

Evaluation of Japanese university students' perception of smoking, interest in quitting, and smoking behavior: An examination and public health challenges during the COVID-19 pandemic

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SUMMARY This study examined college students' perceptions of the association between smoking and novel coronavirus disease 2019 (COVID-19), changes in smoking behavior, and interest in quitting categorized by smoking device, to identify public health challenges. A questionnaire survey was conducted among 8,547 students in a Japanese university in March and April 2021. In response to "Awareness of the increased risk of COVID-19 infection due to smoking and the tendency to develop severe disease", current smokers (70.2%) were more aware of the risk than non-smokers (49.8%) ($p < 0.001$), with no significant difference according to smoking device ($p = 0.213$). "Interest in quitting smoking" ($p = 0.323$), and "Changes in smoking behavior during the COVID-19 pandemic" ($p = 0.146$) did not differ by smoking device. However, approximately 50% of the respondents answered that they were not interested in quitting smoking, while two-thirds reported that the number of cigarettes they smoked did not change during the pandemic. During the COVID-19 pandemic, college students were found to be less interested in quitting and not likely to change their smoking behavior, despite the knowledge of the increased risk of COVID-19 transmission and severity of disease from smoking, regardless of smoking device.

Keywords COVID-19 pandemic, college students, perceptions of smoking, interest in quitting, smoking behavior

1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes novel coronavirus disease 2019 (COVID-19), was first reported in Wuhan, China, in December 2019 (1) and is responsible for a global pandemic. A previous study reported that college students in the United States showed increased stress and anxiety due to COVID-19, including fear and worry about their health, disruption of sleep patterns, and concerns about academic performance (2). Japanese university students may have similar concerns, as they may not be able to lead the student life they envisioned due to online lectures, restrictions on school entry, restrictions on clubs, and other activities.

The WHO estimates that there are currently about

1.1 billion smokers worldwide, and this is expected to increase to 1.3 billion worldwide by 2025 (3). The United Nations has established the Sustainable Development Goals (SDGs), particularly Goal 3, which is to "ensure healthy lives and promote well-being for all people of all ages" including "the implementation of the WHO Framework Convention on Tobacco Control be strengthened in all countries, as appropriate" (target 3.a). Smoking has been reported as a possible risk for COVID-19 infection (4). Furthermore, a study reported that patients with a history of smoking have a higher rate of rapid deterioration in health status during hospitalization than non-smokers (5).

Previous studies have reported that there was no noticeable change in the smoking status of college students during the pandemic (6). However, there are

no studies that have examined changes in smoking behavior by smoking devices, such as cigarettes or new types of cigarettes (heated cigarettes/electronic cigarettes). The use of new types of cigarettes, including electronic and heated cigarettes, is increasing rapidly in every country in the world (7-9). Youth smokers reportedly hold misconceptions such as how easy it is to quit using e-cigarettes and perceived benefits such as having more friends and looking cool (10). Therefore, it is important to clarify the characteristics of different smoking tools, including new types of cigarettes, in terms of the perception of harm, concern, and behavioral changes in smokers during the COVID-19 pandemic.

Therefore, we conducted a survey of smoking among university students in Japan during the COVID-19 pandemic. Its purpose was to compare and evaluate the perceptions of the association between smoking and COVID-19, interest in quitting, and changes in smoking behavior by smoking devices.

2. Methods

2.1. Subjects

From March to April 2021, a self-administered, anonymous, questionnaire was distributed to all 8,547 students from University A in Japan. Eligible students included undergraduate and graduate students. Responses were received from 8,117 students (95%). The valid response rate was 100%. The age of the students was 19.5 ± 2.87 years (mean \pm SD). The survey was conducted between March and April 2021, which was between the third and fourth expansion periods of COVID-19 infection in Japan. At this time, other countries were taking measures to introduce lockdowns (city blockades), but there were no city blockades in Japan. The Japanese government had already lifted its declaration of a state of emergency, requesting the restriction of activities.

2.2. Survey items

For all subjects, responses were obtained for age, sex, and smoking history. To determine why current smokers started smoking, participants were able to check all that applied from the following: "Influence from friends, classmates, and older adults", "Curiosity", "Stress relief", "Influence from people at part-time jobs", and "My family smoked". Participants could select "Yes, I know" or "No, I did not know" about their awareness of the increased risk of COVID-19 infection and the increased severity of the disease due to smoking. Interest in quitting smoking was indicated as follows: "I would like to quit smoking now", "I am interested and plan to quit within a month", "I am interested but want to start after a month", "I am

interested but do not plan to quit within 6 months", and "I am not interested in quitting smoking at all". Respondents were asked to select one of the following items regarding changes in smoking behavior during the COVID-19 pandemic: "I would like to quit smoking", "I have reduced the number of times I smoke", "The number of times I smoke has not changed", or "The number of times I smoke has increased".

2.3. Statistical analysis

To analyze the association between smoking history and "perception of increased risk of COVID-19 infection and susceptibility to severe disease due to smoking", smoking history was divided into three groups: never smokers, former smokers, and current smokers, and Pearson's χ^2 test was performed. In addition, smoking devices were divided into three groups: cigarette smokers, new types of cigarettes smokers, and cigarette smokers who smoked both cigarettes and new types of cigarettes (dual users). In addition, to analyze the relationship between smoking devices and "awareness of increased risk of COVID-19 infection and susceptibility to severe disease due to smoking", "interest in quitting among current smokers", and "changes in smoking behavior during the COVID-19 pandemic", we performed Pearson's χ^2 test. SPSS statistics 26 (IBM Corp Armonk, NY, USA) was used for analysis, and $p < 0.05$ was set as statistically significant.

2.4. Ethics

The purpose, methods, and management of personal information of the study were explained in writing to the subjects, and their consent was obtained by answering the questionnaire. This study was approved by the Chubu University Ethics Review Board (Approval No. 20200095).

3. Results

3.1. Attributes of respondents

The attributes of the respondents are listed in Table 1. The number of current smokers was 356 (4.4%). When the current smokers were divided by smoking devices, 128 (36.0%) were cigarette smokers, 68 (19.1%) were new types of cigarettes smokers, and 160 (44.9%) were dual users.

3.2. Current smokers' reasons for smoking

Table 2 shows the reasons for smoking among current smokers. The results indicate that "influence from friends, classmates, and older adults" was the primary reason for smoking (68.3%), followed by "curiosity" (29.2%).

Table 1. Basic attributes of respondents (n = 8,117)

Gender	Non-smokers (n = 7,202)	Former smokers (n = 559)	Current smokers (n = 356)		
			Cigarette smokers (n = 128)	New type types of cigarettes smokers (n = 68)	Dual users (n = 160)
Male (n = 5,551)	4,789 (66.5%)	456 (81.6%)	116 (90.6%)	56 (82.4%)	134 (83.8%)
Female (n = 2,500)	2,357 (32.7%)	95 (17.0%)	11 (8.6%)	11 (16.2%)	26 (16.3%)
Non-response (n = 66)	56 (0.8%)	8 (1.4%)	1 (0.8%)	1 (0.4%)	0 (0.0%)

Table 2. Current smokers' reasons for smoking (multiple answers) (n = 356)

Items	n	%
Influenced by friends, classmates, and older adults	243	68.3
Curiosity	104	29.2
Stress relief	76	21.3
Influenced by people at my part-time job	74	20.8
A family member was smoking	31	8.7

Table 3. Perception of increased risk of COVID-19 infection and susceptibility to severe disease due to smoking (n = 8,117)

Items	Non-smokers (n = 7,202)	Former smokers (n = 559)	Current smokers (n = 356)	Total	p-value
I knew it.	3,587 (49.8%)	339 (60.6%)	250 (70.2%)	4,176 (51.4%)	< 0.001
I didn't know.	3,615 (50.2%)	220 (39.4%)	106 (29.8%)	3,941 (48.6%)	

3.3. Awareness that smoking increases the risk of COVID-19 infection and the likelihood of severe disease

The increased risk of COVID-19 infection due to smoking and the perception of susceptibility to severe disease are shown in Table 3. Among non-smokers, former smokers, and current smokers, the results demonstrate that the number of respondents who "knew" that smoking increased the risk of COVID-19 infection and increased the severity of the disease was significantly higher among current smokers compared to non-smokers 250 (70.2%) and 3,587 (49.8%) respectively; ($p < 0.001$).

In addition, we divided current smokers according to smoking types and compared their perceptions of increased risk of COVID-19 infection and susceptibility to severe disease due to smoking, as shown in Table 4. There were no significant differences when comparing cigarettes, new types of cigarettes, and dual users ($p = 0.213$). However, the percentage of "knew" was more than half for all smoking equipment groups, especially for the new types of cigarettes, with nearly 80% of students knowing that smoking caused an increased risk of COVID-19 infection and the likelihood of severe disease.

Furthermore, other factors (year, gender) and awareness that smoking increases the risk of COVID-19 infection and the likelihood of severe disease were explored by regression analysis but no significance was found (data not shown).

3.4. Interest in quitting among current smokers

Table 4 shows the results of the responses to the question about interest in quitting smoking among current smokers. There was no association with smoking paraphernalia in terms of interest in quitting ($p = 0.323$). "I want to quit smoking now" was answered by a small number of students for all smoking devices. However, responses of "I am interested but will not quit smoking within six months" were answered by traditional cigarette smokers, 35 students (27.3%), new types of cigarettes smokers, 22 (32.4%), and dual users, 38 (23.8%). The number of students who answered, "I am not interested in quitting smoking at all" was 61 (47.7%) of cigarette smokers, 30 (44.1%) of new types of cigarettes smokers, and 91 (56.9%) among dual users.

3.5. Changes in smoking behavior during the COVID-19 pandemic

The changes in smoking behavior during the COVID-19 pandemic, shown in Table 4, were not associated with smoking device ($p = 0.146$). A small number of students answered, "I will try to quit smoking," for all smoking devices. However, more than half of the students answered that the number of cigarettes smoked did not change during the COVID-19 pandemic: 87 (68.0%) among cigarette smokers, 38 (55.9%) among new types of cigarettes smokers, and 116 (72.5%) among dual

Table 4. Perceptions of increased risk of COVID-19 infection and susceptibility to severe disease due to smoking, interest in quitting smoking among current smokers, changes in smoking behavior during the COVID-19 pandemic by smoking device (n = 356)

Items	Cigarette smokers (n = 128)	New types of cigarettes smokers (n = 68)	Dual users (n = 160)	Total	p-value
Perceptions of increased risk of COVID-19 infection and susceptibility to severe disease due to smoking					
I knew it.	87 (68.0)	54 (79.4)	109 (68.1)	250 (70.2)	0.213
I didn't know.	41 (32.0)	14 (20.6)	51 (31.9)	106 (29.8)	
Interest in quitting smoking among current smokers					
I currently want to work on quitting smoking.	15 (11.7)	7 (10.3)	12 (7.5)	34 (9.6)	
I'm interested and planning to quit smoking within a month.	13 (9.4)	5 (7.4)	8 (5.0)	26 (7.3)	
I'm interested but want to start after 1 month.	4 (3.1)	4 (5.9)	11 (6.9)	19 (5.3)	
I'm interested, but not planning to quit smoking within 6 months.	35 (27.3)	22 (32.4)	38 (23.8)	95 (26.7)	
I have no interest in quitting smoking.	61 (47.7)	30 (44.1)	91 (56.9)	182 (51.1)	
Changes in smoking behavior during the COVID-19 pandemic					
I'm going to quit smoking.	6 (4.7)	4 (4.9)	3 (1.9)	13 (3.7)	0.146
I reduced the number of times I smoke.	29 (22.7)	22 (32.4)	30 (18.8)	81 (22.8)	
The number of cigarettes I smoked (times) remains the same.	87 (68.0)	38 (55.9)	116 (72.5)	241 (67.7)	
The number of cigarettes I smoked (times) increased.	6 (4.7)	4 (4.9)	11 (6.9)	21 (5.9)	

users. There were also a few students who answered, "the number of times I smoke has increased."

4. Discussion

We surveyed students from one university in Japan during the period between the third and fourth expansion of COVID-19 infection in Japan. This study found that although university students who smoke were aware that smoking increases the risk and severity of COVID-19 infection, many of them tended not to change their smoking cessation interest or smoking behavior during the COVID-19 epidemic. This result was true for all smokers. To the best of our knowledge, this is the first study to evaluate COVID-19 awareness, smoking cessation concerns, and changes in smoking behavior among college students during the pandemic.

Many smokers start smoking as adolescents or young adults (11,12). Therefore, it is important to prevent the initiation and continuation of smoking among adolescents. The largest number of current smokers in this study started smoking because they were "influenced by friends, classmates and older adults". In previous studies, the most common reason for initiating smoking was reported to be "smoking by friends" (13), which is consistent with the results of this study.

Smokers were more likely than non-smokers to know that smoking increases the risk and severity of COVID-19. We believe that this result is due to the fact that non-smokers are less interested in smoking than current smokers and have fewer opportunities to gain knowledge about the harmful effects of smoking.

The results of the comparison of awareness of the increased risk of COVID-19 infection due to smoking and the increased severity of the disease by smoking habit showed that the percentage of students who were aware was nearly 80%, especially among smokers who use new types of cigarettes. Prior research has shown that new types of cigarette smokers have lower awareness of the harmfulness of new types of cigarettes (10) and that those who perceived them to be less harmful than cigarettes had higher rates of e-cigarette use (14). Interestingly, our results differed from the results of this previous study in terms of the perceived harmfulness of new tobacco products. Previous studies have reported that beliefs that e-cigarette use helps people quit smoking, tastes good, and looks cool is associated with e-cigarette use, and the belief that heated cigarettes taste good and help people quit smoking is associated with heated cigarette use (15). In summary, we found the new types of cigarettes smokers are aware that smoking increases the risk of COVID-19 infection and the severity of the disease, but they continue to smoke because they prioritize the benefits such as helping them to quit smoking and the attractiveness of the taste.

For interest in quitting smoking, there was no

relationship with smoking device, but the results showed that the percentage of respondents who answered "I am not interested in quitting smoking at all" was over 50%. Additionally, more than 70% of the smokers in this study reported that they were aware of the increased risk of COVID-19 infection and susceptibility to severe disease, suggesting that many students are not at all interested in quitting smoking, even if they are aware of the negative health effects of smoking.

In terms of changes in smoking behavior during the COVID-19 pandemic, there was no association with smoking devices, and more than half of the students reported that the number of cigarettes smoked (times) remained the same for all smoking devices, with a few students reporting an increase. A previous study on changes in smoking behavior during the COVID-19 pandemic reported that 40% of smokers did not change their smoking behaviors (16). This is similar to our results. Furthermore, previous studies have reported that increased smoking is associated with depression, anxiety, and stress symptoms during the COVID-19 pandemic (17). Although this study did not explore the factors that prevented the target students from reducing the number of times they smoked during the pandemic, it did suggest the need for smoking cessation education during the pandemic as well as psychological support for students who smoke.

This study had several limitations. First, the subjects of this study were university students, most of who had probably been smoking for a few months to a few years. Different results may occur when targeting students with a longer smoking history. Second, this study did not distinguish between e-cigarettes and heated cigarettes for new types of cigarettes. Heated cigarettes sold in Japan contain nicotine, whereas e-cigarettes do not. Therefore, different characteristics of cigarettes may result in different perceptions of COVID-19, interest in quitting, and changes in smoking behavior. Third, the questionnaire survey was conducted during the period between the third and fourth expansion of COVID-19 infection in Japan. This was the time when the declaration of a state of emergency to prevent the spread of infection and take measures to secure the medical system had been lifted. The results may vary depending on the future spread of the infection and the measures taken, such as vaccines.

However, the strength of this study is that the questionnaire survey was conducted on a large scale with over 8,000 people. In addition, University A is a general university with many faculties, including humanities, social sciences, natural sciences, and medical sciences. Furthermore, most of the students are from all over Japan. While these results are insufficient to apply to the country as a whole, as they are only an assessment within a single Japanese university, we believe that they are important data for the smoking behavior of college students.

In recent years, a wide variety of smoking devices have been marketed. The current COVID-19 pandemic should be viewed as an opportunity to motivate smokers to quit smoking and to further improve smoking cessation education for smokers who use all types of smoking devices. In addition, from the perspective of the SDGs, since smoking cessation is one factor in achieving the health and well-being of all people, we believe that providing guidance on smoking cessation to smokers, including young people such as college students who have just started smoking, will ultimately lead to the achievement of a sustainable society.

5. Conclusions

In this study, we found that college students who smoked during the COVID-19 pandemic were less interested in quitting smoking and not likely to change their smoking behavior, despite awareness that smoking increases the risk of COVID-19 infection and the severity of the disease. This trend applies to smokers of cigarettes, new types of cigarettes, and dual users. To address these emerging public health challenges identified by this study, the current COVID-19 pandemic should be viewed as an opportunity to motivate smokers to quit and to further improve smoking cessation education for smokers who use all types of smoking devices.

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