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RESEARCH ARTICLE

Smoking Status Association with Intention to Vaccination against Coronavirus Disease-2019

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Abstract:

Objectives:

This paper aimed to examine the association between smoking status and the intention to get the COVID-19 vaccine in a convenience sample of 226 Jordanian adults.

Methods:

Cross-sectional data on smoking status, the intention of vaccination, attitudes toward- and fear of COVID-19, and perceived susceptibility and severity of COVID-19 were collected. Descriptive comparative and correlational bivariate and multivariable statistical analyses were used.

Results:

Most subjects were female and single, with a mean age of 26.8 years. About 27.9% were smokers. Smokers had significantly higher mean scores on the intention of vaccination than non-smokers ($p=.049$). On regression analysis, smoking status was not a significant predictor, but higher scores on attitude toward and fear of COVID-19 were the only significant predictors of the intention for vaccination.

Conclusion:

Although smokers appear to have a higher intention to get the COVID-19 vaccine, variables other than smoking status, such as attitudes towards and fears of COVID-19 may influence people's decisions and should be appropriately addressed. Smoking's effect on the intention of vaccination with COVID-19 warrants further study.

Keywords: Coronavirus, COVID-19, Smoking, Intention, Vaccine, Pandemic.

Article History

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1. INTRODUCTION

Although vaccination against Coronavirus Disease-19 (COVID-19) is the most acceptable measure for overcoming the negative influences of the COVID-19 pandemic [1] through achieving the herd level of immunity [2, 3], people's willingness to uptake the vaccine is a significant issue in the successfulness of such measure. People seem hesitant to receive the vaccine [4, 5]. Efforts to recognize and manage factors that may influence people's decisions to receive the vaccine and provide strong support for the public health efforts to overcome the pandemic are crucial.

Smoking is a well-known risk factor for respiratory disea-

ses and infections, so smokers are at risk of developing a severe form of COVID-19 or having poor outcomes [6]. However, some studies have indicated that tobacco or nicotine, in particular, may reduce the risk of getting COVID-19 disease or the probability of being hospitalized because of the disease [7, 8]. It is claimed that nicotine has anti-inflammatory properties, and in turn, it interferes with how COVID-19 affects the immune system.

Social media coverage of such topics, may give an erroneous message to people about smoking and COVID-19. For example, Kavuluru, Noh, and Rose (2021) [9] found in their study that there was a high prevalence of claims that lack clear scientific evidence about the prevention or treatment of COVID-19 and smoking. The World Health Organization urged people to be cautious about that and urged scientists to

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investigate further because such messages may affect people's beliefs and attitudes towards COVID-19 and smoking behavior [6]. Most importantly, it may influence people's decision to get the vaccine when it is available. Up to the best of our knowledge, no published study has examined the association between smoking status and the intention to get the COVID-19 vaccine. Therefore, the paper aimed to examine the association between smoking status and the intention of getting the COVID-19 vaccine in a sample of Jordanian adults, in part when the variables that may influence the intention of getting the vaccine such as attitudes related to COVID-19, fear of COVID-19, and perceived susceptibility and severity of COVID-19 were controlled.

2. MATERIALS AND METHODS

2.1. Design

This is an analysis of the data of a cross-sectional descriptive correlational study collected using an online survey.

2.2. Sample and Sampling

Jordanian adults were invited to participate in the study using Social Media, particularly Facebook and Whatsapp. Convenience sampling was used to recruit subjects. The participants were included in this study if they did not have a positive COVID test or already had the vaccine, were willing to join in this study, and could read and write in Arabic. The required sample size was around 114 for the regression analysis and was calculated using G*Power 3.1.9.7 at a significance level (α) of 0.05 and β of 0.2, with nine predictors and a medium effect size (Cohen's f^2 , 0.15). The required sample size for the bivariate analysis was 102. We analyzed the data collected by the end of day number 10 when there were 226 subjects with no missing data at that time. Therefore, the study was adequately powered to detect significant differences.

2.3. Measures

Sociodemographic data (e.g., age, sex, marital status, education level, and income) and questionnaires on the intention of vaccination, attitudes related to COVID-19, fear of COVID-19, and perceived susceptibility and severity of COVID-19. Subjects were asked a direct question about their smoking status as a smoker (regardless of the tobacco product they were using) or non-smoker. We also asked participants to indicate whether the statement "Smoking can prevent or kill the coronavirus" is correct, false, or they do not know.

2.3.1. Intention to Get the COVID-19 Vaccine

A 3-item scale was used to measure the intention to get the vaccine [10]. Items asked subjects to indicate their level of agreement or disagreement with statements that were rated on a 5-Likert scale ranging from "1"= "strongly disagree" to "5"="strongly agree" with "being neutral" as the middle point of the scale. An example of the items is "I will get vaccinated against COVID-19 even if I must pay for the vaccine." A total score was calculated by summing the scores of responses. The possible total score ranges between 3 and 15; high scores indicate the high intention to get the vaccine. In this study, the scale of Cronbach's reliability alpha was 0.93.

2.3.2. Attitudes Related to COVID-19

A scale composed of 6 items adapted from valid measures used in previous studies [11 - 13] was used to measure the attitudes toward COVID-19. These items measure subjects' attitudes towards the prevention of COVID-19, governmental measures and instructions, and personal role in controlling the pandemic. Example of item "I play an important role in controlling the epidemic." The items were rated on a 5-Likert scale ranging between "1" = strongly disagree and "5"=strongly agree. Thus, the total scores ranged from 6 to 30, with high scores indicating higher positive attitudes toward COVID-19. The Cronbach's reliability α for the attitude scale in this study was 0.76.

2.3.4. Perceived Susceptibility to COVID-19

The 3 items scale used by Xiao [14] in the context of Human papillomavirus (HPV) was used to measure the perceived susceptibility to COVID-19. Example of item "It is likely that I will contract COVID-19". The items are rated on a 5-point Likert scale with "1"="strongly disagree" and "5"="strongly agree". The total summed scores range from 3 to 15. A high score indicates higher perceived susceptibility. The Cronbach's reliability alpha for the scale in this study was 0.81.

2.3.5. Perceived Severity of COVID-19

A 3-item scale Xiao [14] used in the context of Human papillomavirus (HPV) was also used to measure the perceived severity of COVID-19. It was adapted to be used in the context of COVID-19 instead of the context of Human papillomavirus (HPV) [14]. The items of the perceived severity scale are rated on a 5-point Likert scale with "1"="strongly disagree" and "5"="strongly agree". The range of total scores is similar to the perceived susceptibility range; a high score indicates higher perceived severity of COVID-19. Example "I believe that contracting COVID-19 causes severe health problems". The Cronbach's reliability alpha for the scales in this study was 0.92.

2.3.6. Fear of COVID-19

The fear of COVID-19 was measured using the Fear of COVID-19 Scale [15]. It consisted of 7 items that were rated on a 5-point scale ranging from "1"="strongly disagree" to "5"="strongly agree". Therefore, the total scores could range between 7 and 35, with higher scores indicating severe fear. An example item "I am most afraid of coronavirus-19". The scale is translated and tested (seeming reliable and valid) in Arabic speaking population [16]. The Cronbach's reliability alpha for the scale in this study was 0.92.

2.4. Procedure and Human Protection

The Institutional Review Board (IRB) at a university in Jordan approved the mother study (number 2100014, dated January 19, 2021). The link for the survey was distributed to the public through multiple social media platforms, especially on Facebook and WhatsApp. Participants were also invited to forward the survey link to their contacts and friends. The survey was kept open for 10 days (20th- 29th January 2021). A reminder was sent/announced to the potential participants after

4 days, which included a statement that participants who have already responded to the survey should ignore this reminder. Participants were informed to fill out the survey only once. The Google platform was used for the survey, and the data were stored in an Excel file in a Google Drive (password protected). The data are stored and processed in the first author's computer which is password protected. Filling out the survey took about 10-20 minutes. Participants were informed that their agreement to take part in the study and answer the survey questions constitutes the consent to participate in this study. Participants were assured of their voluntary participation, right to skip any question, and that no identifiable personal information (such as name or email address) would be collected.

2.5. Data Analysis

The Statistical Package for the Social Sciences (SPSS) version 25 was used to analyze the data with the significance level set at $<.05$. Descriptive statistics of mean and standard deviation or frequency and percentages were used to describe the subjects as appropriate to the level of the variable of measurement. Chi-square and independent samples Mann-Whitney U tests were used to examine the differences between smoker and non-smoker subjects for categorical and continuous variables, respectively. Standard multiple linear regression analysis was conducted to examine the association between smoking status and the intention to get the vaccine while controlling other variables. Variables controlled were age, sex, marital status, level of education, attitudes toward COVID-19, fear of COVID-19, and the perceived susceptibility to and the severity of COVID-19.

3. RESULTS

3.1. Sample Description

About 27.9% were smokers (at least using regular cigarettes, hookahs, or any of the electronic nicotine delivery systems, Table 1). About three-quarters of the subjects were

female, single, and had health insurance. The subjects were mainly young with a mean age of 26.8 ± 10.74 years. Table 1 also shows the differences between smokers and non-smokers based on their sociodemographic variables. As shown, using the Chi-square test, there were significant differences between the two groups in terms of sex and marital status but not in terms of income, education level, and having health insurance. There were more non-smoker females than males and more single subjects in the non-smokers' group than in the smokers' group. Regarding the age, smokers were found to be older than non-smokers in the independent samples Mann-Whitney U test (29.36 ± 12.34 vs 25.79 ± 9.92 , $p=0.043$).

3.2. Subjects' scores on the Main Study Variables

Table 2 shows the subjects' scores on the main study variables according to their smoking status. The mean score of the intention to get the vaccine was 9.08 ± 3.34 . This mean of scores indicates that the subjects are in the middle or somewhat reluctant (moderate intention) to get the COVID-19 vaccine. The Mann-Whitney U test indicated that smokers reported slightly higher mean scores on the intention to get the vaccine than non-smokers (9.79 ± 2.82 vs 8.81 ± 3.5 , $p=.049$). Regarding the individual items of the intention to get the vaccine, "I intend to get vaccinated against the COVID-19", there were significant differences in the proportions of respondents based on their smoking status ($p=0.035$). More proportions of those who agree or disagree with the statement were from non-smokers compared to smokers.

There were no other significant differences between smokers and non-smokers regarding attitudes towards COVID-19, perceived susceptibility to and severity of COVID-19, and fear of COVID-19. Regarding the item "smoking can prevent or kill the coronavirus", about 77.9% of the whole subjects answered it as "false" while 5.3% and 16.8 said it was "true" and "I do not know", respectively (Table 2). Although it was insignificant, a higher proportion of non-smokers reported it was true and false than the proportion of smokers.

Table 1. The subjects' sociodemographic and clinical characteristics according to their smoking status (N=226).

Characteristics	Total sample*	Smokers	Non-smokers	p-value
	(N=226)	(n=63, 27.9%)	(n=163, 72.1%)	
Age, years	26.8±10.74	29.36±12.34	25.79±9.92	0.043
Sex,				<0.001
Female	165 (73)	25 (39.7)	140 (85.8)	
Male	61 (27)	38 (60.3)	23 (14.2)	
Marital Status,				0.002
Married	63 (27.9)	27 (42.3)	36 (22.1)	
Single/Widow/divorced	163 (72.1)	36 (57.7)	127 (77.9)	
Income per month, \$US				0.446
<420	55 (24.3)	16 (25.4)	39 (23.9)	
421-700	72 (31.9)	20 (31.7)	52 (31.9)	
701-1120	55 (24.3)	15 (23.8)	40 (24.5)	
1121-1400	25(11.1)	4 (6.4)	21 (13)	
>1400	19 (8.4)	8 (12.7)	11 (6.7)	

(Table 1) contd....

Level of Education,				0.874
≤ high school	19 (8.4)	5 (8)	14 (8.5)	
> high school	207 (91.6)	58 (92)	149 (91.5)	
Have Health Insurance,				0.534
Yes	54 (68.1)	41 (65)	113 (69.3)	
No	72 (31.9)	22 (35)	50 (30.7)	

* Data are presented as mean ± standard deviation or number (%).

3.3. Association between Smoking Status and the Intention of Vaccination

A standard multiple linear regression model was used to examine the association between smoking status and the intention of vaccination while controlling other possible predictor variables. The results of the regression analysis indicated that the model was significant ($F_{(9, 216)} = 9.303, p < .001$) with the variables in the model explaining 27.9% (adjusted R^2) of the variance of the intention to get the vaccine scores. Smoking status did not have an association with the intention to get the vaccine ($p = .442$, Table 3). The attitudes toward COVID-19 and the fears of COVID-19 were the only significant predictors in the model, with those who had higher attitudes scores towards COVID-19 having more intent to get the vaccine. In addition, high scorers on the fear of COVID-19 scale are more likely to accept the vaccine than low scorers.

4. DISCUSSION

Globally, identifying factors influencing the intention of getting the COVID-19 vaccination is still a challenge. To date, the effect of smoking on the intention of vaccination is unclear [6, 8, 17]. In this study, we found that smokers had higher mean scores on the intention of getting the vaccine than non-

smokers. However, smoking status was not a significant predictor of getting the vaccine when other variables were included in the model. High attitude towards and high fear of COVID-19 scores were the only significant predictors of the intention for vaccination.

Consistent with the conservative nature of Jordanian society, there were more non-smoker females than males. Congruent with the mean age of the current sample, more single subjects were evident, especially in the non-smokers, which may pinpoint that getting married and being burdened with the new responsibilities of the family force people to smoke, especially males. Although the current sample is generally young, smokers were older than non-smokers, and they have a higher intention to vaccination against COVID-19; conforming with that vaccination increases with age [18, 19].

In the current sample, the subjects had a moderate intention (somewhat reluctant) to get the COVID-19 vaccine. The negative attitudes towards the COVID-19 vaccine and the reluctance to receive vaccinations are universal barriers to managing the COVID-19 pandemic [4, 5, 20]. The mistrust of the COVID-19 vaccine and its future side effects would negatively influence achieving herd immunity [3, 20].

Table 2. The subjects' scores on main study variables according to smoking status.

Variable	Total sample*	Smokers	Non-smokers	p-value
	(N=226)	(n=63)	(n=163)	
Intent to get the vaccine, total scores	9.08±3.34	9.79±2.82	8.81±3.5	0.049
Items of Intention to get the vaccine				
1. I intend to get vaccinated against the COVID-19				0.035
Disagree	72 (31.9)	12 (16.7)	60 (83.3)	
Neutral	67 (29.6)	23 (34.3)	44 (65.7)	
Agree	87 (38.5)	28 (32.2)	59 (67.8)	
2. I will get vaccinated against the COVID-19 even if I must pay for the vaccine				0.172
Disagree	88 (38.9)	19 (21.6)	69 (78.4)	
Neutral	82 (36.3)	24 (29.3)	58 (70.7)	
Agree	56 (24.8)	20 (35.7)	36 (64.3)	
3. I am willing to put my name on the list to get vaccinated against COVID-19				0.087
Disagree	79 (35)	15 (19)	64 (81)	
Neutral	64 (28.3)	20 (31.3)	44 (68.8)	
Agree	83 (36.7)	28 (33.7)	55 (66.3)	
Attitudes towards COVID-19	24.73±3.34	24.76±3.42	24.72±3.31	0.94
Perceived susceptibility of COVID-19	11.08±2.16	11.44±1.83	10.95±2.26	0.089
Perceived severity of COVID-19	11.68±2.46	11.63±2.72	11.70±2.36	0.847
Fear of COVID-19	19.12±6.32	19.92±6.38	18.82±6.29	0.242

(Table 2) contd.....

Smoking can prevent or kill the coronavirus,				0.558
TRUE	12 (5.3)	4 (33.3)	8 (66.7)	
FALSE	176 (77.9)	46 (26.1)	130 (73.9)	
I don't know	38 (16.8)	13 (34.2)	25 (65.8)	

* Data are presented as mean ± standard deviation or number (%).

Table 3. Association between smoking and the Intention to get the COVID-19 Vaccine using Standard Multiple Linear Regression (N=226).

Predictor Variables	B*	S. Error	β*	t	p
Intercept	.107	1.933			
Smoking status	-.380	.494	-.51	-.770	.442
Age	-.004	.024	-.014	-.184	.854
Sex [†]	-.809	.511	-.108	-1.585	.115
Marital status [†]	-.065	.565	-.009	-.114	.909
Level of education [†]	.012	.725	.001	.017	.986
Attitudes towards COVID-19	.226	.067	.225	3.375	.001
Perceived susceptibility to COVID-19	.078	.098	.050	.791	.430
Perceived severity of COVID-19	-.003	.096	-.002	-.033	.974
Fear of COVID-19	.186	.038	.352	4.926	.000

*B= Unstandardized coefficients and β=Standardized coefficients; [†]= male, single/widow, or ≤high school education level coded as 0.

Smokers in the current study seem more concerned and so they wanted to receive the vaccine. Because they have a fear of COVID-19 and may have the feeling that they are at high risk of becoming seriously ill from the virus, then being hospitalized, smokers jump the line concerning the COVID-19 vaccine. Smoking reduces the effectiveness of the influenza vaccine in the elderly and increased their risk of hospitalization, which may also apply to the COVID-19 vaccine and smokers. It negatively influences the immune system, and in turn, the effectiveness of vaccination [21]. Contrary to our findings, smoking predicted the decision not to be vaccinated [19].

Although smokers in the current study were more willing to receive the COVID-19 vaccine than non-smokers do, smoking status in the current research did not predict the intention of vaccination when other variables were under control in the regression model. Consistent with Thaker (2020) [10], smoking status in the current research did not have an association with the intention to get the vaccine. However, some researchers reported that smokers usually hold negative attitudes toward the COVID-19 vaccine and have low intentions of getting the vaccine [22, 23]. In the current study, higher attitudes regarding COVID-19 and high fear of COVID-19 scores were the only significant predictors of intention to vaccination. Fear predicts public health compliance in the COVID-19 pandemic, and, intention to vaccinate [24, 25]. Held positive attitudes regarding COVID-19, such as the risk of personal and family members getting the illness, would increase the intention of vaccination [6, 26].

4.1. Limitations and Implications

There are several limitations to this study. It is not nationally representative, and basically, it is a young sample. Our analyses were also cross-sectional, thus limiting inferences about the link between smoking and intentions of getting the

COVID-19 vaccine. Despite the richness of the data, it is possible that extreme views on the COVID-19 vaccine were not adequately captured and that certain specific groups within the population were not fully represented.

The current study's findings have implications for practice, research, and policy-making. In practice, improving people's attitudes towards COVID-19 and providing a clear message about the negative influence of COVID-19 should be addressed. Promoting vaccination programs should consider the major concerns about the COVID-19 vaccine among non-smokers in particular.

There is an urgent need for research for a more updated understanding of smoking and its effects on the intention of vaccination with COVID-19. Replication of the study with a larger sample is highly recommended. In this study, subjects were classified as smokers or non-smokers while comparing the intention to get the vaccine scores among smokers, ex-smokers, and never smokers groups may yield a different result. In addition, examining the kind of tobacco product used is recommended as users of these products have different views and many users of hookah or electronic nicotine delivery systems may classify themselves as non-smokers. The daily smoker rate in people infected with COVID-19 should be compared with that in the general population [27]. Future research tracking changing attitudes towards vaccination is essential because this pandemic continues.

For policy-making, without limiting it to smoking, intentions of vaccination against COVID-19 should be studied concerning confidence in government and health services to handle the pandemic. Substantial work is needed to build effective confidence in the vaccine.

SUMMARY AND CONCLUSION

In the first study, the paper examined the association

between smoking and the intention of vaccination against COVID-19 in a sample of Jordanian adults. The effect of smoking on the intention of vaccination with COVID-19 is still vague and warrants further research. Reluctance to getting the COVID-19 vaccine was evident, but smokers were less reluctant. Smokers have more intention to get the vaccination with COVID-19 than non-smokers do, as they are older.

Smoking status was not a significant predictor of the intention of vaccination with COVID-19. Fear of COVID-19 would contribute to preventive measures against COVID-19 including getting vaccinated. Positive attitudes regarding COVID-19 would decrease the risk of getting ill and increase the intention of vaccination.

HIGHLIGHTS

- People showed some hesitancy to get the COVID-19 vaccine.
- Smokers showed a higher intention to get the COVID-19 vaccine than non-smokers did.
- Smokers seem to be trying to protect themselves from COVID-19 by getting the vaccine, but non-smokers were not. Health education efforts should target those who seem reluctant to get the vaccine
- Attitudes towards and fear of COVID-19 were significant predictors of the intention of vaccination.

LIST OF ABBREVIATIONS

COVID-19 = Coronavirus Disease-19

HPV = Human papillomavirus

AUTHORS' CONTRIBUTIONS

Dr. Al-Rawashdeh developed the study's conception and design and analyzed the data; Professor Mrayyan wrote the discussion and did the critical revisions and proofread the whole paper. Both participated in writing the manuscript; Dr. Al-Rawashdeh supervised the work. Dr. Hayajneh participated in data analysis and proofread the final version of the paper.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The Institutional Review Board of the Hashemite University- Jordan approved the study (number 2100014, dated January 19, 2021).

HUMAN AND ANIMAL RIGHTS

No animals were used for studies that are the basis of this research. All the humans used were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975.

CONSENT FOR PUBLICATION

Informed consent was obtained from all individual participants included in the study.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

De-identified data from this study are not available in a public archive. De-identified data from this study will be made available (as allowable according to institutional IRB standards) by emailing the corresponding author [S.R].

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CONFLICT OF INTEREST

The author declares no conflict of interest, financial or otherwise.

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