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Examine Vaping Behavior, Perception and Experience of E-cigarette Smokers in Bangladesh: A Cross Sectional Study During Covid 19

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Abstract

In the past few years, E-cigarettes (or vaping) are getting the popularity among the youth in Bangladesh. This is critical as it may lead to an increase in the number of smokers in future. The study aimed to identify the trend of E-cigarette smoking, habitual pattern of E-cigarette smokers, and their perception and experiences of health hazards. A cross-sectional mixed methods study was conducted from April to November 2020 in Dhaka and Chittagong cities. A total of 370 E-cigarette smoker aged 18 and above years, were surveyed face-to-face using a semi-structured questionnaire. Additionally, sixty-five in-depth interviews were conducted with different E-cigarette vendors using guidelines. Study identified that the usage and selling of E-cigarette increased in last five years in Bangladesh. Friends and social media are the main factors on influencing the behaviour of E-cigarettes using. Users smoked E-cigarettes mainly based on the flavor and taste, brand and price. About 94% of the users agreed that E-cigarette is less harmful than smoked cigarette. Usually, E-cigarette users are also habituated with traditional cigarette and different smokeless tobaccos. The respondents aged between 26-30 years significantly perceived that E-cigarette is less harmful than combustible cigarette. Majority of the respondents (75%) stated that they do not think they have health problems due to using E-cigarettes. However, findings also revealed that 45% of the E-cigarette users have cough and they took medication, 20% of them have hypertension and 19% of them took medication. E-cigarette smoking is a raising public health problem in Bangladesh. It is undoubtedly an alarming phenomenon that the young generation is adopting E-cigarette as a safer alternation of nicotine-based cigarette due to misconception of users and sellers. Therefore, a more intense and comprehensive tobacco control effort is needed including the health education, promotion, taxation and awareness on E-cigarette smoking by public, private and other sectors to reduce the health cost burden in future.

Keywords: Behaviour; Perception; Experience; Youth; E-cigarette; Trend; Bangladesh

List of Abbreviations: ENDS: Electronic Nicotine Delivery Systems; GATS: Global Adult Tobacco Survey; BMRC: Bangladesh Medical and Research Council, SLT: Smokeless Tobacco; COPD: Chronic Obstructive Pulmonary Disease

Introduction

The E-cigarette was first appeared in a U.S. patent application submitted by Herbert A. Gilbert in 1963 and was patented in August 1965 with an aim of providing "a safe and harmless means for and method of smoking" by replacing burning tobacco. However, the first commercial E-cigarette was invented in Beijing, China by Hon Lik, a Chinese pharmacist, inventor and smoker [1]. It has been found that Lik's father death of lung cancer led Hon Lik to invent a smoke-free alternative.

Electronic cigarette (E-cigarette) is one type of electronic nicotine delivery systems (ENDS) that emits a vaporized nicotine solution or salt, allowing users to inhale nicotine without the combustion [2,3], it is a gadget powered by battery that operates by heating a liquid into an aerosol which the user inhales and exhales. Usually, this liquid comprises nicotine, propylene glycol, glycerin, flavorings, and other chemicals [4]. Though E-cigarette produces fewer toxicants than combustible cigarettes still it contains nicotine, humectants including propylene glycol and glycerin, flavor additives including diacetyl, and metal contaminants. Even this gadget is designed as safer alternative to combustible cigarettes but the long term consequence of E-cigarettes are yet unknown due to its short term of initiation and usage [5,6].

The prevalence of electronic cigarette (E-cigarette) use has been increased significantly in the last decades. Vaping or using E-cigarette is particularly familiar among the youth and young adult [7]. The popularity of E-cigarette suddenly raised as it is widely viewed as a safer alternative to combustible cigarettes and helps to cessation of smoking [6]. Nicotine dependence is crucial factors that make harder of smoking cessation among the tobacco users and E-cigarettes have emerged here as a form of nicotine replacement therapy [8]. But, at the end it has found that the users continue to use both products (smoked tobacco and E-cigarette) parallel [6].

Globally, almost 48 countries regulate the marketing of E-cigarettes and among those only 8 countries apply restrictions only to E--cigarettes containing nicotine or considered as medicines. Usually, E-cigarettes are marketed through various networks e.g., newspapers/magazines, TV/movies, and retail stores, with most money spent on television and print media [9]. However, through internet E-cigarettes are widely available for purchasing as well as being sold directly to consumers in various countries and at present more than 2500 brands are sold worldwide [8].

Health Hazard of E-cigarette

According to the Mental Health Foundation of the United Kingdom (UK), there is a common misconception where smoking cigarettes is seen as a way to release stress and pressure along with a way to deal with depression and anxiety. However, studies on similar topics have consistently proven that smoking does not solve any of these issues. In fact, smokers deal with higher levels of stress and anxiety & are likely to smoke even more to cope with depression. At the same time, smokers are prone to early death & other health-related hazards due to complications arising out of smoking. Many smokers are therefore keen to quit smoking, however due to the addictive nature of ingredients such as nicotine; it is difficult for them to do so. As a result, there has been a tendency in recent years in switching to alternatives such as, E-cigarettes, hookahs, etc. Of these, the uses of E-cigarettes have increased globally. In Poland, it was found that E-cigarette use had increased in youths by more than 20% in less than 5 years which is consistent with increasing number of users globally. However, extensive studies done on E-cigarettes in other nations have concluded that E-cigarettes did not necessarily help people in adjusting with these issues, and although it reduced incidences of certain disease, it led to increased respiratory issues. One of the prime reasons that these studies found that vaping does not lead to normal smoking and that most people vaped due to peer pressure. It has been found that use of E-cigarettes was associated with nausea, vomiting, headache, dizziness, choking, burn injuries, upper respiratory tract irritation, dry cough, dryness of the eyes and mucous

membrane, release of cytokines and pro-inflammatory mediators, allergic airway inflammation, decreased exhaled nitric oxide (FeNO) synthesis in the lungs, change in bronchial gene expression and risk of lung cancer [10]. It has also been reported that use of E-cigarettes in indoor areas may expose sick people to harmful aerosols [11].

In the United States, a study conducted among adolescents (mean age 15 years) found that when compared between non-users with users of E-cigarettes, the E-cigarette users were more at risk. This led to the possibility that E-cigarettes were attracting medium risk users who otherwise may not have used tobacco products at all. Another study conducted among 17-18 years old in California reported that E-cigarette users were 6 times likelier than non-users to start smoking normal E-cigarette [12]. This study also suggested that use of E-cigarettes at younger age would push vapers to become normal smokers when they reached the legal age to buy cigarettes.

A major threat of E-cigarettes is that the full harmful effects of it are not yet fully scientifically documented, even though there are evidence that suggests they are not as harmless as thought before. One of these threats comes by due to a lack of extensive pre-clinical toxicology testing or long-term safety trials. A survey conducted in Hong Kong found that E-cigarette use was associated with increased chances of chronic cough or phlegm. A similar study of about 2000 high school students in Southern California reported that E-cigarette use was associated with more than twofold increase in the risk of chronic bronchitis symptoms such as chronic cough, bronchitis, etc. [12]. Additionally, a study of Korean high school students found that self-reported diagnosis of asthma by a physician in the previous year was increased in current E-cigarette users compared with never users [13].

Scenario in Bangladesh

In Bangladesh, E-cigarettes caught the attention among the younger people. However, due to lack of extensive research and data, it has not been estimated how much of the young and adult population are engaged in E-cigarette vaping. Nevertheless, it can be estimated that the trend of smoking E-cigarettes is increasing in Bangladesh every year due to the increasing number of vapor hubs and brands that are being setup or established. In the second round of Global Adult Tobacco Survey (GATS) in Bangladesh, it has been identified that about 6.4% of the population have heard about the E-cigarette aged between 15-24 years. In the Capital city, Dhaka, one in ten persons have heard about E-cigarette, hence, it happened two to seven percent for other divisions [14]. This is critical as it may lead to an increase in smokers in future as it has been found in other countries that smoking E-cigarettes does not necessarily reduce smoking, but rather contributed to increasing the number of smokers in the long run. In fact, owing to the perceived negative impacts of E-cigarettes in other nations, the Bangladesh government proposed to ban E-cigarettes and vaping tobaccos in 2019. However, this ban has not yet come into effect.

In Bangladesh, it is a common practice that E-cigarettes are used without full knowledge of the product, so many consumers are not even aware of how their health may be affected in the long term. A limited study has been conducted so far to identify the chronic health effects of E-cigarettes [12]. One of the most important purposes of research on E-cigarettes is to clear misunderstandings surrounding its health impacts. Many people are of the belief that because of E-cigarettes contain less nicotine, it's less harmful than cigarettes. There is also a common perception in Bangladesh that using E-cigarettes helps in quitting smoking or that E-cigarette use won't lead to normal smoking in the future, both of which do not have any concrete scientific proof. However, it has been found that E-cigarettes did not necessarily aid in smoking cessation [15].

As established here, E-cigarettes are certainly harmful to the user and can have secondhand harm on non-users while the benefits of E-cigarettes are not fully proven yet. Therefore, in Bangladesh's perspective, it is important to conduct research on E-cigarettes due to a variety of factors. Firstly, an extensive database is needed to identify the major reasons behind the rise of vaping. Secondly, research on this matter would educate the populace even more about E-cigarettes and help them make better choices. Thirdly, it would help the government to identify what methods to adopt to reduce the use of E-cigarettes in Bangladesh.

Considering the above facts, this study has aimed to generate evidences on identifying the trend of E-cigarette smoking among E--

cigarette smokers in two cities in Bangladesh (Dhaka and Chittagong); to analysis the pattern of E-cigarette smoking among adults; identifying the perception and experience of health hazards among the E-cigarette smokers. Apart from that, this study has identified the reason behind E-cigarette smoking with relevance to different socio-economic factors (e.g., profession, monthly income, gender, marital status, location). Additionally, this study also has conducted a perception analysis among the E-cigarette smokers, to identify what are the basic criteria for vaping, how the users perceive vaping. There is a very limited study has been conducted yet to address the following issues. Thus, this study would address the following issues within a national context.

Materials and Methods

Study Design

This study was cross-sectional by design and conducted among 370 E-cigarette smokers using a mixed-method of quantitative and qualitative survey.

In current context, selection of the exact location for E-cigarette users was difficult. Since, there were no official statistics of E-cigarette trends, we used the non-traditional methods to narrow down the area. According to various news report Dhaka and other divisional cities had the highest concentration of E-cigarette users. However, the Google map showed that Dhaka city has at least 40+ vaping shop and second highest e-cig related shops were situation in Chittagong (Figure 1). Considering the users and others factor, this study would cover Dhaka and Chittagong city area. The target areas were divided into three segments: university area, E-cigarette hubs and corporate office area.

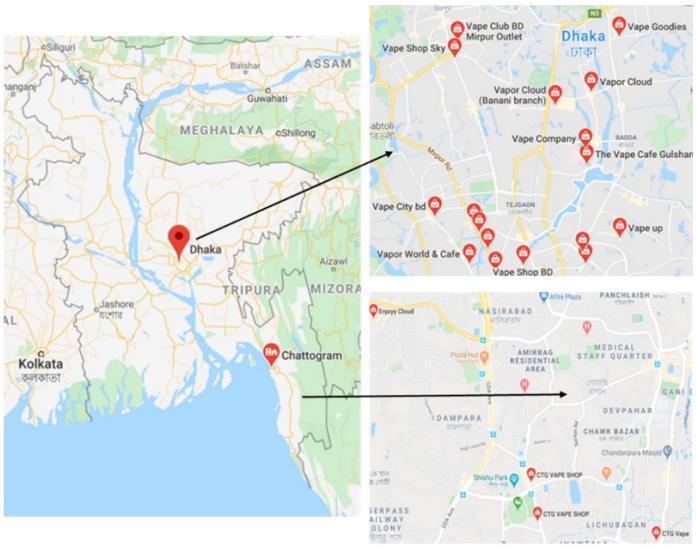

Figure 1: Study Area selected from Google Map

Data Collection Method and Instrument

Primary Data

Sample Size

This study determines a minimum representative sample size with the limited resources which could give the maximum information about the population. Under this design the sample size was determined using the following formula-

$$n = \frac{P * (1 - P) * Z^2 * df}{e^2}$$

Here, p= Proportion desired characteristics of the individuals= 0.5, Z= Tabulated value at 95% confidence level= 1.96 and e= Margin of error=6%, df= Design effect=1.3 (This study considers design effect as this is not simple random sampling method). Incorporating the values, the sample size is 347 (extended and rounded to 370). For each study area we selected 200 survey respondents from Dhaka as well as 150 from Chittagong. However, we interviewed additional 35 E-cigarette smokers because of the availability during the COVID 19 period. In addition to that, around 65 IDIs were conducted with different vendors.

Sampling Technique

The snowball sampling was used for selection of E-cigarette smokers. Snowball sampling uses a small pool of initial informants to nominate, through their social networks, other participants who meet the eligibility criteria and could potentially contribute to this study. The first order E-cigarette respondent selected randomly from the selling hub and through the respondent's connection the second and third order respondent selected from different universities, office and relevant places. In this study, a list of smoking hubs located in the Dhaka & Chittagong city were listed with the help of google map, e-commerce association, informative persons, experts and stakeholders. For quantitative survey, the study population were E-cigarette smokers (users) aged 18 and above years old from different profession, e.g., students, service holders, businessman. For qualitative part, different vendors (retailers and wholesalers) of E-cigarette were considered as participants for this study.

Data Collection, Entry and Cleaning

A 2-days comprehensive training program on data collection operation with KOBO toolbox was organized for the field personnel including enumerators and supervisors in Dhaka. Field personnel were trained on data collection modules and collection strategies. In each day of data collection, the quality of the collected data was assured by the supervisors. After the entry of the data, a cleaning step were run by the analyst for assuring the final quality of the data. Then, an analysis plan was developed following the indicator listing and analyzed the data set. Additionally, one checklist was developed and used for the IDIs with the E-cigarette vendors.

Ethical Consideration

Prior to conduct the research the ethical clearance from Bangladesh Medical and Research Council (BMRC) were taken. However, a number of ethical principles were considered when performing this research (a) obtain informed consent from potential research participants; (b) minimize the risk of harm to participants; (c) protect their anonymity and confidentiality; (d) avoid using deceptive practices; and (e) give participants the right to withdraw from your research.

Analysis

In this study, we analyzed the demographics of the respondents, trend of E-cigarette using, the perception and experience of E-cigarette using, factors of influencing the perception regarding E-cigarette. In the demographic profile, we analysed gender, marital status, age categories, education, types of educational institute, occupation and monthly income. We analyzed the descriptive statistics, frequency, percentage for understanding the responses for each indicator. However, we employed logistic regression to identify the factors which were influencing the perception regarding E-cigarette usage among the respondents.

Result

Demographics of the Data

Table 1 presents the demographics of the data. Results showed that majority of the E-cigarette users were from Dhaka area with 73 out of every 100 users from Dhaka, while the remaining 27 people were from Chittagong area. All respondents were male and most of them were married (58.9%). The mean age of e- cigarette users were 34.8 years (SD±9.3). This indicated that the E-ci-

garette users' age ranges between 25.5 years to 44.1 years. It was also found that people with Higher Secondary (34.1%) and Bachelors (33.8%) education were most likely use E-cigarettes. Considering the educational institutions users from colleges (34.1%), national universities (24.1%) and public universities (20.1%) were most likely to be E-cigarette users. This was in sharp contrast to schools and private universities, which were reported only 14.9% and 6.2% of users; respectively. Result showed that businessmen (39.5%) & jobholders (38.4%) used E-cigarettes most. The use of E-cigarettes was lowest among unemployed (4.9%) and students (17.3%). Results showed that respondents who earned between Tk. 20,000-40,000(39.6%) and Tk. 40,000-60,000 (34.8%) used E-cigarettes most; and followed by monthly earning Tk. 60,000-80,000 (15.4%). Results also found that only 1% of people with their monthly income more than Tk. 80,000, while 9.2% of the people earning below Tk. 20,000 were using E-cigarette. Regarding respondents without own income in sources, result showed that E-cigarette users mostly came from families whose main source of income was jobs (59.8%) and businesses (31.7%). It was also reported that remittances and house rent made up equal sources of income (3.7% each) while part-time jobs accounted for 1.2% of household source of income. According to the indicator of household monthly income, users were most likely to be from households with incomes of between Tk.30,000-Tk.60,000 (30.5%) followed by Tk.60,000-Tk.90,000 (48.8%). It was also found that households between Tk.90,000-Tk.1,20,000 income would account for 12.2% of users. This indicates that E-cigarette users were more likely to be from mid and higher income families.

Indicator	**Percentage**
Zone	
Dhaka	73.2
Chittagong	26.8
Gender	
Male	100
Marital Status	
Married	58.9
Unmarried	41.1
Age of the user	
18 to 25 years	16.49
26 to 30 years	20.27
31 to 35 years	21.89
36 to 40 years	19.19
>40 years	22.16
Education	
Higher secondary	34.1
Master's	33.8
Bachelor's	17.3
Class 5- Class 10	13.5
Less than class 5	1.4
Types of educational institutions	
College	34.1
National university	24.1
Public university	20.8

School	14.9
Private University	6.2
Occupation	
Businessman	39.5
Job	38.4
Student	17.3
Unemployed	4.9
Monthly income of the users	
20,000-40,000 Taka	39.6
40,001-60,000 Taka	34.8
60,001-80,000 Taka	15.4
<20,000 Taka	9.2
>80,000 Taka	1.0
Total (N)	**370**

Table 1: Demographics of the respondents

Trend of E-cigarette Consumption

Figure 2 presents the percentage of the E-cigarette consumption by the users with regards to years of initiation. Result showed that, in 2012, the initiation of E-cigarette consumption rate was 0.3%. Suddenly, in 2016 the initiation of E-cigarette consumption rate reached at 10.5%, in 2017 18.6%, in 2018 27.6% and in 2019 30%. A sharp increase of initiation rate has been observed since 2012 to 2019. From the retailing data, result showed that the average sales unit increased from year to year. In 2016, the average sales were yearly 143 unit, followed by 184 unit (in 2017), 272 unit (in 2018) and 280 unit (in 2019).

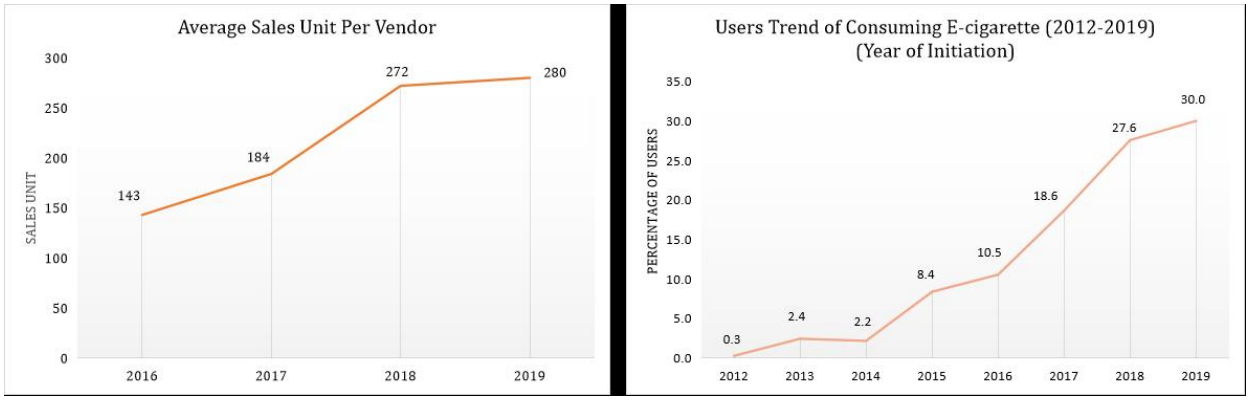

Figure 2: Trend of E-cigarette consumption by respondents

Table 2 represents the habitual information regarding E-cigarette consumption of the respondents. Result showed that most of the respondents started using E-cigarette 3 years prior to the data collection. However, they started to using the E-cigarette regularly after one year of their first-time use. Respondents also reported that the average frequency of E-cigarette smoking was 9 times (SD± 7.1) during COVID 19 and 11 times (SD± 6.0) before COVID 19. Most of them used two types of models and they expend 1500 BDT per month on an average.

Variables	N	Mean ± SD	Median
Used E-cigarette for the first time (in years)	370	3.4 ± 2.1	3
Using E-cigarette regularly (in years)	370	2.5 ± 1.6	2
Frequency of using E-cigarette per day	338	9 ± 7.1	5
Frequency of using E-cigarette per day before corona	242	11 ± 6.0	8
Number of models used	370	2 ± 1.1	2
Cost of E-cigarette per month (BDT)	370	1624.5 ± 1003.0	1500

Table 2: Habitual information of E-cigarette using

Reasons, Factors and Places of Using E-cigarette

The self-reported information regarding reasons, factors and places of E-cigarette use is presented in Table 3. In response to the question of what the users expect from using E-cigarette, about 27% of the users reported that they used these products for the taste and flavors, while 23.0% users reported that they are using it as an alternative of smoked cigarettes. About 14% of the users reported that they used to portray themselves as smart, while 12.6% and 10% used them to decrease nervousness, anxiety and depression, respectively.

Regarding the factors of selecting E-cigarette instruments, about 44.6% of the respondents reported that they used E-cigarette based on taste/flavor. Besides, 25.5% of the users reported that they used E-cigarette due to preferences of brand, 17.2% of them reported pricing being the main factor, while only 10.0% mentioned aesthetics or the outlook of the E-cigarette. Result also showed that most of the E-cigarette users were encouraged by their friends (90.3%), followed by social media (10.0%), colleagues (5.0%) and relatives (4.0%). According to the respondent's opinion about the place of E-cigarette use, most of the users took E-cigarette at homes (24.5%) followed by vaping hubs (23.9%), public places (19.9%) and workplaces (16.2%). And 3.7% and 3.3% respondents reported that they took E-cigarette at friend's house and educational campus, respectively.

Indicators	Percentage
Reasons of E-cigarette use	
Taste and flavors	27.2
Smoking alternative	23.0
Smartness	14.7
Reduce nervousness	12.6
Reduce anxiety	10.0
Following trends	5.4
Reduce depression	4.5
Nothing specific	2.7
Factors of selection of an E-cigarette instrument	
Flavor/taste	44.6
Brand	25.5
Price	17.2
Aesthetics/Structure	10.0

Concoction of chemicals	2.2
Smartness	0.3
Less harmful	0.2
Who/what encourage E-cigarette consumption	
Friends	90.3
Social media	12.7
Colleagues	6.8
Relative	5.7
Internet	3.8
Advertisement	3.5
Family	0.8
None	0.5
Places of E-cigarette use	
Home	24.5
Vaping hub	23.9
Public place	19.9
Workplace	16.2
Restaurants	8.5
Friend's house	3.7
School/College/University campus	3.3
Total(N)	**370**

Table 3: Reasons, factors and places of using E-cigarette

Habitual Pattern of E-cigarette Users

Findings revealed that about 24.9% of the respondents reported that they used other tobacco. Among them, 90.2% respondents reported that they had habit of smoking conventional cigarette and only 9.8% reported that they used smokeless tobacco (SLT). Around one-third (33.7%) of the respondents reported that they used E-cigarette to quit their regular tobacco intake habit (Figure 3).

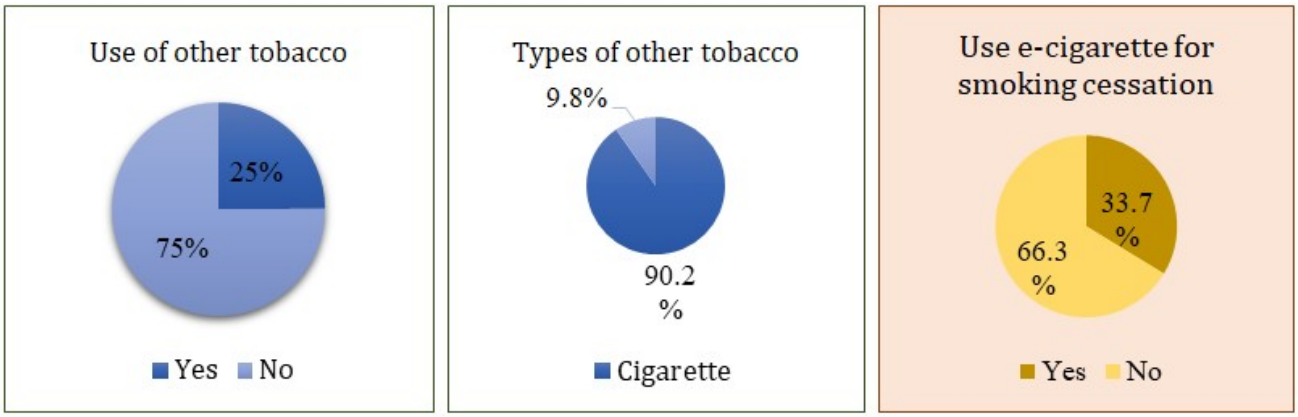

Figure 3: Information regarding other tobacco use and smoking cessation of the E-cigarette users

Perception of E-cigarette Smokers

The respondents were also asked about, "Is E-cigarette harmful than combustible cigarette" and in respond to that question, about 57% respondents negatively replied that E-cigarette is safer than combustible/smoked cigarette. The respondents were also asked about whether E-cigarette is a gateway of other smoking and more than 55% of the respondents positively replied that E-cigarette was a gateway of other smoking habit (Figure 4).

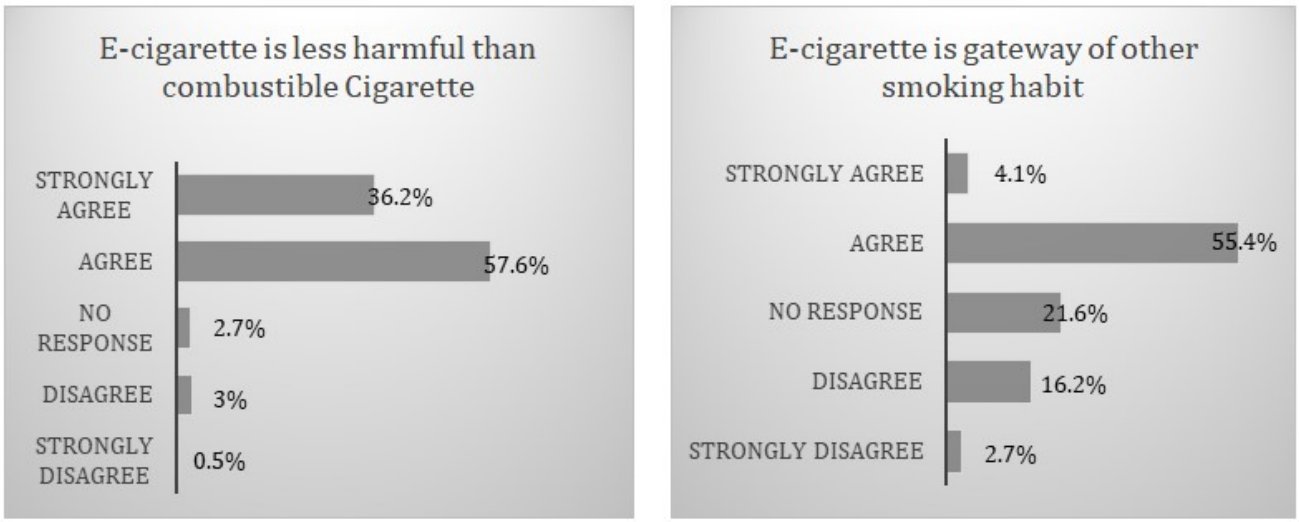

Figure 4: Percentage of E-cigarette smoker

Perception and Experiences Regarding Health Hazards of E-cigarette Smokers

The respondents were asked about their perception and experiences regarding E-cigarette using. Only 14% of the respondents reported that E-cigarette caused health problem, whereas, 74% of the respondents reported that E-cigarette didn't cause any health problem (Figure 5). Among the positive responses (n=53), the respondents frequently mentioned that the E-cigarette users might prone to cough, hypertension, breathing problem/asthma, stroke, heart attack, COPD and other cardiovascular diseases.

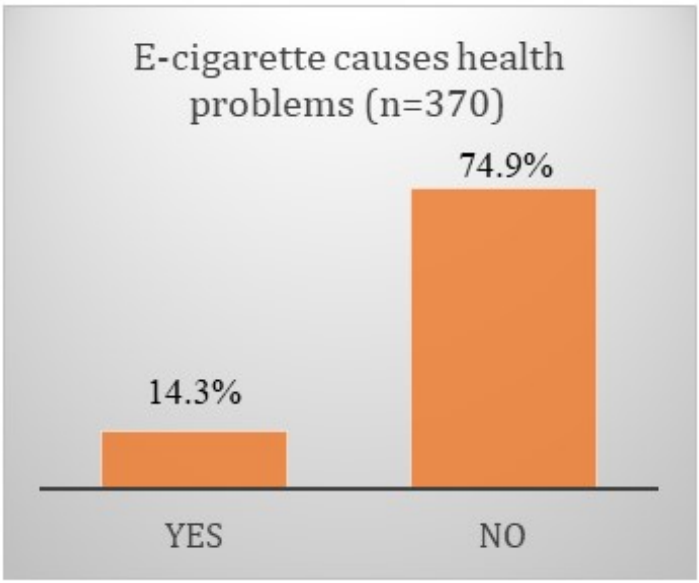

Figure 5: Perception of the respondents regarding E-cigarette using

The respondents were also asked about 'are they suffering from any diseases and took medicine' and about 45% of the respondents mentioned that they suffered from cough and took medicine. About 20% of the respondents reported that they suffered from hy-

pertension and about 19% of them took medicine. Only 10% of the respondents suffered from breathing difficulties/asthma and took medicine (Figure 6).

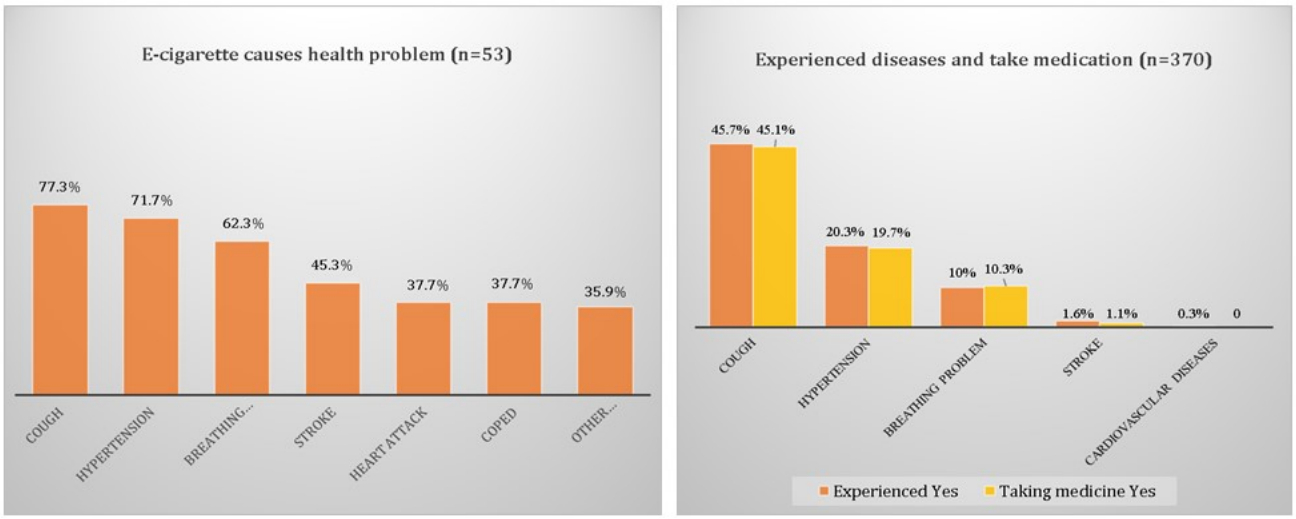

Figure 6: Perception regarding health hazards and consequent diseases reported by E-cigarette

Impact of COVID 19 on E-cigarette and Combustible Cigarette Usage

Figure 7 represents the status of cigarette using during the COVID 19 period. Almost 99% of the respondents reported that their tendency of using E-cigarette decreased during COVID 19 due to selling points were closed (40%), lack of money (31%), maintaining social distance (14%) and lack of supplying instruments (13%). In contrast, 15% of the respondents reported that their nicotine-based cigarette smoking had been increased during COVID 19 period due to availability.

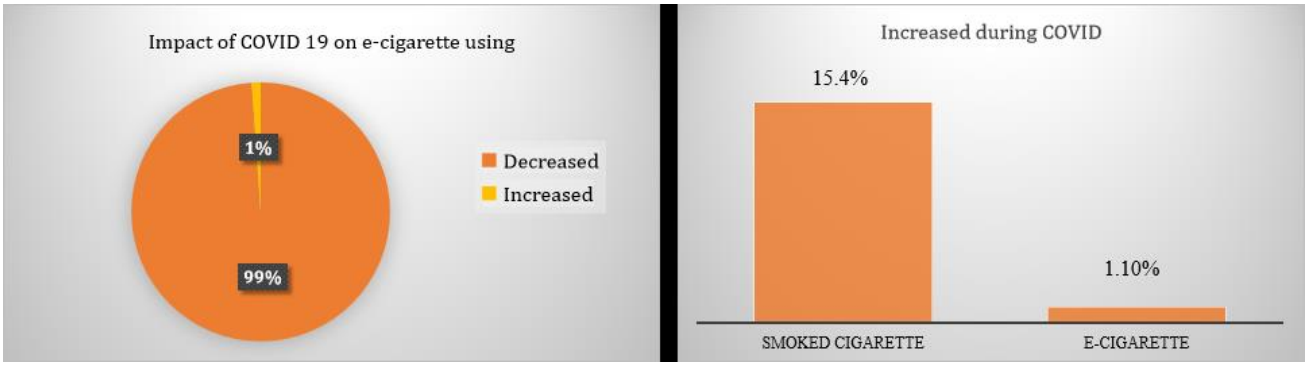

Figure 7: Experience regarding health hazards of E-cigarette user

Factors for Identifying the Knowledge of "E-cigarette is Injurious to Health"

As we find in the univariate analysis that only 14.3% users perceived/felt that E-cigarette is injurious to health. Now, the outcome demands an in-depth analysis to determine the factors that were significantly related with the perception. In the following model we fitted a logistic regression model for multiple independent variables (Table 4). For examine the knowledge on "E-cigarette is injurious to health", logistic regression identified that the respondents aged 26-30 years were reported negatively about the harmfulness of E-cigarette. Similarly, result showed that respondents attending secondary school ($p<0.01$) and higher secondary school ($p<0.001$) were significantly unaware about the harmfulness of E-cigarette. Among the respondents, the service holders were significantly ($p<0.05$) aware about the adverse impact of E-cigarette. Among different user's criteria, addicted E-cigarette users ($p<0.001$) and user with different chemicals ($p<0.01$) reported positively that E-cigarette is harmful. Besides, result showed that E--cigarette users who used different test and flavor ($p<0.05$) and zero nicotine ($p<0.01$) reported negatively regarding the harmfulness of E-cigarette. However, users who used chemical in E-cigarette significantly ($p<0.01$) reported that E-cigarette is harmful. In

contrast, users without any diseases reported negatively that E-cigarette is harmful ($p<0.001$). The overall adjusted R squared of the model is 0.37.

Independent variables	**Dependent variable** E-cigarette is injurious to health
	Coefficient β (SD)
Age	
18-25 years (Base)	
26-30 years	-1.605* (0.85)
31-35 years	-0.385 (0.95)
36-40 years	-1.290 (1.03)
>40 years	-1.291 (1.04)
Education	
< class 5 (Base)	
Class 5 - class 10	-2.624** (1.31)
Higher secondary	-3.590*** (1.34)
Honor's/equivalent	0.280 (1.28)
Master's/equivalent/above	-0.331 (1.29)
Profession	
Business (base)	
Job	0.856* (0.51)
Student	1.111 (0.96)
Unemployed	0.982 (1.02)
Different types of users	
Addicted in E-cigarette	2.880*** (0.49)
Use E-cigarette for test and flavor	-0.766* (0.42)
Use E-cigarette of zero nicotine	-1.157** (0.48)
Use E-cigarette with different chemicals	1.737** (0.49)
Use other tobaccos	0.709* (0.42)
Users without any diseases	-1.424*** (0.53)
R^2	**0.37**

Table 4: Factors for identifying the knowledge of "E-cigarette is injurious to health"

Discussion

This study identifies that E-cigarette use is rapidly increasing in Bangladesh. It has continued to increase among the population aged between 20-40 years. Following the global trend, the young generation of Bangladesh get attracted by E-cigarette. Findings of this study revealed that the selling of E-cigarette in smoking hubs are increased by years. Not only that, the percentage of E-cigarette users also increased with times. In order to understand the various dynamics behind the rise of E-cigarette usage in

Bangladesh, it has been found that the sellers claimed that E-cigarettes are harmless than combustible cigarette as in combustible cigarette tobacco leaves are used. Such kind of misinformation led to the consumers feeling a false sense of safety while vaping. It has been found in another study that the manufacturers claims E-cigarette is harmless due to absence of tobacco leaves [8]. Findings revealed that friends and social media are the main factors on using E-cigarettes. Similar finding also corresponds with another study that most of the E-cigarette users are being influenced by their friend while starting [16]. The usage of E-cigarette happened largely in one's own homes, vaping hubs, public places and workplaces.

About 45% of the smokers used E-cigarette based on taste/flavor whereas 23% of the users mentioned that they used E-cigarette as an alternative of combustible cigarette. Users smoked E-cigarettes mainly because they liked the flavor and taste, brand and price. However, adding flavor on E-cigarette is a business strategy which affect the human health while heated and vaporized [17]. This study also identified that about 33% of the respondent's used E-cigarette for smoking cessation. Similarly, another study also identified that the E-cigarette users use E-cigarette as a viable means for smoking cessation [16]. Additionally, 94% of the users agreed that E-cigarette is less harmful than smoked cigarette. A study conducted among the medical students in Jordan, similarly identified that the main reason of the students using the E-cigarette was different flavors provided by these cigarettes and the perception that E-cigarettes are less harmful and helpful in quitting smoking [5]. Usually, E-cigarette users also habituated with traditional cigarette and different non-combustibles. Findings of this study also revealed that 25% of the respondents reported that they used other tobacco of which 90.2% respondents reported of smoking conventional cigarette and only 9.8% reported that they used smokeless tobacco (SLT). Another study similarly prevails that E-cigarette users are usually also habituated with other combustible and non-combustible [18] rather than smoking cessation.

In this study, it has been identified that the respondents aged between 26-30 years significantly perceived that E-cigarette is less harmful than combustible cigarette. Additionally, a study conducted on the perceptions of E-cigarettes among US youths found that 33% of students thought E-cigarettes were less harmful than smoked cigarettes [18]. The school and college going students are significantly perceived that E-cigarette is harmless. Additionally, this study also identified that E-cigarette users who used different test and flavor ($p<0.05$) and zero nicotine ($p<0.01$) perceived that E-cigarette is less harmful for health. A recent study conducted in Australia similarly identified that the respondents from all age groups perceived that non-nicotine and flavored E-cigarettes are less harmful than nicotine E-cigarettes [7].

Regarding the health aspects of E-cigarettes, an overwhelming majority (75%) stated that they do not think they have health problems due to using E-cigarettes. The respondents believed that E-cigarettes could not be linked to any health concerns, while a few of the respondents reported that it has contributed to increasing cough, breathing problems/asthma and hypertension. Findings also revealed that 45% of the E-cigarette users have cough and they took medication, 20% of them have hypertension and 19% of them took medication. This is also reinforced the findings in Hong Kong where E-cigarette usage was believed to have increased chronic cough [12]. Additionally, a study of Korean high school students found that self-reported diagnosis of asthma by a physician in the previous year was increased in current E-cigarette users compared with never users [13].

This study has undertaken during a major pandemic COVID 19, almost 99% of the respondents reported that their tendency of using E-cigarette decreased during COVID 19 due to selling points were closed, lack of money, maintaining social distance and lack of supplying instruments. In contrast, the respondents reported that their nicotine-based cigarette smoking increased during COVID 19 period due to availability. This indicated that restriction might have strong impact on the behaviour or habit of E-cigarette smoking. On the other hand, availability of smoking product might allow the continuation of the smoking habits.

In Bangladesh, the number of E-cigarette users has been increasing on an alarming trend. Besides, almost every user and seller believed that E-cigarettes were less harmful than conventional cigarettes and did not lead to addiction. They also believed that E-cigarettes helped alleviate anxiety and depression. However, public health experts agreed upon the harmful of E-cigarette as it contains nicotine and that such products did not do anything to address anxiety or depression. Additionally, there is misinformation being spread by the sellers and certain international journals and this had to be addressed as soon as possible. In their viewpoint,

the usage was higher among younger people, which is consistent with the findings of our own study. In order to control such usage, widespread awareness campaigns should be arranged in various institutions including educational institutions. Such awareness campaigns should address the misinformation and make aware potential users/current users about the harmful effects of E-cigarettes and how it can serve as a gateway to other forms of smoking. In our study we found that almost every seller had a social media presence on platforms such as YouTube and Facebook where they often advertised their products. Such advertisements were their only form of advertisement besides their verbal influence. Due to the sheer attractiveness of the advertisements, many new users were influenced to start smoking E-cigarettes. As a consequence, this created even more users who were influenced by current users and this cycle continued. This finding matches with another study conducted in the United States [9].

However, these findings are subject to several limitations. In this study, it has been found that 25% of the respondents also used other tobaccos in addition to E-cigarettes. Among those 25%, a majority of the respondents (90% respondents) reported that they smoke combustible cigarette along with E-cigarette. However, this study has limited to identify whether the respondents who are former smoker and use E-cigarette have higher chances of reporting the health issues. This study also limited to identify whether smoking rates are going down after using E-cigarette or going up (or vice versa).

Conclusion

E-cigarette smoking is a raising public health problem in Bangladesh. It is undoubtedly an alarming phenomenon that the young generation is adopting E-cigarette as a safer alternation of nicotine-based cigarette due to misconception of users and sellers. Therefore, a more intense and comprehensive tobacco control effort is needed including the health education, promotion, taxation and awareness on E-cigarette smoking by public, private and other sectors to reduce the health cost burden in future.

Supplementary Table

Variable	VIF
Age category	
18-25 years (Base)	
26-30 years	2.24
31-35 years	3.02
36-40 years	2.99
>40 years	3.65
Highest education	
< class 5 (Base)	
Class 5 - class 10	2.46
Higher secondary	3.63
Honor's/equivalent	1.2
Master's/equivalent/above	3.02
Current profession	
Business (base)	
Job	2.29
Student	2.22
Unemployed	1.31

Different types of users	
Addicted in E-cigarette	3.82
Use E-cigarette for test and flavor	4.19
Use E-cigarette of zero nicotine	2.86
Select a E-cigarette instrument by the concoction of chemicals	1.09
Use of other tobaccos	1.41
Healthy user	3.36
Monthly expenses of E-cigarette	4.69

Table S1: VIF of the independent variables for multi-collinearity checking

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