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The Characteristics of Electronic Cigarette Users in Indonesia: A Cross-sectional Study

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Abstract:

Introduction: Data shows that in the last ten years, there has been an increase in e-cigarette users, especially vaping in Indonesia. However, data on the relationship between vape e-cigarette users and sociodemographic background and vape use habits are lacking. However, it is needed as a consideration for vape regulation in Indonesia. This study aims to determine the characteristics of vape e-cigarette users in Indonesia based on sociodemographic background and vape use habits.

Methods: This research is a cross sectional study using a questionnaire that is filled in by the respondents themselves. The survey was conducted online on vape users aged 17 years and older. The data were analyzed using descriptive statistics and chi-square tests.

Results: Data was obtained from 297 respondents. Most respondents were male with an average age of 19-44 years, working, married, living with family, and domiciled in major cities on the island of Java. The average vape user has a high school educational background, an income of more than 5 million per month, with more indoor jobs. They have generally been using vape for more than 3 years, using nicotine levels of 6 mg, with a volume of e-liquid of 60 ml, which runs out in 2 weeks, and a small percentage also still use conventional cigarettes. Dry mouth was the most complained condition.

Conclusion: This study provides valuable sociodemographic insights and usage patterns of vape e-cigarette users in Indonesia, highlighting the need for further research and informed considerations in regulatory decisions regarding vape products in the country.

Keywords: Cigarettes, Electronic cigarettes, Habits, Indonesian, Sociodemographic, Vaping.

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1. INTRODUCTION

Electronic cigarettes (e-cigarettes) are currently growing and are favored by the public. Research shows that the use of e-cigarettes globally continues to increase. Similarly, in Indonesia, over the past decade, there has been a 10% increase in e-cigarette users [1]. Although it is seen as safer than conventional cigarettes, the use of e-vapes and electronic cigarettes has raised new concerns regarding lung health. In 2017, research conducted by Hartwell *et al*. compared cigarette users across various characteristics, including residence, race, gender, and occupation [2]. The impact of e-cigarettes is becoming increasingly diverse, both in terms of the systemic effects and the effects on the oral cavity [3, 4]. Research on the sociodemographic characteristics of e-cigarette users in Indonesia and the health complaints associated with e-cigarettes has been conducted, but the findings are not yet comprehensive. The objective of this study is to provide an overview of the sociodemographic characteristics of e-cigarette users in Indonesia, their patterns of use, the health issues associated with e-cigarette use, and their perceptions and knowledge about e-cigarettes.

2. MATERIALS AND METHOD

The study design of this research is cross-sectional, meaning that data were collected at a single point in time to assess the characteristics of vape e-cigarette users based on their sociodemographic background and vape use habits. This study was conducted by distributing surveys filled out online by respondents from September 2022 to January 2023. The survey consisted of respondents' information, sociodemographic background, knowledge about e-cigarettes, attitudes towards e-cigarette policies in Indonesia, efforts to quit smoking, and oral health conditions related to e-cigarette use. The outcome of vape use habits is the duration of vape use, nicotine levels used, volume of e-liquid consumed, co-use of conventional cigarettes, and reported health complaints (*e.g.*, “dry mouth”). The exposure to sociodemographic factors like age, gender, employment status, marital status, living situation, income level, educational background, and geographical location. This study utilized stratified analysis to examine differences in vaping habits and health outcomes across specific sociodemographic subgroups. The primary method for addressing missing data in this study involved the exclusion of incomplete responses and underage participants.

The survey is a questionnaire that was compiled by the research team and has been tested for validity and reliability on 30 respondents other than the research respondents before the study was conducted. The calculation of the number of sample respondents was carried out using the sample size calculation formula. The inclusion criteria for this study were that the respondents were users of e-cigarettes and conventional cigarettes for at least the last 1 month continuously, were more than 18 years old, and were willing to follow the provisions of this study correctly. This research has been approved by the Unpad Ethics Committee with number 896/UN6.KEP/EC/2021.

3. RESULTS

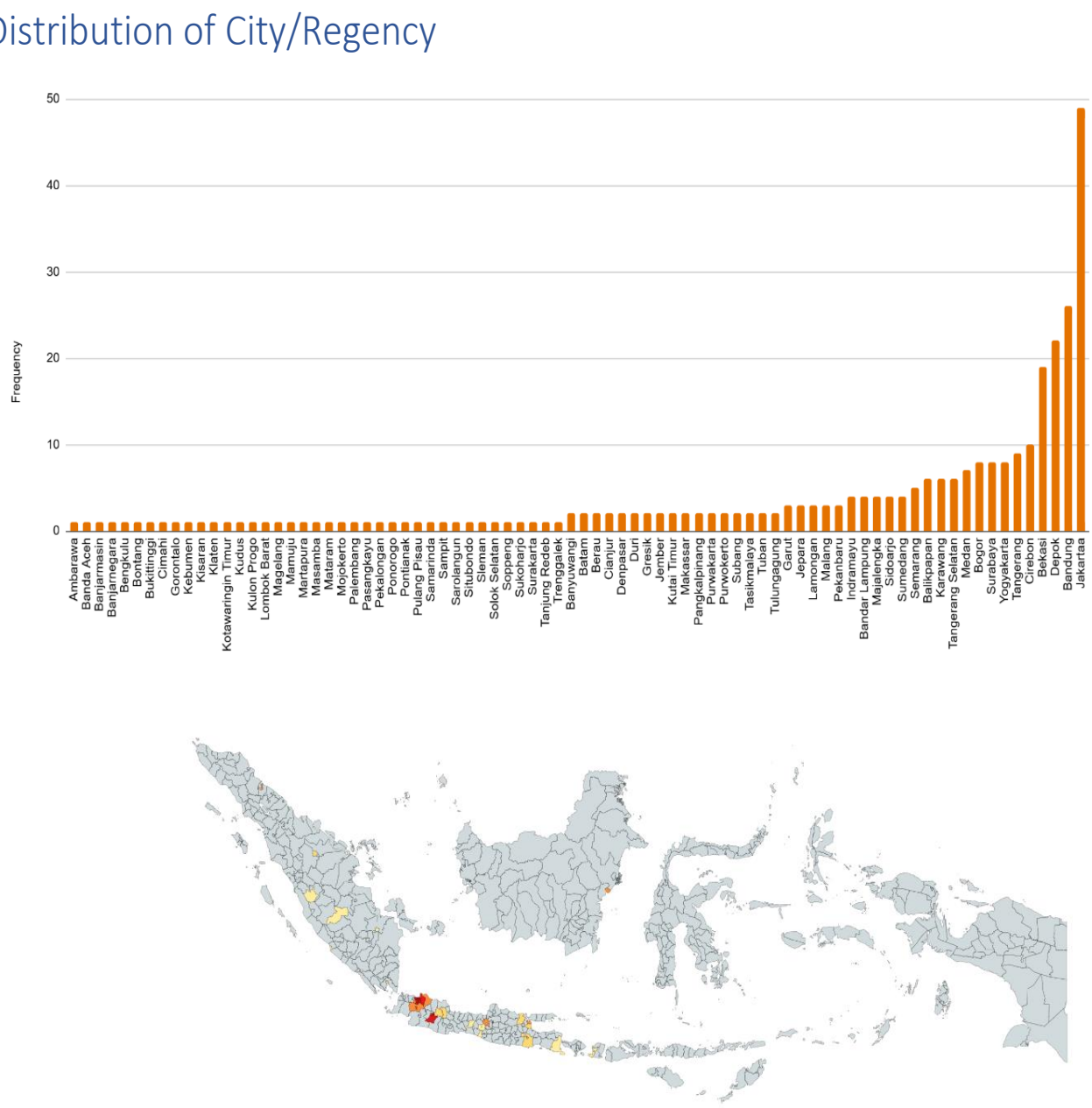
The study relied on a cross-sectional design using a self-administered online questionnaire to collect data from vape users aged 17 and older. The questionnaire was designed to gather detailed sociodemographic information and vaping habits, allowing for descriptive analysis. Ensuring a diverse sample from various demographic backgrounds and geographic locations can help mitigate selection bias. Targeting participants from both urban and rural areas in different regions of Indonesia may provide a more comprehensive view of vape users. The statistical methods that we used are descriptive statistics such as calculation of means and standard deviations, and also frequency distributions to show how respondents were distributed across different categories.

Of the 332 individuals who completed the survey, only 297 met the inclusion criteria. Overall, the sample size of 297 respondents was determined through a combination of statistical calculations, pilot testing, and practical considerations to ensure the study's findings would be robust and representative of vape e-cigarette users in Indonesia. The remaining 35 were excluded due to their age (less than 18 years) and incomplete survey responses. Quantitative variables were handled by descriptive statistics, such as the calculation of means and standard deviations. For continuous quantitative variables such as age, duration of vape use, nicotine levels, and volume of e-liquid consumed, we calculated descriptive statistics (means, medians, ranges, and standard deviations) to summarize the data. For variables like income level or education, we used frequency distributions to show how many respondents fall into different categories.

A total of 287 respondents were identified as male. The majority of respondents to the survey were identified as Muslim and residents of Java Island, particularly in the cities of Jakarta, Bandung, Depok, Bekasi, and Cirebon. In addition to Java, a considerable number of respondents reside on the islands of Sumatra and Kalimantan. The mean age of the respondents was 33.4 years (SD = 11.7), with a range of 18 to 59 years. The average respondent had completed secondary education. 91.6% of respondents wereemployed, and their work was typically conducted indoors. The average monthly income of respondents was above Rp. 5,000,000 and within the range of Rp. 1,000,000 to Rp. 3,000,000. The majority of respondents were married and resided with their families in residential neighborhoods (Fig. **1**).

The data indicated that the respondents were primarily e-cigarette smokers (81.8%), followed by conventional smokers who also used e-cigarettes daily (19.2%). Other tobacco products utilized by dual users included conventional cigarettes, nicotine pouches, and snus. The mean frequency of e-cigarette use was greater than 20 suctions per day, with an average of 60 ml of e-liquid containing 6 mg of nicotine. The estimated time required to consume the e-liquid was between one and two weeks. The monthly expenditure on e-cigarettes ranged from Rp. 100,000 to Rp. 500,000 (Table **1**).

The effects of e-cigarette use on oral health include xerostomia, gingival recession, oral ulcers, increased dental calculus, and alterations in taste perception. However, most of these effects were not accompanied by significant complaints. The most frequently reported symptom was halitosis, with a prevalence of 90.2%. In comparison to conventional cigarettes, e-cigarettes/vapes were perceived to have a more favorable impact on general health and exercise capacity. The anxiolytic effect of e-cigarette use was found to be comparable to that of conventional cigarette use. As evidenced in Table **2**, e-cigarette users demonstrated a limited understanding of the health risks associated with nicotine. The respondents expressed the view that conventional cigarettes are more harmful than e-cigarettes. Moreover, respondents believe that e-cigarettes/vapes can assist conventional cigarette smokers in transitioning to e-cigarettes or quitting smoking. As illustrated in Table **3**, the majority of respondents (87.2%) had successfully quit smoking, with the primary motivating factors being health-related concerns. Furthermore, the majority of respondents indicated a desire to quit smoking, with an average of over three documented attempts to do so (Fig. **2**).



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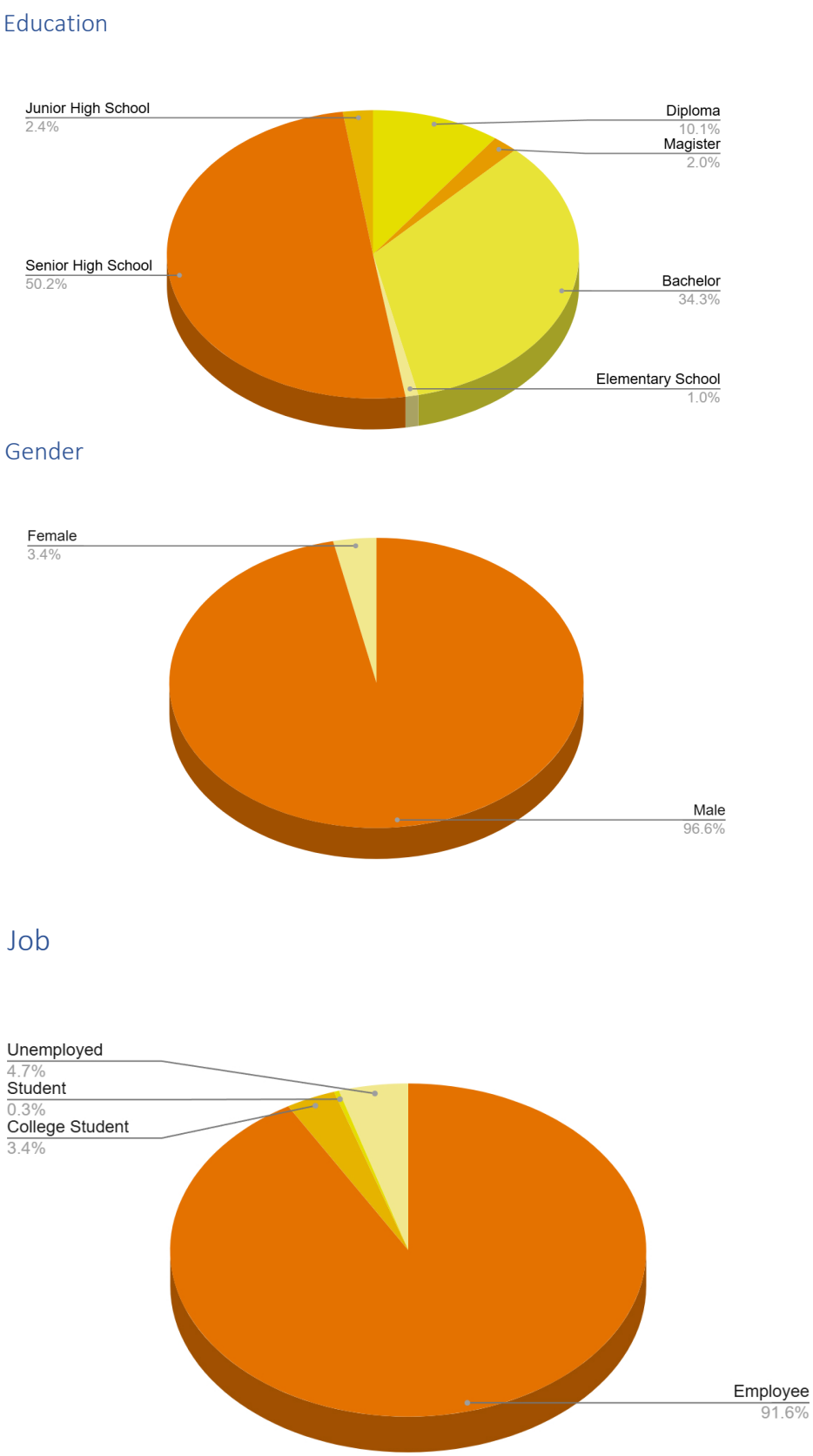

Education
Junior High School
2.4%
Diploma
10.1%
Magister
2.0%
Senior High School
50.2%
Bachelor
34.3%
Elementary School
1.0%
Gender
Female
3.4%
Male
96.6%
Job
Unemployed
4.7%
Student
0.3%
College Student
3.4%
Employee
91.6%

Fig. 1 contd.....

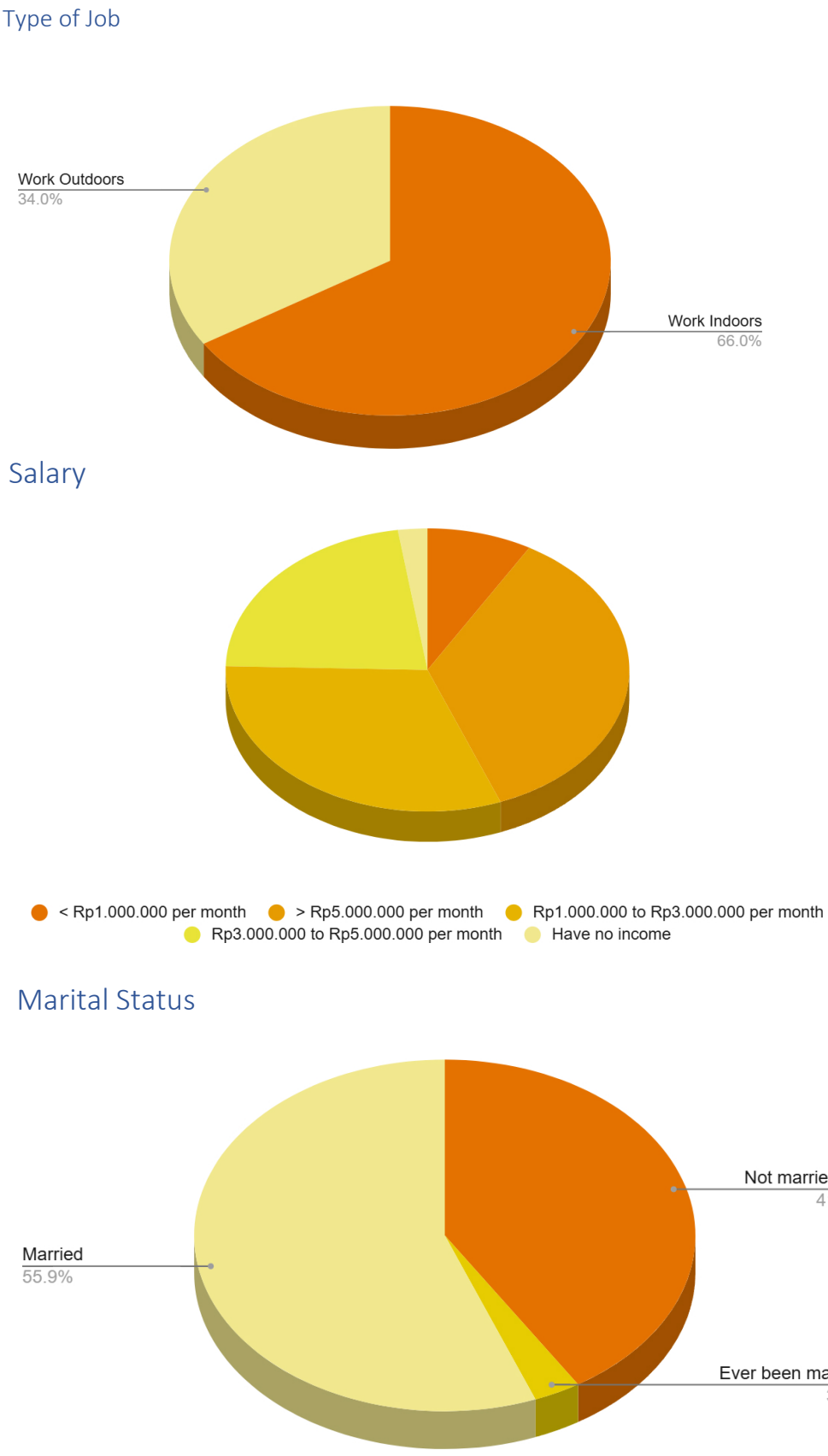

Type of Job
Work Outdoors
34.0%
Work Indoors
66.0%
Salary
< Rp1.000.000 per month
> Rp5.000.000 per month
Rp1.000.000 to Rp3.000.000 per month
Rp3.000.000 to Rp5.000.000 per month
Have no income
Marital Status
Not married yet
41.1%
Married
55.9%
Ever been married
3.0%

Fig. 1 contd.....

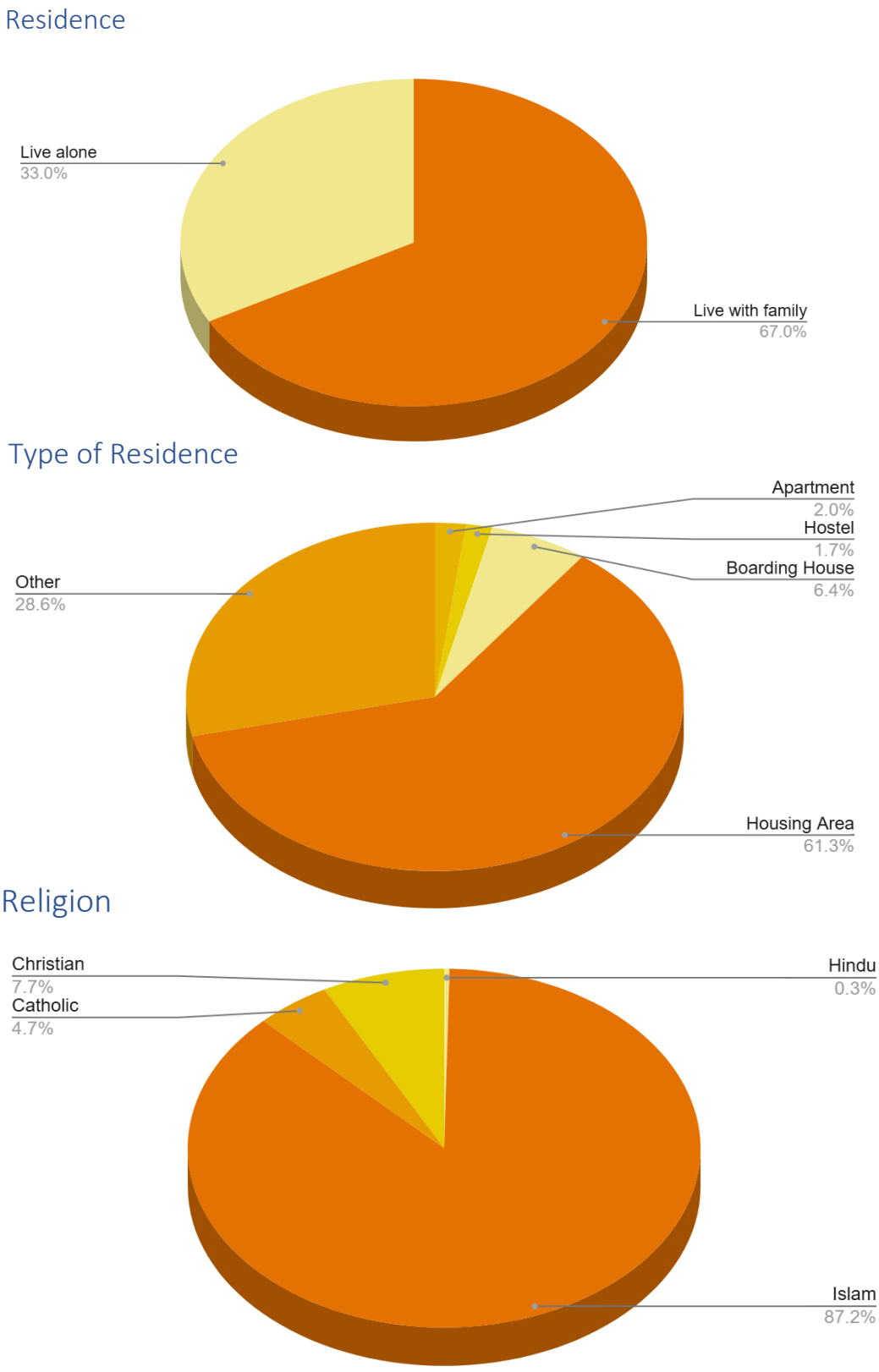

Residence
Live alone
33.0%
Live with family
67.0%
Type of Residence
Apartment
2.0%
Hostel
1.7%
Boarding House
6.4%
Other
28.6%
Housing Area
61.3%
Religion
Christian
7.7%
Hindu
0.3%
Catholic
4.7%
Islam
87.2%

Fig. 1 contd.....

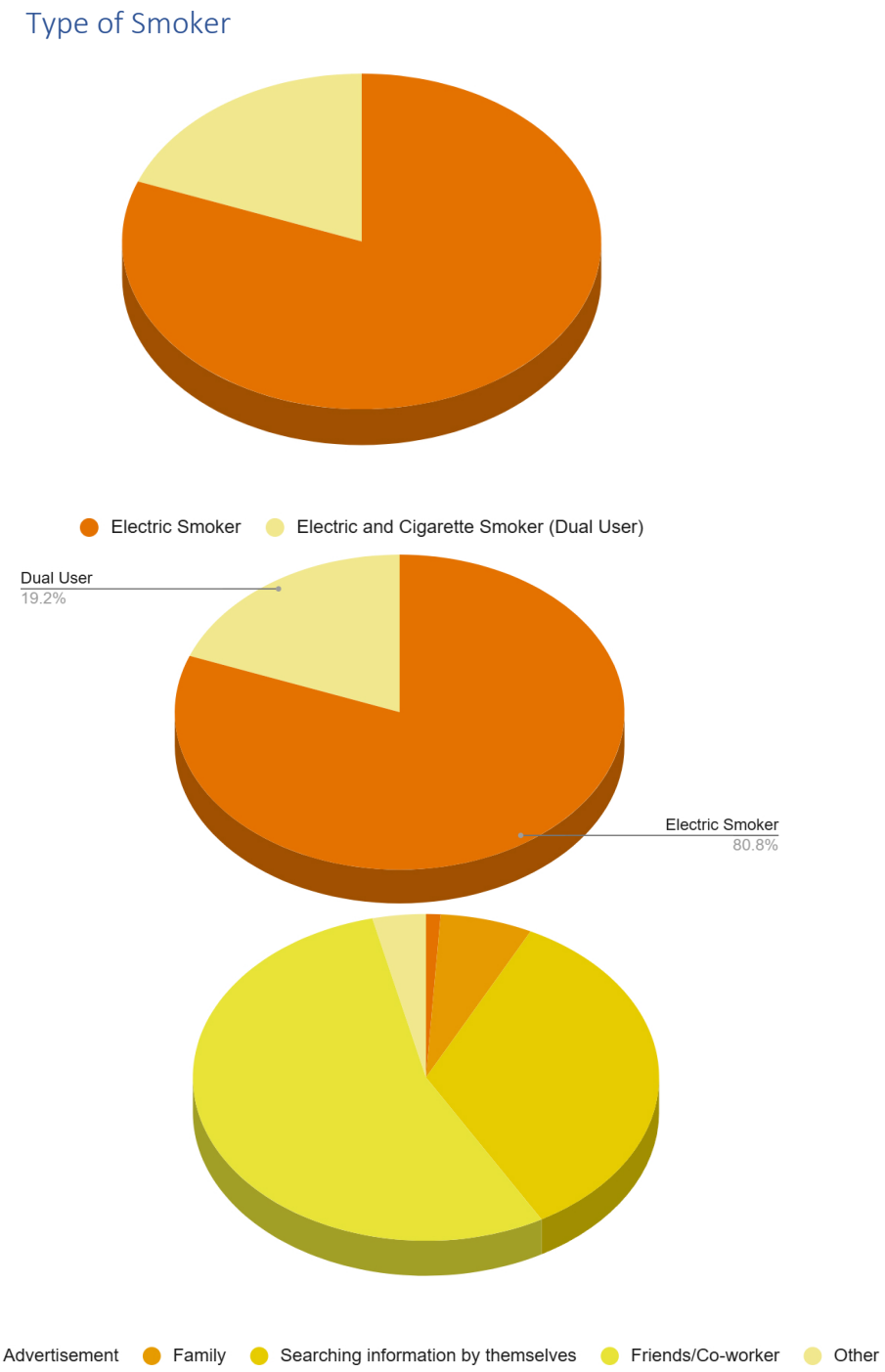


Fig. (1). Characteristics of e-cigarette users in Indonesia based on sociodemographic background.

A majority (96.6%) of e-cigarette users in Indonesia expect that e-cigarette regulation in Indonesia should be distinct from that of conventional cigarettes. It is recommended that the minimum age for e-cigarette users be set at 18 years old. The imposition of restrictions on e-cigarette use in specific locations, such as homes, offices, or public transportation, should be minimized. It is recommended that a dedicated space be allocated for e-cigarette users, separate from that allotted for conventional cigarette users. It is recommended that the Ministry of Health and the Indonesian Food and Drug Administration (BPOM) assume responsibility for the regulation and distribution of e-cigarettes in Indonesia. E-cigarettes are subject to excise taxation in accordance with their risk profile. They are sold with a SIUP license, which can be accessed by presenting an ID card (Table **4**).

Table 1. Habits related to e-cigarette use.

Variable	n (%)	*p*
Since when have you been using e-cigarettes?	-	-
<1 tahun	23 (7.7)	0.000
>3 tahun	207 (69.7)	
1-3 tahun	67 (22.6)	
Are you a daily e-cigarette user?	-	-
Yes	266 (89.6)	0.000
No	31 (10.4)	
Do you currently still use products other than e-cigarettes?	-	-
Yes	92 (31.0)	0.000
No	205 (69.0)	
What types of products other than e-cigarettes do you use?	-	-
Nicotine pouches	36 (12.1)	0.678
Snus	7 (2.4)	
Other	49 (16.49)	
Not using other product	205 (69.0)	
What level of nicotine do you use?	-	-
3 mg	72 (24.2)	0.875
6 mg	107 (36.0)	
8 mg	12 (4.0)	
12 mg	26 (8.8)	
16 mg	10 (3.4)	
24 mg	32 (10.8)	
36 mg	38 (12.8)	
What volume of e-liquid do you use?	-	-
10 ml	13 (4.3)	0.117
15 ml	10 (3.4)	
30 ml	57 (19.2)	
60 ml	190 (64.0)	
100 ml	27 (9.1)	
How long does it take to use up the e-liquid you are using?	-	-
<1 weeks	22 (7.4)	-
1-2 weeks	142 (47.8)	
3-4 weeks	111 (37.4)	
5-6 weeks	15 (5.1)	
<6 weeks	7 (2.4)	
How often do you use e-cigarettes in a day?	-	-
<5 times	4 (1.3)	0.003
5-10 times	22 (7.4)	
11-15 times	20 (6.7)	
16-20 times	32 (10.8)	
>20 times	219 (73.7)	
How much does it cost per month to consume e-cigarettes?	-	-
<Rp100.000	18 (6.1)	-
Rp100.000-Rp200.000	132 (44.4)	
Rp200.000-Rp500.000	127 (42.8)	
>Rp500.000	20 (6.7)	

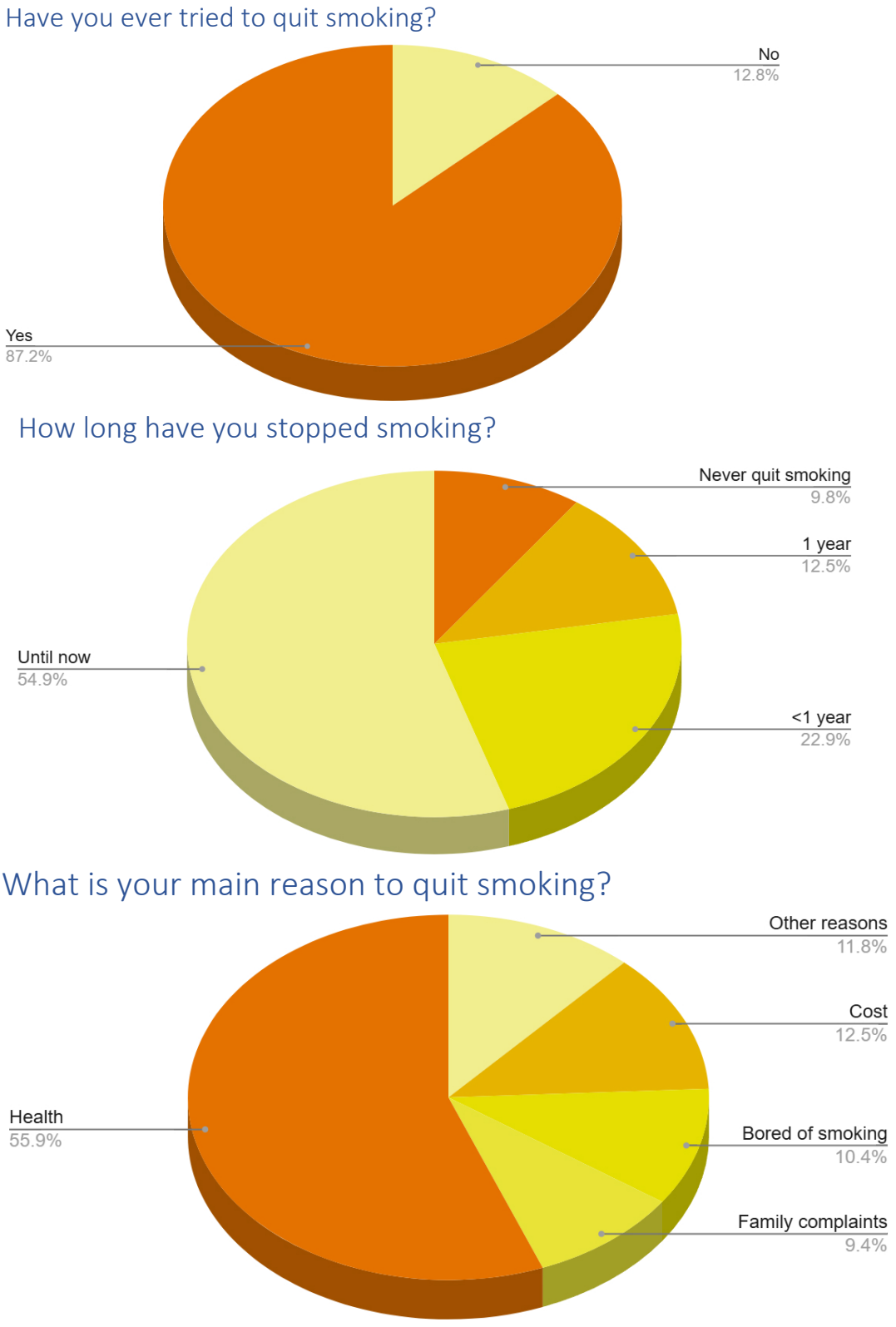
Table 2. Health complaints related to electronic cigarettes.

Variable	n (%)	*p*
Calming effect	-	-
Yes	120 (40.4)	0.201
No	3 (1.0)	
Just normal	168 (56.6)	
Don't know	6 (2.0)	
Bad breath	-	-
Yes	268 (90.2)	0.088
No	29 (9.8)	
Dry mouth	-	-
Yes	130 (43.8)	0.755
No	167 (56.2)	
Gingival recession	-	-
Yes	17 (5.7)	0.270
No	280 (94.3)	
Canker sores	-	-
Yes	32 (10.8)	0.588
No	265 (89.2)	
Heavy calculus	-	-
Yes	50 (16.8)	0.083
No	247 (83.2)	
General health condition	-	-
Improved	192 (64.6)	0.071
Same/not improved	105 (35.4)	
Capabilities in exercise	-	-
Improved	160 (53.9)	0.583
Worsen	3 (1.0)	
Same/not improved	134 (45.1)	
Changes in taste buds	-	-
Improved	132 (44.4)	0.243
Worsen	1 (0.3)	
Same/not improved	164 (55.2)	

Table 3. Perceptions and knowledge of e-cigarette users regarding e-cigarettes.

Variable	n (%)
According to your knowledge, what portion of the health risks caused by smoking comes from the nicotine in cigarettes?	-
Less than half of health risks are caused by nicotine	136 (45.8)
More than half of health risks are caused by nicotine	35 (11.8)
Almost all health risks are caused by nicotine	20 (6.7)
No risk	39 (13.1)
Don't know	67 (22.6)
Which statement is true, in your opinion?	-
E-cigarettes are more harmful than cigarettes	4 (1.3)
E-cigarettes are as harmful as cigarettes	21 (7.1)
Cigarettes are more harmful than e-cigarettes	254 (85.5)
Don't know	18 (6.1)
E-cigarettes have been proven to help smokers quit or switch	-
Not really	17 (5.7)
Strongly agree	162 (54.5)
Agree	110 (37.0)
Disagree	6 (2.0)
Strongly disagree	2 (0.7)

The Characteristic of Electronic Cigarettes Users in Indonesia



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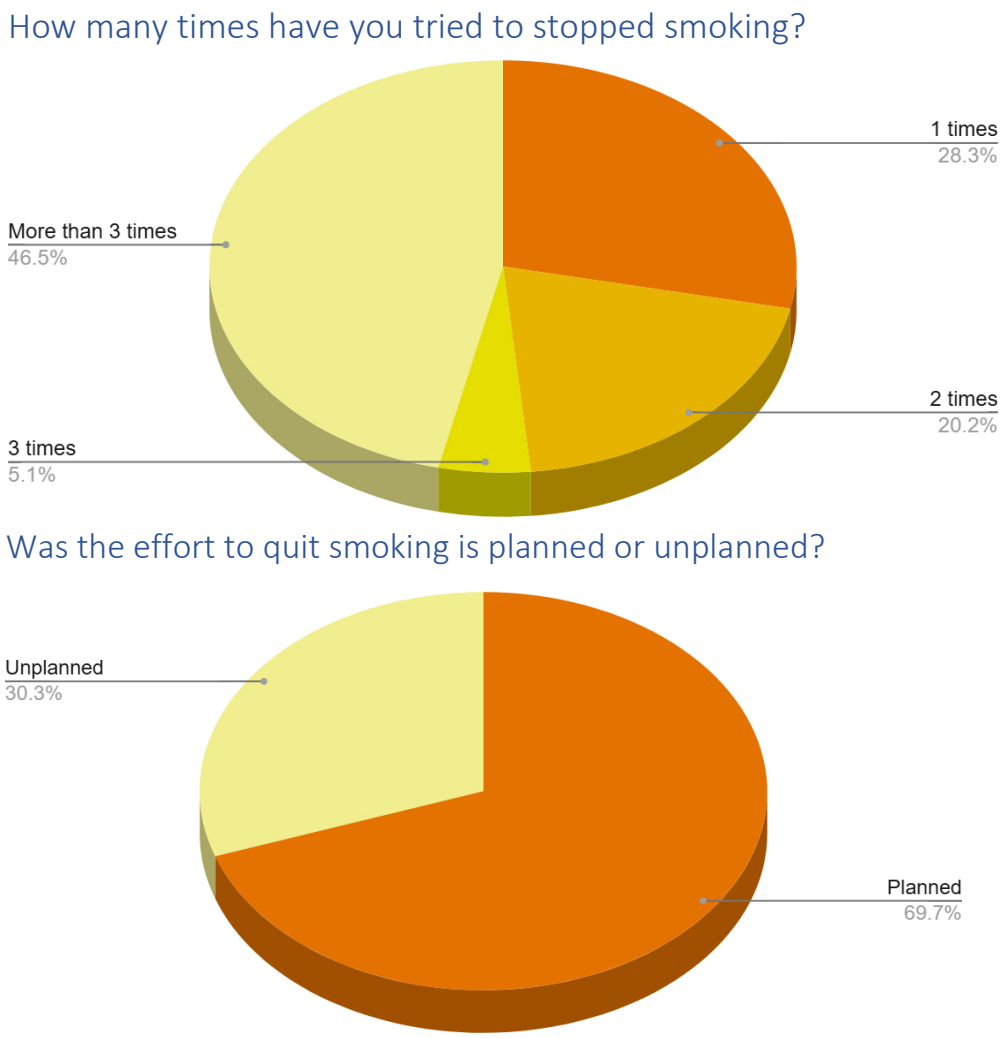

Fig. (2). Reasons and efforts of e-cigarette users to stop smoking.

Table 4. Perceptions of e-cigarette users towards e-cigarette policy in Indonesia.

Variable	n (%)
E-cigarettes should be used in areas where smoking is prohibited	-
Not really	41 (13.8)
Strongly agree	79 (26.6)
Agree	87 (29.3)
Disagree	68 (22.9)
Strongly disagree	22 (7.4)
Rules for e-cigarette use and smoking: Restrictions on e-cigarette use at home	-
Allowed at anywhere	102 (34.3)
Partially limited	188 (63.3)
Not allowed at all	7 (2.4)
Rules for using e-cigarettes and smoking cigarettes: If you work, is the use of e-cigarettes and cigarettes prohibited in office areas?	-
Yes	116 (39.1)
No	158 (53.2)
Unemployed	23 (7.7)
Rules for using e-cigarettes and smoking cigarettes: Restrictions on use in cars	-

(Table 4) contd.....

Variable	n (%)
Allowed at anywhere	89 (30.0)
Partially limited	179 (60.3)
Not allowed at all	29 (9.8)
E-cigarette distribution and control should be regulated by Kemenkes and BPOM	-
Not really	58 (19.5)
Strongly agree	67 (22.6)
Agree	130 (43.8)
Disagree	20 (6.7)
Strongly disagree	22 (7.4)
E-cigarette user rooms should be separated from cigarette users	-
Agree	246 (82.8)
Disagree	51 (17.2)
E-cigarettes are subject to excise tax proportionally based on risk profile, sold with SIUP licensing, and accessed by showing ID card.	-
Agree	280 (94.3)
Disagree	17 (5.7)
The age of e-cigarette users is limited to at least 18 years	-
Agree	285 (96.0)
Disagree	12 (4.0)
Regulations for e-cigarettes are made different and separate from cigarettes.	-
Agree	287 (96.6)
Disagree	10 (3.4)

4. DISCUSSION

In the past decade, the use of electronic cigarettes (e-cigarettes) and vaping products (e-vapes) has emerged as a rapidly growing phenomenon worldwide, particularly among adolescents and young adults [5]. E-cigarettes are one of the tobacco products that were commercially introduced in Beijing in 2003 [5]. E-cigarettes are a term that covers all devices that use the Electronic Nicotine Delivery Systems (ENDS) mechanism consisting of a battery, reservoir for e-liquid, heating element and mouth-piece [6-8]. Although initially perceived as a safer alternative to conventional cigarettes, the use of e-vapes and electronic cigarettes has raised new concerns regarding pulmonary health [8]. E-liquid in e-cigarettes contains alcohol (propylene glycol and/or glycerin) as a solvent, nicotine, and flavoring chemicals [9, 10]. The heat generated by e-cigarettes converts the e-liquid into an aerosol, which is then inhaled by the user [6, 8, 9].

Since 2006 until now, e-cigarettes have been increasingly recognized by the world community at large [5, 11, 12]. The prevalence of e-cigarette users among both adults and adolescents has increased significantly in recent years [1, 11-17]. Likewise, in Indonesia, data shows a 10-fold increase in e-cigarette users from 2011–2021 [18]. In this study, e-cigarette users were found to be more men than women, which is similar to the condition of e-cigarette users in Indonesia and the world [12, 18-20]. Men's greater susceptibility to e-cigarette use than women in relation to work, relationships, and psychological conditions are considered factors that cause e-cigarette users to be more male than female [21-24]. Respondents, on average lived in big cities in the provinces of West Java, DKI Jakarta, East Java, Central Java, Banten, North Kalimantan, Central Kalimantan, West Nusa Tenggara, Bali, North Sumatra, West Sumatra, South Sulawesi, West Sulawesi, Southeast Sulawesi, North Sulawesi, Jambi, Bangka Belitung, South Sumatra, and Lampung. This finding is almost similar to the data of the 10 provinces with the largest percentage of e-cigarette consumers in Indonesia in 2022 [25]. The tendency of e-cigarette users to be more in big cities is related to the distribution of shops providing e-cigarette equipment, which are more commonly found in big cities, easier access to purchasing e-cigarettes online, higher media exposure to e-cigarettes compared to small cities, and psychosocial factors of big city people who consider e-cigarettes as a form of lifestyle and social trends [24, 26]. The results of research by Mayer *et al*. [19] and Damayanti [27] show the same pattern as the results of this study, namely that most e-cigarette users are adults aged between 18-59 years. However, there is an increasing trend of e-cigarette users globally among adolescents [12, 26, 28]. This increasing trend occurs in line with the increasingly massive marketing of e-cigarettes, especially on social media [16]. In addition, the perception of adolescents who consider the negative impact of e-cigarettes to be lower than conventional cigarettes, diverse flavors, and easy to use are the reasons more and more adolescents are using e-cigarettes [29-31].

The present study demonstrates that the educational level of e-cigarette users is comprised primarily of high school graduates and undergraduates. This finding is consistent with the results of research conducted by Elsa *et al*.and the 2017 review of electronic cigarettes in Indonesia [26, 29]. Some studies have indicated that individuals with higher levels of education are more likely to use e-cigarettes compared to those with lower levels of education [19, 29]. The majority of respondents reported having jobs with an average monthly income between

Rp.1,000,000 and Rp.5,000,000, with a few reporting incomes exceeding Rp.5,000,000. Individuals who are employed and possess a sufficient income are more likely to utilize e-cigarettes, as they are not only able to purchase them but are also exposed to a greater frequency and intensity of advertisements for e-cigarettes. The majority of respondents were married, which aligns with the findings of Obisesan's research [33]. Ramsey examined the relationship between marital status and conventional cigarette use. Compared to marital status itself, the level of stress in a relationship is more influential on the preference for conventional cigarette use [34]. However, the relationship between marital status and e-cigarette use status remains unclear. From the results of the study, it was found that most e-cigarette users lived with their families and in residential neighborhoods. Studies conducted by Shih showed an influence between family factors and the living environment of e-cigarette users [35]. This is similar to Oxa's research, which shows that family conditions, friends, and neighbors affect the status of e-cigarette use. If one of the family members, friends, and neighbors use e-cigarettes, the chances of someone using e-cigarettes are greater [36].

The results of this study found that respondents were e-cigarette users only and users of e-cigarettes and conventional cigarettes or so-called dual users. This condition is similar to conditions in the USA, where adults (18-45 years) are more likely to find e-cigarette users alone than dual users [37]. The assumption of most respondents who think that e-cigarettes have a lower risk to health than conventional cigarettes and that e-cigarettes are one way to quit conventional smoking is the reason why they prefer to use e-cigarettes. This is also the reason why most people in the world choose to become e-cigarette users [29, 38-41]. They use e-cigarettes every day, and the average frequency of smoking e-cigarettes every day is more than 20 times. The same phenomenon was also found in a study by Alhajj [38] and Hayati [42]. The e-cigarettes used by respondents, on average, use e-liquid with a volume of 60 ml and nicotine levels of 6mg, which runs out in 1-4 weeks. The same thing is also seen in previous studies, which found that the average e-cigarette user uses e-liquid with levels of 6-8 mg [43]. In Indonesia, most e-cigarette users use e-liquid with a volume of 60 ml and 80 ml [36]. The volume of e-liquid used by e-cigarette users varies depending on the type of e-cigarette used and the products circulating in the area of e-cigarette users [44]. However, currently, the volume and nicotine levels on the label of e-cigarette e-liquids circulating on the world market are still not in accordance with reality [44, 45]. Therefore, it is difficult to know which e-liquid is widely used by e-cigarette users and measure the effects caused [46]. Damayanti examined that the affordability of e-cigarette users in Indonesia is > Rp.100,000 [27]. This is in line with the findings of this study, namely that in a month, the costs incurred by respondents ranged from Rp.100,000 to Rp. 500,000 (USD $6-USD $33). The costs incurred by e-cigarette users vary greatly depending on the type of e-cigarette used, brand, volume of e-liquid, nicotine levels, and flavors chosen [47]. In Indonesia, the affordable price of e-cigarette devices increases the opportunity for people to use e-cigarettes. The affordable price of e-cigarette devices in Indonesia is due to the absence of clear and firm regulations regarding e-cigarettes, including the tax [26, 48].

In this study, respondents were asked questions about health complaints related to the use of e-cigarettes including the calming effects of e-cigarettes, bad breath, dry mouth, decreased gums, mouth ulcers, tartar, general health condition, ability to exercise, and changes in taste buds. 40.4% of respondents stated that e-cigarettes provide a sense of calm after consuming them. This may be related to nicotine that is absorbed by the body, causing activation of nicotine receptors in the brain and increased dopamine release, which causes a sense of comfort [49, 50]. The sensation of comfort makes users want to inhale the e-cigarette again, but over time, this condition turns into an addictive condition [49]. Bad breath is most frequently complained about by respondents regarding oral health compared to dry mouth, mouth ulcers, decreased gums, increased tartar, and changes in the sense of taste. During the e-cigarette smoking process, the oral mucosa is directly exposed to harmful substances produced by e-cigarettes and is damaged by heat or trauma due to the e-cigarette device [51-53]. The process of smoking e-cigarettes and e-liquid compounds in e-cigarettes consisting of various components has been shown to cause dysbiosis in the oral cavity, damage to the oral epithelium, induce chronic inflammation, and changes in oral homeostasis related to saliva and genotoxicity, which increases the risk of malignancy in the oral cavity [51, 54-57]. Among the e-liquid components, among others, there are saccharides and sucralose which function to provide a sweet taste. High sugar levels caused by saccharides and sucralose and the repetitive process of e-cigarette smoking cause a shift in the microbiome of oral pathogens [51]. E-cigarettes and the process of e-cigarette smoking also cause high Reactive Oxidant Stress (ROS), so the risk of oral epithelial cell damage increases [53, 58-61]. Acrolein, aldehydes, copper, and heavy metals contained in e-cigarettes are thought to be responsible for the mechanism of increased ROS and cell damage (59). High levels of ROS and decomposition products from the process of using e-cigarettes also result in salivary glands, especially hyposalivation [61]. The bad breath that many e-cigarette users complain about is most likely related to the condition of dysbiosis and hyposalivation [54, 61]. Although decreased gums, mouth ulcers, and increased tartar were not commonly complained of by respondents, these periodontal tissue complaints are closely related to dysbiosis, epithelial damage, hyposalivation, and chronic inflammatory conditions caused by e-cigarettes [56, 59, 60]. Changes in the sense of taste are related to the nicotine levels often used by e-cigarette users, but the trend is that the perception of sweetness is found to increase in e-cigarette users [62]. Half of the respondents thought that their general health condition was quite good despite using e-cigarettes. They also felt there was no significant difference in their ability to exercise before and after using e-cigarettes. The results of this study contradict with the findings of Almeida [4], Huiqi [63], and Herman [49], who found that e-cigarettes adversely affect lung, heart, and brain health, which affects general health and exercise ability. The difference in findings

may be due to different research methods. In addition, the levels of harmful substances contained in e-cigarettes that are absorbed by the user's body also play a major role in the manifestation of health problems due to the use of e-cigarettes which in this study cannot be measured [64].

The majority of respondents expressed the view that e-cigarettes are a safer alternative to conventional cigarettes, citing the minimal impact of nicotine on health issues as a key factor in this assessment. This result is consistent with the findings of prior research conducted by BPOM [26], Elsa [29], Ambrose [31], and Duncan [40]. Furthermore, the hypothesis that the utilization of e-cigarettes can assist conventional smokers in transitioning to an alternative form of nicotine consumption or even in cessation of smoking was also a prevalent viewpoint amongst the respondents. This finding aligns with the results of several previous studies [13, 26, 30, 31]. These assumptions are closely related to e-cigarette advertisements currently available on the market [32].

Given that Indonesia is one of the countries with the largest e-cigarette users in the world, it is imperative that the government implement strict and clear regulations regarding the circulation, sale, and use of e-cigarettes. The regulations pertaining to e-cigarettes should be distinct from those governing conventional cigarettes. The institutions responsible for regulating and monitoring the distribution and sale of e-cigarettes should also involve the Ministry of Health and the Food and Drug Administration (BPOM). The minimum age for e-cigarette users should be 18 years. Purchases of e-cigarettes must be made with a valid identity card. The use of e-cigarettes in public facilities should be limited, and separate rooms should be designated for their use, separate from those designated for conventional cigarettes.

The study successfully met its objectives by providing a comprehensive overview of vape e-cigarette users in Indonesia, highlighting key sociodemographic characteristics, usage patterns, health perceptions, and attitudes towards regulation. These findings underscore the importance of targeted public health initiatives and informed policy decisions regarding vaping in Indonesia.

5. LIMITATIONS

This study is subject to certain limitations. These include the relatively small size of the sample, the lack of in-depth questioning in the survey, and the fact that the survey was completed online by the respondents themselves. Further research is required in the form of observational and experimental studies on a larger scale to corroborate the findings of this study.

CONCLUSION

This study shows that the characteristics of e-cigarette users in Indonesia are influenced by diverse sociodemographic backgrounds. Users' perceptions and level of knowledge about e-cigarettes also influence their preference for using e-cigarettes. Health complaints about the impact caused by e-cigarettes on the oral cavity are mostly bad breath and dry mouth, while general health complaints are not really felt.

The government must immediately formulate strict and clear regulations regarding the circulation, sale, and use of e-cigarettes in Indonesia in order to prevent the rapid rate of e-cigarette use in Indonesia and reduce the risks and/or negative impacts that arise from the use of e-cigarettes in the community.

AUTHORS' CONTRIBUTIONS

It is hereby acknowledged that all authors have accepted responsibility for the manuscript's content and consented to its submission. They have meticulously reviewed all results and unanimously approved the final version of the manuscript.

LIST OF ABBREVIATIONS

ENDS	=	Electronic Nicotine Delivery Systems
ROS	=	Reactive Oxidant Stress

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This research has been approved by the Unpad Ethics Committee with number 896/UN6.KEP/EC/202.

HUMAN AND ANIMAL RIGHTS

All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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