

Media Search Frequency, Source Credibility About e-Cigarette Health Information, and Motivation to Quit EC Among University Students in Chengdu, China

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Purpose: E-cigarettes (ECs) are gaining popularity among young people. This study aimed to assess university student vapers' search frequency and source credibility of commonly used media in China, and their association with daily EC users' motivation to quit EC use.

Participants and Methods: This was a cross-sectional study involving an online quantitative survey in six universities in Chengdu, China. Participants answered questions on their EC use patterns, motivation to quit EC, use frequency and source credibility of media use. Hierarchical linear regression analyses were performed to determine the association between media search frequency and source credibility concerning EC health information with the motivation to quit EC.

Results: There were a total of 325 participants (Mean age = 20.43, SD = 1.333). Video platforms and social media were ranked frequently used by the participants and were deemed to be more trustworthy. Perceived trustworthiness of online media was the most influential predictor of motivation to quit EC. Those who reported a higher frequency of accessing video platforms and medical health applications recorded higher motivation to quit EC use. Source credibility of news portals were associated higher motivation to quit EC. The association between higher nicotine dependence and lower motivation to quit EC was attenuated when media source credibility and trustworthiness of online media were added into the fully adjusted regression models.

Conclusion: There is an association between media use frequency and source credibility to search for EC health information and motivation to quit vaping. More studies could be conducted to examine the effects of media use content on perceptions towards vaping and their motivation to quit vaping.

Keywords: vaping, media search, health information, motivation to quit, college students

Introduction

The use of electronic cigarettes (EC) is a controversial public health topic due to their increasing popularity among youth and the uncertainty about their risks and benefits. In May 2019, a survey by the Chinese Center for Disease Control and Prevention showed that the main group of consumers who consume electronic cigarettes in China are young people. The highest usage rate was in the 15–24 age group, nearly half of the ECs being obtained through the Internet. It has increased by four times in three years (2016–2019).¹ Over 70% of teenagers believe that EC is safer than traditional

cigarettes.¹ In the US, in August 2018, the State Tobacco Monopoly Administration and the State Administration for Market Regulation issued a notice prohibiting the sale of EC to minors, ie, those who are less than 18 years old. EC advertisements are prohibited in China, where the government believes that EC are harmful and that they should discourage minors from consuming ECs.²

Studies have shown that disseminated media information on EC tended to be advertisements by EC providers, and they influenced EC use decisions.² With the democratization of information in recent years, individuals may actively interact with the media to look for preferred information, rather than being passive consumers of those information.³ The mixed messages concerning EC's benefits and harm may have prompted young people to pay attention to or search for information on EC health-related information through various media platforms, particularly the Internet.

In assessing the views and attitudes of EC use, a study is required to elaborate on the factors associated with these attitudes. Trustworthiness of media source regarding online EC information may be one of these factors. Source credibility is conceptually defined as both the "expertise" and the "trustworthiness" of a person or an organization that sends a message and is an essential element in the development of information processes.⁴ High source credibility frequently serves as a reference for processing information, allowing attitudes to be aligned with message content, particularly in the age where there is a proliferation of fake information and contrasting messages.⁵ However, research that examines the views of the creditworthiness of EC information from various media channels is lacking. A systematic study showed that trust in health messages about EC harm tended to lead to lower intention to initiate EC use with nicotine.⁶ The study also found that the most trusted sources were health providers and government agencies, and lower credibility was associated with EC providers.⁶ In young adults, a study observed that higher source credibility increased EC harm perceptions when the message came from an expert.⁷ One study, however, showed that among those who had used EC, government agencies were less trusted when conveying health information on EC use.⁸

Research is required to evaluate perceptions of various sources to identify which sources may most effectively convey EC health messages based on perceptions of their credibility, which in turn may influence their intentions on EC use behaviors. This observation is especially true considering that messages and information disseminated through media vary from country to country. In China, the "Healthy Media 2030" initiative has been active since 2016 to popularize health literacy through various media to improve health literacy.⁹ The influence of government-based policies may be stronger in Chinese media compared to Western media, in both traditional media (such as newspapers and radio broadcasts) and "new media" (ie, social media and online video platforms).^{9,10}

In general, the Chinese government has been active in regulating media activities concerning EC, such as notices by the State Tobacco Monopoly Administration (STMA) and the State Administration for Market Regulation (SAMR) to stop and withdraw Internet-based EC advertisements.¹¹ A study exploring the content of Chinese media on health communication regarding EC reported that most of the communication tended to be prohibitive of EC use, such as protecting minors from using EC due to their harm, regulations and control that governed EC production and sale in China, and health effects of EC use.¹² According to the authors, these negative health effects included the creation of toxic vapor, EC being more harmful than tobacco cigarettes, higher risk of illness, and EC's addictiveness.¹² In newspapers, a content analysis indicated that the focus on the negative health impacts of EC use was salient.¹³ With the exception of the relative health impacts of EC compared to tobacco cigarettes, taste, and economic prospect,¹⁴ the framing of EC use was predominantly negative in Chinese media, and this was attributed to the pivotal influence of Chinese policymakers.¹⁵

The media coverage and proliferation of health information on EC use play an important role in determining EC use behaviors. Nevertheless, this topic is understudied in China. This is especially important since university students actively engage with media to obtain information. Therefore, the aims of this study was to investigate the characteristics of media use frequency to access EC health information, credibility perception of media sources on EC information, and trustworthiness of online health information on EC use among ever users of EC, and (2) to examine the associations between media search frequency and media source credibility about EC health information and the motivation to quit EC among daily users of EC. We tested these associations while taking into account the relative influences of socio-demographic factors, hours spent on the internet, and EC and tobacco use factors such as positive perceptions of EC use and the level of nicotine addiction.

Materials and Methods

Study Design, Setting, and Participants

This study used results from a mobile app-based survey conducted between March and April 2023. A total of six universities in Chengdu, China, participated in this study.

The minimum sample size was estimated using G*Power software, version 3.1.9.2. Using the linear multiple regression: Fixed model, R² deviation from zero statistical test, assuming a medium effect size, alpha error probability of 0.05, power of 0.95, and 17 predictors, a total of 208 participants would be adequate for this study.

This research applied purposive sampling using a set of inclusion and exclusion criteria. The inclusion criteria are university students aged 18 to 25 years old, who had ever used EC, and who could read Chinese language. An online survey was disseminated to six participating universities in Chengdu, China, through snowball sampling. The researchers approached university lecturers to disseminate the survey to their students, and encouraged the students themselves to disseminate it to their peers. The inclusion and exclusion criteria were stated in the Participant Information Sheet to ensure only those who fulfilled them participated. Those who did not provide informed consent were excluded.

Upon providing informed consent, participants were provided with an online questionnaire to be filled out. The questionnaire would take 20 minutes to complete. The participants were required to fill in the consent form before answering the survey. The respondents were duly informed that participation in the study was voluntary, and that personal identities would remain anonymous. They were also informed that a response to a question was neither “right” nor “wrong”. As the questionnaire was administered online, we could not ascertain the response rate.

Study Instrument

This study adopted a structured, closed-ended, self-administered online questionnaire in Chinese. The questionnaire was pilot tested among 30 EC users who were not included in the analysis. The purpose of pilot testing the questionnaire was to obtain feedback on the wording of the questions and check if there were irregularities in responses to the questionnaire. Feedback from these EC users during the pilot study helped to rephrase the wording of some questionnaire items.

In the main study, the following questions were asked:

Sociodemographic information:¹⁶ The information collected included age, sex, ethnicity, level of education, and monthly family household income. EC users' profile:¹⁷ The objective of this section of the questionnaire was to obtain information on the use of EC and tobacco cigarettes. The questions included the age of first starting using EC, whether they used EC every day (daily user), whether they had ever used tobacco cigarettes, and whether they were currently a dual user of EC and tobacco cigarettes. A question on total hours of all media use was asked.

The Hooked-on Nicotine Checklist (HONC):¹⁸ The HONC is a 10-item instrument used to determine the onset and strength of tobacco or EC dependence. The scores could range from 0 to 10, with higher scores indicating higher levels of being hooked on nicotine. The higher the score, a higher nicotine addiction level was indicated. When the score is greater than 6, it is generally considered that the smoker is highly dependent on nicotine, the possibility of relapse in the process of quitting smoking is high, and the withdrawal symptoms will be more obvious. This is defined by the authors as occurring when the sequelae of tobacco use, either physical or psychological, present a barrier to quitting. This questionnaire was translated to the Chinese language by Huang et al.¹⁹ A sample item of this scale was “Have you ever tried to quit, but couldn't?” Participants rated each item on a two-point scale (1=Yes and 0=No) for which Cronbach's alpha was 0.83 in the original Chinese validated questionnaire,¹⁹ and 0.82 in this study. (Note: Cronbach's alpha is a way of assessing reliability by comparing the amount of shared variance, or covariance, among the items making up an instrument to the amount of overall variance.)

Motivation to quit EC:¹⁷ The purpose of this questionnaire is to measure the motivation to quit EC, and the reasons for doing so. It consisted of 30 questions on reasons to quit EC use. Participants answered each item on a five-point Likert scale ranging from “Strongly Disagree” (score of 1) to “Strongly Agree” (score of 5). A sample item was “For the sake of good health, I will strictly implement the e-cigarette cessation plan I have formulated.” Higher scores denoted

higher motivation to quit EC use. The questionnaire for EC use was back-translated into the Chinese language by language and subject-matter experts. The Cronbach's alpha of the scale score in this study was 0.79.

Source of EC health information and credibility of media sources:²⁰ The EC information-seeking and source credibility questionnaire measured EC information-seeking frequency from seven sources (newspaper or magazine, radio, TV, online news portal, social media, video platform, and medical health applications; 7 items) and source credibility of seven aforementioned media containing EC health information (7 items). Participants answered 14 items on a five-point Likert scale. A sample item of the source of EC health information subscale was "Frequency of accessing channels for EC health information: Newspaper or magazine", to which the participants answered on a five-point scale, from "Never" (score 1) to "Always" (score 5). A higher score denoted a higher frequency of accessing the particular media source of EC health information. A sample item of the credibility of media sources was, "The credibility of media sources: Newspaper or magazine" to which participants answered on a five-point Likert scale ranging from "Very trustworthy" (score 1) to "Very untrustworthy" (score 5). A higher total score denotes a lower source credibility of online health information about EC.

Trustworthiness of online health information on EC use.²⁰ This questionnaire was originally used to measure trustworthiness of online health information on HIV/AIDs, and was adapted to measure trustworthiness of online health information on EC use. The questionnaire consists of 10 items, where participants answered on a 5-point Likert scale ranging from "Strongly disagree" (score 1) to "Strongly agree" (score 5). A sample item was "I think the health information I retrieved on the internet about EC is trustworthy." The higher the score, the higher the trustworthiness perception of online health information on EC use. This questionnaire achieved a Cronbach's alpha of more than 0.80 in the original scale, and was 0.97 in this study.

The questions, "EC feels healthier than smoking" and "EC helps cut down tobacco use" were asked to measure the positive perception of EC use, to which the participant answered "Yes" (score of 1) or "No" (score of 0).²¹ All the questionnaires used in this study has been validated by the original authors in Chinese, except for the motivation to quit EC and positive perception of EC use, which were translated by the authors of this study.²⁰

Statistical Methods

Descriptive statistics were used to analyze the frequency, percentages, means, and standard deviations of the demographic and media use information among all participants of the study (ie, ever users of EC). Hierarchical linear regressions were used to determine, among daily users of EC, the influence of media use frequency to access EC health information, credibility of various media health information, and trustworthiness of online health information on EC use as the predictors and motivation to quit EC use as the dependent. The Statistical Package for Social Sciences (SPSS V.27; SPSS Inc., Chicago, IL) was employed for the analyses. P-value of <0.05, two-tailed was considered significant. Missing data were deleted listwise.

Ethical Considerations

The study was performed in accordance with institutional ethics approval. This study was reviewed by the Ethics Committee of the Institutions and meets the requirements of the Declaration of Helsinki as amended in 2013. Ethical approval was obtained from the Ya'an Polytechnic College (approval number: 0001) and the Research Ethics Committee of Universiti Kebangsaan Malaysia (approval number: UKM/PPI/111/8/JEP-2022-606). All participants provided consent electronically. They were informed about the study and were assured that all data would be stored securely, analyzed on a group level, and treated confidentially, ie, no information regarding the students or universities would be identifiable.

Results

A total of 354 participants responded to the survey. However, due to missing data, a total of 29 participants were excluded from further analysis. The remaining 325 participants recorded an age range of 18 to 25 years old (Mean age = 20.43, SD = 1.333). A large majority of the participants were males (83.7%), of Han ethnicity (89.5%), and were doing their Bachelor's degree (84.6%). More than half (53.2%) reported a monthly family household income of more than RMB10,000 and above. A large majority (93.2%) started EC use at 18 years old and above (median = 20.00, IQR =

2.00). A large majority of them had used tobacco cigarettes (94.4%). About two-thirds were currently dual users of tobacco cigarettes and EC (62.8%) while more than one-third used EC every day (35.7%). A majority felt that EC use was healthier than tobacco smoking (72.9%) and EC use helps to cut down on tobacco use (76.9%). The mean score for the motivation to quit EC was 89.35 (SD = 11.380) and for the HONC was 6.24 (SD = 2.689). Only 7.7% reported media use of more than 8 hours (see Table 1).

Table 1 Demographics and EC Use Characteristics of Study Participants (N = 325)

Characteristic	Frequency (n)	Percentage (%)
Age (in years; mean, SD)	20.43	1.333
Sex		
Male	272	83.7
Female	53	16.3
Ethnicity		
Han	291	89.5
Tibetan	15	4.6
Yi	17	5.2
Others	2	0.6
Level of education		
College	27	8.3
Bachelor's degree	275	84.6
Master's degree and above	23	7.1
Monthly family household income		
<RMB1000 (USD140.89)	4	1.2
RMB1000-4999 (USD140.89-USD704.31)	21	6.5
RMB5000-9999 (USD704.45-USD1408.77)	127	39.1
≥RMB10000 (USD1408.91)	173	53.2
Age first started using EC		
<18	22	6.8
18 and above	303	93.2
Use EC every day		
Yes	116	35.7
No	209	64.3
Ever used tobacco cigarettes		
Yes	310	95.4
No	15	4.6

(Continued)

Table 1 (Continued).

Characteristic	Frequency (n)	Percentage (%)
Current dual user of EC and tobacco cigarettes		
Yes	204	62.8
No	121	37.2
Nicotine dependence (HONC) (Mean, SD)	6.15	2.717
Low	93	28.6
High	217	66.8
Motivation to quit EC among daily EC users (Mean, SD)	89.35	11.380
Positive perception of EC use (answered Yes)		
EC feels healthier than smoking	237	72.9
EC helps to cut down on tobacco	250	76.9
Duration of all media use (hours)		
<8 hours	300	92.3
8 hours and above	25	7.7

Abbreviations: EC, electronic cigarettes; HONC, Hooked on Nicotine Checklist.

In [Table 2](#), the characteristics of media use with regard to accessing EC information through diverse media channels were reported. Video platforms (mean = 3.15, SD = 1.188) and social media (mean = 3.03, SD = 1.126) ranked highest as the most frequently accessed channels for EC health information. Concerning source credibility, video platforms (mean = 3.03, SD = 1.126), social media (mean = 2.95, SD = 1.168), and newspapers or magazines (mean = 2.94, SD = 1.160) ranked first to third in credibility ratings respectively. Perceived trustworthiness of online health information for EC scored a mean of 29.86 (SD = 10.105) (see [Table 2](#)).

[Table 3](#) depicts the hierarchical linear regression of media use frequency to access EC health information and motivation to quit EC use. The change in R^2 values (ie, the coefficient of determination that provides information about the goodness of fit of a model. In the context of regression, it is a statistical measure of how well the regression line approximates the actual data.) was 0.327 from Step 1 to Step 2, and 0.342 from Step 2 to Step 3 of the model, with a total variance of 77.5% explained by the predictors in Step 3 of the model, $F(19, 95) = 17.248, p < 0.001$. Those with household incomes of RMB1000-4999 were significantly less motivated to quit EC use at step 1 to 3 of the model ($B = -24.29, 95\% \text{ CI} [-40.40, -8.18], \beta = -0.20, p = 0.004$ at step 3 of the model) compared to those who earned RMB10000 and above. In Step 2 and 3, those who had higher nicotine dependence were also significantly less motivated to quit EC in Step 3 ($B = -1.28, 95\% \text{ CI} [-2.48, -0.07], \beta = -0.22, p = 0.039$ at step 3). Participants who used 8 hours or more of media were also associated with lower motivation to quit EC in step 2 and 3 ($B = -16.96, 95\% \text{ CI} [-27.60, -6.31], \beta = -0.24, p = 0.002$ at step 3). Those who reported higher frequencies of accessing video platforms ($B = 3.27, 95\% \text{ CI} [1.54, 5.00], \beta = 0.34, p < 0.001$) and medical health applications ($B = 4.15, 95\% \text{ CI} [2.07, 6.22], \beta = 0.41, p < 0.001$) reported a higher motivation to quit EC use (see [Table 3](#)).

[Table 4](#) reports the results of the hierarchical linear regression of credibility of media channels on EC health information and motivation to quit EC use among daily EC users. The change in R^2 values were 0.327 from Step 1 to Step 2, and 0.365 from Step 2 to Step 3 of the model, with a total variance of 79.8% explained by the predictors in Step 3 of the model, $F(20, 290) = 21.476, p < 0.001$. In Step 2 and 3 of the models, those who had higher nicotine dependence were also significantly less motivated to quit EC in step 2 of the model ($B = -2.16, 95\% \text{ CI} [-3.85, -0.48], \beta = -0.37, p =$

Table 2 Frequency of Media Use to Search for EC Information, Source Credibility, and Trustworthiness of Online Health Information About EC Use

Variable	Mean	SD	n (%)				
			Never	Occasionally	Sometimes	Often	Always
Media Use Frequency to Access EC Health Information							
Total score	24.95	7.631	–	–	–	–	–
Newspaper or magazine			56 (17.2)	70 (21.5)	108 (33.2)	61 (18.8)	30 (9.2)
Radio broadcast			62 (19.1)	67 (20.6)	92 (28.3)	69 (21.2)	35 (10.8)
TV			51 (15.7)	72 (22.2)	106 (32.6)	65 (20.0)	31 (9.5)
News portals (eg, Toutiao)			49 (15.1)	69 (21.2)	106 (32.6)	75 (23.1)	26 (8.0)
Social media (eg, WeChat, Weibo)			45 (13.8)	52 (16.0)	106 (32.6)	79 (24.3)	43 (13.2)
Video platforms (eg, Douyin, Youku)			42 (12.9)	39 (12.0)	116 (35.7)	85 (26.2)	43 (13.2)
Medical health applications and websites			55 (16.9)	56 (17.2)	118 (36.3)	65 (20.0)	31 (9.5)
Credibility Perception of Media Sources on EC Information							
	Mean	SD	Very Trustworthy	Trustworthy	Average	Untrustworthy	Very Untrustworthy
Total score	20.52	7.244	–	–	–	–	–
Newspaper or magazine			35 (10.8)	82 (25.2)	119 (36.6)	47 (14.5)	42 (12.9)
Radio broadcast			41 (12.6)	79 (24.3)	120 (36.9)	40 (12.3)	45 (13.8)
TV			39 (12.0)	85 (26.2)	115 (35.4)	43 (13.2)	43 (13.2)
News portals (eg, Toutiao)			42 (12.9)	76 (23.4)	123 (37.8)	37 (11.4)	47 (14.5)
Social media (eg, WeChat, Weibo)			35 (10.8)	79 (24.3)	122 (37.5)	44 (13.5)	45 (13.8)
Video platforms (eg, Douyin, Youku)			22 (6.8)	92 (28.3)	109 (33.5)	59 (18.2)	43 (13.2)
Medical health applications and websites			38 (11.7)	90 (27.7)	114 (35.1)	35 (10.8)	48 (14.8)
Trustworthiness of online health information on EC use	29.86	10.105	–	–	–	–	–

Abbreviations: EC, electronic cigarettes; HONC, Hooked on Nicotine Checklist.

0.013) but became non-significant in Step 3. Those who perceived higher source credibility for news portals ($B = -3.36$, 95% CI $[-5.14, -1.58]$, $\beta = -0.37$, $p < 0.001$) had a higher motivation to quit EC use (see Table 4).

Table 5 illustrates the hierarchical linear regression results of trustworthiness perception of online EC information and motivation to quit EC use among daily EC users. The change in R^2 values was 0.327 from Step 1 to Step 2, and 0.278 from Step 2 to Step 3 of the model, with a total variance of 71.1% explained by the predictors in Step 3 of the model, $F(12, 102) = 20.906$, $p < 0.001$. In Step 3, the trustworthiness perception of online information on EC health information had the greatest influence on the motivation to stop EC use ($B = 0.77$, 95% CI $[0.62, 0.92]$, $\beta = 0.71$, $p < 0.001$), followed by using media for any purpose for 8 hours or more ($B = -20.54$, 95% CI $[-29.07, -12.02]$, $\beta = -0.29$, $p < 0.001$). Nicotine dependence was significant in step 2 of the model ($B = -2.16$, 95% CI $[-3.85, -0.48]$, $\beta = -0.37$, $p = 0.013$), but became non-significant when trustworthiness of online EC information was entered into the model in step 3. (see Table 5).

Discussion

The aim of this paper was to examine the association between media search frequency and source credibility about EC health information with the motivation to quit EC among university students who vaped daily in Chengdu, China, while taking into consideration the relative influence of sociodemographic factors, EC and tobacco use characteristics, and hours spent on the internet. The results primarily found that the influence of media use to search for EC information, source credibility, and trustworthiness of online health information about EC use were medium to large, even after adjusting for the influence of demographic and EC use characteristics. Media use for any purpose of 8 hours or more was associated with a lower motivation to quit vaping. Higher media use frequency of video platforms and medical health applications to look for EC health information, higher source credibility of news portals, and higher perceived trustworthiness of online EC information predicted higher motivation to quit EC. The association between higher

Table 3 Hierarchical Linear Regression of Media Use Frequency to Access EC Health Information and Motivation to Quit EC Use Among Daily EC Users

Variable	Step 1: Demographics					Step 2: EC Use Characteristics					Step 3: Media Use Characteristics				
	B	95% CI		Beta	p	B	95% CI		Beta	p	B	95% CI		Beta	p
		Lower	Upper				Lower	Upper				Lower	Upper		
Age	-2.34	-3.90	-0.79	-0.28	0.004	-1.10	-2.44	0.25	-0.13	0.110	-0.91	-1.81	-0.02	-0.11	0.046
Sex (Male)	1.27	-5.73	8.27	0.01	0.719	-1.49	-7.33	4.36	-0.04	0.615	-2.06	-6.09	1.96	-0.06	0.311
Ethnicity (Han)	-0.85	-7.20	5.51	-0.02	0.792	0.83	-4.46	6.12	0.02	0.756	2.29	-1.32	5.89	0.07	0.211
Household income															
<RMB1000 (US\$140.89)	3.19	-11.23	17.62	0.05	0.662	5.70	-6.75	18.15	0.08	0.366	0.06	-9.48	9.60	0.00	0.990
RMB1000-4999 (USD140.89-USD704.31)	-23.76	-46.09	-1.43	-0.19	0.037	-35.16	-57.65	-12.66	-0.29	0.003	-24.29	-40.40	-8.18	-0.20	0.004
RMB5000-9999 (USD704.45-USD1408.77)	-1.35	-5.68	2.98	-0.06	0.538	0.33	-3.25	3.91	0.01	0.855	0.74	-1.70	3.17	0.03	0.548
≥RMB10000 [†] (US\$1408.91)	0.00														
Dual user (Yes)						-2.24	-6.36	1.88	-0.09	0.283	-1.69	-4.44	1.05	-0.06	0.224
Nicotine dependence (HONC)						-2.16	-3.85	-0.48	-0.37	0.013	-1.28	-2.48	-0.07	-0.22	0.039
EC feels healthier than tobacco (Yes)						-4.44	-12.86	3.99	-0.14	0.299	-1.64	-7.36	4.08	-0.05	0.571
EC helped cut down tobacco (Yes)						-2.82	-9.34	3.70	-0.08	0.393	4.21	-0.27	8.68	0.13	0.065
Media use for any purpose (≥8 hours)						-17.16	-29.00	-5.31	-0.24	0.005	-16.96	-27.60	-6.31	-0.24	0.002
Frequency accessing media channels for EC health information															
Newspaper or magazine											-0.24	-1.69	1.21	-0.02	0.742
Radio broadcast											-0.12	-2.02	1.78	-0.01	0.901
TV											0.04	-1.84	1.92	0.00	0.966
News portals											0.10	-1.83	2.02	0.01	0.923
Social media											-1.02	-2.97	0.93	-0.10	0.302
Video platforms											3.27	1.54	5.00	0.34	<0.001
Medical health apps											4.15	2.07	6.22	0.41	<0.001
Constant	137.85	104.75	170.95		<0.001	136.11	107.53	164.68		<0.001	94.55	73.51	115.59		<0.001
R ² , adjusted R ²	0.106, 0.057					0.433, 0.373					0.775, 0.730				
F statistics	F (6, 108) = 2.145, p=0.054					F (11, 103) = 7.154, p<0.001					F (19, 95) = 17.248, p<0.001				
Δ R ²	0.106, p=0.054					0.327, p<0.001					0.342, p<0.001				

Notes: [†]Reference group. B refers to the unstandardized coefficient. B or beta refers to the standardized coefficient.

Abbreviations: EC, electronic cigarettes; HONC, Hooked on Nicotine Checklist.

Table 4 Hierarchical Linear Regression of Credibility of Media Channels on EC Information and Motivation to Quit EC Use Among Daily EC Users

Variable	Step 1: Demographics					Step 2: EC Use Characteristics					Step 3: Media Use Characteristics				
	B	95% CI		Beta	p	B	95% CI		Beta	p	B	95% CI		Beta	p
		Lower	Upper				Lower	Upper				Lower	Upper		
Age	-2.34	-3.90	-0.79	-0.28	0.004	-1.10	-2.44	0.25	-0.13	0.110	-1.00	-1.88	-0.12	-0.12	0.026
Sex (Male)	1.27	-5.73	8.27	0.04	0.719	-1.49	-7.33	4.36	-0.04	0.615	0.04	-3.68	3.77	0.00	0.982
Ethnicity (Han)	-0.85	-7.20	5.51	-0.02	0.792	0.83	-4.46	6.12	0.02	0.756	1.69	-1.82	5.20	0.05	0.342
Household income															
<RMB1000 (US\$140.89)	3.20	-11.23	17.62	0.05	0.662	5.70	-6.75	18.15	0.08	0.366	4.42	-3.66	12.49	0.06	0.280
RMB1000-4999 (USD140.89-USD704.31)	-23.77	-46.09	-1.43	-0.19	0.037	-35.16	-57.65	-12.66	-0.29	0.003	-13.75	-28.17	0.66	-0.11	0.061
RMB5000-9999 (USD704.45-USD1408.77)	-1.35	-5.68	2.98	-0.06	0.538	0.33	-3.25	3.91	0.01	0.855	-0.12	-2.38	2.13	-0.01	0.913
≥RMB10000 [†] (US\$1408.91)															
Dual user (Yes)						-2.24	-6.36	1.88	-0.09	0.283	-0.61	-3.25	2.03	-0.02	0.648
Nicotine dependence (HONC)						-2.16	-3.85	-0.48	-0.37	0.013	-1.05	-2.13	0.03	-0.18	0.057
EC feels healthier than tobacco (Yes)						-4.44	-12.86	3.99	-0.14	0.299	1.01	-4.41	6.43	0.03	0.712
EC helps cut down tobacco (Yes)						-2.82	-9.34	3.70	-0.08	0.393	1.91	-2.29	6.11	0.06	0.369
Media use for any purpose (≥ 8 hours)						-17.16	-29.00	-5.31	-0.24	0.005	-17.71	-25.68	-9.74	-0.25	<0.001
Credibility of media channels for EC health information															
Newspaper or magazine											-0.704	-2.53	1.12	-0.07	0.445
Radio broadcast											-1.564	-3.38	0.25	-0.17	0.090
TV											-1.470	-3.10	0.16	-0.16	0.077
News portals											-3.359	-5.14	-1.58	-0.37	<0.001
Social media											-1.048	-2.84	0.75	-0.11	0.250
Video platforms											-0.264	-1.97	1.44	-0.03	0.759
Medical health apps											0.604	-1.11	2.32	0.07	0.486
Constant	137.85	104.75	170.95		<0.001	136.11	107.54	164.69		<0.001	137.72	119.17	156.27		<0.001
R ² , adjusted R ²	0.106, 0.057					0.433, 0.373					0.798, 0.760				
F statistics	F (6, 304) = 5.122, p<0.001					F (12, 298) = 14.041, p<0.001					F (20, 290) = 21.476, p<0.001				
Δ R ²	0.106, p<0.001					0.327, p<0.001					0.365, p<0.001				

Notes: [†]Reference group. B refers to the unstandardized coefficient. B or beta refers to the standardized coefficient.

Abbreviations: EC, electronic cigarettes; HONC, Hooked on Nicotine Checklist.

Table 5 Hierarchical Linear Regression of Trustworthiness Perception of Online EC Information and Motivation to Quit EC Use Among Daily EC Users

Variable	Step 1: Demographics					Step 2: EC Use Characteristics					Step 3: Media Use Characteristics				
	B	95% CI		Beta	p	B	95% CI		Beta	p	B	95% CI		Beta	p
		Lower	Upper				Lower	Upper				Lower	Upper		
Age	-2.34	-3.90	-0.79	-0.28	0.004	-1.10	-2.44	0.25	-0.13	0.110	-0.95	-1.92	0.02	-0.11	0.054
Sex (Male)	1.27	-5.73	8.27	0.04	0.719	-1.49	-7.33	4.36	-0.04	0.615	-2.43	-6.63	1.77	-0.07	0.253
Ethnicity (Han)	-0.85	-7.20	5.51	-0.02	0.792	0.83	-4.46	6.12	0.02	0.756	1.92	-1.89	5.72	0.06	0.320
Household income															
<RMB1000 (US\$140.89)	3.19	-11.23	17.62	0.05	0.662	5.70	-6.75	18.15	0.08	0.366	1.44	-7.54	10.41	0.02	0.752
RMB1000-4999 (USD140.89-USD704.31)	-23.76	-46.09	-1.43	-0.19	0.037	-35.16	-57.65	-12.66	-0.29	0.003	-9.55	-26.49	7.40	-0.08	0.266
RMB5000-9999 (USD704.45-USD1408.77)	-1.35	-5.68	2.98	-0.06	0.538	0.33	-3.25	3.91	0.01	0.855	-0.15	-2.71	2.42	-0.01	0.910
≥RMB10000 [†] (US\$1408.91)															
Dual user (Yes)						-2.24	-6.36	1.88	-0.09	0.283	-1.32	-4.29	1.64	-0.05	0.377
Nicotine dependence (HONC)						-2.16	-3.85	-0.48	-0.37	0.013	-0.52	-1.78	0.73	-0.09	0.411
EC feels healthier than tobacco (Yes)						-4.44	-12.86	3.99	-0.14	0.299	-1.02	-7.11	5.06	-0.03	0.739
EC helps to quit tobacco (Yes)						-2.82	-9.34	3.70	-0.08	0.393	1.42	-3.33	6.18	0.04	0.554
Media use for any purpose (≥ 8 hours)						-17.16	-29.00	-5.31	-0.24	0.005	-20.54	-29.07	-12.02	-0.29	<0.001
Trustworthiness of online EC information											0.77	0.62	0.92	0.71	<0.001
Constant	137.85	104.75	170.95		<0.001	136.11	107.54	164.69		<0.001	91.37	68.99	113.75		<0.001
R ² , adjusted R ²	0.106, 0.057					0.433, 0.373					0.711, 0.677				
F statistics	F (6, 108) = 2.145, p=0.054					F (11, 103) = 7.154, p<0.001					F (12, 102) = 20.906, p <0.001				
Δ R ²	0.106, p=0.054					0.327, p<0.001					0.278, p<0.001				

Note: [†]Reference group.

Abbreviations: EC, electronic cigarette; HONC, Hooked on Nicotine Checklist. B refers to the unstandardized coefficient. B or beta refers to the standardized coefficient.

nicotine dependence and lower motivation to quit EC was attenuated when media credibility and trustworthiness of online information were entered into the last step of the hierarchical regression models.

It was interesting to find that online media such as medical health applications and video portals, when used more frequently to find health information on EC use, were associated with higher motivation to quit, whilst none of the conventional media (eg, radio broadcasting and newspapers or magazines) were significantly associated. The results were not consistent with a past study which found that those exposed to conventional media, including newspaper and magazines, made EC to be less acceptable to the public.²¹ It is also interesting that social media use frequency was not predictive of higher motivation to quit EC use. This was in contrast with a United States (US) study, which found that a higher frequency of exposure to social media and other online platforms increased use intention in adolescents.⁷ This result may be culturally determined, considering that social media may be more highly regulated in China than in the US, to enable a wider dissemination of EC harm information in line with the prohibitive policy on EC use in China. In contrast, medical health applications and video portals may have exerted an influence on the motivation to quit EC for young people as these online sources of knowledge may be considered more authoritative than social media information. Therefore, rather than conventional media, authoritative online media may be more appealing to university students in influencing their motivation to quit EC use.

Media source credibility of news portals was associated with higher motivation to quit EC use. It is not surprising that the credibility of new portals' health information had the highest influence on the motivation to quit EC use, as they are used mainly for information dissemination rather than entertainment. These media may carry more authoritative messages from health authorities and EC experts,²² and therefore are considered more credible compared with other communication media focused on providing entertainment materials. News portal messages in China, the online extension of newspaper messages, tended to focus on the negative influences on EC use,¹⁵ and thus may lead to a higher motivation to quit EC use with more exposure.

Judging online health information on EC as being trustworthy showed the greatest influence on motivation to quit EC. This factor was even more influential than nicotine dependence on motivation to quit EC. In this study, "new media", such as social media and video platforms, were judged to be highly trustworthy, with credibility mean scores higher than traditional media. This observation indicated that online health information on EC use remains an important factor influencing motivation to stop EC use, if they are presented in a way that is trustable. Online platforms are increasingly used to search for health information,²³ and can be beneficially explored as an educational platform to educate the public about EC use.²⁴ It is also noteworthy that the use of online media has been systematically employed by Provincial Health Committees and public hospitals to convey health information in China targeting the younger generation.^{25,26}

Finally, the results of this study showed that consistently across all models, nicotine dependence was significantly associated with a lower motivation to quit EC use. Similarly, a study among US adolescent vapers showed that those with higher nicotine dependence had lower intention to quit EC,²⁷ whilst another study among university students in Malaysia showed that motivation to quit EC for those with mild to high nicotine dependence compared to those with no dependence.²⁸ This may be because having a higher nicotine dependence makes withdrawal symptoms worse when one ceases the nicotine intake.²⁷ However, the strength of its association with motivation to quit EC use was consistently attenuated when source credibility of media and trustworthiness of online media were added into the last step of the hierarchical regression model. Thus, searching for health information may be influential in increasing motivation to quit EC use in our study sample. This may be due to the fact that individuals who seek for health information may already be motivated to quit EC, or that the media health content they accessed was able to convince them that it was worth quitting EC.

This study had implications of the use of media for those who may have higher motivation to quit EC use. Considering that the increased use and credibility of new media was associated with higher motivation to quit EC use, more health information should be targeted at young people in universities who are using EC to quit EC use completely. The potential of online news portals as an authoritative and credible source to influence quitting EC use should be seriously considered. More importantly, as young adults are more drawn toward online media, credible information on EC impact on health could be uploaded on various online platforms to enable more frequent access by university students.

Despite the noteworthy outcomes of this study, there are several constraints that require consideration when the results are interpreted. Firstly, this study included solely university students from one city in this sample, which therefore restricted the generalization of the findings to other populations. Secondly, the study design was cross-sectional, and therefore could not draw causal inferences regarding the associations among the variables. Future longitudinal studies are needed to establish the directionality of motivation to quit EC use and health information search on EC through various media. Thirdly, self-report measures were used, which are susceptible to bias. Finally, other plausible confounding variables that might impact the relationships between the variables were not considered in this study, such as the level of health literacy and the nature of the health information accessed. Therefore, it is imperative that future studies explore the role of these variables.

Conclusions

Higher media use frequency of video portals and online medical applications to seek EC health information was associated with higher motivation to quit EC. Higher media source credibility of online news portals also predicted higher motivation to quit EC. New media may appeal to younger generations who seek information regarding EC use and the influence of authoritative, online sources of information should be monitored to provide unbiased and accurate information on EC use benefits and harms.

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Disclosure

The authors report no conflicts of interest in this work.

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