


# Beliefs Toward Smoking and COVID-19, and the Pandemic Impact on Smoking Behavior and Quit Intention: Findings from a Community-Based Cross-Sectional Study in Jordan

Tobacco Use Insights  
Volume 14: 1–16  
© The Author(s) 2021  
Article reuse guidelines:  
[sagepub.com/journals-permissions](https://sagepub.com/journals-permissions)  
DOI: 10.1177/1179173X211053022  


Ala'a B. Al-Tammemi, MD, MPH<sup>1,2</sup> , Muna Barakat, PhD<sup>3</sup>,  
Dua'a Al Tamimi, MSN, BSN<sup>4</sup>, Sami A. Alhallaq, MD<sup>5</sup>,  
Dima M. Al Hasan, BSc<sup>6</sup>, Ghena M. Khasawneh, MD<sup>7</sup>,  
Khalil Abu Naqera, MD, MPH<sup>8</sup>, Raghad M. Jaradat, MD<sup>9</sup>,  
Fadi W. Farah, MD<sup>10</sup>, Hindya O. Al-Maqableh, MSc<sup>11</sup>,  
Alaa Abuawad, PhD<sup>12</sup>, Bayan Othman, MSc<sup>12</sup>,  
Zeinab Tarhini, BSc, MPH<sup>13,14</sup>, Hamza Odeh, MD<sup>15</sup>,  
Moawiah Khatatbeh, PhD<sup>11</sup>, Amal Akour, PhD<sup>16,17</sup>,  
Musheer A. Aljaberi, PhD<sup>18,19</sup>  and  
László Róbert Kolozsvári, MD, MBA, PhD<sup>1,2</sup> 

<sup>1</sup>Department of Family and Occupational Medicine, Faculty of Medicine, University of Debrecen, Debrecen, Hungary. <sup>2</sup>Doctoral School of Health Sciences, University of Debrecen, Debrecen, Hungary. <sup>3</sup>Department of Clinical Pharmacy and Therapeutics, Faculty of Pharmacy, Applied Science Private University, Amman, Jordan. <sup>4</sup>Department of Community Health Nursing, Princess Muna College of Nursing, Mutah University, Amman, Jordan. <sup>5</sup>Department of Internal Medicine, Division of Pulmonology, King Hussein Medical City, Jordanian Royal Medical Services, Amman, Jordan. <sup>6</sup>Department of Dental Technology, Faculty of Applied Medical Sciences, Jordan University of Science and Technology, Irbid, Jordan. <sup>7</sup>Faculty of Medicine, Jordan University of Science and Technology, Irbid, Jordan. <sup>8</sup>Department of Health, The United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA), Jordan Field Office, Amman, Jordan. <sup>9</sup>Department of Internal Medicine, King Hussein Medical City, Jordanian Royal Medical Services, Amman, Jordan. <sup>10</sup>Department of Internal Medicine, Al-Basheer Hospital, Jordanian Ministry of Health, Amman, Jordan. <sup>11</sup>Department of Basic Medical Sciences, Faculty of Medicine, Yarmouk University, Irbid, Jordan. <sup>12</sup>Department of Pharmaceutical Sciences and Pharmaceutics, Faculty of Pharmacy, Applied Science Private University, Amman, Jordan. <sup>13</sup>CAPTUR Laboratory, Control of Cell Activation in Tumor Progression and Therapeutic Resistance, Limoges, France. <sup>14</sup>Institute of Epidemiology and Tropical Neurology, GEIST, Limoges, France. <sup>15</sup>International Medical Corps (IMC), Amman, Jordan. <sup>16</sup>Department of Biopharmaceutics and Clinical Pharmacy, School of Pharmacy, The University of Jordan, Amman, Jordan. <sup>17</sup>Department of Pharmacy, Faculty of Pharmacy, Al-Zaytoonah University of Jordan, Amman, Jordan. <sup>18</sup>Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Selangor, Malaysia. <sup>19</sup>Faculty of Medicine and Health Sciences, Taiz University, Taiz, Yemen.

## ABSTRACT

**BACKGROUND:** The relationship between smoking and coronavirus disease-2019 (COVID-19) is still topical with mixed epidemiological evidence. However, the pandemic may affect people's beliefs toward smoking as well as their smoking behavior and quit intentions. Considering high smoking rates in Jordan, our current study aimed to assess the following domains in a community-based sample from Jordan: (i) the beliefs that surround smoking/vaping and COVID-19 and (ii) the pandemic impact on smoking behavior and quit intention.

**METHODS:** A cross-sectional study was conducted in Jordan from March 9 to March 16, 2021, utilizing a web-based structured questionnaire. The questionnaire comprised 13 items on sociodemographic, health, and smoking profiles, 14 items to assess beliefs surrounding COVID-19 and the use of combustible cigarettes (CCs), waterpipe (WP), and electronic cigarettes (ECs), and 12 items to assess the pandemic impact on smoking behavior and quit intention.



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (<https://us.sagepub.com/en-us/ham/open-access-at-sage>).

**RESULTS:** Of 2424 survey respondents who participated in our study, there were 1163 never-smokers, 1044 current smokers, and 217 ex-smokers. The mean age of participants was 35.2 years (SD: 11.06). Most participants have reported anti-smoking beliefs with around 72.9% believed that WP smoking is related to the risk of contracting COVID-19. Also, 71.7% believed that smoking CC may worsen the COVID-19 clinical course, while 74.1% of respondents believed that smoking has no protective effect against COVID-19. During the pandemic, about 28.1% and 19.3% of current smokers reported increased or reduced smoking, respectively. Besides, 459 current smokers have expressed their plans/intention to quit smoking during the pandemic, of whom 27.5% (n = 126) confirmed that the driving force for their decision is a COVID-19-related reason, such as self-protection (n = 123) and protection of family members (n = 121) which were the most cited reasons. Also, around 63 participants have successfully ceased smoking during the pandemic. However, only 22 of them reported that the main driving motivation of their successful quit attempt was the COVID-19 pandemic.

**CONCLUSION:** Most participants' beliefs and attitudes were against smoking during the pandemic. Nevertheless, the double-edged effect of the pandemic on smoking habits should be carefully considered, and reliable anti-smoking measures should be strengthened and sustained in the country.

**KEYWORDS:** COVID-19, pandemic, Jordan, smoking behavior, quit, tobacco

**TYPE:** Original Research

**DECLARATION OF CONFLICTING INTERESTS** The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**FUNDING** The author(s) received no financial support for the research, authorship, and/or publication of this article.

**ETHICAL APPROVAL** The protocol of this study was reviewed and approved by the institutional review board at Applied Science Private University in Jordan (Ref. 2021-PHA-7).

**INFORMED CONSENT** All participants have provided online written informed consent.

**DATA AVAILABILITY** The dataset generated and analyzed in the current study is available from the corresponding author on a reasonable request.

**CORRESPONDING AUTHOR:** László Róbert Kolozsvári, MD, PhD Department of Family and Occupational Medicine, Faculty of Medicine, University of Debrecen, Móricz Zs. krt. 22, Debrecen, 4032, Hungary. Email: [kolozsvari.laszlo@med.unideb.hu](mailto:kolozsvari.laszlo@med.unideb.hu)

## Introduction

The coronavirus disease-2019 (COVID-19) pandemic has significantly impacted most life domains, including economy, politics, education, social life, travel, entertainment, and health services provision.<sup>1-3</sup> To retard the spread of the disease, most countries have applied several mitigation strategies including restrictions on international travel, closing universities and schools, and enforcing face-masking, physical distancing, and quarantine/lockdowns.<sup>4-6</sup> Unfortunately, the influence of COVID-19 induced stress and lockdowns came up with substantial socio-economic and psychological consequences.<sup>7-14</sup> Despite various mitigation measures and vaccination rollouts,<sup>15</sup> the COVID-19-related morbidity and mortality are still rising globally, with over 216 million confirmed cases and more than 4.4 million deaths as of August 30, 2021.<sup>16</sup> In Jordan, a middle-income country in the Eastern Mediterranean Region (EMR), the situation is not different as the country has been severely afflicted by the pandemic with a total of 739 847 confirmed cases and 9530 fatalities as of August 30, 2021.<sup>17</sup> The successive pandemic waves accompanied by many factors such as people's non-compliance to the recommended health precautions, pandemic fatigue, and the pandemic-induced psychologic and economic impacts were all believed to have negative impacts on the epidemic situation in Jordan.<sup>18-20</sup> Also, the successive pandemic waves have impacted the health system imposing a significant burden on healthcare institutions and the health workforce in the country.<sup>18,21,22</sup>

Many factors were linked to the severity and outcome of COVID-19 among patients, and one of those factors was smoking. Globally, tobacco use still represents a major threat to global public health with its proven effects in suppressing the immune system and increasing the risk of various respiratory and cardiovascular illnesses.<sup>23-25</sup> Also, tobacco use may lead to a vicious cycle of poverty

among families with limited financial resources.<sup>26,27</sup> An yearly estimation of more than 8 million deaths occurs due to tobacco-related diseases, of which 1 million deaths are due to second-hand/passive smoking.<sup>26</sup> It is essential to stress the point that the majority of smokers and tobacco-induced morbidity and mortality are found in low- and middle-income countries.<sup>25,26</sup>

The negative impacts of smoking on the respiratory and immune systems and the linkage of smoking with the progression of various pulmonary diseases are well addressed in the literature.<sup>24,28</sup> However, mixed epidemiological evidence has characterized the relationship between smoking and the progression/severity of COVID-19<sup>28-30</sup>. Current epidemiological evidence suggests that smoking is linked to the severity and progression of COVID-19,<sup>28,31</sup> while other studies reported lower-than-expected risks of COVID-19 among smokers.<sup>32-35</sup> A systematic review by Vardavas et al<sup>29</sup> reported a statistically significant association between smoking status and primary endpoints of admission to Intensive Care Unit (ICU), ventilator use, or death among COVID-19 patients. The review has shown that smokers were 1.4 times more likely to have severe symptoms of COVID-19, and approximately 2.4 times more likely to be admitted to an ICU, need mechanical ventilation or die compared to non-smokers. Also, another systematic review and meta-analysis by Alqahtani et al<sup>36</sup> reported that 22% of current smokers and 46% of ex-smokers in the studies included had severe COVID-19 complications, and current smoking was associated with a higher mortality rate among COVID-19 patients.

Moreover, the physical, mental, and financial impacts that accompanied the COVID-19 pandemic may exhibit an effect on current smokers, including their smoking habits as well as their intention to quit smoking. For example, during the pandemic in Turkey, smoking cessation rates have increased as reported in a study conducted by Tetik et al.<sup>37</sup> This finding

might be as a result of the widespread fear that accompanied the pandemic and the infection as it is primarily a respiratory illness, given the possibility that people who smoke will be at higher risk of COVID-19 or more prone to a worse outcome.

Recent reports declared Jordan to be amongst the countries with the highest rates of smoking in the EMR and the world with an average daily consumption of 23 cigarettes per male smoker, surpassing the figures of Indonesia.<sup>22,38-40</sup> Besides, Jordan was ranked the sixth globally with a smoking prevalence of 70.2% among men and 10.7% among women.<sup>40</sup> Jordan has an extensive anti-tobacco history that started in the 1970s.<sup>41</sup> Despite the immense efforts, the country is found to have high smoking rates revealing an insufficient anti-tobacco policy implementation and monitoring.<sup>22</sup> Moreover, the country has adopted the National Tobacco Control Strategy for 2017-2019 with the more stringent implementation of the WHO's MPOWER package (Monitor, Protect, Offer help, Warn, Enforce and Raise taxes), aiming to reduce tobacco usage by 30% by 2025.<sup>42</sup>

## Study Rationale and Aims

The COVID-19 associated morbidity and mortality are expected to pose an impact on the attitudes of people toward smoking during the pandemic crisis. Besides, the pandemic-induced social, economic, and psychological impacts may affect smoking-related behaviors and attitudes among current smokers.<sup>43-46</sup> On the other hand, this pandemic might encourage tobacco users to quit smoking considering the reported association between smoking and adverse outcomes of COVID-19 compared to non-smokers.<sup>46-48</sup> Considering the importance of understanding people's beliefs about smoking and its implications on developing targeted interventions and smoking cessation programs, and in the line with the previously described pandemic impacts, the linkage between smoking and COVID-19, the high smoking rates in Jordan, and the paucity of studies that assessed this topic during the pandemic in the EMR, our current study aims were (i) to assess and explore the attitudes and beliefs that surround smoking/vaping and COVID-19 and (ii) to assess the impacts of the pandemic on smoking behaviors and quit plans/attempts, in a community-based sample from Jordan.

## Methods and Materials

### Study Setting

Our current study was conducted in Jordan, a middle-income country located in the Eastern Mediterranean Region. According to the latest statistics, the population count of Jordan is about 10.8 million.<sup>49</sup> The official language of the country is Arabic.

### Study Design and Participants

This study was a descriptive quantitative cross-sectional survey that spanned from March 9, 2021, to March 16, 2021. Data

were collected utilizing an anonymous self-administered online questionnaire that was developed using Google Form® (A secure cloud-based survey tool). The questionnaire was delivered in Arabic, the national language of Jordan. Considering the control measures of the COVID-19 pandemic (eg, physical distancing) and to reach participants from various regions in the country in a time-efficient way, the decision was made by the research team to collect the data using a web-based (online) survey tool. We advertised our study on various social media forums including Facebook®, WhatsApp®, LinkedIn®, and Twitter®. Employing a snowball convenience sampling technique, participants were recruited and further encouraged to share the survey link with their family members and social network.

Eligible participants should have been at least 18 years or older, able to read and understand Arabic, and reside in Jordan. The nature of our study, its objectives, and eligibility criteria for participation were explained in the introductory letter of our survey questionnaire. Participation was voluntarily and individuals who were interested to get involved in the study have given online informed consent by declaring their eligibility and accepting to fill out the questionnaire. There were no incentives/rewards upon participation.

### Assessment Tool and Measures

A structured questionnaire was developed by the authors after reviewing relevant and related literature.<sup>30,46,48,50-59</sup> The questionnaire comprised 39 items that were distributed over three sections as the following:

*Sociodemographic, health, and smoking profiles.* The first section included 13 items that solicited data on the sociodemographic profile, health profile, and smoking profile of participants. The sociodemographic data included *age* (in years), *gender* (female, male or prefer not to say), *marital status* (single or married), *educational level* (up to secondary school or higher education), *residence area* (rural or urban), *employment status* (unemployed, employed in the health sector, employed in non-health sector), and the *number of household members* (less than 3 persons, 3-5 persons, or 6 persons and more).

In the health profile, we asked the participants to report their *physical activity* based on the WHO recommendation of whether they maintain at least 150 minutes of moderate-intensity aerobic activity in a week (Yes or No), *history of chronic diseases* like hypertension, diabetes, chronic respiratory diseases or any other chronic illnesses (Yes or No), *history of laboratory-confirmed COVID-19 infection* (Yes or No), and *history of COVID-19 infection among family members in the same house* (Yes or No).

Regarding smoking profile, participants were requested to report their *current smoking status* (past 30-day use) regarding combustible cigarettes (CCs), waterpipe (WP), and electronic

cigarettes (ECs) which are the most popular smoking methods in Jordan. Those who reported not using any of the above-mentioned products in the past 30 days were further asked to report whether they never used any of the three products (classified as never-smokers) or if they previously used any of the products but had already quit (classified as ex-smokers). In our survey questionnaire, the participants were provided with a detailed description of the definition of each smoking category to guarantee a complete understandability and correct reporting as well.

*Beliefs About Smoking and COVID-19.* The second section of the questionnaire included 14 items that aimed to assess the participants' attitudes and beliefs surrounding various smoking methods and COVID-19. The participants were instructed to answer these items based on their beliefs and opinions. The 14 items of this section were adapted from a study after obtaining the authors' permission.<sup>30</sup> The 14 items were distributed as the following: three items on *the relationship between smoking CC, WP, or EC and risk of contracting COVID-19* (related, not related or I do not know), three items on the *safety of smoking CC, WP or EC inside the residence place* during the pandemic crisis (safe, not safe, I do not know), three items on the *safety of smoking CC, WP or EC in public places* during the pandemic crisis (safe, not safe, I do not know), one item on the *safety of EC as a substitute to any other form of smoking products* during the pandemic (safe, not safe, I do not know), three items on the *general outcome of a CC, WP or EC smoker in case of contracting COVID-19 infection* (similar to non-smokers, recover sooner, get worse). Lastly, the respondents were asked *whether they believe that smoking or nicotine use could provide protection against COVID-19* (Yes, No, or I do not know).

*Smoking Behavior and Quit Plans.* The third section of our survey questionnaire assessed the impacts of the COVID-19 pandemic on smoking behavior and quit attempts/plans through 12 items that targeted both, current smokers, and ex-smokers with six items for each. Current smokers were asked about *how the pandemic impacted their smoking habits* in comparison to their habits before the pandemic crisis (no change, increased consumption, decreased consumption, shifting to another smoking method, in an active quitting trial, or the initiation of smoking), and participants were requested to choose the most applicable scenario. Also, participants were asked *if they consider/plan to quit smoking during the pandemic* (Yes, No), *if they intend to use smoking cessation tools* (Yes, No), *types of smoking cessation tools they intend to use* (all that applies from: consulting a healthcare provider, behavioral advice, Nicotine Replacement Therapy (NRT), medications or using EC), *the primary motivation for planning to quit smoking* (COVID-19-related reasons, or reasons not related to COVID-19), and *the main driving reasons to quit smoking due to COVID-19* (all that applies from: to protect myself, to protect my family, due to pandemic measures such as mask-wearing and closure of cafes or due to economic impacts/financial

constraints induced by the pandemic). In the same section, ex-smokers were asked to report if *they have successfully quit smoking during COVID-19 or before the pandemic* (yes, no), *if their successful quit attempts were due to COVID-19-related reasons or not*, *the main driving reasons behind their decision to quit smoking due to COVID-19 issues*, *their prospective plan concerning their smoking cessation* (sustaining it even after the pandemic is over, or resuming smoking after the pandemic is over), *if they have used smoking cessation tools* (yes, no), and *types of smoking cessation tools used* (response choices were similar to those provided for current smokers).

### *Face/Content Validity and Pilot-Testing*

The questionnaire was initially developed in English and evaluated by two academics in the field of tobacco research for content and face validity. Then, it was translated into Arabic by two independent academic translators using translation and back-translation techniques. To ensure clarity and understandability of the questionnaire's items among the general population, it was piloted on 50 participants from various academic and professional backgrounds, and linguistic refinements were made as needed based on the feedback from the pilot-testing phase. The pilot responses were not included in the final analyses.

### *Data Management and Analyses*

Completed responses were extracted from Google Form<sup>®</sup> as an Excel sheet for quality check, data cleaning, and coding. Then, the Excel sheet was exported into Statistical Package for Social Sciences version 24.0 (SPSS Inc, Chicago, IL, USA) for further statistical analyses. Mean and standard deviation was used to describe numerical variables, while categorical variables were reported as frequency counts and percentages. Pearson's chi square test was employed to assess significant differences between smoking groups (never-smokers, ex-smokers, and current smokers) according to their sociodemographic profile, health profile, and beliefs surrounding smoking. Moreover, we estimated the adjusted Odds Ratio (AOR) and 95% Confidence Interval (95% CI) for smoking-related attitudes/beliefs using multinomial logistic regression, with smoking status (never-smokers, ex-smokers, and current smokers/reference) as a dependent outcome variable, while adjusting for sociodemographic and health factors. A  $P < .05$  was implemented for statistical significance.

### *Ethical Considerations*

The protocol of this study was reviewed and approved by the institutional review board at Applied Science Private University in Jordan (Ref. 2021-PHA-7). In addition, the study was conducted conforming to the ethical standards of the World Medical Association Declaration of Helsinki. The survey questionnaire ensured the confidentiality and anonymity of the study participants. Participation was voluntary and online

written informed consent was obtained from all participants as a pre-requisite before answering the survey items.

## Results

### *Sociodemographic, Health, and Smoking Profile of Participants*

A total of 2424 participants have consented and responded to our survey questionnaire. The mean age of the overall cohort was 35.2 years (SD: 11.06). Female participants slightly predominated the sample (n = 1256, 51.8%). Most participants were married (n = 1471, 60.7%), with college/university education (n = 2164, 89.3%), employed in non-health sector (n = 949, 39.2%), living in urban areas (n = 2122, 87.5%), and residing with three to five persons in the same living place (n = 1398, 57.7%). Of the overall sample, 29.8% (n = 723) of the participants were found to practice sufficient physical activity,

while around 17.4% (n = 421) of participants reported having a chronic disease. Those who got infected with COVID-19 comprised 27.5% (n = 666) of participants, and 35.9% (n = 870) have reported at least one household member (living in the same house) who suffered from COVID-19. Regarding smoking status, around 48.0% (1163/2424), 8.9% (217/2424), and 43.1% (1044/2424) of participants were identified to be never-smokers, ex-smokers, and current smokers, respectively. Additionally, of the total current smokers (n = 1044), exclusive CC smokers comprised 566 (54.2%) participants, while around 245 (23.5%), 98 (9.4%), and 135 (12.9%) participants were found to be exclusive WP smokers, exclusive EC users, and dual/poly users (those who reported concurrent use of at least two of the three products), respectively. [Table 1](#) shows a detailed presentation of the participants' sociodemographic and health profiles classified per their overall smoking status.

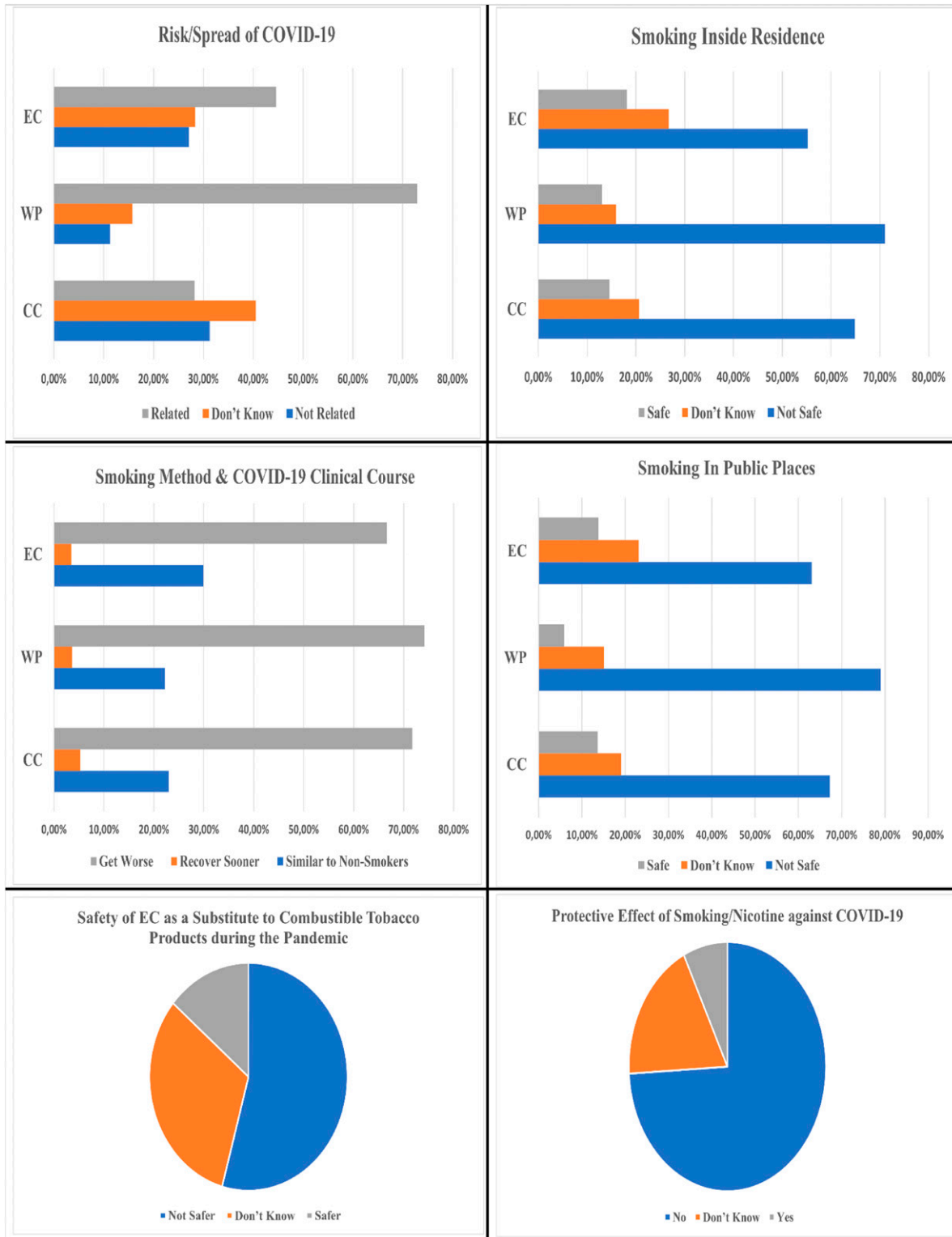
**Table 1.** Sociodemographic and Health Profile of Participants (n = 2424) Based on Smoking Status.

CHARACTERISTIC	SUBCATEGORY	NEVER-SMOKER (N = 1163)	EX-SMOKER (N = 217)	CURRENT SMOKER (N = 1044)	CHI SQUARE'S P-VALUE
Mean age (SD)	-	33.8 (11.79)	39.8 (11.59)	35.7 (9.74)	-
Gender	<i>Female</i>	898 (77.2%)	62 (28.6%)	296 (28.4%)	<.001
	<i>Male</i>	265 (22.8%)	155 (71.4%)	748 (71.6%)	
Marital status	<i>Single</i>	537 (46.2%)	56 (25.8%)	360 (34.5%)	<.001
	<i>Married</i>	626 (53.8%)	161 (74.2%)	684 (65.5%)	
Residence area	<i>Rural</i>	183 (15.7%)	18 (8.3%)	101 (9.7%)	<.001
	<i>Urban</i>	980 (84.3%)	199 (91.7%)	943 (90.3%)	
Educational level	<i>Up to Secondary School</i>	116 (10.0%)	22 (10.1%)	122 (11.7%)	.413
	<i>Higher Education</i>	1047 (90.0%)	195 (89.9%)	922 (88.3%)	
Employment sector	<i>Unemployed</i>	518 (44.5%)	57 (26.3%)	271 (26.0%)	<.001
	<i>Non-Health sector</i>	311 (26.7%)	108 (49.8%)	530 (50.8%)	
	<i>Health sector</i>	334 (28.7%)	52 (24.0%)	243 (23.3%)	
Household members	<i>&lt;3 persons</i>	148 (12.7%)	36 (16.6%)	173 (16.6%)	<.001
	<i>3-5 persons</i>	635 (54.6%)	137 (63.1%)	626 (60.0%)	
	<i>≥6 persons</i>	380 (32.7%)	44 (20.3%)	245 (23.5%)	
Sufficient physical activity	<i>No</i>	777 (66.8%)	147 (67.7%)	777 (74.4%)	<.001
	<i>Yes</i>	386 (33.2%)	70 (32.3%)	267 (25.6%)	
History of chronic diseases	<i>No</i>	964 (82.9%)	158 (72.8%)	881 (84.4%)	<.001
	<i>Yes</i>	199 (17.1%)	59 (27.2%)	163 (15.6%)	
History of COVID-19 infection	<i>No</i>	832 (71.5%)	133 (61.3%)	793 (76.0%)	<.001
	<i>Yes</i>	331 (28.5%)	84 (38.7%)	251 (24.0%)	
Family member's COVID-19 infection	<i>No</i>	734 (63.1%)	130 (59.9%)	690 (66.1%)	.139
	<i>Yes</i>	429 (36.9%)	87 (40.1%)	354 (33.9%)	

*Attitudes and Beliefs Toward Smoking and COVID-19 Among All Participants (n = 2424)*

Concerning smoking and the risk of contracting COVID-19, 72.9% of the study participants believed that WP smoking is related to the risk of COVID-19, while around 44.6 and

38.2% of respondents believed that CC and EC use are related to the risk of COVID-19 infection, respectively. Also, a significant proportion of participants believed that smoking CC, WP, or EC inside the residence place is not safe (64.9, 71.0, and 55.2%, respectively), compared to using the same smoking products in public places (67.3, 79.0, and 63.1%,



**Figure 1.** Beliefs surrounding different smoking methods and various domains of COVID-19 among all participants (n = 2424). [EC: electronic cigarette, CC: combustible cigarette, WP: waterpipe].

**Table 2.** Participants' Beliefs Toward Various Smoking Methods and COVID-19 Based on Smoking Status<sup>†</sup>.

DOMAIN	ITEM	RESPONSE	NEVER-SMOKER (N = 1163)	EX-SMOKER (N = 217)	CURRENT SMOKER (N = 1044)	CHI SQUARE'S P-VALUE
Smoking and spread/risk of contracting COVID-19 infection. (3 items)	What do you believe about CC smoking and spreading/risk of contracting COVID-19 infection?	<i>Not Related</i>	209 (18.0%)	62 (28.6%)	487 (46.6%)	<.001
		<i>I Do Not Know</i>	346 (29.8%)	65 (30.0%)	328 (31.4%)	
		<i>Related</i>	608 (52.3%)	90 (41.5%)	229 (21.9%)	
	What do you believe about WP smoking and spreading/risk of contracting COVID-19 infection?	<i>Not Related</i>	64 (5.5%)	24 (11.1%)	185 (17.7%)	<.001
		<i>I Do Not Know</i>	133 (11.4%)	38 (17.5%)	213 (20.4%)	
		<i>Related</i>	966 (83.1%)	155 (71.4%)	646 (61.9%)	
	What do you believe about EC use and spreading/risk of contracting COVID-19 infection?	<i>Not Related</i>	206 (17.7%)	73 (33.6%)	379 (36.3%)	<.001
		<i>I Do Not Know</i>	313 (26.9%)	54 (24.9%)	318 (30.5%)	
		<i>Related</i>	644 (55.4%)	90 (41.5%)	347 (33.2%)	
Smoking inside residence place during COVID-19 pandemic (3 items)	What do you believe about using CC at home during the COVID-19 pandemic?	<i>Not Safe</i>	924 (79.4%)	151 (69.6%)	498 (47.7%)	<.001
		<i>I Do Not Know</i>	165 (14.2%)	43 (19.8%)	291 (27.9%)	
		<i>Safe</i>	74 (6.4%)	23 (10.6%)	255 (24.4%)	
	What do you believe about using WP at home during the COVID-19 pandemic?	<i>Not Safe</i>	974 (83.7%)	164 (75.6%)	583 (55.8%)	<.001
		<i>I Do Not Know</i>	113 (9.7%)	28 (12.9%)	245 (23.5%)	
		<i>Safe</i>	76 (6.5%)	25 (11.5%)	216 (20.7%)	
	What do you believe about using EC at home during the COVID-19 pandemic?	<i>Not Safe</i>	804 (69.1%)	127 (58.5%)	408 (39.1%)	<.001
		<i>I Do Not Know</i>	248 (21.3%)	45 (20.7%)	355 (34.0%)	
		<i>Safe</i>	111 (9.5%)	45 (20.7%)	281 (26.9%)	
Smoking in public places during COVID-19 pandemic (3 items)	What do you believe about using CC in public places during the COVID-19 pandemic?	<i>Not Safe</i>	944 (81.2%)	152 (70.0%)	536 (51.3%)	<.001
		<i>I Do Not Know</i>	161 (13.8%)	37 (17.1%)	264 (25.3%)	
		<i>Safe</i>	58 (5.0%)	28 (12.9%)	244 (23.4%)	
	What do you believe about using WP in public places during the COVID-19 pandemic?	<i>Not Safe</i>	1032 (88.7%)	180 (82.9%)	703 (67.3%)	<.001
		<i>I Do Not Know</i>	107 (9.2%)	26 (12.0%)	235 (22.5%)	
		<i>Safe</i>	24 (2.1%)	11 (5.1%)	106 (10.2%)	
	What do you believe about using EC in public during the COVID-19 pandemic?	<i>Not Safe</i>	885 (76.1%)	135 (62.2%)	510 (48.9%)	<.001
		<i>I Do Not Know</i>	218 (18.7%)	41 (18.9%)	301 (28.8%)	
		<i>Safe</i>	60 (5.2%)	41 (18.9%)	233 (22.3%)	
Smoking and clinical outcome of COVID-19 (3 items)	What do you believe about the outcome of a CC smoker when contracting COVID-19?	<i>Similar to non-smokers</i>	115 (9.9%)	46 (21.2%)	396 (37.9%)	<.001
		<i>Recover Sooner</i>	23 (2.0%)	12 (5.5%)	93 (8.9%)	
		<i>Get worse</i>	1025 (88.1%)	159 (73.3%)	555 (53.2%)	
	What do you believe about the outcome of a WP smoker when contracting COVID-19?	<i>Similar to non-smokers</i>	123 (10.6%)	42 (19.4%)	374 (35.8%)	<.001
		<i>Recover Sooner</i>	21 (1.8%)	7 (3.2%)	60 (5.7%)	
		<i>Get worse</i>	1019 (87.6%)	168 (77.4%)	610 (58.4%)	
	What do you believe about the outcome of an EC user when contracting COVID-19?	<i>Similar to non-smokers</i>	194 (16.7%)	58 (26.7%)	473 (45.3%)	<.001
		<i>Recover Sooner</i>	27 (2.3%)	9 (4.1%)	48 (4.6%)	
		<i>Get worse</i>	942 (81.0%)	150 (69.1%)	523 (50.1%)	

(Continued)

Table 2. Continued.

DOMAIN	ITEM	RESPONSE	NEVER-SMOKER (N = 1163)	EX-SMOKER (N = 217)	CURRENT SMOKER (N = 1044)	CHI SQUARE'S P-VALUE
EC as a substitute for combustible tobacco products (1 item)	What do you believe about the safety of EC as a substitute for any form of combustible tobacco products (eg, CC and WP) during the COVID-19 pandemic?	<i>Not Safer</i>	786 (67.6%)	124 (57.1%)	407 (39.0%)	<.001
		<i>I Do Not Know</i>	309 (26.6%)	53 (24.4%)	411 (39.4%)	
		<i>Safer</i>	68 (5.8%)	40 (18.4%)	226 (21.6%)	
Protective effect of tobacco/nicotine (1 item)	Do you believe that smoking or nicotine use has a protective effect against COVID-19?	<i>No, may worsen the disease</i>	985 (84.7%)	173 (79.7%)	639 (61.2%)	<.001
		<i>I Do Not Know</i>	136 (11.7%)	30 (13.8%)	286 (27.4%)	
		<i>Yes, may have a protective effect</i>	42 (3.6%)	14 (6.5%)	119 (11.4%)	

† EC: electronic cigarette, CC: combustible cigarette, WP: waterpipe. Significant *P* values at <.05.

respectively). Never-smokers were more likely to believe that smoking CC, WP, and EC are not safe inside residence places and in public places as well.

Moreover, around 71.7% believed that CC smokers would have a worse COVID-19 clinical course compared to those who do not smoke, and this finding was closely similar to the beliefs surrounding WP and EC usage. On the other hand, about one-quarter of respondents believed that smokers of CC, WP, or EC would have the same COVID-19 clinical course as that for non-smokers (23.0, 22.2, and 29.9%). Similarly, never-smokers were more likely to believe that smoking CC, WP, or EC may worsen the COVID-19 illness (see Figure 1 and Table 2).

When we asked the participants about their beliefs toward EC as a substitute to other forms of smoking during the pandemic crisis, more than half (54.3%) responded that EC is not a safer option according to their opinion. Besides, 74.1% of respondents believed that the use of tobacco products/nicotine does not provide a protective effect against COVID-19, and instead, they can worsen the disease course (see Figure 1 and Table 2).

#### *Attitudes and Beliefs Toward Smoking and COVID-19 Among Current Smokers Based on Smoking Products (n = 1044)*

As previously described, our study sample comprised a total of 1044 participants who were identified to be current smokers and were classified per smoking products as the following: exclusive CC smokers (n = 566), exclusive WP smokers (n = 245), exclusive EC users (n = 98), and dual/poly users (n = 135). Most exclusive CC smokers believed that smoking cigarettes is not associated with an increased risk of contracting COVID-19, while most of them believed the opposite regarding WP smoking. Interestingly, most exclusive CC smokers, exclusive WP smokers, exclusive EC users, and dual/poly users believed that WP smoking is related to a higher risk of spreading/contracting COVID-19. The same applies to the beliefs surrounding CC, WP, and EC use in public

places, where most current smokers in the four smoking categories believed that these smoking practices are not safe. Exceptionally, most EC users believed that using EC in the residence place is a safe practice and considered a safer substitute to other tobacco products. Around 11.4% (n = 119) of current smokers believed that tobacco/nicotine use may have a protective effect against COVID-19, and this belief was more prominent among exclusive CC smokers. Table 3 provides more details about various beliefs surrounding smoking and COVID-19 among current smokers, classified per smoking products.

#### *Findings of the Multinomial Regression Analysis*

As described in the data analysis section, a multinomial regression analysis was employed to assess the adjusted odds ratio (AOR) and 95% confidence interval (95% CI) of attitudes/beliefs that surround smoking during the COVID-19 pandemic. The overall smoking status was treated as an outcome variable with current smokers as a reference category while adjusting for sociodemographic and health factors.

Regarding smoking and risk of COVID-19, the multinomial regression analysis revealed that never-smokers and ex-smokers were less likely to believe that smoking CC is not related to the risk of COVID-19 infection and spread (AOR=.48, 95% CI: .33-.69; and AOR=.57, 95% CI: .337-.964, respectively). On the other hand, never-smokers had higher odds in believing that WP smoking is not related to the risk of COVID-19 infection (AOR=1.872, 95% CI: 1.078-3.251). Ex-smokers were more likely to believe that EC use is not related to the risk of COVID-19 infection and spread (AOR=1.792, 95% CI: 1.021-3.146).

In the domain of smoking inside residence places and in public places, ex-smokers had lower odds and were less likely to believe that smoking CC inside residence place is safe (AOR=.33, 95% CI: 0.155 - .720), and never-smokers were more likely to believe that smoking WP in public places is not safe (AOR=1.83, 95% CI: 1.156-2.896).



**Table 3.** Current Smokers' Beliefs Toward Smoking and COVID-19, Based on Smoking Products (n = 1044)<sup>†</sup>

DOMAIN	ITEM	RESPONSE	EXCLUSIVE CC SMOKERS (N = 566)	EXCLUSIVE WP SMOKERS (N = 245)	EXCLUSIVE EC USERS (N = 98)	DUAL/POLY USERS (N = 135)	CHI SQUARE'S P-VALUE
Smoking and spread/risk of contracting COVID-19 infection. (3 items)	What do you believe about CC smoking and spreading/risk of contracting COVID-19 infection?	<i>Not Related</i>	268 (47.3%)	98 (40.0%)	48 (49.0%)	73 (54.1%)	<.001
		<i>I Do Not Know</i>	202 (35.7%)	64 (26.1%)	26 (26.5%)	36 (26.7%)	
		<i>Related</i>	96 (17.0%)	83 (33.9%)	24 (24.5%)	26 (19.3%)	
	What do you believe about WP smoking and spreading/risk of contracting COVID-19 infection?	<i>Not Related</i>	81 (14.3%)	51 (20.8%)	14 (14.3%)	39 (28.9%)	<.001
		<i>I Do Not Know</i>	139 (24.6%)	31 (12.7%)	12 (12.2%)	31 (23.0%)	
		<i>Related</i>	346 (61.1%)	163 (66.5%)	72 (73.5%)	65 (48.1%)	
	What do you believe about EC use and spreading/risk of contracting COVID-19 infection?	<i>Not Related</i>	176 (31.1%)	84 (34.3%)	54 (55.1%)	65 (48.1%)	<.001
		<i>I Do Not Know</i>	209 (36.9%)	60 (24.5%)	15 (15.3%)	34 (25.2%)	
		<i>Related</i>	181 (32.0%)	101 (41.2%)	29 (29.6%)	36 (26.7%)	
Smoking inside residence place during COVID-19 pandemic (3 items)	What do you believe about using CC at home during the COVID-19 pandemic?	<i>Not Safe</i>	274 (48.4%)	122 (49.8%)	51 (52.0%)	51 (37.8%)	.192
		<i>I Do Not Know</i>	161 (28.4%)	67 (27.3%)	23 (23.5%)	40 (29.6%)	
		<i>Safe</i>	131 (23.1%)	56 (22.9%)	24 (24.5%)	44 (32.6%)	
	What do you believe about using WP at home during the COVID-19 pandemic?	<i>Not Safe</i>	334 (59.0%)	131 (53.5%)	62 (63.3%)	56 (41.5%)	<.001
		<i>I Do Not Know</i>	147 (26.0%)	40 (16.3%)	18 (18.4%)	40 (29.6%)	
		<i>Safe</i>	85 (15.0%)	74 (30.2%)	18 (18.4%)	39 (28.9%)	
	What do you believe about using EC at home during the COVID-19 pandemic?	<i>Not Safe</i>	232 (41.0%)	105 (42.9%)	32 (32.7%)	39 (28.9%)	<.001
		<i>I Do Not Know</i>	214 (37.8%)	75 (30.6%)	21 (21.4%)	45 (33.3%)	
		<i>Safe</i>	120 (21.2%)	65 (26.5%)	45 (45.9%)	51 (37.8%)	
Smoking in public places during COVID-19 pandemic (3 items)	What do you believe about using CC in public places during the COVID-19 pandemic?	<i>Not Safe</i>	277 (48.9%)	151 (61.6%)	49 (50.0%)	59 (43.7%)	.014
		<i>I Do Not Know</i>	150 (26.5%)	52 (21.2%)	26 (26.5%)	36 (26.7%)	
		<i>Safe</i>	139 (24.6%)	42 (17.1%)	23 (23.5%)	40 (29.6%)	
	What do you believe about using WP in public places during the COVID-19 pandemic?	<i>Not Safe</i>	376 (66.4%)	184 (75.1%)	68 (69.4%)	75 (55.6%)	.004
		<i>I Do Not Know</i>	137 (24.2%)	36 (14.7%)	19 (19.4%)	43 (31.9%)	
		<i>Safe</i>	53 (9.4%)	25 (10.2%)	11 (11.2%)	17 (12.6%)	
	What do you believe about using EC in public during the COVID-19 pandemic?	<i>Not Safe</i>	263 (46.5%)	153 (62.4%)	40 (40.8%)	54 (40.0%)	<.001
		<i>I Do Not Know</i>	188 (33.2%)	51 (20.8%)	23 (23.5%)	39 (28.9%)	
		<i>Safe</i>	115 (20.3%)	41 (16.7%)	35 (35.7%)	42 (31.1%)	
Smoking and clinical outcome of COVID-19 (3 items)	What do you believe about the outcome of a CC smoker when contracting COVID-19?	<i>Similar to non-smokers</i>	235 (41.5%)	67 (27.3%)	33 (33.7%)	61 (45.2%)	<.001
		<i>Recover Sooner</i>	61 (10.8%)	19 (7.8%)	5 (5.1%)	8 (5.9%)	
		<i>Get worse</i>	270 (47.7%)	159 (64.9%)	60 (61.2%)	66 (48.9%)	
	What do you believe about the outcome of a WP smoker when contracting COVID-19?	<i>Similar to non-smokers</i>	214 (37.8%)	76 (31.0%)	29 (29.6%)	55 (40.7%)	.179
		<i>Recover Sooner</i>	29 (5.1%)	19 (7.8%)	4 (4.1%)	8 (5.9%)	
		<i>Get worse</i>	323 (57.1%)	150 (61.2%)	65 (66.3%)	72 (53.3%)	
	What do you believe about the outcome of an EC user when contracting COVID-19?	<i>Similar to non-smokers</i>	258 (45.6%)	81 (33.1%)	60 (61.2%)	74 (54.8%)	<.001
		<i>Recover Sooner</i>	25 (4.4%)	13 (5.3%)	4 (4.1%)	6 (4.4%)	
		<i>Get worse</i>	283 (50.0%)	151 (61.6%)	34 (34.7%)	55 (40.7%)	

(Continued)

Table 3. Continued.

DOMAIN	ITEM	RESPONSE	EXCLUSIVE CC SMOKERS (N = 566)	EXCLUSIVE WP SMOKERS (N = 245)	EXCLUSIVE EC USERS (N = 98)	DUAL/POLY USERS (N = 135)	CHI SQUARE'S P-VALUE
EC as a substitute for combustible tobacco products (1 item)	What do you believe about the safety of EC as a substitute for any form of combustible tobacco products (eg, CC and WP) during the COVID-19 pandemic?	<i>Not Safer</i>	229 (40.5%)	126 (51.4%)	20 (20.4%)	32 (23.7%)	<.001
		<i>I Do Not Know</i>	253 (44.7%)	74 (30.2%)	35 (35.7%)	49 (36.3%)	
		<i>Safer</i>	84 (14.8%)	45 (18.4%)	43 (43.9%)	54 (40.0%)	
Protective effect of tobacco/nicotine (1 item)	Do you believe that smoking or nicotine use has a protective effect against COVID-19?	<i>No, may worsen the disease</i>	326 (57.6%)	166 (67.8%)	67 (68.4%)	80 (59.3%)	.115
		<i>I Do Not Know</i>	167 (29.5%)	57 (23.3%)	23 (23.5%)	39 (28.9%)	
		<i>Yes, may have a protective effect</i>	73 (12.9%)	22 (9.0%)	8 (8.2%)	16 (11.9%)	

† Current smokers comprised those who reported being current smokers of one of the following products: EC (electronic cigarette), CC (combustible cigarette), WP (waterpipe) or a combination of them. Significant *P* values at <.05.

Besides, never-smokers had statistically significant higher odds in believing that smoking CC would worsen the COVID-19 clinical course (AOR=3.501, 95% CI: 1.970-6.222). Both never-smokers and ex-smokers were more likely to believe that smoking/nicotine use does not provide a protective effect against COVID-19 (AOR=1.88, 95% CI: 1.389-2.545; and AOR=1.85, 95% CI: 1.162-2.927, respectively). Regarding the use of EC as a substitute to other forms of smoking during the pandemic, never-smokers were less likely to believe that EC could be a safer substitute (AOR=.53, 95% CI: 0.333-830), and ex-smokers were more likely to believe that EC use is not a safer substitute as well (AOR=1.70, 95% CI: 1.059-2.736) (see Table 4).

#### Impacts of the Pandemic on Smoking Behavior and Quit Plans Among Current Smokers

Among current smokers (n = 1044), 42.4% (n = 443) have reported no change in their smoking behavior in general, while around 28.1% (n = 293) and 19.3% (n = 202) have reported increased consumption, or reduced consumption, respectively. Also, 2.6% (n = 27) and 1.2% (n = 13) reported shifting to another smoking method, and initiation of smoking, respectively. Regarding quit plans, around 6.3% (n = 66) expressed being in current active trials to quit smoking. When current smokers were asked if they have near-future plans/intention to quit smoking during the pandemic crisis (apart from those who were in an active quitting trial), around 44.0% (n = 459) of current smokers answered *yes*, of whom 152 participants cited their plans to use various smoking cessation tools with behavioral advice (45.4%) and using EC (48.0%) were the most reported items (see Figure 2). Besides, of the 459 current smokers who expressed their plans to quit smoking during the pandemic, around 27.5% (n = 126) confirmed that the primary driving force for their intention to quitting smoking is a

COVID-19-related issue, of which self-protection (n = 123) and protection of family members (=121) were the most reported reasons, followed by pandemic measures such as mask-wearing and lockdowns (n = 63) and pandemic-induced financial constraints (n = 67).

#### Impacts of the Pandemic on Successful Quitters

Of the total number of ex-smokers who participated in our study (n = 217), 63 participants have reported their successful quit attempts during the pandemic crisis, while the rest were successful quitters before the beginning of the pandemic. Of the 63 successful quitters during the pandemic, only 12 have used smoking cessation tools, mostly EC (see Figure 3).

Besides, of the 63 successful quitters during the pandemic, only 22 have reported that the main driving motivation of their successful quit attempts was COVID-19-related issue, with self-protection and protection of family members were the most frequent reasons (n = 22 and n = 20, respectively), followed by pandemic measures such as mask-wearing and lockdowns (n = 9) and pandemic-induced financial constraints (n = 6). Moreover, of the COVID-19 motivated ex-smokers (n = 22), 19 ex-smokers reported that they will sustain cessation even after the pandemic is over, while 3 have expressed their intention to resume smoking after the pandemic is over.

#### Discussion

Our study's first aim was to assess the beliefs surrounding various methods of smoking amid the COVID-19 pandemic in a study sample from the Jordanian community. Different beliefs were expressed by the participants regarding the relationship between smoking and many domains of COVID-19 including risk/spread of infection, the safety of smoking inside residences

and in public places, COVID-19 clinical outcome, EC as a substitute to other tobacco products, and protective effect of smoking/nicotine. Of the overall cohort, around 38.2%, 72.9%, and 44.6% of the participants believed that CC, WP, and EC are related to the risk of contracting COVID-19, with WP smoking being on the top of the list.

WP smoking is highly prevalent worldwide and in the WHO EMR.<sup>60-62</sup> The popularity of WP smoking is possibly grounded in the attractiveness of flavored WP tobacco (Moassel or Maassel), the usability of WP devices in smoking illicit drugs like Cannabis/Marijuana, and the social implications as this smoking method is prominent in social gatherings. Also, WP smoking is widely spread among young adults and youths in Arab states, where most cafés and restaurants provide WP service, and many individuals own a WP device at home. In general, the possibility of transmitting various infectious microbial agents through waterpipe usage is high, especially in cafés where cleaning and washing of WP devices after each customer's use is not feasible, and where sharing the same WP device with multiple users is also common practice.<sup>60</sup> Bacterial, viral and fungal microbes were reported in the literature to be transmitted to users through WP devices, such as *Mycobacterium tuberculosis*, *Helicobacter pylori*, hepatitis C virus, Epstein-Barr virus, herpes simplex virus, respiratory viruses, and even respiratory fungal pathogens (eg, *Aspergillus*).<sup>60,63-68</sup> These facts about WP and the associated infectious risks have forced many countries to enforce a ban on the use of WP in public places during the pandemic.<sup>69</sup>

Additionally, a notable proportion of participants believed that various smoking methods (CC, WP, and EC) are not safe to be used inside the residence place, with closely similar findings regarding their usage in public places as well. However, WP received the highest safety concerns among the respondents. Besides, most participants (71.7%) expressed that that being a CC smoker may worsen the COVID-19 clinical course compared to those who do not smoke, with closely similar concerns surrounding WP (74.1%) and EC (66.7%) usage. Several recent studies addressed an association between smoking and the severity of COVID-19. Reddy et al<sup>70</sup> reported in their systematic review and meta-analysis that current smokers had an increased risk of severe and critical COVID-19 with risk ratios of 1.80, and 1.98, respectively.<sup>70</sup> They also found that COVID-19 patients with a smoking history had an increased risk for severe or critical COVID-19, in-hospital mortality, disease progression, and need for mechanical ventilation.<sup>70</sup>

On the contrary, a large-scale ecological study across 38 European countries that aimed to examine different factors associated with the number of COVID-19 cases per million people at a specific time-point revealed a significant negative relationship between the prevalence of smoking among the adult population and COVID-19 cases.<sup>54</sup> In line with this finding, a systematic review by Farsalinos et al<sup>32</sup> that examined

the prevalence of current smoking among hospitalized COVID-19 patients in China, found a surprisingly low smoking prevalence among those patients, and this could be hypothetically linked to the immunomodulatory effect of nicotine.<sup>32</sup> However, this finding was criticized to have numerous biases.<sup>71</sup> In our study, 74.1% of respondents believed that the use of tobacco products/nicotine does not provide a protective effect against COVID-19, and instead, they believed that tobacco/nicotine may have a negative consequence on the clinical outcome of COVID-19. Never-smokers and ex-smokers were more likely to have this belief compared to current smokers in our study.

Moreover, EC as a novel smoking method is gaining popularity worldwide due to its appealing flavors and the commercial claims of their benefits as a smoking cessation tool, despite the controversial scientific evidence.<sup>72-75</sup> In Jordan, EC use is increasing as the government has recently legalized the importation, distribution, and sale of EC in various retail stores in the country.<sup>72,74,76</sup> In a national survey that was conducted in 2019 in Jordan, and among the 1820 participants involved, the prevalence of exclusive EC use and dual-use was estimated to be 11.7%, and 4.0%, respectively.<sup>77</sup> Another recent online cross-sectional survey in Jordan that included 1536 participants found that around 18% of the study sample were EC users, and its usage was more prominent among males and young age groups.<sup>78</sup> In our study, 54.3% of participants reported their belief that EC is not a safe option to replace combustible tobacco products during the pandemic crisis, while around 13.8% believed EC is a safer option compared to WP or CC. Most believers in EC safety were current smokers. These EC-related beliefs may have been impacted by the pandemic crisis, and this was explored by a mixed-method study that was carried out in the United States.<sup>56</sup> Among these impacts were the perceived COVID-19 health risks that may be related to the inhaled toxic substances found in EC vapor and their effects on the lungs.

Concerning our study's second aim, the majority of current smokers (57.6%, 601/1044) have reported a change in their smoking habits during the pandemic crisis. Most participants reported an increased consumption or reduced consumption. Increased tobacco use during the pandemic has been also reported in recent studies.<sup>50,53,55</sup> Besides, many current smokers in our study have reported their intention to quit smoking during the pandemic, which was also one of the findings of various studies during the pandemic crisis.<sup>48,55</sup> Various COVID-19-related reasons were cited by quit planners during the pandemic (among current smokers) and successful quitters during the pandemic (among ex-smokers). These reasons may reflect the profound effects of the pandemic crisis on individual's lifestyles and habits. Additionally, most successful quitters due to COVID-19 in our study have reported their willingness to sustain smoking cessation after the pandemic is over, which is also in line with the findings of a study that was conducted in Iran.<sup>30</sup>

**Table 4.** Findings of Multinomial Logistic Regression of Smoking-Related Beliefs<sup>†</sup>.

DOMAIN	ITEM	RESPONSE	NEVER-SMOKER AOR (95% CI)	EX-SMOKER AOR (95% CI)
Smoking and spread/risk of contracting COVID-19 infection. (3 items)	What do you believe about CC smoking and spreading/risk of contracting COVID-19 infection?	<i>I Do Not Know</i>	Reference	Reference
		<i>Not Related</i>	.479 (.333-.690)*	.570 (.337-.964)*
		<i>Related</i>	1.366 (.968-1.926)	1.569 (.933-2.640)
	What do you believe about WP smoking and spreading/risk of contracting COVID-19 infection?	<i>I Do Not Know</i>	Reference	Reference
		<i>Not Related</i>	1.872 (1.078-3.251)*	.801 (.384-1.668)
		<i>Related</i>	1.315 (.889-1.945)	.687 (.401-1.178)
	What do you believe about EC use and spreading/risk of contracting COVID-19 infection?	<i>I Do Not Know</i>	Reference	Reference
		<i>Not Related</i>	.866 (.583-1.287)	1.792 (1.021-3.146)*
		<i>Related</i>	.781 (.546-1.118)	1.002 (.578-1.735)
Smoking inside residence place during COVID-19 pandemic (3 items)	What do you believe about using CC at home during the COVID-19 pandemic?	<i>I Do Not Know</i>	Reference	Reference
		<i>Not Safe</i>	1.218 (.796-1.864)	.764 (.416-1.402)
		<i>Safe</i>	.668 (.389-1.148)	.334 (.155-.720)*
	What do you believe about using WP at home during the COVID-19 pandemic?	<i>I Do Not Know</i>	Reference	Reference
		<i>Not Safe</i>	1.129 (.711-1.792)	1.409 (.720-2.758)
		<i>Safe</i>	.628 (.337-1.170)	1.706 (.732-3.976)
	What do you believe about using EC at home during the COVID-19 pandemic?	<i>I Do Not Know</i>	Reference	Reference
		<i>Not Safe</i>	1.217 (.839-1.764)	1.495 (.854-2.617)
		<i>Safe</i>	1.177 (.699-1.983)	1.344 (.673-2.685)
Smoking in public places during COVID-19 pandemic (3 items)	What do you believe about using CC in public places during the COVID-19 pandemic?	<i>I Do Not Know</i>	Reference	Reference
		<i>Not Safe</i>	1.194 (.783-1.821)	1.053 (.551-2.011)
		<i>Safe</i>	.919 (.517-1.633)	.716 (.313-1.638)
	What do you believe about using WP in public places during the COVID-19 pandemic?	<i>I Do Not Know</i>	Reference	Reference
		<i>Not Safe</i>	1.830 (1.156-2.896)*	1.686 (.832-3.416)
		<i>Safe</i>	1.321 (.599-2.914)	.829 (.294-2.335)
	What do you believe about using EC in public during the COVID-19 pandemic?	<i>I Do Not Know</i>	Reference	Reference
		<i>Not Safe</i>	.657 (.421-1.027)	.699 (.354-1.378)
		<i>Safe</i>	.556 (.300-1.030)	1.584 (.678-3.701)

(Continued)

Table 4. Continued.

DOMAIN	ITEM	RESPONSE	NEVER-SMOKER AOR (95% CI)	EX-SMOKER AOR (95% CI)
Smoking and clinical outcome of COVID-19 (3 items)	What do you believe about the outcome of a CC smoker when contracting COVID-19?	<i>Similar to non-smokers</i>	Reference	Reference
		<i>Recover Sooner</i>	.660 (.238-1.829)	1.003 (.308-3.263)
		<i>Get worse</i>	3.501 (1.970-6.222)*	1.069 (.500-2.282)
	What do you believe about the outcome of a WP smoker when contracting COVID-19?	<i>Similar to non-smokers</i>	Reference	Reference
		<i>Recover Sooner</i>	1.080 (.330-3.539)	.534 (.116-2.453)
		<i>Get worse</i>	.808 (.445-1.466)	1.083 (.511-2.297)
	What do you believe about the outcome of an EC user when contracting COVID-19?	<i>Similar to non-smokers</i>	Reference	Reference
		<i>Recover Sooner</i>	2.367 (.884-6.337)	2.919 (.888-9.593)
		<i>Get worse</i>	1.082 (.718-1.630)	1.691 (.951-3.005)
EC as a substitute for combustible tobacco products (1 item)	What do you believe about the safety of EC as a substitute for any form of combustible tobacco products (eg, CC and WP) during the COVID-19 pandemic?	<i>I Do Not Know</i>	Reference	Reference
		<i>Not Safer</i>	1.225 (.897-1.672)	1.702 (1.059-2.736)*
		<i>Safer</i>	.526 (.333-.830)*	1.181 (.650-2.147)
Protective effect of tobacco/nicotine (1 item)	Do you believe that smoking or nicotine use has a protective effect against COVID-19?	<i>I Do Not Know</i>	Reference	Reference
		<i>No</i>	1.880 (1.389-2.545)*	1.845 (1.162-2.927)*
		<i>Yes, maybe</i>	1.377 (.754-2.515)	1.315 (.575-3.006)

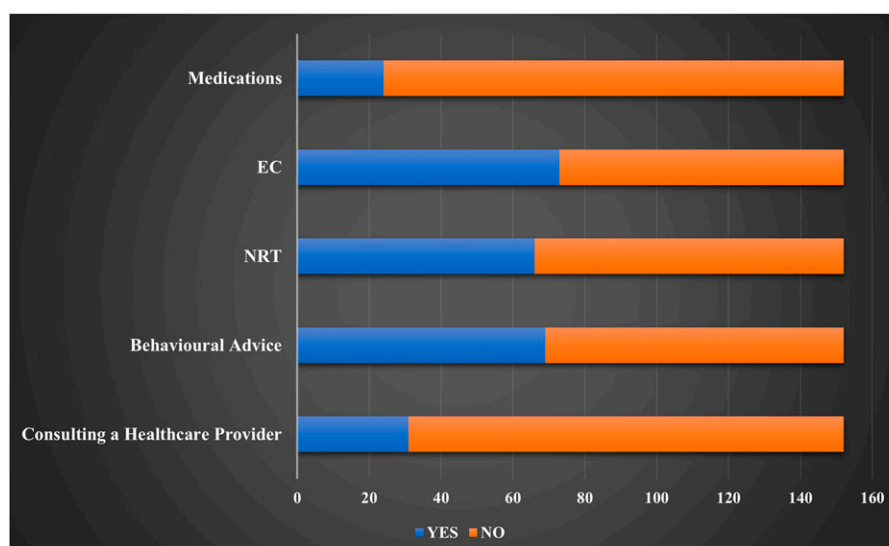
† EC: electronic cigarette, CC: combustible cigarette, WP: waterpipe. Current smoking was treated a Reference category of the outcome variable, and statistically significant results are marked with asterisk ( $P < .05$ ). The regression model was adjusted for both sociodemographic variables (age, gender, marital status, education, living place, and number of household members) and health status variables (physical activity, chronic diseases, and COVID-19 status). Only the results covering beliefs toward smoking are reported in this table.

### Study Implications and Limitations

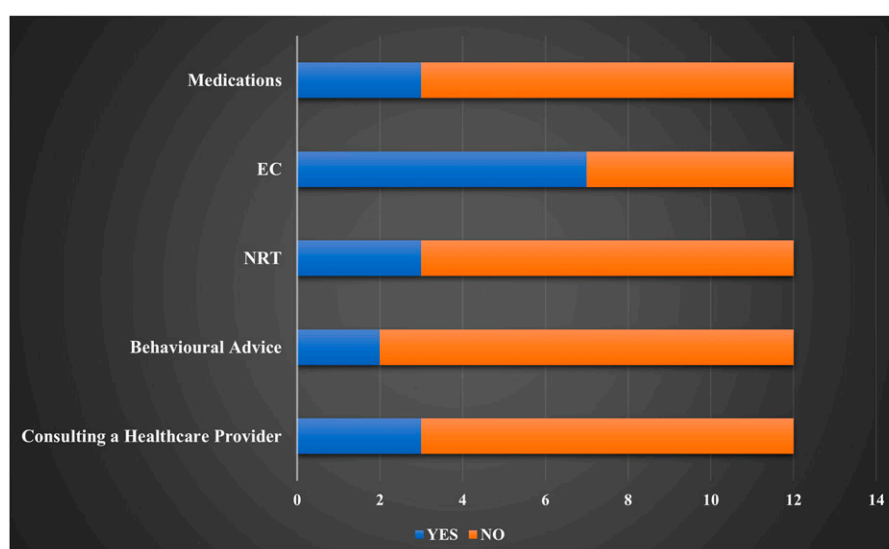
Our present study sheds the light on an important yet under-reported topic that is related to COVID-19 and smoking in Jordan. Various beliefs have surrounded smoking in its most common forms in the country, namely, combustible cigarettes, waterpipe, and electronic cigarettes. Despite the controversial evidence about the effect of smoking on COVID-19 during the early stages of the pandemic crisis, most recent studies pointed to a significant connection between smoking and the risk of COVID-19 progression, hospitalization, and mortality. In Jordan, a country that is ranked the sixth globally in the smoking rate, where anti-smoking policies are present but weakly enforced, where smoking has socio-cultural influences, and where tobacco industry front groups have significant interference in tobacco policymaking in the country, it is imperative to take the benefit of the pandemic crisis to advocate more stringent implementation of anti-tobacco measures in

the community. Also, it is crucial to raise community awareness about the dangers of smoking in general and in relation to the COVID-19 utilizing mass media messages and to encourage smoking cessation using scientifically valid quitting tools. Although the pandemic may encourage current smokers to reduce their consumption or to quit, there is a possibility for the opposite scenario where pandemic-induced stress may lead to increased smoking,<sup>53</sup> or even initiation of smoking which was noticed among few participants in our study. Therefore, public health decision-makers should be aware of the double-edged effect of the COVID-19 pandemic on tobacco use, and appropriate measures should be taken to prevent further escalation of smoking rates in Jordan, considering the severe economic and psychological impacts that afflicted most people in the country.

Our study has limitations that should be considered when interpreting the results. These include (i) using non-



**Figure 2.** Tools that were cited by 152 current smokers who reported their intention to quit smoking during the pandemic by the assistance of smoking cessation tools. [EC: electronic cigarette, NRT: Nicotine Replacement Therapy].



**Figure 3.** Smoking cessation tools that were used by 12 successful quitters during the pandemic. [EC: electronic cigarette, NRT: Nicotine Replacement Therapy].

probability sampling that may limit the generalizability of our findings, (ii) using an online survey which also impacts the representatives of the study sample as this tool targets people with sufficient level of digital literacy and access to the internet, (iii) the cross-sectional nature of our study in which exploring cause–effect relationship is not feasible, (iv) the study was limited to Arabic-speaking individuals in Jordan, and lastly, and (v) our questionnaire items represented self-reporting states; thus, recall bias might have an effect on the results. Nevertheless, we encourage nationally representative longitudinal studies to assess the dynamicity of these beliefs, smoking behaviors, and successful quit attempts among those who have a willingness to cease smoking.

## Conclusions

A significant proportion of participants have reported anti-smoking attitudes toward certain smoking methods while a minority did not have a conclusive attitude/belief. Besides, our study findings suggest that the pandemic crisis may impact the smoking habits of current smokers and may encourage smokers to consider smoking cessation. Nevertheless, given that the data were collected cross-sectionally, and only during the pandemic, the true impact of the pandemic on smoking behaviors is not possible to gauge, and longitudinal studies are needed. Additionally, considering the dynamicity of human health behaviors, a large-scale event like the current COVID-19 pandemic may exhibit significant effects that lead to adopting risky behaviors

(eg, initiation of smoking and increased smoking), or more healthy behaviors (eg, quitting smoking and reducing consumption). Consequently, public health authorities and decision-makers should consider the double-edged effect of the COVID-19 pandemic on people's attitudes/beliefs toward smoking in order to maintain a more prominent anti-smoking attitude among people and to provide accessible quitting services on a wide range. Reliable anti-smoking actions and measures should be implemented and maintained especially in contexts where smoking prevalence is high and stressful events are prominent as these events may act as a spark for stress-induced smoking.

## Acknowledgments

The authors provide their sincere thanks and appreciation to all study participants for completing the survey questionnaire.

## Author contributions

Conceptualization: ABA, MB, and LRK; supervision: LRK; methodology: ABA, MB, and LRK; data collection: ABA, MB, DA, SAA, DMA, GMK, KAN, FWF, RMJ, MK, and AA; data analysis and interpretation: ABA; literature review: ABA, MB, HOA, AAB, BO, ZT, HO, and MAA; writing—original draft preparation: ABA ; and writing—critical review and editing: ABA, MAA, and LRK. All authors have read and approved the submitted manuscript.

## ORCID iD

Ala'a B. Al-Tammemi  <http://orcid.org/0000-0003-0862-0186>

Musheer A. Aljaberi  <http://orcid.org/0000-0001-6533-7868>

László Róbert Kolozsvári  <http://orcid.org/0000-0001-9426-0898>

## REFERENCES

- Al-Tammemi AB. The Battle Against COVID-19 in Jordan: An Early Overview of the Jordanian Experience. *Front Public Heal.* 2020;8:188. doi:10.3389/fpubh.2020.00188
- Ramadan M, Hasan Z, Saleh T, et al. Beyond knowledge: Evaluating the practices and precautionary measures towards COVID-19 amongst medical doctors in Jordan. *Int J Clin Pract.* 2021;75(6):e14122. doi:10.1111/ijcp.14122
- Akour A, Elayeh E, Tubeileh R, Hammad A, Ya'Acoub R, Al-Tammemi AB. Role of community pharmacists in medication management during COVID-19 lockdown. *Pathog Glob Health.* 2021;12:1-10. doi:10.1080/20477724.2021.1884806
- Folayan MO, Ibigbami O, Brown B, et al. Differences in COVID-19 Preventive Behavior and Food Insecurity by HIV Status in Nigeria. *AIDS Behav.* Published online 2021. doi:10.1007/s10461-021-03433-3
- Folayan MO, Ibigbami O, El Tantawi M, et al. Factors Associated with Financial Security, Food Security and Quality of Daily Lives of Residents in Nigeria during the First Wave of the COVID-19 Pandemic. *Int J Environ Res Public Health.* 2021; 18(15):123. doi:10.3390/ijerph18157925
- Kolozsvári LR, Bérczes T, Hajdu A, et al. Predicting the epidemic curve of the coronavirus (SARS-CoV-2) disease (COVID-19) using artificial intelligence: An application on the first and second waves. *Informatics Med Unlocked.* 2021;25: 100691. doi:10.1016/j.imu.2021.100691
- Nicola M, Alsaifi Z, Sohrabi C, et al. The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *Int J Surg.* 2020;78:185-193. doi:10.1016/j.ijsu.2020.04.018
- Brooks SK, Webster RK, Smith LE, et al. Rapid Review The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet.* 2020;395: 912-920. doi:10.1016/S0140-6736(20)30460-8
- Al-Tammemi AB, Akour A, Alfalah L. Is It Just About Physical Health? An Online Cross-Sectional Study Exploring the Psychological Distress Among University Students in Jordan in the Midst of COVID-19 Pandemic. *Front Psychol.* 2020;11: 562213. doi:10.3389/fpsyg.2020.562213
- Akour A, Al-Tammemi AB, Barakat M, et al. The Impact of the COVID-19 Pandemic and Emergency Distance Teaching on the Psychological Status of University Teachers: A Cross-Sectional Study in Jordan. *Am J Trop Med Hyg.* 2020; 103(6):2391-2399. doi:10.4269/ajtmh.20-0877
- Garbóczy S, Szemán-Nagy A, Ahmad MS, et al. Health anxiety, perceived stress, and coping styles in the shadow of the COVID-19. *BMC Psychol.* 2021;9(1):53. doi: 10.1186/s40359-021-00560-3
- Aljaberi MA, Alareqe NA, Qasem MA, et al. Rasch Modeling and Multilevel Confirmatory Factor Analysis for the Usability of the Impact of Event Scale-Revised (IES-R) during the COVID-19 Pandemic. *SSRN Prepr.* 2021. Published online 2021. doi:10.2139/ssrn.3815681
- Fares ZEA, Al-Tammemi AB, Gadelrab H F, et al. Arabic COVID-19 Psychological Distress Scale: development and initial validation. *BMJ Open.* 2021; 11(6):e046006. doi:10.1136/bmjopen-2020-046006
- Khatatbeh M, Khasawneh A, Hussein H, Altaahat O, Alhalaia F. Psychological Impact of COVID-19 Pandemic Among the General Population in Jordan. *Front Psychiatry.* 2021;12:618993. doi:10.3389/fpsyg.2021.618993
- Al-Tammemi AB, Tarhini Z. Beyond equity: Advocating theory-based health promotion in parallel with COVID-19 mass vaccination campaigns. *Public Heal Pract.* 2021;2:100142. doi:10.1016/j.puhip.2021.100142
- World Health Organization. Coronavirus (COVID-19) Dashboard. 2021. Accessed March 15, 2021. <https://covid19.who.int/>
- Jordanian Ministry of Health. COVID-19 Statistical Report. 2021. Accessed March 15, 2021. <https://corona.moh.gov.jo/en>
- Al-Tammemi AB, Tarhini Z, Akour A. A swaying between successive pandemic waves and pandemic fatigue: Where does Jordan stand? *Ann Med Surg.* 2021;65: 102298. doi:10.1016/j.amsu.2021.102298
- Khatatbeh M. The Battle Against COVID-19 in Jordan: From Extreme Victory to Extreme Burden. *Front Public Heal.* 2021;8:1038. doi:10.3389/fpubh.2020.634022
- Khatatbeh M. Efficacy of Nationwide Curfew to Encounter Spread of COVID-19: A Case From Jordan. *Front Public Heal.* 2020;8:394. doi:10.3389/fpubh.2020.00394
- Alrawashdeh HM, Al-Tammemi AB, Alzawahreh MK, et al. Occupational Burnout and Job Satisfaction Among Physicians in Times of COVID-19 Crisis: A Convergent Parallel Mixed-Method Study. *BMC Publ Health.* 2021;21:811. doi:10.1186/s12889-021-10897-4
- Khatatbeh M, Alhalaia F, Khasawneh A, et al. The Experiences of Nurses and Physicians Caring for COVID-19 Patients: Findings from an Exploratory Phenomenological Study in a High Case-Load Country. *Int J Environ Res Public Health.* 2021;18(17). doi:10.3390/ijerph18179002
- World Health Organization. *Health Topics - Tobacco Facts.* 2021. Accessed February 2, 2021. [https://www.who.int/health-topics/tobacco#tab=tab\\_1](https://www.who.int/health-topics/tobacco#tab=tab_1)
- Strzelak A, Ratajczak A, Adamiec A, Feleszko W. Tobacco Smoke Induces and Alters Immune Responses in the Lung Triggering Inflammation, Allergy, Asthma and Other Lung Diseases: A Mechanistic Review. *Int J Environ Res Public Health.* 2018;15(5):1033. doi:10.3390/ijerph15051033
- Al-Tammemi AB. Tobacco epidemic in Jordan: the time to act is now. *Glob Health Promot.* 2021. doi:10.1177/17579759211026181
- World Health Organization. Tobacco Key Facts. 2020. Accessed March 15, 2021. <https://www.who.int/news-room/fact-sheets/detail/tobacco>
- World Health Organization. Tobacco Increases the Poverty of Individuals and Families. 2004. Accessed March 15, 2021. [https://www.who.int/tobacco/communications/events/wntd/2004/tobacofacts\\_families/en/](https://www.who.int/tobacco/communications/events/wntd/2004/tobacofacts_families/en/)
- Shastri MD, Shukla SD, Chong WC, et al. Smoking and COVID-19: What we know so far. *Respir Med.* 2021;176:106237. doi:10.1016/j.rmed.2020.106237
- Vardavas CI, Nikitara K. COVID-19 and smoking: A systematic review of the evidence. *Tob Induc Dis.* 2020;18:20. doi:10.18332/tid/119324
- Kalan ME, Ghobadi H, Taleb ZBen, et al. COVID-19 and beliefs about tobacco use: an online cross-sectional study in Iran. *Environ Sci Pollut Res.* 2020. doi:10.1007/s11356-020-11038-x
- Patanavanich R, Glantz SA. Smoking Is Associated With COVID-19 Progression: A Meta-analysis. *Nicotine Tob Res.* 2020;22(9):1653-1656. doi:10.1093/ntr/ntaa082
- Farsalinos K, Barbouni A, Niaura R. Systematic review of the prevalence of current smoking among hospitalized COVID-19 patients in China: could nicotine be a therapeutic option? *Intern Emerg Med.* 2020;15(5):845-852. doi:10.1007/s11739-020-02355-7
- Rentsch CT, Kidwai-Khan F, Tate JP, et al. Covid-19 Testing, Hospital Admission, and Intensive Care Among 2,026,227 United States Veterans Aged 54-75 Years. *MedRxiv Prepr.* 2020. doi:10.1101/2020.04.09.20059964

34. de Lusignan S, Dorward J, Correa A, et al. Risk factors for SARS-CoV-2 among patients in the Oxford Royal College of General Practitioners Research and Surveillance Centre primary care network: a cross-sectional study. *Lancet Infect Dis*. 2020;20(9):1034-1042. doi:10.1016/S1473-3099(20)30371-6
35. Simons D, Shahab L, Brown J, Perski O. The association of smoking status with SARS-CoV-2 infection, hospitalization and mortality from COVID-19: a living rapid evidence review with Bayesian meta-analyses (version 7). . 2021. doi:10.1111/add.15276
36. Alqahtani JS, Oyelade T, Aldhahir AM, et al. Prevalence, Severity and Mortality associated with COPD and Smoking in patients with COVID-19: A Rapid Systematic Review and Meta-Analysis. *PLoS One*. 2020;15(5):e0233147. DOI: 10.1371/journal.pone.0233147
37. Kayhan Tetik B, Gedik Tekinemre I, Taş S. The Effect of the COVID-19 Pandemic on Smoking Cessation Success. *J Community Health*. 2020:1-5. doi:10.1007/s10900-020-00880-2
38. Safi M, Al-tahat J. Jordan smoking rates highest in world amid claims of big tobacco interference. *The Guardian*. 2021. <https://www.theguardian.com/world/2020/jun/23/jordan-smoking-rates-highest-in-world-amid-claims-of-big-tobacco-interference>
39. Burki TK. Tobacco control in Jordan. *Lancet Respir*. 2019;7(5):P386. doi:10.1016/S2213-2600(19)30077-3
40. World Population Review. Global Country Ranking by Smoking Rates. 2021. Accessed February 2, 2021. <https://worldpopulationreview.com/country-rankings/smoking-rates-by-country>
41. Campaign for Tobacco-Free Kids. Tobacco Control Laws - Jordan. 2021. Accessed April 2, 2021. <https://www.tobaccocontrol.org/legislation/country/jordan/laws>
42. World Bank Group. Overview of Tobacco Use, Tobacco Control Legislation, and Taxation in Jordan. 2019. Accessed April 16, 2021. <https://elibrary.worldbank.org/doi/abs/10.1596/31954>
43. Bommelé J, Hopman P, Walters BH, et al. The double-edged relationship between COVID-19 stress and smoking: Implications for smoking cessation. *Tob Induc Dis*. 2020;18(July):63. doi:10.18332/TID/125580
44. Heffler M, Gartner CE. The tobacco industry in the time of COVID-19: Time to shut it down? *Tob Control*. 2020;29(3):245-246. doi:10.1136/tobaccocontrol-2020-055807
45. Eisenberg SL, Eisenberg MJ. Smoking Cessation During the COVID-19 Epidemic. *Nicotine Tob Res*. 2020;22(9):1664-1665. doi:10.1093/ntr/ntaa075
46. Kayhan Tetik B, Gedik Tekinemre I, Taş S. The Effect of the COVID-19 Pandemic on Smoking Cessation Success. *J Community Health*. 2020. doi:10.1007/s10900-020-00880-2
47. Vardavas CI, Nikitara K. COVID-19 and smoking: A systematic review of the evidence. *Tob Induc Dis*. 2020;18(March):20. doi:10.18332/tid/119324
48. Ho LLK, Li WHC, Cheung AT, et al. Impact of COVID-19 on the hong kong youth quitline service and quitting behaviors of its users. *Int J Environ Res Public Health*. 2020;17:8397. doi:10.3390/ijerph17228397
49. Department of Statistics - Jordan. Population Count. 2020. Accessed April 16, 2020. <http://dosweb.dos.gov.jo/>
50. Mistry SK, Ali AM, Rahman MA, et al. Changes in Tobacco Use Patterns During COVID-19 and Their Correlates among Older Adults in Bangladesh. *Int J Environ Res Public Health*. 2021;18(4):1779. doi:10.3390/ijerph18041779
51. Joyce AA, Styklunas GM, Rigotti NA, Neil JM, Park ER, Kruse GR. Quit Experiences among Primary Care Patients Enrolled in a Smoking Cessation Pilot RCT Early in the COVID-19 Pandemic. *Int J Environ Res Public Health*. 2021;18(3):1011. doi:10.3390/ijerph18031011
52. Kelly BC, Pawson M, Vuolo M. Beliefs on COVID-19 Among Electronic Cigarette Users: Behavioral Responses and Implications for COVID Prevention and E-Cigarette Interventions. *J Drug Issues*. 2020;51(2):284-300. doi:10.1177/0022042620977828
53. Yingst JM, Krebs NM, Bordner CR, Hobkirk AL, Allen SI, Foulds J. Tobacco Use Changes and Perceived Health Risks among Current Tobacco Users during the COVID-19 Pandemic. *Int J Environ Res Public Health*. 2021;18(4):1795. doi:10.3390/ijerph18041795
54. Tsigaris P, Teixeira Da Silva JA. Smoking Prevalence and COVID-19 in Europe. *Nicotine Tob Res*. 2020;22(9):1646-1649. doi:10.1093/ntr/ntaa121
55. Bar-Zeev Y, Shauly-Aharonov M, Lee H, Neumark Y. Changes in smoking behaviour and home-smoking rules during the initial COVID-19 lockdown period in Israel. *Int J Environ Res Public Health*. 2021;18(4):1931. doi:10.3390/ijerph18041931
56. Soule EK, Mayne S, Snipes W, Guy MC, Breland A, Fagan P. Impacts of COVID-19 on electronic cigarette purchasing, use and related behaviors. *Int J Environ Res Public Health*. 2020;17(18):6762. doi:10.3390/ijerph17186762
57. Jha P, Peto R. Global effects of smoking, of quitting, and of taxing tobacco. *N Engl J Med*. 2014;370(1):60-68. doi:10.1056/NEJMra1308383
58. Yach D. Tobacco Use Patterns in Five Countries During the COVID-19 Lockdown. *Nicotine Tob Res*. 2020;22(9):1671-1672. doi:10.1093/ntr/ntaa097
59. Ioannidis JPA, Jha P. Does the COVID-19 pandemic provide an opportunity to eliminate the tobacco industry? *Lancet Glob Heal*. 2021;9(1):e12-e13. doi:10.1016/S2214-109X(20)30466-6
60. Alagaili AN, Briese T, Amor NMS, Mohammed OB, Lipkin WI. Waterpipe smoking as a public health risk: Potential risk for transmission of MERS-CoV. *Saudi J Biol Sci*. 2019;26(5):938-941. doi:10.1016/j.sjbs.2018.05.006
61. Maziak W, Taleb ZBen, Bahelah R, et al. The global epidemiology of waterpipe smoking. *Tob Control*. 2015;24 suppl 1(suppl 1):i3-i12. doi:10.1136/tobaccocontrol-2014-051903
62. Khatatbeh MM, Alkhalidi S, Khader Y, et al. Prevalence of nicotine dependence among university students in Jordan: a cross-sectional study. *Epidemiol Biostat Public Health*. 2019;16(2):e13075. doi:10.2427/13075
63. Urkin J, Ochaion R, Peleg A. Hubble Bubble Equals Trouble: The Hazards of Water Pipe Smoking. *Merrick J, ed. Sci World J*. 2006;6:817863. doi:10.1100/tsw.2006.332
64. Munckhof WJ, Konstantinos A, Wamsley M, Mortlock M, Gilpin C. A cluster of tuberculosis associated with use of a marijuana water pipe. *Int J Tuberc Lung Dis*. 2003;7(9):860-865.
65. El Barrawy MA, Morad MI, Gaber M. Role of Helicobacter pylori in the genesis of gastric ulcerations among smokers and nonsmokers. *East Mediterr Heal J*. 1997;3(2):316-321. doi:https://apps.who.int/iris/handle/10665/117395
66. Habib M, Mohamed MK, Abdel-Aziz F, et al. Hepatitis C virus infection in a community in the Nile Delta: Risk factors for seropositivity. *Hepatology*. 2001;33(1):248-253. doi:10.1053/jhep.2001.20797
67. Knishkowsky B, Amitai Y. Water-Pipe (Narghile) Smoking: An Emerging Health Risk Behavior. *Pediatrics*. 2005;116(1):e113-e119. doi:10.1542/peds.2004-2173
68. Szyper-Kravitz M, Lang R, Manor Y, Lahav M. Early Invasive Pulmonary Aspergillosis in a Leukemia Patient Linked to Aspergillus Contaminated Marijuana Smoking. *Leuk Lymphoma*. 2001;42(6):1433-1437. doi:10.3109/10428190109097776
69. Shekhar S, Hannah-Shmouni F. Hookah smoking and COVID-19: call for action. *Can Med Assoc J*. 2020;192(17):E462. doi:10.1503/cmaj.75332
70. Reddy RK, Charles WN, Sklavounos A, Dutt A, Seed PT, Khajuria A. The effect of smoking on COVID-19 severity: A systematic review and meta-analysis. *J Med Virol*. 2021;93(2):1045-1056. doi:10.1002/jmv.26389
71. Alla F, Berlin I, Nguyen-Thanh V, et al. Tobacco and COVID-19: a crisis within a crisis? *Can J Public Heal*. 2020;111(6):995-999. doi:10.17269/s41997-020-00427-x
72. Barakat M, Assaf AM, Al-Qudah R, et al. Perception of adults toward electronic cigarettes: a cross-sectional study from Jordan. *Prim Health Care Res Dev*. 2021;22(e3):1-9. doi:10.1017/S1463423621000062
73. Barakat M, Jirjees F, Al-Tammemi AB, et al. The Era of E-Cigarettes: A Cross-Sectional Study of Vaping Preferences, Reasons for Use and Withdrawal Symptoms Among Current E-Cigarette Users in the United Arab Emirates. *J Community Health*. 2021. doi:10.1007/s10900-021-00967-4
74. Barakat MM, Al-Qudah RA, Alfayoumi I, Al-Obaidi HJ, Jirjees FJ, Basheti I. Electronic cigarettes' withdrawal severity symptoms among users during intermittent fasting: a cross-sectional study. *Addict Sci Clin Pract*. 2021;16(1):10. doi:10.1186/s13722-021-00219-9
75. Karasneh R, Al-Azzam S, Nusair M, Hawamdeh S. Perceptions, symptoms, and practices of electronic cigarette users: Descriptive analysis and validation of Arabic short form vaping consequences questionnaire. *PLoS One*. 2021;16(1):e0245443. doi:10.1371/journal.pone.0245443
76. Institute for Global Tobacco Control. E-cigarettes Regulations: A Policy Scan. 2020. Accessed March 3, 2020. <https://www.globaltobaccocontrol.org/e-cigarette/jordan>
77. Abdel-Qader DH, Al Meslamani AZ. Knowledge and Beliefs of Jordanian Community toward E-Cigarettes: A National Survey. *J Community Health*. 2020. doi:10.1007/s10900-020-00896-8
78. Al-Balas HI, Al-Balas M, Al-Balas H, Almehaiza S, Melhem H bany, AL-Balas B. Electronic Cigarettes Prevalence and Awareness Among Jordanian Individuals. *J Community Health*. 2020. doi:10.1007/s10900-020-00904-x