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Research Article

Electronic Cigarettes and their Knowledge, Attitude and Practices among Pakistani Population: A Multi-City Study Across Pakistan

Ayesha Nasir Hameed[1], Muhammad Talha Nawaz[1], Meher Angez[1], Khujasta Gul[2], Amal Farrukh[1], Alveena Zafar[1], Muhmmad Saad Abbass[1] and Javaid Ahmed Khan[3]*

[1]*Medical College, Aga Khan University, Pakistan*

[2]*Medical College, Multan Medical and Dental College, Multan, Pakistan*

[3]*Department of Medicine, Section of Pulmonary and Critical Care Medicine, Aga Khan University Hospital, Karachi, Pakistan*

***Corresponding Author:** Javaid Ahmed Khan, Consultant Pulmonologist, Professor, Section of Pulmonology and Critical Care Medicine, Department of Medicine, Aga Khan University Hospital, Karachi, Sindh, Pakistan.

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Abstract

Introduction: E-cigarettes are devices that are powered by a battery, are portable, and can be used repeatedly. These devices utilize a piezo-electric component to convert a solution into vapor that is then inhaled by the user via a refillable cartridge and mouthpiece. Although there is limited information regarding the safety and composition of e-cigarettes, they have become popular among young people worldwide due to their discreet nature and availability in a wide variety of flavors. Despite this, they are being marketed and used extensively. Given that tobacco consumption is common in Pakistan, our research aims to investigate the knowledge, attitudes, and practices (KAP) of the Pakistani population regarding e-cigarettes.

Methods: An anonymous online survey in the form of a Google form was utilized to conduct a substantial cross-sectional study. The survey consisted of questions that inquired about the use of e-cigarettes, demographics, knowledge about e-cigarettes, and attitudes towards e-cigarettes. Aside from descriptive analysis, univariate and multivariate analyses were conducted to determine any correlations between sociodemographic factors as exposure variables and KAP scores as outcome variables.

Results: A total of 695 participants were included in the final analysis. The mean age of the respondents was 29.6 years, with a majority of responders from the Punjab province (44.4%) Majority (96.7%) of the participants had adequate knowledge while 56.3% had a negative attitude towards E-cigarettes. Three hundred and eighty-four (43.4%) of the respondents reported using E-cigarettes. A concurrent use of cigarette smoking, and e-cigarettes was also recorded (19.3%).

Conclusion: Our study concluded that the prevalence of e-cigarette use was 43.4% and that most of the population had sufficient knowledge and a negative attitude. This study also highlights the perception among the youth that e-cigarette smoking is socially desirable and that certain provinces in the country have a lack of awareness regarding the devices.

Keywords: *Electronic Cigarettes; E-cigs; Cigarette Smoking; Tobacco; Nicotine; Smoking*

Introduction

Electronic cigarettes are portable and re-usable battery-operated devices [1] that use a piezo-electric element to vaporize a solution which is then inhaled by the user through a mouthpiece attached to a refillable cartridge [2]. Consumers can choose from several nico-

tine strengths, including non-nicotine liquids and a countless list of flavors, setting e-cigarettes apart from other tobacco harm reduction products [3]. Since their introduction into the Chinese market in the early 2000s, e-cigarettes have become increasingly popular among young people worldwide [4].

The prevalence of e-cigarettes amongst university students in five different European countries was found to be 43.7% (n = 14,352) [5]. Likewise, prevalence of e-cigarette use among US population over the period 2014-2018 fits a significant quadratic trend [6] (P = .03) (n = 155 556). Similarly, the use of e-cigarettes in Asian countries has also shown an upward trend in the recent years [7,8]. Furthermore, to determine the prevalence of e-cigarettes in Pakistan, a cross sectional survey was conducted in 2016 in five medical universities of Karachi, Pakistan using a self-administered questionnaire and the prevalence was found to be 6.2% (n = 500) [9]. Many characteristics and factors have been seen to influence the use of electronic cigarettes and result in the increased global, regional, and local prevalence rates. Research using a cross sectional survey with 351 undergraduate students from Udayana showed that reasons provided for using electronic cigarettes included a desire to stop using tobacco cigarettes (29.51%), the fact that electronic cigarettes are considered safer (26.23%), are considered "cool" (22.95%), experimental reasons, and other (26.23%) [10].

As important as it is to know the prevalence of e-cigarettes, understanding knowledge, attitude and practices towards e-cigarette use and factors affecting these is equally relevant to build a holistic picture and take effective interventions as a clinician and public health advisor. Health Styles surveys in the US show rising trends of e-cigarette awareness amongst teenagers and adults mainly via advertisements and close family and friends [11,12]. It is seen that the information from the media as reported in the National survey on e-cigarettes is biased and only presents them in a positive manner hiding the potential negative effects of e-cigarettes. Other probable reasons for global e-cigarettes use were curiosity, flavoring/taste, and low perceived harm compared to other tobacco products [13]. Teenagers' use of e-cigarettes appeared also to be strongly influenced by their social environments [14].

Moreover, national surveys conducted in different Asian countries indicate that awareness about e cigarettes and its use is more among male, younger, more educated, and higher socioeconomic class respondents [15]. Sensory stimulation and simulation of smoking behavior and cigarette manipulation provided by e-cigarettes were noted to be important determinants of the increasing use of e-cigarettes for reducing or completely substituting traditional smoking [16,17]. Surveys monitoring perception of e-cigarettes across Asia revealed that while parents considered e-cigarettes to be a healthy substitute for conventional smoking, youth expressed the failure of e-cigarettes to provide satiety level same as conventional cigarette smoking [18]. In Asia, cigarette smoking is an important factor associated with e-cigarette use among people especially since the use of tobacco smoke has increased in the region over the years [19]. Another important factor associated with practice of e-cigarette in Asia is gender. In most male dominant societies, a higher ratio in knowledge and practice of e-cigarettes is seen in males than females [20]. The perceptions regarding e-cigarettes in many Asian countries were associated with poor knowledge about the harms of e-cigarette usage [21].

A few cross-sectional studies using convenience sampling were done in Karachi targeting people aged 13 - 19 years and it was found that males were more aware about e-cigarettes and were more common to either have smoked or be current e-cigarette smokers. Furthermore, middle school students were more likely to believe that it is more harmful and addictive than conventional cigarettes. However, no nationwide study has been done and the absence of legitimate information towards e-cigarette use among Pakistani population is mainly due to cultural and social stigmas that create a taboo on the topic. However, the fact that there is no age restriction for smoking in the country and no laws governing the use of e-cigarettes makes the need for country-wide research on their knowledge, attitude, and practices even more demanding.

Aim of the Study

Our study aims to assess knowledge, attitude, and practices regarding electronic cigarettes among Pakistani population in different cities of Pakistan and to determine the prevalence of electronic cigarette use among the population in different cities. Having data from

various cities will lead us to determine the city or cities with highest prevalence of e-cigarettes and hence allow for targeted interventions to reduce the use of e-cigarettes in those specific cities. Moreover, being the first study done all across Pakistan and targeting the general population without any other restrictions, it will give a numerical prevalence of e-cigarettes in the country which is still unknown.

Methods

Study design and setting: A cross-sectional study using an anonymous web-based survey focused on determining the burden of e-cigarette users and factors associated with it in the general population of Pakistan and also assessing the knowledge, attitude, and practices regarding e-cigarettes use in the general population of Pakistan. This will help to identify the existing gap areas to put in place appropriate awareness programs. Study was conducted in Pakistan having an approximate population of 221,565,832. The survey was introduced on the internet in the form of a google form. Individuals residing in Pakistan having access to technology will have access to the form via a link which will be generated allowing permission to view and fill the google form. The link will be circulated on various internet forums such as 'WhatsApp' groups, Facebook pages, twitter, email, school, university, and office groups etc. Consent was obtained from the participants to take part in the study which will be available as an electronic consent form that will appear before the start of the questionnaire.

Data instrument and data collection: A pre-existing KAP questionnaire was used. Data was collected from the online survey of study participants using google form.

All data collected via the Google forms was stored in the Google drive protected by password, which was only accessible by the principal investigators and Co-principal investigators. Each participant will be given an auto generated code number in order to maintain privacy. Each participant could only access once in the study.

The questionnaire was provided in both English and Urdu. It contained five sections. The first section consisted of demographics such as age, province, income, marital status etc. The second section was about past medical history. The third section was about knowledge of e cigarettes. The fourth and fifth section was regarding attitude towards e cigarettes and use of e cigarettes respectively. The knowledge and attitude responses were converted to scores. In the knowledge section, 6 questions were scored. The total maximum score of knowledge section was 6 and the cut off for adequate knowledge was kept at a score of > 4. In attitude part, 10 questions were scored and the cut off for negative attitude towards the liking of E-cigarettes was kept at a score of > 6.

Data analysis and sample size

Data from the Google Forms was converted to an Excel Spreadsheet from where statistical analysis was conducted using SPSS. The questions on knowledge, attitude and practices were converted into scores. The variables like knowledge, attitude, practice scores and age of the respondent will be summarized as means with standard deviations if distributed symmetrically or were summarized as median with interquartile range if distributed asymmetrically. Other variables like gender, place of residence and level of education were summarized in terms of frequencies and percentages. A non-probability purposive sampling technique was adopted.

The frequencies and percentages were reported for the burden of e-cigarettes in the general population that were then calculated as point prevalence. Independent samples t-test were used to observe the difference in mean knowledge, attitude, and practice scores amongst e-cigarette users and non-users post-hoc. Mean and standard deviation were reported for knowledge, attitude, and practices. Simple and multiple linear regression were used to assess the relationship of knowledge, attitude, and practices of e-cigarettes with e-cigarette usage and non-usage. A p-value of less than 0.05 was considered significant. Chi-square test was used for assessing relationship of covariates with ever-usage of e-cigarettes.

In total, at least 695 individuals were needed to be interviewed for all objectives. Assuming that 10% of the forms will have incomplete information, a total of 765 individuals were required to fill out the form.

Results

Socio demographic characteristics

A total of 907 people filled in the forms and among these 22 forms were discarded due to incomplete or irrelevant information. After exclusion 885 individuals took part in this study. Among these 57.2 were females and 42.8 were males. The mean age of the respondents was 19.6 ± 3.0. The majority of the respondents belonged to Punjab (44.4) followed by Sindh (34.5), KPK (7.5), Kashmir (0.6), Baltistan (0.3). The total income was greater than 60 thousand PKR for 78.9% of the respondents. Table 1 shows detailed characteristics of the sociodemographic status.

Medical and smoking background

Among the 885 participants 5.9% of the individuals had hypertension, around 0.1% reported asthma and 35.4% had a positive history of anxiety, depression, or any other psychiatry illness (Table 1).

Variables	n (%)
Age, years	19.6 ± 3.0
Gender	
Male	506 (57.2)
Female	379 (42.8)
Marital status	
Single	859 (97.1)
Married	24 (2.7)
Widowed/separated	2 (0.2)
Province	
Punjab	393 (44.4)
Sindh	305 (34.5)
Khyber Pakhtunkhwa	66 (7.5)
Azad Jammu Kashmir	5 (0.6)
Gilgit Baltistan	3 (0.3)
Islamabad	112 (12.7)
Which setting do you live in?	
Rural	109 (12.3)
Urban	776 (87.7)
Education	
Honors	20 (2.3)
Doctorate	29 (3.3)
Bachelors or master	236 (26.7)
Intermediate	481 (54.5)
Matric	111 (12.5)
Middle school	6 (0.7)
None	2 (0.2)

Employment	
Unemployed	655 (74)
Professional	151 (17.1)
Skilled	66 (7.5)
Clerical	3 (0.3)
Unskilled worker	10 (1.1)
Chief earner	
Father	753 (85.1)
Mother	56 (6.3)
Brother	29 (3.3)
Sister	2 (0.2)
Other	20 (2.3)
Self	24 (2.7)
Occupation of the wage earner	
Health professional	94 (10.7)
Engineer	71 (8.1)
Businessman	264 (30)
Office work	171 (19.4)
Teacher	49 (5.6)
Other	224 (25.5)
Chief wage earner's monthly income	
> 60k	698 (78.9)
30,000 - 60000	137 (15.5)
22500 - 30000	25 (2.8)
15000 - 22500	12 (1.4)
9000 - 15000	7 (0.8)
3000 - 9000	2 (0.2)
< 3000	4 (0.5)
Chronic illnesses	
Hypertension	52 (5.9)
Diabetes	4 (0.5)
Asthma	56 (6.3)
COPD	1 (0.1)
Any other lung disease	4 (0.5)
Any heart disease	2 (0.2)
Other	36 (4.1)
None	730 (82.5)

Depression/anxiety/any psychiatric illness	
Yes	313 (35.4)
No	572 (64.6)
Would you say that you are currently under any kind of stress?	
Yes	496 (56)
No	239 (27)
I don't know	150 (16.9)
Would you say that you are currently under any kind of stress?	
Yes	856 (96.7)
No	29 (3.3)

Table 1: *Descriptive characteristics of study population.*

Knowledge, attitude and uses related to E-cigarettes

The knowledge section had a total of 6 marks and individuals who scored equal to or more than 4 were considered to have adequate knowledge regarding E cigarettes. Among the participants 55.1% (n = 488) had adequate knowledge regarding E-cigarettes. Around 3.3% scored zero. Most of the respondents knew of E cigarettes via the internet or through friends and family. Amongst the 865 individuals 62.9% were aware of the various ingredients found in e cigarettes. A total of 49.6% of the participants knew that E cigarettes were addictive while 9.6% of the people were not aware of it. 52% of the individuals knew the long-term health implications caused by E cigarettes. The results are displayed in table 2.

Questions	n (%)
Do you know what e-cigarettes are?	
Yes	856 (96.7)
No	29 (3.3)
If yes, then how did you learn about them?	
Internet	300 (35.0)
Friends/family	540 (63.1)
TV	9 (1.1)
Magazine/Books	5 (0.6)
Newspaper	2 (0.2)
Are you aware of the various ingredients and chemicals in e-cigarette smoke?	
Yes	557 (62.9)
No	328 (37.1)
Do you know about the different levels of nicotine in e-cigarettes?	
Yes	584 (66)
No	301 (34)

Do you think e-cigarettes are addictive?	
No	85 (9.6)
Yes	439 (49.6)
Don't know	38 (4.3)
Some what	323 (36.5)
E-cigarettes contain chemicals that have long-term health implications	
No	53 (6.0)
Yes	460 (52)
Maybe	372 (42)
E-cigarette smoke inhalation by people around can be harmful for them?	
No	170 (19.2)
Yes	446 (50.4)
Maybe	269 (30.4)
Adequate knowledge	
Not adequate	397 (44.9)
Adequate	488 (55.1)

Table 2: *Knowledge of electronic cigarettes.*

In the attitude section a total of 10 questions were asked and people who scored equal to or more than 6 were considered to have a negative attitude towards the liking of E cigarettes. Among the participants 38.1% (n = 337) had a negative attitude towards the liking of E-cigarettes. The majority of the participants (56.3%) think that e cigarettes are slightly ineffective in helping people quit regular smoking while 20.5% of the people think that it's extremely effective. Around 41.2% of the people thought in comparison E cigarettes had lesser harmful effects as compared to the regular cigarettes. At least 31.1% of the people thought that E cigarettes were just as addictive as regular cigarettes while 11% thought that they were less addictive. Around 58% individuals agreed that people smoke E cigarettes to look "cool" or be socially acceptable. Out of these 695 people 77.5% were not in favor of promoting E cigarettes to other people if given the chance, on the other hand 12.4% people said that they would promote it. The results of this are displayed in table 3.

Questions	n (%)
What do you think makes people start using e-cigarettes?	
How effective do you think e-cigarettes are in helping people quit smoking regular cigarettes?	
'Extremely effective	181 (20.5)
Slightly effective	498 (56.3)
Slightly ineffective	27 (3.1)
Extremely ineffective	23 (2.6)
No effect at all	156 (17.6)

When comparing harmful effects of e-cigarettes to regular cigarettes, how harmful do you think they are?	
Much more harmful	87 (9.8)
Slightly more harmful	58 (6.6)
Equally harmful	165 (18.6)
Slightly less harmful	365 (41.2)
Much less harmful	209 (23.6)
When comparing the addiction of e-cigarettes to regular cigarettes, how addictive do you think they are?	
Much more addictive	123 (13.9)
Slightly more addictive	139 (15.7)
Equally addictive	275 (31.1)
Slightly less addictive	250 (28.2)
Much less addictive	97 (11)
Do you think using e-cigarettes makes young people "fit in", feel "cool" and become socially more acceptable?	
No	302 (34.1)
Yes	513 (58)
2	70 (7.9)
How easy do you think it is to buy e-cigarettes for young people of your age?	
Very easy	529 (59.8)
Easy	273 (30.8)
Difficult	76 (8.6)
Very difficult	7 (0.8)
If a good friend of yours wanted you to try e-cigarettes, would you try them?	
Definitely will	114 (12.9)
Probably will	348 (39.3)
Probably will not	128 (14.5)
Definitely will not	295 (33.3)
Would you ever promote or recommend the use of e-cigarettes to other people if you got the chance to?	
No	686 (77.5)
Yes	110 (12.4)
I don't know	89 (10.1)
Do you think that the use of e-cigarettes should be regulated like other tobacco-products?	
No	415 (46.9)
Yes	359 (40.6)
I don't know	111 (12.5)

Do you think e-cigarettes are associated with diseases such as lung cancer, COPD, asthma, or heart disease?	
No	92 (10.4)
Yes	364 (41.1)
I don't know	429 (48.5)
Do you think e-cigarettes are safe to use in pregnancy?	
No	622 (70.3)
Yes	7 (0.8)
I don't know	216 (24.4)
3	40 (4.5)
Attitude	
Negative	337 (38.1)
Positive	548 (61.9)

Table 3: *Attitude towards electric cigarettes.*

For uses regarding E cigarettes, 384 (43.4%) people reported using E cigarettes at least once in a lifetime with the mean age ranging between 16 - 19 years. Among the users 60.9% were current users of e cigarettes and 48.9% people would smoke it at least twice or thrice a week. Around 97 participants (32%) used E cigarettes just to try it. The concentration (mg) of nicotine in the e cigarettes ranged between 3 - 35.

The brand most used by people was Koko (18%) followed by Caliburn and Vaperesso. Most of the users (67.4%) had their own E cigarette device while 19.1% shared with others and around 80.7% of the people did not use regular cigarettes along with E cigarettes. In contrast to this, 19.3% of the respondents used regular cigarettes along with it. Out of 695 people, 113(37%) planned on quitting E cigarettes eventually while 13.8 said that they would use it for the rest of their life (Table 4).

Questions	n (%)
Have you ever used e-cigarettes?	
No	384 (43.4)
Yes	501 (56.6)
If yes, when did you first use an e-cigarette?	17 (16-19) years
Are you a current e-cigarette user?	
No	196 (39.1)
Yes	305 (60.9)
How often do you use e-cigarettes?	
Daily	
2-3 times a week	149 (48.9)
once a week	54 (17.7)
2-3 times a month	23 (7.5)
once a month	33 (10.8)
only tried once	14 (4.6)
8	8 (2.6)

If you are a current e-cigarette user or have ever used e-cigarettes, what made you start using e-cigarettes?	97 (32)
Just to try	14 (4.6)
Peer pressure	19 (6.3)
Recreational	7 (2.3)
Problems	30 (9.9)
stress	81 (26.7)
To quit conventional smoking	2 (0.7)
Your parents smoke	1 (0.3)
TV/ movie advertisements	3 (1.0)
You believe it is a sign of maturity	2 (0.7)
You started as a dare/bet from a friend	46 (15.2)
Like the smell and thought the taste would be a pleasant experience	1 (0.3)
You were able to buy or obtain cigarettes easily as a minor	1 (0.3)
Do you own a e-cigarette device?	
Yes, I have mine	205 (67.4)
No, I share with another	58 (19.1)
No, I borrow from other people	41 (13.5)
What brand of e-cigarettes do you currently use?	
Zero	2 (0.7)
Vapresso	42 (13.8)
U well	36 (11.8)
Smok	32 (10.5)
Koko	55 (18)
Caliburn	50 (16.4)
Don't know	16 (5.2)
Drag	33 (10.8)
Slth	39 (12.8)
What nicotine concentration of e-cigarette do you use currently? (in mg)	20 (3-35)
Do you use regular cigarettes along with e-cigarettes?	
No	246 (80.7)
Yes	59 (19.3)

If yes, how many cigarettes did you smoke when you started using regular cigarettes? (number of cigarettes/week)	28 (7-58)
How many tobacco cigarettes do you smoke currently, along with using e-cigarettes?	14 (7-28)
Do you think that e-cigarettes have had an impact on your smoking habit?	
Yes they have decreased my smoking habit	33 (56.9)
No they have not impact	15 (25.9)
yes they have increased my smoking habit	5 (8.6)
the change in my smoking habit is not due to e-cigarettes	5 (8.6)
Have you ever thought of quitting the use of e-cigarettes?	
Yes as soon as possible	78 (25.6)
Yes I think I am not ready	72 (23.6)
No I plan to eventually	113 (37)
No I plan on smoking for the rest of my life	42 (13.8)

Table 4: *Use of electronic cigarettes.*

Univariate analysis

A univariate analysis was carried out for adequate and non-adequate Knowledge score with the demographic and medical history variables, as shown in table 1. Regarding mean age around 19.7% had non adequate knowledge while 19.5 had adequate knowledge with a p value of 0.28. Most demographic variables were non-significant for knowledge score except province. In Punjab 178 (44.9%) of the people had non adequate knowledge while 215 (44.1%) had adequate knowledge with the p value of 0.03. For attitude scores the entire population had a negative attitude towards the study. The results are provided in table 5 below.

	Not adequate	adequate	Odd ratio (95% CI)	p value
Age; years	19.7 ± 3.2	19.5 ± 3.0	0.97 (0.93-1.02)	0.28
Gender				
Male	222 (55.9)	284 (58.2)	1.0	
Female	175 (44.1)	204 (41.8)	0.91 (0.69-1.19)	0.49
Marital status				
Single	383 (96.5)	476 (97.5)	1.0	
Married	13 (3.3)	11 (2.3)	0.68 (0.30-1.53)	0.35
Widowed/separated	1 (0.3)	1 (0.2)	0.80 (0.05-12.90)	0.87

Province				0.03
Punjab	178 (44.9)	215 (44.1)	1.0	
Sindh	123 (31.1)	182 (37.3)	1.22 (0.90-1.65)	0.18
Khyber Pakhtunkhwa	41 (10.4)	25 (5.1)	0.50 (0.29-0.86)	0.01
Azad Jammu Kashmir	1 (0.3)	4 (0.8)	3.31 (0.36-29.89)	0.28
Gilgit Baltistan	2 (0.5)	1 (0.2)	0.41 (0.03-4.60)	0.47
Islamabad	51 (12.9)	61 (12.5)	0.99 (0.65-1.51)	0.96
Which setting do you live in?				
Rural	55 (13.9)	54 (11.1)	1.0	
Urban	342 (86.1)	434 (88.9)	1.29 (0.86-1.93)	0.21
Education				
None	2 (0.5)	0	-	
Schooling	50 (12.6)	67 (13.7)	1.22 (0.79-1.88)	0.36
Intermediate	209 (52.6)	272 (55.7)	1.18 (0.88-1.59)	0.25
Bachelors and above	136 (34.3)	149 (30.5)	1.0	
Occupation				
Unemployment	295 (74.3)	360 (73.8)	0.97 (0.71-1.31)	0.85
Employment	102 (25.7)	128 (26.2)	1.0	
Chief earner				0.06
Parent	355 (89.4)	455 (93.2)	1.0	
Sibling	15 (3.8)	16 (3.3)	0.83 (0.40-1.70)	0.61
Other	15 (3.8)	5 (1.0)	0.26 (0.09-0.72)	0.01
Self	12 (3.0)	12 (2.5)	0.78 (0.34-1.75)	0.54
If you are not the wage earner of the house, please mention the occupation of the wage earner				
Health professional	42 (10.9)	48 (10.1)	1.0	
Engineer	29 (7.5)	42 (8.8)	1.26 (0.67-2.37)	0.46
Businessman	113 (29.4)	148 (31.1)	1.14 (0.70-1.85)	0.57
Office work	78 (20.3)	98 (20.6)	1.09 (0.66-1.83)	0.71
Teacher	24 (6.2)	25 (5.3)	0.91 (0.45-1.82)	0.79
Other	99 (25.7)	115 (24.2)	1.01 (0.62-1.66)	0.94

Monthly income				
< 30k	23 (5.8)	27 (5.5)	1.0	
30 - 60K	65 (16.4)	72 (14.8)	0.94 (0.49-1.80)	0.86
> 60K	309 (77.8)	389 (79.7)	1.07 (0.60-1.90)	0.81
Chronic illness				
No	327 (82.6)	402 (82.4)	1.0	
Yes	69 (17.4)	86 (17.6)	1.01 (0.71-1.43)	0.93
Depression				
No	263 (66.2)	309 (63.3)	1.0	
Yes	134 (33.8)	179 (36.7)	1.13 (0.86-1.50)	0.36

Table 5: *Univariate analysis.*

Discussion

The sale of e-cigarettes in Pakistan primarily began in Karachi in 2008 and rapidly spread to various other cities. Healthcare professionals have struggled to accurately identify trends in the awareness and use of e-cigarettes due to a lack of research conducted on a national scale in the general population. Tobacco companies have flaunted the claim that e-cigarettes are a 'healthier' alternative to regular cigarettes, and some even ran social media campaigns about the health advantages of their products during the COVID-19 pandemic [22]. These companies have been able to target adolescents and young adults in their promotional campaigns due to Pakistan's lack of legislation regarding e-cigarettes. In this study, the prevalence of e-cigarette use was found to be 43.4% of the population of whom 60.9% were current users. This is significantly higher than a 2017 study conducted among adolescents where prevalence was just 23.8% [23]. The current study also found that the mean age at which people start using e-cigarettes is 17 years old and that 58% of people believe smoking makes young people look 'cool'. The use of e-cigarettes by people under the age of 18 may be attributed to the duplicitous promotion of e-cigarettes by influencers and celebrities as harmless to a young audience who perhaps would have otherwise not smoked at all [24]. Pakistan does not have any set minimum age of purchase of e-cigarettes, nor does it have any laws regarding the promotion and regulation of such products [25]. This has resulted in online shops operating unregulated, companies selling products without any health warnings on the packaging, and a lack of age-verification at vape stores [26,27]. The increased advertising of e-cigarette smoking as safe and desirable harkens back to the trend in tobacco cigarettes between the 1940s and 1960s [28]. The rise in prevalence and awareness of these devices is alarming as it could indicate a future health crisis like the one caused by tobacco cigarettes in the 20th century.

The majority (55.1%) of respondents had adequate knowledge regarding e-cigarettes, compared to a previous study involving adult smokers where only 64.3% of individuals had even heard of e-cigarettes [29]. Although, this could be ascribed to the fact that most of respondents in the current study come from educated backgrounds with 54.5% having completed intermediate education. Most individuals learned about e-cigarettes from either their family and friends or the internet. This highlights the increased promotion and social acceptability in recent years. Furthermore, 58% of individuals believed that e-cigarette use helped young people 'fit in' and 39.3% admitted that they would probably try e-cigarettes if their friends asked them to. This deviates from a previous study conducted in Pakistan in which most respondents did not think that people began smoking due to peer pressure and 59.3% claimed that they would not smoke for their friends [23]. However, another study observed that most participants first smoked with their siblings or peers and that younger smokers

were more likely to share devices with their friends [30]. It also stated that underage smokers mostly bought their devices through their friends and family. The rise in social acceptability should be a cause for concern considering the ease of purchase of e-cigarettes.

Although avoiding the health risks of regular tobacco cigarettes is one of the most common reasons for e-cigarette smoking initiation [31], nearly half (48.5%) of our study population were unsure about whether e-cigarette use can cause cardiovascular conditions. This highlights that companies have so effectively pushed their products as safer alternatives that users are unaware of the health detriments of e-cigarettes. The literature shows that e-cigarettes are associated with a risk of dyspnea, lung cancer, chest pain, nausea, vomiting, and a myriad of other ailments [32]. In the current study, most participants believed that e-cigarettes were either slightly or extremely effective at smoking cessation. This perception is at odds with the World Health Organization's recommendation that e-cigarettes only be used for cessation in patients who refuse other treatment options [29]. Rather, studies have found that individuals aged 14 - 30 who use e-cigarettes are likely to start smoking regular cigarettes [33]. Our study only found a significant association between residing in the provinces of Khyber and Punjab and having an inadequate knowledge score. It is imperative that initiatives be taken in these provinces to raise awareness about e-cigarette smoking and its dangers. However, one previous study noted that there was a significant correlation between gender and inadequate knowledge and prevalence of e-cigarettes, with women being far less knowledgeable [23]. Furthermore, another study among medical students in Sindh found that there was a positive association between smoking conventional cigarettes and using e-cigarettes [34].

This is the first study to assess knowledge, awareness, and perception regarding e-cigarettes in Pakistan on a national scale, but it is not without limitations. Although our sample size is adequate, the demographics of our respondents may not accurately represent the general population. When analyzing the findings of this study, it is important to keep in mind that only 0.6% and 0.3% of respondents were from Azad Jammu Kashmir and Gilgit Baltistan respectively. As convenience sampling was used, there is a risk of selection bias as most participants were from a younger age group, educated social class, and urban areas. This is because online surveys were used which require an internet connection to access. This aligns with how 66% of internet users in Pakistan are from urban areas and are mostly from Generation-Z [35]. This can result in underrepresentation of rural areas and overestimation of awareness in the general population. Most respondents were from a higher economic class (monthly income greater than 60k) which corresponds with how e-cigarettes can cost 3k to 10k [27]. However, this may also lead to overestimation of the prevalence of e-cigarette smoking. As this is a cross-sectional study, the temporality of the findings cannot be concluded so it is essential that further prospective studies be conducted to establish causality.

Conclusion

Our study concluded that the prevalence of e-cigarette use was 43.4% and that most of the population had sufficient knowledge and a negative attitude. This study also highlights the perception among the youth that e-cigarette smoking is socially desirable and that certain provinces in the country have a lack of awareness regarding the devices. Considering the increased promotion of these products, their health risks, and their ineffectiveness at smoking cessation, our study indicates the need for effective policy implementation and regulation at a national level. More research should be done to find more risk factors for e-cigarette use and there need to be initiatives to prevent this from becoming a national health crisis.

Authors' Contributions

All the authors have made substantial contributions. ANH conceptualized the study. MTN, ANH, MA, KG, AF, AZ, SA, and JAK designed the study, and all authors drafted the protocol. MTN performed statistical analyses. MTN, ANH, MA, KG, AF, AZ, and SA drafted the initial version of the manuscript which was reviewed and edited by all authors. All authors approved the final version of the manuscript to be published.

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Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Approval

Ethical exemption obtained from Ethical Review Committee of the Aga Khan University, Karachi, Pakistan (Reference ID: 2021-6901-1996)

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