



The Effect of Public Health Measures during the COVID-19 Pandemic on Smoking Dependence & Passive Smoking

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: According to increasing concern about the COVID-19 pandemic and the risk of smoking this study was conducted to find the effect of health measures during the COVID-19 pandemic on smoking dependence & passive smoking.

Methods: A cross-sectional study was conducted in September 2020, by using a valid and reliable questionnaire, the data were analyzed by using SPSS, version 20 software.

Results: The study showed 16.9% of participants increased their nicotine use and 12.4% decreased their nicotine use. Despite no significant change in smoking dependence, we found that smokers who used to smoke more than 30 cigarettes per day before the quarantine increased by two folds. In addition, we found that smokers who awaken at night sometimes to have cigarettes before quarantine had increased markedly by 50% during quarantine. Furthermore, smokers who

had an extreme urge to smoke over the week before the quarantine have elevated markedly during the quarantine from 31 smokers to 60. Also, over 35.2 % of surveyed individuals experienced a rise in smoking desire during the quarantine.

Regarding passive smoking, the surveyed individuals reported a generally slight decline in exposure to secondhand smoking. However, the number of exposed individuals to smoking for more than 8 hours increased by 27%.

Conclusion: During the lockdown, individuals smoked marginally more cigarettes compared to the periods before the lockdown with no significant change in smoking dependence. There was a slight decline in exposure to secondhand smoking. However, the number of exposed individuals to household smoking for more than 8 hours had been increased.

Keywords: COVID-19; quarantine; secondhand smoking; smoking dependence; lockdown; smoking, smokers.

1. INTRODUCTION

1.1 Background

The Coronavirus disease (COVID-19) has spread to become a worldwide pandemic. It first appeared in China Wuhan in December 2019, and the World Health Organization (WHO) declared it a pandemic on 11th of March 2020. Novel Coronavirus (COVID-19) was found to cause severe acute respiratory syndrome-Cov-2 (SARS-CoV-2). On the 11th of February 2020 the WHO decided to name it (COVID-19). The virus attacks the respiratory system with different clinical pictures that vary from severe that required admission to the Intensive Care Unit (ICU) or can be asymptomatic in many cases, there is no cure so far for this virus [1-4]. The first patient with Covid-19 in Saudi Arabia was confirmed on the 2nd of March 2020. He was a person who came back from Iran where there are positive cases of Covid. The Saudi government responded to the pandemic on 8th of March 2020 by many precautionary measures, from partial lockdown and online schools and universities learning, till the 12th of March when they announced applying of the quarantine and suspension of all social and governmental events, except those related to health and security. As a review, quarantine is defined as the separation of communities or individuals who have been exposed to an infectious disease. While Isolation refers to the separation of individuals who are known to be infected [5]. At 21st of June 2020, the government canceled the lockdown [6-7].

It is well known that tobacco in all forms is associated with the risk of developing serious diseases and harmful effects on human body. Globally cigarette smoking is the most common

form of tobacco used. There are many other tobacco forms (e.g. cigars, water-pipe tobacco, bidis, and electronic cigarette). Direct use of tobacco caused more than 7 million deaths/year according to WHO [8]. Health hazards of smoking were included cardiovascular disease, cancer, COPD, and death [9]. In 2018, a study was conducted to assess the prevalence of smoking and the factors related to cigarette smoking in Saudi Arabia. The prevalence of cigarette smoking all over 13 Saudi Arabian regions included in the study of 7,317 adults revealed that 21.4 percent of the population smoked cigarettes, 32.5 percent of males, and 3.9 percent of females [10]. A study in Al-Madinah city, Saudi Arabia was done at schools, to evaluate the prevalence and predictors of adolescent cigarette smoking, there were 3322 participants between [11–19] years. The study showed that 15.17% of the participants were cigarette smokers [11].

According to (WHO), second-hand smoke is defined as: “the smoke that fills enclosed spaces when people burn tobacco products such as cigarettes, smoking pipes and bidis.” Unfortunately, second-hand smoke leads to 1.2 million or more premature deaths each year and, can cause serious respiratory and cardiovascular diseases [8]. Children are prone to develop acute and chronic diseases (e.g. asthma, chest infections, meningitis) if there is 1 smoker at least in the same house [12,13,14]. Also, it can cause ear infections [15]. In Saudi Arabia, it was reported that 17.2% of the Saudi population was exposed to second hand smoking inside their homes [16]. Another Saudi study was done to evaluate passive smoking with 3210 students were participated in the the study. It showed that smoking exposure percentage was 32.7% household exposure, 49.3% public exposure, 25% both household and public [17].

A number of studies were conducted worldwide to evaluate the effects of quarantine on many health conditions. One study showed a 48.6% of 3533 respondents gained weight during the quarantine [18]. Different studies showed 7% of 1656 participants reported anxiety symptoms, whereas 3% reduction after 4–6 months of the quarantine [19]. In the United States, there is a study showed 1198 of 2125 e-cigarette users (56.4%) changed their use during COVID-19 pandemic: 388 individuals (32.4%) quit, 422 individuals (35.3%) reduced the amount of nicotine, 211 individuals (17.6%) increased nicotine use [20]. In England the COVID-19 lockdown was not associated with a significant change in smoking prevalence [17.0% (after) versus 15.9% (before), odds ratio (OR) = 1.09, 95% CI = 0.95-1.24], but was associated with increases in quit attempts [21]. In Belgium, a study reported smoking more cigarettes ($d = 0.13$) than before the COVID-19 pandemic (both $p < 0.001$). During the quarantine, the number of cigarettes smoked per day increased relatively, with younger participants having a higher tendency of smoking more during the quarantine. Living alone, having a low educational background, and being unemployed all raised the probability of smoking more cigarettes during the quarantine [21].

Another study in Poland revealed an increase in smoking frequency in 45% of smokers during the quarantine [22]. Up to the authors' knowledge, no study was conducted locally to evaluate the effect of the public health measures during the COVID-19 pandemic on smoking dependence and passive smoking.

1.2 Rational

Due to insufficient data of active and passive smoking in relation to the quarantine of COVID-19 as well as the significant risk of smoking on health. We believe there might be an impact on nicotine dependence and second-hand smoking during the quarantine either by increasing, decreasing, or quitting smoking. For these reasons, the authors decided to conduct this research.

1.3 Aim

The authors of this study aim to evaluate if quarantine increases both active and passive smoking, and if there are smoking reductions or smoking cessation during the quarantine. Thus that will require urgent move with possible

prevention measures from the health ministries and organizations to help the smokers to quit. Moreover, that may provide an opportunity to help smokers to quit in similar situations.

This study was conducted in an effort to provide data that can be used as a reference.

2. METHODS

2.1 Study Design and Sampling

This is a multi-region cross-sectional study which conducted in September 2020. Inclusion criteria: this study include people who have been smoking before and during the quarantine (12th of March in 2020 till 21st of June 2020) in Saudi Arabia, and non-smokers who expose to household and workplace smoking, age group above 14 years old. Moreover, people who smoke shisha or smoke pipes, passive smokers in any place rather than household or workplace, people who had been outside Saudi Arabia during the quarantine were excluded. The sample size was calculated by Raosoft.com [23] with a margin of error 5 % and with confidence 99% by using a population of (27,136,977) [24]. The sample size was 664 participants in all regions of Saudi Arabia. A random sample technique was used by sending the online questionnaire to random people through social media. All responses met the inclusion criteria were included.

2.2 Study Tool

Self-administrated questionnaires were used as a data collection tool. The questionnaires have been used before in many studies and proved to be valid and reliable. The web-based consent is assigned by the volunteers to be a part of our study, the study questionnaire consists of two parts:

The first part: demographic information, age, gender, smoking status, residency, job status (during quarantine).

The second part: two different lists of questions were used, the first list for smokers included ten questions measures nicotine dependence by using a validated questionnaire called Penn State Cigarette Dependence Index. The dependence status was assigned according to the total score: 0–3= not dependent, 4–8 low dependence, 9–12 medium dependence, 13+ = high dependence [25]. The volunteers answered

these questions depending on the period before quarantine then the period during quarantine. The two states were compared (before and during) and the participants have been divided to three groups according the change in nicotine dependence index: increased dependence, decreased dependence or no change. The second list of questions for non smokers includes four questions evaluates the second-hand smoking [26]. Same method of answering was applied. Furthermore, our questionnaire involves a general question about smoking desire in quarantine.

2.3 Data Analysis

The data were verified and entered by a personal computer and analyzed by using SPSS, version 20 software. The researchers applied descriptive statistics through a form of frequency and percentage for categorical variables and mean and use standard deviation for continuous variables.

3. RESULTS

1020 responses were obtained 38 responses that did not meet the inclusion criteria were excluded, thus we have 982 responses valid for analysis with a response rate of 147.9%.

3.1 Socio-demographic Data of Participants

Most of the participants in this study questionnaire were females (53.7%), while 46.3% were males, with a mean age of 30 years, and the vast majority of them were from Madina region by 81.1%, 77.3% have a university level, 10.4% of them were on duty during quarantine, while 89.6% were off duty.

3.2 Effect of Quarantine on Active Smoking

Regarding the number of cigarettes consumed daily before quarantine, it is noticed that 3.4% of participants smoke more than 30 cigarettes a day. While during quarantine, 6.8% smoke more than 30 cigarettes a day. Before quarantine: 6.8% of the participants have not strong cravings to smoke. While during quarantine: 12.6% of the participants have no strong cravings to smoke.

Before quarantine: 13.6% of the participants wake up during the night to smoke while during quarantine 19.5% of the participants wake up during the night to smoke. Before quarantine:

33.3% of the participants awaken 2-3 nights per week to smoke while during quarantine the percentage had markedly increased to 51.4%. 17.5% of participants are craving to smoke over the past week before quarantine while during quarantine increased to 31.6%.

The score of nicotine dependence index had been calculated for each participant twice (before and during quarantine) and then classified into three groups according to the change in dependence index (increased dependence, decreased dependence, and no change in dependence index) as shown in Fig. 2. The relationship between the change in nicotine dependency index and socio-demographic characteristics had been examined. As shown in Table3, nationality was the only variable that showed a significant relationship with dependency index change while gender, education, job status during quarantine and city of residence didn't reveal a significant relationship.

3.3 Effect of Quarantine on Passive Smoking

Generally, 39.3% are usually exposed to passive smoking in household or work before quarantine that had been dropped to 30.9% during quarantine. Moreover, When participants were asked about the number of smokers in the same place of residence, before quarantine: 19.9% answered from "2-3", While during quarantine: 13.8% answered from "2-3."

Regarding the number of hours per day during exposure to second-hand smoke, before quarantine: 2.3% answered 8 hours or more. and during quarantine: 2.9% answered 8 hours or more.

3.4 Effect of Quarantine on Smoking Desire

35.2% of the participants reported that they feel that the desire to smoke increased during the home quarantine, 64.8% while did not feel that the desire to smoke increased during the home quarantine.

4. DISCUSSION

Our study showed 19.34% of 982 participants are smokers in Saudi Arabia, compared with Saudi MOH statics that showed 21.4% of the population were smokers, as well the smoking

exposure was 39.3%, meanwhile a study in Al-Madinah City, Saudi Arabia showed that smoking exposure percentage was 32.7% in the household, these results come in agreement with our study had a certain degree of similarity with previously conducted studies.

In a study conducted United States, it showed a change of 56.4% of 2125 in smoking use during the lockdown, 67.7% either quit or reduced the amount of nicotine, and 17.6% increased nicotine use [20]. Despite the significant change reported in the previous study, our study showed 70.6% of smokers have been not changed, on the other hand, 29.4% of smokers have been changed,

16.9% increased their nicotine use and 12.4% decreased their nicotine use. A similar conclusion was revealed by a different study in the United Kingdom which showed that the COVID-19 lockdown did not lead to a significant change in smoking prevalence [17.0% (after) versus 15.9% (before) but was related to an increase in quit attempts [27]. The authors believe that the significant variation between the results is due to the difference of governmental public health measures, furthermore, there were marked impact on individual income status globally, however, there was less impact income status locally, due to the governmental support.

Table 1. Socio-demographic data of participants

Variable (N=982)		Frequency	Percent
Gender:	Male	455	46.3
	Female	527	53.7
Age:	Mean \pm SD	30.0 \pm 11.34	
Nationality:	Saudi	947	96.4
	Non-Saudi	35	3.6
Education level:	Illiterate	1	0.1
	Middle school	7	0.7
	Secondary school	171	17.4
	University	759	77.3
	advanced studies	44	4.5
Were you on duty (work) during quarantine?	Yes	102	10.4
	No	880	89.6
City:	Medina region	796	81.1
	Mecca region	63	6.4
	Riyadh region	56	5.7
	Middle region	15	1.5
	Other	52	5.2

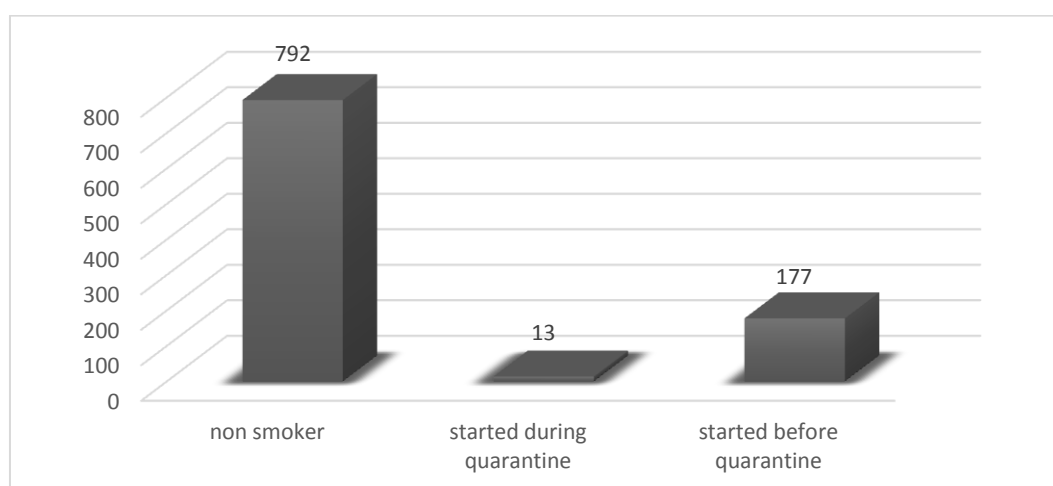


Fig. 1. Active smoking status of participants

Table 2. Nicotine dependence index questions

Variable		Before quarantine		During quarantine	
		N=177		N=190	
		N	%	N	%
How many cigarettes [times] per day do you usually smoke?	0-4	32	18.1	42	22.1
	5-9	40	22.6	40	21.1
	10-14	26	14.7	25	13.2
	15-19	43	24.3	34	17.9
	20-29	30	16.9	36	18.9
	More than 30	6	3.4	13	6.8
On days that you can smoke freely, how soon after you wake up do you smoke your first cigarette of the day?	0-5 minutes	37	20.9	42	22.1
	6-15 minutes	31	17.5	29	15.3
	16-30 minutes	34	19.2	30	15.8
	31-1 hours	25	14.1	26	13.7
	1-2 hours	23	13.0	22	11.6
	2 hours and more	27	15.3	41	21.6
Do you sometimes awaken at night to have a cigarette?	Yes	24	13.6	37	19.5
	No	153	86.4	153	80.5
If yes, how many nights per week do you typically awaken to smoke?	0-1 nights	9	37.5	7	18.9
	2-3 nights	8	33.3	19	51.4
	more than 4 nights	7	29.2	11	29.7
Did you smoke because it is hard to quit?	Yes	116	65.5	114	60.0
	No	61	34.5	76	40.0
Do you ever have strong cravings for smoke?	Yes	165	93.2	166	87.4
	No	12	6.8	24	12.6
Over the past week, how strong have the urges to smoke been?	Very Strong/Extremely Strong	31	17.5	60	31.6
	Moderate/Strong	129	72.9	108	56.8
	None/Slight	17	9.6	22	11.6
Is it hard to keep from smoking in places where you are not supposed?	Yes	85	48.0	86	45.3
	No	92	52.0	104	54.7
Did you feel more irritable because you could not smoke?	Yes	118	66.7	130	68.4
	No	59	33.3	60	31.6
Did you feel nervous, restless, or anxious because you could not smoke?	Yes	101	57.1	109	57.4
	No	76	42.9	81	42.6

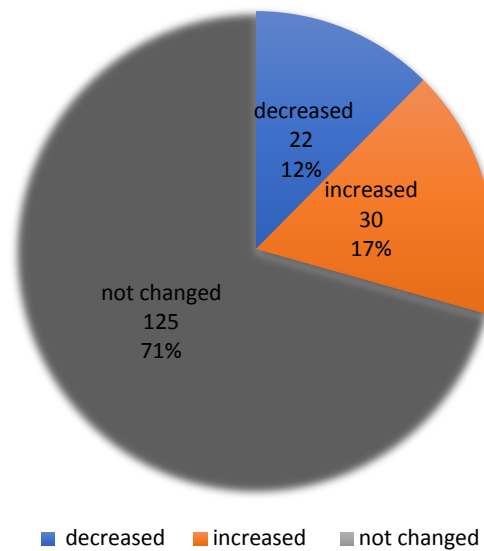


Fig. 2. Change in participants nicotine dependence index

Table 3. Relationship between the change in nicotine dependency index and socio-demographic characteristics

Personal data		Dependency Index			P-value
		Increase d	Decrease d	Not changed	
Gender:	Male	25	19	109	.857//
	Female	5	3	16	
Nationality:	Saudi	30	18	123	.000**
	Non-Saudi	0	4	2	
Education level:	Middle school	1	0	1	.299//
	Secondary school	7	3	34	
	University	22	17	87	
	advanced studies	0	2	3	
Were you on duty (work) during quarantine?	Yes	9	2	26	.186//
	No	21	20	99	
City:	Medina region	25	16	96	.452//
	Mecca region	2	2	11	
	Riyadh region	2	3	6	
	Middle region	0	0	3	
	Other	1	1	9	

Chi-square test: ** P-value is significant at 0.05, // Not significant

In another study in Belgium, different outcomes have been reported. Respondents smoke more cigarettes than before the COVID-19 pandemic ($p < 0.001$) [21]. Similarly, despite no significant change on smoking dependence, we found that smokers who used to smoke more than 30 cigarettes per day before the quarantine increased by two folds. In addition, we found that smokers who awaken at night sometimes to have cigarettes before quarantine has increased markedly by 50% during quarantine.

Furthermore, smokers who had extreme urge to smoke over the week before the quarantine have elevated markedly during the quarantine from 31 smokers to 60. Also, over 35.2 % of surveyed individuals experienced a rise in smoking desire during the quarantine. We think the reason of this rise in desire of smoking and number of smoked cigarettes daily is due to plenty of free times, lack of activities, less individual's duties and declined social events.

Table 4. Passive smoking exposure questions

Variable		Before quarantine		During quarantine	
		N=792		N=792	
		N	%	N	%
Usually do you expose to passive smoking in your household or work?	Yes	311	39.3	245	30.9
	No	481	60.7	547	69.1
Do people smoke regularly in the room where you set in?	Yes	229	28.9	195	24.6
	No	563	71.1	597	75.4
Not counting yourself, how many people in your household smoke regularly?	0-1	595	75.1	649	81.9
	2-3	158	19.9	109	13.8
	4 and more	39	4.9	34	4.3
How many hours per day are you exposed to other people's tobacco smoke?	0-1 hours	596	75.3	602	76.0
	2-4 hours	155	19.6	139	17.6
	4-8 hours	23	2.9	28	3.5
	8 hours and more	18	2.3	23	2.9

Significant relationship between the change in nicotine dependency index and nationality is probably caused by very small number of non-Saudi participants. The limited use of technology of non-Saudis and the effect of personal relations on distribution of the survey makes the reach of foreigners difficult.

Regarding passive smoking, the surveyed individuals reported generally slight decline in exposure to secondhand smoking, however the number exposed individuals to smoking more than 8 hours increased by 27%. The explanation for that, before quarantine, the individuals used to be exposed to smoking in public places such as workplaces, restaurants, café shops, social events, and local markets. During the quarantine, these have been shut down which makes the public smoking exposure decreased and the time of household smoke exposure prolonged.

5. CONCLUSION

During the lockdown, individuals smoked marginally more cigarettes compared to the periods before the lockdown with no significant change in smoking dependence. There was a slight decline in exposure to secondhand smoking, however, the number of exposed individuals to household smoking more than 8 hours had been increased, we recommend to make tobacco cessation interventions part of Corona management and prevention preprogram.

6. LIMITATIONS

Regulations to reduce the chance of transmission of COVID-19 like social distancing and minimizing handling of objects enforce the researchers to use online survey instead of interviews which eliminates the possibility of objectively verifying the data. Being a self-budgeted and limited time of researchers limit the distribution of the survey.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

This study was conducted following the approval of Scientific Research Ethics Committee at Taibah University (012-1442).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDICES

- Data collection instrument (e.g. questionnaire)

Do you accept to answer this questionnaire?

Accept reject

Personal information:

Gender:

Male female

Age:

Nationality:

Saudi non-Saudi

Where do you live? (city)

Education level:

Illiterate

Primary school

Middle school

Secondary school

University

advanced studies

were you on duty (work) during quarantine?

Yes no

1stQ /

When did you start smoking?

-I am not a smoker.

-I started before quarantine.

-I started during quarantine.

-I started after quarantine.

Were you in Saudi Arabia during quarantine?

Yes no

Do you smoke tobacco?

Yes no

Do you smoke electronic cigarettes?

Yes no

Regarding the period before quarantine, answer the following questions:

2ndQ /

How many cigarettes [times] per day do you usually smoke?

0–4

5–9

10–14

15–19

20–29

30+

3RDQ /

On days that you can smoke freely, how soon after you wake up do you smoke your first cigarette of the day?

0–5 mins

6–15 mins

16–30 mins

31–1 h

1 h–2 h

2+ h

4thQ /

Do you sometimes awaken at night to have a cigarette?

Yes no

If yes, how many nights per week do you typically awaken to Smoke?

0–1 nights

2–3 nights

4+ nights

5thQ /

Did you smoke because it is really hard to quit?

Yes no

6thQ /

Do you ever have strong cravings to smoke?

Yes no

Over the past week, how strong have the urges to smoke been?

None/Slight

Moderate/Strong

Very Strong/Extremely Strong

7thQ /

Is it hard to keep from smoking in places where you are not supposed to?

Yes no

8thQ /

Did you feel more irritable because you couldn't smoke?

Yes no

Did you feel nervous, restless, or anxious because you couldn't Smoke?

Yes no

Passive smoking

9thQ /

Usually do you expose to passive smoking in your household or work?

Yes no

10thQ /

Do people smoke regularly in the room where you set in?

Yes no

11thQ /

Not counting yourself, how many people in your household smoke regularly?

0-1

2-3

4+

12thQ /

How many hours per day are you exposed to other people's tobacco smoke?

0-1 h

2-4 h

4-8 h

8+ h

Regarding the period during quarantine, answer the following questions:

13thQ /

How many cigarettes [times] per day do you usually smoke?

0-4

5-9

10-14

15-19

20-29

30+

14thQ /

On days that you can smoke freely, how soon after you wake up do you smoke your first cigarette of the day?

0-5 mins

6-15 mins

16-30 mins

31-1 h

1 h-2 h

2+ h

15thQ /

Do you sometimes awaken at night to have a cigarette?

Yes no

If yes, how many nights per week do you typically awaken to Smoke?

0-1 nights

2-3 nights

4+ nights

16thQ /

Did you smoke because it is really hard to quit?

Yes no

17thQ /

Do you ever have strong cravings to smoke?

Yes no

Over the past week, how strong have the urges to smoke been?

None/Slight

Moderate/Strong

Very Strong/Extremely Strong

18thQ /

Is it hard to keep from smoking in places where you are not supposed to?

Yes no

19thQ /

Did you feel more irritable because you couldn't smoke?

Yes no

Did you feel nervous, restless, or anxious because you couldn't

Smoke?

Yes no

Passive smoking

20thQ /

Usually do you expose to passive smoking in your household or work?

Yes no

21thQ /

Do people smoke regularly in the room where you set in?

Yes no

22thQ /

Not counting yourself, how many people in your household smoke regularly?

0-1

2-3

4+

23thQ /

How many hours per day are you exposed to other people's tobacco smoke?

0-1 h

2-4 h

4-8 h

8+ h

24thQ /

In general, do you feel the desire of smoking increase during quarantine?

Yes no

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