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## Research paper

# Perception, knowledge and attitude towards influenza vaccine during COVID-19 pandemic in Jordanian population

Waleed A. Zalloum<sup>a,\*</sup>, Eman R. Elayeh<sup>b</sup>, Basel Al Haj Ali<sup>c</sup>, Needa Zalloum<sup>b,\*</sup>

<sup>a</sup> Department of Pharmacy, Faculty of Health Science, American University of Madaba, P.O. Box 2882, Amman 11821, Jordan

<sup>b</sup> Department of Biopharmaceutics and Clinical Pharmacy, Faculty of Pharmacy, University of Jordan, Jordan

<sup>c</sup> Department of Medical Oncology, Sheikh Khalifa Specialty Hospital, United Arab Emirates



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## ABSTRACT

**Introduction:** Seasonal influenza is considered as one of the major causes of morbidity and mortality worldwide. This needs solutions to decrease burdens on the healthcare systems especially during the Coronavirus Disease (COVID-19) pandemic. Population knowledge, perception and attitude towards influenza vaccine during COVID-19 pandemic could have a positive impact to decrease mortality, morbidity and burdens on the healthcare system. This study focuses on investigating knowledge, attitude and practice (KAP) of Jordanian adults towards influenza vaccine during COVID-19 pandemic.

**Methods:** This cross-sectional study recruited 1112 randomly selected Jordanian adults. A four-part questionnaire was designed and included questions about the demographic and clinical characteristics, perception about influenza, attitudes towards the role of influenza vaccine during COVID-19 pandemic and the factors that affect respondents' practice towards influenza vaccine.

**Results:** 73.1% population were not vaccinated, and most were not willing to be vaccinated during the COVID-19 pandemic. 55% of the population thought that influenza vaccine decreased the burden on the Jordanian healthcare system. The major refusal factor to be vaccinated was because influenza was not considered as a threat (41.3%). People mostly got their information about influenza vaccine from social media (64.3%). The role of the pharmacist and physician was neglected.

**Conclusions:** The reinforcement of the role of pharmacists, physician and media to educate people about the importance of influenza vaccine during the COVID-19 pandemic is needed. Furthermore, campaigns should be conducted to increase the population awareness towards the importance of influenza vaccine uptake and its importance.

## 1. Introduction

Seasonal influenza is a major cause of morbidity, mortality, and the use of healthcare services worldwide [1]. It was estimated that up to 645,000 annual death cases are associated with seasonal influenza respiratory infections, which puts substantial burden on health care systems globally [2].

Historically, vaccines are crucial in controlling infections of most contagious diseases [3–6]. One of the most important vaccines is influenza vaccine, which was able to decrease the burden of seasonal influenza [7]. It was reported by Centers for Disease Control and Prevention (CDC) that it prevented 4.4 million influenza illnesses, 58 000 hospitalizations and 3500 deaths during 2018 and 2019 [8]. According to the

WHO recommendations, pregnant women should have the highest priority to be vaccinated. Also, other groups at risk should be vaccinated, for example children aged 6–59 months, elderly people, individuals with specific chronic medical conditions and health-care workers [7]. However, during the COVID-19 pandemic the priority of influenza vaccine uptake by WHO has been amended for application during the pandemic [9]. According to these amendments, the highest priority risk groups included the health workers and older adults, and the additional risk groups which included pregnant women, individuals with underlying health conditions and children. In Jordan there is no national seasonal influenza vaccine program available, however it is available for purchase by the public through the community pharmacies [10–12]. Influenza vaccine is only offered free of charge to the healthcare workers

\* Corresponding authors.

E-mail addresses: [w.zalloum@aum.edu.jo](mailto:w.zalloum@aum.edu.jo) (W.A. Zalloum), [n.zalloum@ju.edu.jo](mailto:n.zalloum@ju.edu.jo) (N. Zalloum).

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in the government sector, which is not mandatory. Yet, vaccination coverage is still low/suboptimal and did not reach the target of 75% of the population in most countries [13]. In Jordan, influenza vaccination coverage was previously studied and showed that the coverage rate is very low (9.9% to 27.5%) [10].

In December 2019 a newly emerged virus was found in Wuhan, China, known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This virus was responsible for Coronavirus Disease (COVID-19), an infectious disease that causes severe Acute Respiratory Distress Syndrome (ARDS) [14–16]. SARS-CoV-2 subsequently spread rapidly across the world, and was declared as pandemic on 11th March 2020 [17]. Currently, the COVID-19 pandemic is a major public health problem worldwide. As of March 2021, there were more than 139 million cases of COVID-19 reported globally, with more than three million death cases reported across the world [18]. In Jordan, there have been more than half million cases and more than 8000 death cases [19].

Both COVID-19 and seasonal influenza viruses share similar disease presentation [20]. Both viruses cause respiratory symptoms, which present a wide range of illnesses from asymptomatic or mild to severe disease, and can lead to death. The most common symptoms for patients infected with COVID-19 are fever, cough, difficulty breathing, fatigue and headache. Some COVID-19 patients may progress to serious illness, such as pneumonia, acute respiratory distress syndrome, multi-organ dysfunction and possible death [21–23]. Higher mortality rates and risk of developing severe complications were noticed in elderly, males, and patients with co-morbidities, especially those with diabetes, hypertension and chronic respiratory diseases such as asthma and Chronic Obstructive Pulmonary Disease (COPD) [24,25].

Different studies have investigated the association between seasonal influenza vaccine coverage rate and COVID-19 mortality, where association between influenza vaccine and reduced mortality rate of COVID-19 in elderly population has been found. There was no obvious understanding of the mechanism behind this relationship [26–30]. As a consequence of the similarity of the clinical presentation between the two diseases and the possible correlation between the reduction of COVID-19 disease mortality rate in influenza vaccinated patients, the rational of the importance of increasing the coverage rate of influenza vaccine has emerged [26,30]. Increasing the rate of influenza vaccine uptake could decrease the burden on health care facilities associated with seasonal influenza infections, and could help to decrease COVID-19 mortality rates [26,27]. There are different explanations for the decreased mortality rate of influenza vaccinated individuals. One explanation is the direct protective effect of influenza vaccine against COVID-19, where there is growing evidence that BCG, measles and influenza vaccinations demonstrated a possible role in wider protection against unrelated pathogens [31–35]. A second explanation is influenza vaccination will decrease the burden on the healthcare system, so COVID-19 patients will benefit from better healthcare services [28]. There is no study in Jordan that investigates the importance of influenza vaccination during COVID-19 pandemic and its positive role in decreasing burden on Jordanian health care facilities. Furthermore, there is no study in Jordan that has explored the awareness of Jordanian adults towards influenza vaccine during COVID-19 pandemic.

The current study aims to assess the awareness of Jordanian adult population towards influenza vaccine during COVID-19 pandemic. Also, it investigates the willingness of Jordanian adults to be vaccinated against influenza during COVID-19 pandemic in 2020/2021 season. The results of this study may be useful at both national and regional levels for official authorities to modulate (i) future campaigns of seasonal influenza vaccination and (ii) assign proper roles to educate people about influenza vaccine and future COVID-19 pandemics and increase the coverage of the influenza vaccination rate.

## 2. Methodology

### 2.1. Study design and sample

This cross-sectional study was conducted among the general population in Jordan, during the COVID-19 pandemic, over a period of 2 weeks (18th December 2020 to 1st January 2021). This study was conducted in order to understand current influenza vaccination-related knowledge, attitude and practice (KAP) of the adult Jordanian population ( $\geq 18$  years). Data were collected online, via a self-reported questionnaire, using Google form. A link of the survey was distributed to participants via WhatsApp, Facebook Messenger, and Facebook groups. Ethical approval of the study protocol and the questionnaire was obtained from the Institutional Review Board (IRB) at the American University of Madaba.

### 2.2. Sample size calculation

A minimum sample of 672 adults was estimated based on the following equation [36]:  $N = \frac{PQ(Z_{\alpha} + Z_{\beta})^2}{d^2}$ , where N is the sample size,  $Z_{\alpha}$ : type one error = 1.96 when  $\alpha = 5\%$ ;  $Z_{\beta}$ : type two error = 1.28 when  $\beta = 10\%$ ;  $Q = 1 - P$ : expected non-prevalence;  $P$  = proportion in the population possessing the characteristic of interest (based on the estimate that the average of influenza vaccine coverage among adults in Jordan is 20% [37],  $d$  = one-half of the desired interval of confidence, in this study  $d = 5\%$ . Accordingly, by filling in the equation,  $N = 0.2 \times 0.8 (1.96 + 1.28)^2 / 0.05^2 = 672$ .

### 2.3. Survey instrument

The study tool was developed after reviewing the literature, [37]. The questionnaire content was translated from English into Arabic and then critically revised and face-validated by several academic colleagues. Then, it was piloted to a sample of 20 adults and was modified accordingly. The questionnaire was structured to include different items that were categorized into the following groups: (i) Socioeconomic; (ii) Public perception towards influenza vaccine; (iii) Respondents and their relative's history of infection by COVID-19; (iv) Respondents' attitudes towards the role of influenza vaccine during COVID-19 pandemic, assessed using a five-point Likert-scale (strongly disagree, disagree, neutral, strongly agree, agree); (v) Factors that affect adult respondents' practice towards seasonal influenza vaccination.

### 2.4. Statistical analysis

Statistical analysis was performed using SPSS version 20.0 (SPSS Inc., Chicago, IL). Descriptive statistics were used to describe the demographic characteristics of the respondents. Categorical variables were presented as percentages with their frequencies, while continuous variables were presented as means with standard deviations (SD).

## 3. Results

### 3.1. Demographic and clinical characteristics

A total of 1112 respondents completed the survey questionnaire. The mean age (years) of respondents was  $31.7 \pm 11.2$ . More than two thirds were females (74.1%,  $n = 824$ ) vs. males (25.9%,  $n = 288$ ). Almost two thirds had university level education (67.2%,  $n = 747$ ), and 16.9% ( $n = 188$ ) had a postgraduate degree. Almost half of the study sample (45.0%,  $n = 500$ ) were either full or part-time employees. 29.9% ( $n = 333$ ) of the population worked in the medical field. More than half of the sample (55.2%,  $n = 543$ ) had an income of equal or more than 500 JD/month.

The majority of the study sample had no chronic diseases (87.3%,  $n = 971$ ). Two thirds of the study sample (66.6%,  $n = 741$ ) had medical

insurance where 27.1% ( $n = 301$ ) and 29.9% ( $n = 332$ ) of them had a governmental or private medical insurance respectively. Full socio-demographic characteristics of respondents are described in [Table 1](#).

### 3.2. Respondent's perception about influenza vaccine

Majority of the respondents had never been vaccinated with influenza vaccine (73.1%,  $n = 813$ ). Unfortunately, 72.3% ( $n = 804$ ) of respondents were not willing to take influenza vaccine during COVID-19 pandemic. Those who were willing to take the influenza vaccine or already took it were advised by either physicians (17.1%,  $n = 128$ ) or friends (13.2%,  $n = 99$ ) to take the vaccine. Many of the respondents agreed that elderly (59.7%,  $n = 664$ ), people with chronic diseases (62.4%,  $n = 694$ ), and health care providers in direct contact with patients (52.6%,  $n = 585$ ) represented the highest priority to receive influenza vaccine this year ([Table 2](#)).

### 3.3. Respondents' attitudes towards the role of influenza vaccine during COVID-19 pandemic

Of the total respondents, 12.0% ( $n = 133$ ) had been infected with SARS-COV-2, confirmed by Reverse Transcriptase Polymerase Chain Reaction (RT-PCR), 20.6% ( $n = 229$ ) thought that they have had SARS-COV-2 infection but that was not confirmed by RT-PCR, 53.0% ( $n = 589$ ) had a friend or a family member who died because of SARS-COV-2 infection and 30.8% ( $n = 343$ ) had a friend or a family member who

**Table 1**  
Demographic and clinical characteristics of respondents ( $n = 1112$ ).

Variables	% (n)
Age (years) [mean $\pm$ SD]	31.7 $\pm$ 11.2
<b>Gender</b>	
Male	25.9 (288)
Female	74.1 (824)
<b>Marital status</b>	
Married	44.5 (495)
Single	52.3 (582)
Others	3.1 (35)
<b>Pregnant females</b>	4.8 <sup>#</sup> (24)
<b>Educational level</b>	
Post graduate (MSc or PhD)	16.9 (188)
University level	67.2 (747)
Diploma	7.6 (85)
High school or less	8.3 (92)
<b>Residency place</b>	
North sector	9.4 (104)
Middle sector	84.4 (938)
South sector	6.3 (70)
<b>Income</b>	
Less than 500 JD/month	44.8 (440)
At least 500 JD/month	55.2 (543)
<b>Employment status</b>	
Unemployed	51.6 (574)
Part time	9.9 (110)
Full time	35.1 (390)
Retired	3.4 (38)
<b>Education in the health or medical field* (yes)</b>	50.0 (556)
<b>Work in the medical field (yes)</b>	29.9 (333)
<b>Chronic illness</b>	
No chronic diseases	87.3 (971)
Lung diseases (Asthma and COPD)	2.6 (29)
Heart diseases	1.3 (14)
Diabetes mellitus	2.0 (22)
Others	6.8 (76)
<b>Current smokers</b>	22.0 (245)
<b>Medical insurance</b>	
Governmental medical insurance	27.1 (301)
Military medical insurance	9.7 (108)
Private medical insurance	29.9 (332)
No medical insurance	33.4 (371)

<sup>#</sup> Out of married females.

\* Includes pharmacy, dentistry, nursing, medicine, lab sciences and dieticians.

**Table 2**

Respondents' perception and practice towards influenza vaccine ( $n = 1112$ ).

Perceptions	% (n)
<b>Have you ever been vaccinated by Influenza vaccine?</b>	
Yes, I was vaccinated last year	8.0 (89)
Yes, I was vaccinated 2 years ago	5.8 (65)
I have been vaccinated several times before	13.0 (145)
I have never been vaccinated	73.1 (813)
<b>Who advised you to get influenza vaccine</b>	
TV	4.4 (33)
Social media	4.5 (34)
Physician	17.1 (128)
Pharmacist	6.0 (45)
Friends	13.2 (99)
None	54.8 (411)
<b>In your opinion, which of following have the priority to receive influenza vaccine this year? #</b>	
People aged > 65 years	59.7 (664)
People with chronic comorbidities	62.4 (694)
Health care providers in direct contact with patients	52.6 (585)
Adults	6.3 (70)
Children	14.6 (162)
All individuals	20.6 (229)
None	20.0 (222)
<b>Are you willing to receive influenza vaccine this year</b>	
I already took it	9.3 (103)
I'm planning to take it	18.4 (205)
I will not take it	72.3 (804)

#Respondents were asked to choose answers as many as apply to them.

got infected with SARS-COV-2.

Many of the respondents had positive attitudes regarding the role of influenza vaccine during COVID-19 pandemic. In particular, 55.8% ( $n = 620$ ) thought that influenza vaccine decreases the risk of influenza infection, thus decreasing the burden on Jordanian health care system, and 63.1% ( $n = 702$ ) thought that influenza vaccine decreases the risk of seasonal influenza infection, which may be misdiagnosed as SARS-COV-2 infection. In addition, 47% ( $n = 523$ ) thought that people should receive the influenza vaccine this year due to COVID-19 pandemic and almost half of the respondents (51.9%,  $n = 577$ ) believed that last years influenza vaccination was not enough and there was a need for revaccination. Similarly, 60.3% ( $n = 671$ ) of respondents believed that influenza vaccine does not protect from SARS-COV-2 infection. However, less than 40% of respondents (39.4%,  $n = 438$ ) thought that vaccines are general safe ([Table 3](#)).

### 3.4. Factors that affect adult respondents' practice towards influenza vaccine

[Table 4](#) presents the assessment of the reasons that contributed to the practice of receiving influenza vaccine. Accordingly, the most commonly reported reason for having influenza vaccine was to protect the participant himself/herself and his/her family members (45.1%,  $n = 501$ ) followed by compliance with physician recommendations (19.0%,  $n = 211$ ).

On the other hand, 41.3% ( $n = 459$ ) of respondents reported that the most common reason for not getting vaccinated was not considering influenza a threat. In addition, almost equal proportions of respondents reported that doubts about the safety (29.2%,  $n = 325$ ) and efficacy

**Table 3**

Respondents' attitudes towards the role of influenza vaccine during COVID-19 pandemic.

	Strongly agree % (n)	Agree	Neutral	Disagree	Strongly disagree
I'm scared of SARS-COV-2 infection	10.7 (119)	29.0 (323)	34.3 (381)	17.6 (196)	8.4 (93)
Vaccines in general are safe.	7.7 (86)	31.7 (352)	35.8 (398)	17.7 (197)	7.1 (79)
Influenza vaccine protects from SARS-COV-2	1.4 (16)	6.7 (74)	31.6 (351)	35.7 (397)	24.6 (274)
Influenza vaccine decreases the complications associated with SARS-COV-2 infection	3.2 (36)	24.4 (271)	40.0 (445)	22.1 (246)	10.3 (114)
Influenza vaccine decreases the risk of influenza infection, thus decreasing the burden on Jordanian health care system	15.5 (172)	40.3 (448)	27.9 (310)	12.2 (136)	4.1 (46)
Influenza vaccine decreases the risk of seasonal influenza infection, which may be misdiagnosed with SARS-COV-2 infection.	17.9 (199)	45.2 (503)	24.2 (269)	9.4 (105)	3.2 (36)
People should be vaccinated by Influenza vaccine this year due to SARS-COV-2 pandemic.	13.5 (150)	33.5 (373)	30.6 (340)	17.4 (194)	4.9 (55)
Last year influenza vaccination is enough and there is no need for revaccination	2.2 (25)	9.3 (103)	36.6 (407)	37.6 (418)	14.3 (159)

(26.1%,  $n = 290$ ) of the vaccine were among the reasons for not getting vaccinated. Other reasons reported by the respondents for not getting vaccinated included unavailability of the vaccine because of the huge demands due to SARS-COV-2 pandemic (23.2%,  $n = 258$ ), fear of mortality due to vaccination (12.0%,  $n = 133$ ), and fear of contracting illness (11.6%,  $n = 129$ ).

### 3.5. Sources of information about influenza vaccine

On inquiring about the participant source of information about influenza vaccine, our results showed that the most commonly used source was social media (64.3%,  $n = 715$ ) followed by TV (45.2%,  $n = 503$ ), while much lower proportions of respondents used symposiums and workshops (10.1%,  $n = 112$ ), physician office (10.3%,  $n = 115$ ) or pharmacists (12.6%,  $n = 140$ ), results are shown in [Table 4](#).

## 4. Discussion

During the COVID-19 pandemic, different beliefs and attitudes have emerged amongst Jordanian adults towards influenza vaccination. The present study is the first study, to our knowledge, that considers the awareness of Jordanian adults towards influenza vaccine during COVID-19 pandemic. This study also investigates the willingness of Jordanian adults to be vaccinated against influenza during COVID-19 pandemic in

**Table 4**

Factors that affect adult respondents' practice towards influenza vaccine and their sources of information.

Reason	% (n)
<b>Reasons for getting influenza vaccine<sup>#</sup></b>	
Having a chronic medical condition	3.6 (40)
Worries of becoming severely ill because of influenza	13.6 (151)
Compliance with physician recommendation	19.0 (211)
To protect myself and my family members	45.1 (501)
No need to be vaccinated	44.5 (495)
<b>Reasons for rejecting influenza vaccine<sup>#</sup></b>	
Fear of vaccination due to weakened immune system	6.7 (75)
Cost of the vaccine	8.3 (92)
Fear of contracting illness	11.6 (129)
Fear of mortality due to vaccination according to the published reports	12.0 (133)
The vaccine is not available because of the huge demands due to SARS-COV-2 pandemic	23.2 (258)
Doubts about the efficacy of the vaccine	26.1 (290)
Doubts about the safety of the vaccine	29.2 (325)
Not considering influenza a threat	41.3 (459)
<b>Sources of information about influenza vaccine<sup>#</sup></b>	
Social media	64.3 (715)
TV	45.2 (503)
Friends	26.4 (294)
Family	25.2 (280)
Scientific research	23.7 (264)
Pharmacists	1.3 (140)
Physicians	10.3 (115)
Workshops provided by Jordan pharmacists association	10.1 (112)
Others	10.2 (113)
Did not hear about influenza vaccine	1.7 (19)

<sup>#</sup> Respondents were asked to select as many factors that applied to them.

2020/2021 season. Results of this study are generated amongst sample of the Jordanian adults according to the sample size calculated above that could be considered to be powered from the statistical point of view. Results of this survey could help in future national vaccination policies.

The sample represents healthy, well-educated adults with a good percent of them working in a medical field. 74.1% of the sample were females. The observed skew in the sample toward females and well educated respondents has been seen in previous studies in Jordan [37–40]. The high percent of females in the sample could be a source of bias due to female unwillingness to uptake influenza vaccine (76.0% of females compared to 63.2% of males answered I will not take the vaccine).

Although high percent of the respondents are working in the medical field and highly educated, most of them were not vaccinated against influenza. Only 27% of the respondents are already received and willing to receive the vaccine (9.3% and 18.4% respectively). These results are consistent with previous Jordanian reports by Abu-rish et al. which showed that 20.4% of the respondents have ever had the vaccine [37]. Also, Assaf et al. results indicated that the coverage rate defined as the number (or percentage) of people who have received the vaccine at least once during 5 years was (27.5%) and in 2011–2012 season was 9.9% [10]. Moreover, Wu et al. showed that vaccination coverage rates

worldwide relatively increased during the H1N1 pandemic in 2009/2010 and then declined [41]. However the current study showed that COVID-19 pandemic did not affect the willingness of vaccination in Jordan. This is in contrast to the willingness for vaccination in Italy, where Domnich et al. showed that COVID-19 pandemic may have positive influence on the vaccination against influenza during 2020/2021 seasonal influenza [42].

According to the results of this survey, people mostly do not consider influenza as a threat, doubts about the safety and efficacy of the vaccine, and the shortage of influenza vaccine due to the COVID-19 pandemic. These results are consistent with a previous study that was conducted in Jordan by Abu-rish et al. which showed that 22%, 19.4% and 18.9% were not considering influenza as a threat, doubts about the efficacy of the vaccine, doubts about the safety of the vaccine, respectively. Similar barriers were noticed in other populations worldwide, for example Malosh et al. reported that in the United States the concern about influenza vaccine safety and efficacy were the most common reasons for rejecting the vaccine [43]. Furthermore, Black C et al., 2014 showed reasons for refusing the vaccine which included fear of infection from the vaccine, doubts about its effectiveness, and belief of unnecessary of the vaccine. Also, similar results were achieved in the United Kingdom in a study conducted on qualified nurses, where fear from side effects and concerns about the safety were the major barriers against receiving the vaccine [44].

Interestingly, most of the respondents do not consider influenza as a threat. This attitude is risky since there is an increased risk of influenza infection especially by virulent influenza viruses [45–47]. Although the majority of the respondents are not willing to take influenza vaccine during COVID-19, most of them have good perceptions about the priority for influenza vaccination. This is an important perception since it may be possible to educate them to uptake the influenza vaccine to increase the rate of coverage in Jordan. Encouraging these people to uptake influenza vaccine could also contribute to decrease mortality of COVID-19 patients due to the positive correlation between mortality rates of COVID-19 and uptake of influenza vaccine [26–30]. These results are in contrast to the results in Italy shown by Domnich et al. which demonstrate that general practitioners (GPs) are the most credible source of information on the annual influenza vaccination. Also, the National Immunization Coverage Survey conducted in Canada found that many Canadians (65%) prefer to obtain vaccination information from a health care provider, whereas 28% of the Canadian adults preferred media, Internet, and publication sources [48]. The same results were found in the United States, where 87% of the survey respondents were likely or somewhat likely to get adult vaccines if recommended by their doctors [49]. Results of the current study reflect the neglected role of pharmacists and the weak role of physicians in Jordan. Accordingly, there should be campaigns to educate pharmacists and physicians to take a role in educating people about the importance of influenza vaccine, especially during the COVID-19 pandemic. Also, there should be governmental efforts to guide people where they can seek information about influenza vaccine, and the important role of physician and pharmacists to educate people about the vaccine. Also, there should be campaigns on media to deliver information on the importance of the influenza vaccine during COVID-19 pandemic.

SARS-CoV-2 infection is confirmed by RT-PCR test. 20.6% of the population thought that they have been infected by SARS-CoV-2 and they did not test for that. These results are consistent with Sughayera et al. 2021, who found that there are 8 cases for every confirmed case by testing SARS-CoV-2 antibodies in 1374 blood donor [50]. This indicates that the official number of infections is lower than the real numbers according to the current representative sample. This behavior is concerning in two aspects. The first one, this could be misdiagnosed as influenza or common cold, which will increase the potential incidence of infection and the burden on the health system in Jordan. The second, this information should be considered in future to arrange the priority of getting COVID-19 vaccine.

It is important to investigate the attitude of people towards influenza vaccine during the COVID-19 pandemic, since most people are not aware of the importance of influenza vaccination. Although most of the population has not been vaccinated against influenza, the results of this study showed that nearly half of the population surveyed had a positive perception towards influenza vaccine. One of the most interesting perceptions is that most people knew the priority for influenza vaccination, where they believed that elderly people and health care providers in direct contact with patients were of highest priority. Also, according to the statistical analysis in this survey, a high percent of the respondents were aware of the importance of influenza vaccine from two perspectives. The first perspective was that vaccination against influenza would help to decrease the burden on the Jordanian health system, which is extremely important during COVID-19 pandemic. The second perspective was that it would decrease the misdiagnosis of SARS-CoV-2 infection, thus early treatment could be applied to prevent severe prognosis of SARS-CoV-2 infection. High percent of the respondents also had an awareness that they have to take influenza vaccine yearly, as 60% believed the last year influenza vaccine was not enough for this year.

The awareness of the influenza vaccine is not enough since most of participants believe that vaccine could kill. Accordingly, there should be more efforts to be applied to spread awareness to people about the safety and efficacy of influenza vaccine. People get their information about influenza vaccine mostly from social media and TV. This is also a valid reason that people are anxious about getting vaccine due to the absent role of pharmacists and physicians. Also, it is noticed that the role of Jordanian Pharmaceutical Association (JPA) has a minimal role in educating people about the importance of vaccination against influenza. In contrast to Jordanian population, physicians in Italian population are the most credible source of information on the annual influenza vaccination [36,51].

Finally, people have good perception towards influenza vaccine in general and during COVID-19 pandemic. There should be emphasis on the role of pharmacists, JPA and physicians to educate people about the importance of influenza vaccine during COVID-19 pandemic. Also, it is recommended to establish a funded governmental program for influenza vaccination, since a national influenza vaccination programs are absent in Jordan.

## 5. Study limitations

Our study has interesting findings, however some limitations have emerged. Most of the population were from the middle sector of Jordan, which may not necessarily representative of the general population of Jordan. Also, the results of the vaccination history were based on the self-reported information rather than official medical records. Responses related to attitudes and practices could have been reported based on social desirability like any other self-reported study. Sampling of the study was made through social media, which could represent some bias to the study where people having problems using electronic devices may not be able to participate. Other limitations which are inherent to surveys include recall bias and survey fatigue.

## 6. Conclusions

Seasonal influenza is considered as one of the major causes of morbidity, mortality and increased burdens on healthcare systems worldwide. Vaccination is a well known and important method used to protect people against most viral infections including influenza virus. Influenza vaccine has succeeded to decrease the rate of mortality as well as the burdens on the healthcare systems. Recently, the emergence of COVID-19 pandemic increased the mortality rate and the burdens on the global healthcare system. Different studies showed positive impact of influenza vaccine on the rate of mortality in elderly population who were infected by SARS-CoV-2. There is no study showing the awareness and knowledge of Jordanian population towards influenza vaccine

during the COVID-19 pandemic. Thus, this cross-sectional study focused on investigating KAP of adult Jordanian population towards influenza vaccine during COVID-19 pandemic. The current study resulted in an interesting findings: (i) the adult Jordanian population have good perceptions towards the influenza vaccine, however high percent of them have not been vaccinated, (ii) the role of physicians, pharmacists and media is minimal in educating people about influenza vaccine during COVID-19 pandemic, (iii) high percent of the population do not consider influenza as a threat, thus they have not been vaccinated and (iv) Jordanian population have good perception about the priority of getting vaccines. According to these results, the reinforcement of the role of pharmacists, physician and media to educate people about importance of influenza vaccine during COVID-19 is needed. Also, campaigns should be formulated to relieve the fear of influenza vaccine uptake and encourage those people with positive perception towards influenza vaccines and not willing to uptake it during the COVID-19 pandemic.

### CRedit author statement

**Waleed A. Zalloum:** Conceptualization, Writing – review & editing. **Eman R. Elayeh:** Formal analysis, Writing – review & editing. **Basel Al Haj Ali:** Conceptualization. **Needa Zalloum:** Conceptualization, Writing – review & editing.

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The authors have no conflict of interest to declare

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### Data availability

Any reasonable request for further data will be supplied by the authors.

### References

- H.C. Maltezou, K. Theodoridou, G. Poland, Influenza immunization and COVID-19, *Vaccine* 38 (39) (2020) 6078–6079.
- A.D. Iuliano, K.M. Roguski, H.H. Chang, et al., Estimates of global seasonal influenza-associated respiratory mortality: a modelling study, *Lancet* 391 (10127) (2018) 1285–1300.
- J.L. Excler, M. Saville, S. Berkley, J.H. Kim, Vaccine development for emerging infectious diseases, *Nat. Med.* 27 (4) (2021) 591–600, 2021/04/01.
- J.H. Ellwanger, V. Ana Beatriz Gorini da, K. Valéria de Lima, J.M. Valverde-Villegas, F. Abner Willian Quintino de, J.A.B. Chies, Control and prevention of infectious diseases from a one health perspective, *Genet. Mol. Biol.* (2021) 44.
- E.P. Chevalier-Cottin, H. Ashbaugh, N. Brooke, et al., Communicating benefits from vaccines beyond preventing infectious diseases, *Infect. Dis. Ther.* 9 (3) (2020) 467–480, 2020/09/01.
- S.A. Plotkin, Vaccination against the major infectious diseases, *C. R. Acad. Sci. III* 322 (11) (1999) 943–951.
- World Health Organization (WHO), Weekly epidemiological record Relevé épidémiologique hebdomadaire 87 (47) (2012) 461–476.
- D.A. Solomon, Seasonal influenza vaccination, *JAMA* 324 (13) (2020) 1362, <https://doi.org/10.1001/jama.2020.14772>. Oct 6.
- O. mondiale de la Santé, Organization WH, WHO seasonal influenza vaccination recommendations during the COVID-19 pandemic–Recommandations du SAGE de l’OMS pour la vaccination contre la grippe saisonnière pendant la pandémie de COVID-19, *Weekly Epidemiol. Record Relevé Épidémiolog. Hebd.* 95 (45) (2019) 539–543.
- A.M. Assaf, E.A. Hammad, R.N. Haddadin, Influenza vaccination coverage rates, knowledge, attitudes, and beliefs in Jordan: a comprehensive study, *Viral Immunol.* 29 (9) (2016) 516–525, 2016/11/01.
- S. Hirve, Organization WH., Seasonal Influenza Vaccine Use in Low and Middle Income Countries in the Tropics and subtropics: a Systematic Review, World Health Organization, 2015.
- M.M. Masadeh, K.H. Alzoubi, S.I. Al-Azzam, H.S. Al-Agedi, B.E. Abu Rashid, T. L. Mukattash, Public awareness regarding children vaccination in Jordan, *Hum. Vaccin. Immunother.* 10 (6) (2014) 1762–1766.
- European Centre for Disease Prevention and Control. Seasonal influenza vaccination and antiviral use in EU/EEA Member States. Stockholm: ECDC; 2018.
- N. Zhu, D. Zhang, W. Wang, et al., A novel coronavirus from patients with pneumonia in China, 2019, *N. Engl. J. Med.* 382 (8) (2020) 727–733, 2020/02/20.
- C.C. Lai, T.P. Shih, W.C. Ko, H.J. Tang, P.R. Hsueh, Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): the epidemic and the challenges, *Int. J. Antimicrob. Agents* 55 (3) (2020), 105924–105924.
- H. Li, S.M. Liu, X.H. Yu, S.L. Tang, C.K. Tang, Coronavirus disease 2019 (COVID-19): current status and future perspectives, *Int. J. Antimicrob. Agents* 55 (5) (2020), 105951–105951.
- World Health Organization (WHO). (2020). Coronavirus disease 2019 (COVID-19): situation report, 52. World Health Organization. <https://apps.who.int/iris/handle/10665/331476>.
- World Health Organization COVID-19 Dashboard. Geneva: World Health Organization, 2020. Available online: <https://covid19.who.int/>.
- Jordan Ministry of Health, COVID-19 statistical report. <https://corona.moh.gov.jo/en>.
- World health organization (WHO). Coronavirus disease (COVID-19): Similarities and differences with influenza.2020. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19-similarities-and-differences-with-influenza>.
- Z. Wu, J.M. McGoogan, Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the chinese center for disease control and prevention, *JAMA* 323 (13) (2020) 1239–1242, 2020/04/01.
- Centers for Disease Control and Prevention. Symptoms of COVID-19. 2021; <https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html>.
- Mayo Clinic. Coronavirus disease 2019 (COVID-19). 2019; <https://www.mayoclinic.org/diseases-conditions/coronavirus/symptoms-causes/syc-20479963>.
- F. Zhou, T. Yu, R. Du, et al., Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study, *Lancet* 395 (10229) (2020) 1054–1062.
- S. Richardson, J.S. Hirsch, M. Narasimhan, et al., Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York city area, *JAMA* 323 (20) (2020) 2052–2059.
- D. Marín-Hernández, R.E. Schwartz, D.F. Nixon, Epidemiological evidence for association between higher influenza vaccine uptake in the elderly and lower COVID-19 deaths in Italy, *J. Med. Virol.* 93 (1) (2021) 64–65.
- C.R. Wilcox, N. Islam, H. Dambha-Miller, Association between influenza vaccination and hospitalisation or all-cause mortality in people with COVID-19: a retrospective cohort study, *BMJ Open Respir. Res.* 8 (1) (2021), e000857.
- C. Zanettini, M. Omar, W. Dinalankara, et al., Influenza vaccination and COVID-19 mortality in the USA: an ecological study, *Vaccines* 9 (5) (2021).
- M. Candelli, G. Pignataro, E. Torelli, et al., Effect of influenza vaccine on COVID-19 mortality: a retrospective study, *Intern. Emerg. Med.* (2021), 2021/03/20.
- A. Conlon, C. Ashur, L. Washer, K.A. Eagle, M.A. Hofmann Bowman, Impact of the influenza vaccine on COVID-19 infection rates and severity, *Am. J. Infect. Control* (2021).
- C. Covián, A. Fernández-Fierro, A. Retamal-Díaz, et al., BCG-induced cross-protection and development of trained immunity: implication for vaccine design, *Front. Immunol.* 10 (2806) (2019), 2019–November-29.
- R.J.W. Arts, S. Moorlag, B. Novakovic, et al., BCG vaccination protects against experimental viral infection in humans through the induction of cytokines associated with trained immunity, *Cell Host Microbe* 23 (1) (2018) 89–100.
- K. Chumakov, C.S. Benn, P. Aaby, S. Kottillil, R. Gallo, Can existing live vaccines prevent COVID-19? *Science* 368 (6496) (2020) 1187–1188.
- P.A. Debisarun, P. Struycken, J. Domínguez-Andrés, et al., The effect of influenza vaccination on trained immunity: impact on COVID-19, *medRxiv* (2020), 2020.2010.2014.20212498.
- B.R. Long, J. Michaelsson, C.P. Loo, et al., Elevated frequency of gamma interferon-producing NK cells in healthy adults vaccinated against influenza virus, *Clin. Vaccine Immunol.* 15 (1) (2008) 120–130.
- M. Lino, G. Di Giuseppe, L. Albano, I.F. Angelillo, Parental knowledge, attitudes and behaviours towards influenza A/H1N1 in Italy, *Eur. J. Public Health* 22 (4) (2012) 568–572.
- E.Y. Abu-Rish, E.R. Elayeh, L.A. Mousa, Y.K. Butanji, AM. Albsoul-Younes, Knowledge, awareness and practices towards seasonal influenza and its vaccine: implications for future vaccination campaigns in Jordan, *Fam. Pract.* 33 (6) (2016) 690–697.
- E. Elayeh, S.M. Aleidi, R. Ya’acoub, R.N. Haddadin, Before and after case reporting: a comparison of the knowledge, attitude and practices of the Jordanian population towards COVID-19, *PLoS ONE* 15 (10) (2020), e0240780.
- A.N. Olaimat, I. Aolymat, H.M. Shahbaz, R.A. Holley, Knowledge and information sources about COVID-19 among university students in Jordan: a cross-sectional study, *Front Public Health* 8 (254) (2020).
- R. Sharaydih, S. Abuloha, M. Wazaifi, Promotion of appropriate knowledge and attitude towards medicines among schoolchildren in Jordan: the role of teachers, *Int. J. Pharm. Pract.* 28 (1) (2019) 84–91.
- S. Wu, P. Yang, H. Li, C. Ma, Y. Zhang, Q. Wang, Influenza vaccination coverage rates among adults before and after the 2009 influenza pandemic and the reasons for non-vaccination in Beijing, China: a cross-sectional study, *BMC Public Health* 13 (1) (2013) 636, 2013/07/08.

- [42] A. Domnich, M. Cambiaggi, A. Vasco, et al., Attitudes and beliefs on influenza vaccination during the COVID-19 pandemic: results from a representative Italian survey, *Vaccines* 8 (4) (2020).
- [43] R. Malosh, S.E. Ohmit, J.G. Petrie, M.G. Thompson, A.E. Aiello, A.S. Monto, Factors associated with influenza vaccine receipt in community dwelling adults and their children, *Vaccine* 32 (16) (2014) 1841–1847.
- [44] J. Zhang, A.E. While, I.J. Norman, Seasonal influenza vaccination knowledge, risk perception, health beliefs and vaccination behaviours of nurses, *Epidemiol. Infect.* 140 (9) (2012) 1569–1577.
- [45] A.S. Fauci, Pandemic influenza threat and preparedness, *Emerg. Infect. Dis.* 12 (1) (2006) 73–77.
- [46] E.S. Bailey, J.Y. Choi, J.K. Fieldhouse, et al., The continual threat of influenza virus infections at the human-animal interface: what is new from a one health perspective? *Evol. Med. Public Health* 2018 (1) (2018) 192–198.
- [47] L.G. Goh, P.Y. Cheong, The pandemic influenza threat: a review from the primary care perspective, *Prim. Care Respir. J.* 15 (4) (2006) 222–227, 2006/08/01.
- [48] Canada Communicable Disease Report. Immunization across the lifespan. 2015, 41S.
- [49] Z. Makhmreha, N. Almanasyeha, Analyzing the state and pattern of urban growth and city planning in Amman using satellite images and GIS, *European journal of Social sciences* 24 (2) (2011) 252–264.
- [50] M.A. Sughayer, A. Mansour, A. Al Nuirat, et al., Dramatic rise of seroprevalence rates of SARS-CoV-2 antibodies among healthy blood donors: the evolution of a pandemic, *medRxiv* (2021), 2021.2003.2002.21252448.
- [51] A. Giannattasio, M. Mariano, R. Romano, et al., Sustained low influenza vaccination in health care workers after H1N1 pandemic: a cross sectional study in an Italian health care setting for at-risk patients, *BMC Infect. Dis.* 15 (1) (2015) 329, 2015/08/12.