/152(61)	
	Unsure	60/205(29)	34/156(22)		65/210(31)	30/152(20)	
Should vaping be banned in public places similarly to traditional cigarettes?	Yes	135/206(66)	86/156(55)	**<0.01**	144/211(68)	78/152(51)	**<0.01**
	No	26/206(13)	43/156(28)		31/211(15)	38/152(25)	
	Unsure	45/206(22)	27156(17)		36/211(17)	36/152(24)	
Do you believe vapes are more or less harmful than traditional cigarettes?	Much less harmful	11/208(5)	9/157(6)	0.70	12/214(6)	8/152(5)	0.49
	Slightly less harmful	97/20847(47)	66/157(42)		102/214(48)	63/152(41)	
	Equally harmful	67/208(32)	48/157(31)		67/214(31)	48/152(32)	
	Slightly more harmful	24/208(12)	24/157(15)		25/214(12)	22/152(14)	
	Much more harmful	9/208(4)	10/157(6)		8/214(4)	11/152(7)	
How easy do you think it would be to quit using vapes compared to traditional cigarettes?	Much less difficult	2/206(1)	12/157(8)	**<0.01**	5/213(2)	9/152(6)	0.17
	Slightly less difficult	44/206(21)	28/157(18)		49/213(23)	23/152(15)	
	Equally easy	78/206(38)	44/157(28)		73/213(34)	50/152(33)	
	Slightly more difficult	62/206(30)	48/157(31)		61/213(29)	50/152(33)	
	Much more difficult	20/206(10)	25/157(16)		25/213(12)	20/152(13)	
How addictive do you think vapes are compared to traditional cigarettes?	Much less addictive	2/207(1)	13/157(8)	**<0.01**	4/213(2)	11/152(7)	0.08
	Slightly less addictive	22/207(11)	21/157(13)		26/213(12)	17/152(11)	
	Equally addictive	106/207(51)	44/157(28)		84/213(39)	67/152(44)	
	Slightly more addictive	46/207(22)	41/157(26)		55/213(26)	31/152(20)	
	Much more addictive	31/207(15)	38/157(24)		44/213(21)	26/152(17)	

Perceptions regarding potential harms associated with vaping and their utility as a smoking cessation methodology by area of study and university location. US: United States of America; UK: United Kingdom

that vaping is an effective method to help someone quit smoking traditional cigarettes (19% *vs.* 33%, respectively, $p < 0.01$) and that vaping should be banned in public places (51% *vs.* 68%, respectively, $p < 0.01$) *vs.* UK students. Table III provides additional information.

Discussion

This study is among the first to compare vape use and perceptions among pharmacy and non-pharmacy students from two universities in different countries. As hypothesized, given pharmacy students' healthcare interest and training, vape use and perceived harms differed significantly between pharmacy and non-pharmacy students. Pharmacy students were less likely to vape and possessed a better understanding of their risks. However, few differences were observed based on which country the students studied in.

Given the important role pharmacists play in patient education, public health, and preventable medicine as the most accessible healthcare providers, and commonly the frontline for patient health questions, it is important that pharmacists are well aware of the potential risks of vaping and able to accurately educate patients on these risks. This will likely become even more important going forward, with vaping rates increasing, and as more states pass legislation granting pharmacists provider status or allowing pharmacists to independently provide prescription-only smoking cessation medications [14]. Thus, it was encouraging that pharmacy students were less likely to vape and significantly more likely to cite health consequences and addiction risk as deterrents to vaping than their non-pharmacy student counterparts. It's

possible this difference may have been more pronounced if not for the relatively high percentage of healthcare students in the non-pharmacy control group (40%), as these students may have also received education regarding vaping-related health concerns. Among the 31 non-pharmacy students who reported current vaping, 77% were in non-healthcare related courses and 23% were in other healthcare related courses. In the present study, pharmacy students also reported less use of traditional cigarettes or tobacco, cannabis, or alcohol as well, potentially indicating that their pharmacy interest or training confers them greater appreciation of the risks of substance use. However, despite the rates being lower than non-pharmacy students, it was still disconcerting that nearly half of all pharmacy students reported having vaped, with 12% reporting current vape use. Several recent papers have identified gaps in student pharmacists' knowledge regarding vaping versus traditional cigarettes and have called for increased education and a standardized vaping cessation curriculum across pharmacy schools [15-19]. Specifically, the pharmacy curriculum of both universities surveyed in the present study did include vaping related content prior to this study being conducted, though this may not be the case for all pharmacy schools. It is unclear if these results would be generalizable to schools that do not specifically address vaping within their curriculum.

There are limited studies regarding pharmacy student vaping to compare to the rates identified in the present study (49% ever use; 12% current use), and most are older studies that may not accurately reflect the present state. Two studies previously compared US pharmacy students to students from other health profession schools in the same university; a 2020 survey found pharmacy students were less likely to currently vape (6%) than other healthcare students (19%, $p < 0.001$) [13], while a 2014 survey found the rate of pharmacy students ever vaping (22%) was similar to the total sample of health profession students (23%) [12]. Outside of the US, a 2020 survey of male students from several Saudi Arabian health colleges found that 34.5% of pharmacy students had ever vaped, a numerically lower rate than medical (47.4%) and dental (40.7%) students, but not nursing students (32%) [20]. And among Serbian pharmacy students surveyed in 2016, only 9.9% reported ever vaping, though a much higher proportion (47%) reported ever smoking traditional cigarettes [21]. This rate of smoking traditional cigarettes was much higher than reported by pharmacy students in the present study (28%), likely indicative of cultural differences, as Serbia has one of the highest tobacco use rates worldwide [22]. Each of these previous studies identified lower pharmacy student vaping rates than the present study. Reasons for these differences are likely multifactorial, but may include increased vaping prevalence, vape acceptance, and vape accessibility over the past several years, cultural differences between the locations the studies took place, inclusion of only male students in one study, and different study designs and recruitment methods.

To the authors' knowledge, the present study was the first to simultaneously survey pharmacy students from multiple countries regarding vape use, identifying no difference between the US and UK students surveyed. The present study also identified similar responses regarding vaping-related risks between students from the two countries, seemingly indicating that vape use and perceptions may not greatly differ among the two student groups surveyed. While these two student groups should not be extrapolated to represent all students in the US or UK, the congruence observed in these two samples could be due to the greater cultural similarities between the US and UK *vs.* Serbia and Saudi Arabia, and the fact that these students were surveyed simultaneously using the same questionnaire.

However, in the present study, one interesting difference that did emerge between the students from the two universities, was that a significantly higher proportion of US students (61%) believed that vaping was not an effective method to help someone quit smoking traditional cigarettes compared to UK students (36%). This could be indicative of the UK's greater acceptance of vaping as a harm reduction method for those who use tobacco. Recently, the UK introduced the first national governmental program to distribute vaping kits as a tobacco cessation tool in an effort to reduce smoking rates in the country [23]. This was predicated on Public Health England's assertion that vaping is 95% less harmful than smoking traditional cigarettes, though some have questioned whether vaping truly produces that level of harm reduction [24-26]. Recent evidence does support vaping as a potentially efficacious tool to help people quit smoking, though it also indicates that many of these patients often continue vaping, potentially trading one harmful habit for another [27, 28]. Additionally, opponents worry that increased vape use, particularly in adolescents and young adults, may represent a gateway to future tobacco use [6]. Thus, whether or not vapes should be recommended as a smoking cessation tool remains unclear at this time, so it was not surprising that many students in the present study indicated they were unsure.

However, it is important that students realize that, while vapes may be less harmful than traditional cigarettes, they are not devoid of risks. A recent meta-analysis found that vaping significantly reduced respiratory disease risk but not cardiovascular disease risk and found that dual use (e.g., concurrently vaping and smoking traditional cigarettes) significantly increased patient harms [8]. The majority of students in the present study agreed that vapes were slightly less harmful than traditional cigarettes, and pharmacy students were less likely to support vaping as a smoking cessation tool than non-pharmacy students. Additionally, significantly more pharmacy students expressed concern regarding their carcinogenic effects and the negative impact of their vapor on others' health, as well as greater advocacy for public vaping bans. This ultimately suggests that, within this sample, pharmacy students had more negative attitudes towards vaping than non-pharmacy students. Sahr and colleagues similarly found pharmacy students to have a more negative

perception surrounding vapes than other health care students and that pharmacy students were less likely to agree that vapes are an effective method to help someone quit smoking traditional cigarettes than non-pharmacy students [13].

Limitations

The authors acknowledge several limitations of this study. First, survey respondents were recruited from two schools in the US and UK and may not be generalizable to all students in these countries or students of other universities or locations. Furthermore, the study was limited to current university students between the ages of 18-30 years, so results are not generalizable to individuals of similar ages who are not enrolled in a university or those from different age groups. Demographics collected were limited, and thus it is unclear how factors such as ethnicity or religion may have influenced trends in vape usage and perceptions. Other demographic factors that could have impacted the results but were not collected include the year of school the students were enrolled in and the specific program the non-pharmacy health care students were studying. Furthermore, given the many vape options on the market, additional information may be needed to identify nuances in vaping habits. For example, the survey did not identify what substances the students were vaping (*e.g.,* nicotine, flavored non-nicotine, or cannabis) which could affect the extent of harm and addiction risk students perceive. Lastly, because the investigators did not have a means of contacting all students outside of the pharmacy program, a different method was used to recruit non-pharmacy participants, which could have introduced selection bias into the control sample (*e.g.,* a fairly high proportion of the non-pharmacy students were studying other healthcare disciplines). However, despite these limitations, to the authors' knowledge, this study represents one of the largest studies comparing vaping rates of pharmacy versus non-pharmacy students and students studying at universities in different countries.

Conclusion

Vape use and harm perception significantly differed between the pharmacy and non-pharmacy university students surveyed, with pharmacy students less likely to vape and exhibiting heightened awareness of the associated risks than non-pharmacy students. However, few differences were observed between UK and US students in this sample.

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Conflicts of interest statement

The authors have no conflicts of interest to disclose.

Authors' contributions

SM: conceived and designed study; collected data; wrote first draft of manuscript. HO: performed analysis; revised manuscript. CF: performed analysis; revised manuscript. KE: conceived and designed study; collected data; wrote first draft of manuscript.

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