

Research Paper

# Perception and attitude of the public on vaccine practices and pharmacists as immunizers in Jordan

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## Abstract

**Objective** To assess general perception and attitude of the public on vaccines current practices and pharmacists as immunizers in Jordan

**Methods** In this study, computer-assisted personal interviews technique was utilized using a quantitative approach of a structured questionnaire. The survey instrument was completed with random telephonic interviews covering different geographic areas in the country of Jordan with a total sample size of 366.

**Key findings** Majority of respondents had a positive perception of vaccines in general. Regarding the respondents' perception of current vaccination status, the majority felt it is good as is or requires some enhancements. Furthermore, 53% believe pharmacists should administer vaccines. Majority strongly agree (76%) that pharmacists should be trained and certified to do so. However, 57% strongly disagree that current pharmacies in Jordan have the facilities allowing them to administer vaccines. Finally, a significant increase of 26% in public willingness to have a pharmacist immunizer after certification was observed compared to without being certified (52%).

**Conclusion** Respondents support the role of vaccination as a preventative tool. However, to their opinion, contrary to the high effectiveness in paediatric vaccination in Jordan, current adult vaccination systems need to be revised and improved to increase its adult coverage. Additionally, respondents highly support the idea of allowing pharmacists to become immunizers under certain conditions regarding proper training, accredited certification and licensed administration facilities.

**Keywords:** pharmacists immunizers; clinical pharmacy; vaccination; Jordan; preventative medicine; pharmaceutical care

## Introduction

Vaccination process is considered as one of the most common disease preventative approaches world wide according to the Center for Disease Control and Prevention (CDC) globally and Jordanian Ministry of Health (MoH) guidelines.<sup>[1]</sup> Moreover, its safety and cost-effectiveness profiles are unequivocally a major appealing characteristic in our current healthcare systems. With its low risk and cost, the benefit almost all the time outweighs the potential risk involved.<sup>[2,3]</sup>

With this major advantage, expectations for current diseases that have available vaccines are to be less impactful and burdensome on healthcare systems. Unfortunately, this is not the case according to the World Health Organization (WHO). In a world-wide WHO report, more than 10 million children under 5 years old pass away per year.<sup>[4]</sup> Of those numbers, 1.4 million are due to vaccine-preventable diseases. Therefore, those alarming statistics shed light on the importance of effectively applying vaccine-enforcing policies to minimize avoidable deaths in paediatrics and adults. Moreover, vaccines have been shown to have a global disease preventative effect saving the lives of more than 3 million individuals per year.<sup>[5]</sup>

For these reasons, Jordan is considered a leading country in providing essential vaccines. National vaccination programme is responsible for around 95% of child vaccinations as part of MOH-sponsored free programmes, including Bacille Calmette Guerin, oral polio, diphtheria-pertussis-tetanus, measles mumps-rubella and hepatitis B vaccines.<sup>[6]</sup> Recent events regarding viral coronavirus (COVID-19) pandemic<sup>[7]</sup> dictates upgrading national healthcare systems to expand the scope of immunizers. Pharmacists especially in a community pharmacy setting would be a well-suited healthcare immunizer after proper training and certification, due to their strong relations and accessibility to their local community. Pharmacy is no longer a product oriented profession, in fact it is now considered patient oriented and emphasizes on providing patients point of care services. Pharmacists are experts on vaccines mode of actions, effect onset, drug-drug interactions, side-effects profiles and pharmacokinetics, as well as, their other administrative roles regarding vaccination supply and proper storage conditions.<sup>[8-11]</sup> The idea of having a pharmacist involved in the immunization process is not new globally; recent literature supports the role of pharmacists as immunizers to increase effective vaccination rates and consequently reduce the likelihood of unnecessary vaccine-preventable infections. Interestingly, according to the international pharmaceutical federation,<sup>[12]</sup> integrated and joint immunization collaborations between different healthcare workers including pharmacists are becoming the status quo. The impact of pharmacists as vaccine educators, facilitators and immunizers is becoming highly recognized and appreciated, moreover, pharmacists contribute to public health and disease prevention by enforcing vaccination strategies via acting as educators and advisers, facilitating and participating in national and global routine immunization initiatives. These competencies are being highly highlighted in pharmaceutical education.

Because community pharmacies are considered very accessible to Jordanian public, this by itself accelerates the process of vaccination which leads to increasing the scope of individuals getting vaccines and reduces the possibility of treatment related problems associated with either vaccines or other interfering medications or medical conditions.<sup>[13-16]</sup>

Up until the present time, Jordanian pharmacists are not considered immunizers and their contributions are mainly dispensing vaccines to other healthcare professionals. A joint collaborative

pharmacy practice effort consisting of academic and practicing pharmacists, under the umbrella of the Jordanian Pharmacists Association (JPA) has led to the launching of a pharmacist vaccination campaign, which aims to start a series of studies to assess the feasibility and need of pharmacists as immunizers in Jordan. In this work, as part of this project, we aim to assess general perception and attitude of the public on vaccines current practices and pharmacists as immunizers in Jordan.

## Methods

### Study design

In this study, computer-assisted personal interviews (CAPI) technique was utilized using a quantitative approach of a structured questionnaire with a mix of close-ended and open-ended questions. CAPI is another term used for tablet computer-based interviewing; interviewers use tablets to fill in the answers of respondents, in which quality checks can be conducted in a more convenient manner, in addition to being environmentally friendly. Also, this technique helps record interviews and capture interview location when permitted and suitable. All participating respondents were asked to verbally consent to be a part of this work. Also, ethical approval was obtained from JPA.

The survey instrument was completed with random telephonic interviews covering different geographic areas in Jordan; Amman, Irbid, and Zarqa. Randomization was assured through the use of a software, which generates random phone numbers from telecom providers. Survey response rate was 25% achieving a sample size of 366 consented participants. The study was carried out in January 2019.

### Survey questionnaire

A 69-item questionnaire collected data about current public perception and attitude towards vaccines and potential role of Jordanian pharmacists as immunizers. The questionnaire involved mainly Likert-type, multiple-choice questions and open-end questions. Content validity was assured by extensive review of the literature. The survey instrument was revised for length, flow and clarity.

### The survey instrument consisted of the following parts:

#### Demographic information

Documentation of demographic data included area, gender, nationality, age, marital status, presence and number of children, level of education, current occupational status, household income and health insurance coverage.

#### Current vaccine practices and general perceptions

Current practices regarding vaccination in respondents of the questionnaire and their children was assessed by identifying percentages of adults/children getting vaccinations, place of purchase and administration. To evaluate general perception of vaccination, we assessed the opinion of respondents on the beneficial therapeutic effect, their importance and global impact, long-term effectiveness, manufacturers' authenticity, current application in Jordan and suggestions to enhance vaccination efficiency.

#### Perceptions and attitudes towards pharmacists as immunizers in Jordan

Attitude towards the suggested role of pharmacists to administer vaccines was evaluated by assessing respondents' opinion on

whether pharmacists should be involved in this process. In case of disapproval, follow-up questions regarding reasons were asked. Additionally, respondents were presented the option of pharmacists' vaccination training and certification, following that they were asked several questions on their acceptance to pharmacist's vaccination role after certification, benefits of pharmacy involvement in this process and facilities involved.

### Data analysis

Data were coded, entered and analyzed using SPSS for Windows Version 22.0. Descriptive statistics and pivot tables were used to calculate the frequencies and percentages. Pearson correlation test was performed to note significant correlations among the data (correlation significant to the 0.05 level and 0.01 level). Paired sample *t*-test was used to confirm significant mean differences ( $P < 0.05$  was considered significant).

### Results

Prior to the main data collection process, a 10% pilot of the total sample was conducted to measure the feasibility of the study.

### Demographics

The demographics of the completed surveys are given in Table 1. Average interview length was 13 min. Response rate was approximately 25% equivalent to a final sample size of 366. The total sample size including uninterested respondents was around 1500 trials, out of which 366 were successfully interviewed. Gender was well distributed in our sample with slightly more males (52%). More than half of the respondents were from Amman (53%), while the remaining were almost equally distributed between Zarqa and Irbid cities (23% and 24%, respectively). Age among respondents was categorized into five groups and tended to belong to younger age groups. Furthermore, marital status was also assessed, with the majority of participants being married (62%). More than 90% of our participants received at least high school education. Additionally, current employment status was assessed in respondents and occupations were categorized as the following: employees in private sectors represented 34% of our sample followed by public sector (8%) and military (7%) employees, with only 10% being retired and 41% unemployed. Income of participants in most of the cases (88%) was less than 1000 Jordanian Dinars per month. Moreover, 64% of respondents had either governmental, military or private insurances. Also, 56% of respondents had at least one child, respondents ( $n = 206$ ) mean number of children was 2.05 (SD = 2.362).

Pearson correlation analysis showed multiple correlation patterns in our data. As given in Table 4, significant correlations appeared among the demographic variables including age group; older individuals had significantly more children ( $R = 0.485$ ) and significantly lower education ( $R = -0.202$ ); education level; people with a higher education level had a significantly higher income ( $R = 0.302$ ), however, had significantly lower number of children ( $R = -0.325$ ).

### Current vaccines practices and general perceptions

Overall, participants had positive perceptions on vaccines and their effectiveness (Table 2). The majority strongly believed that vaccines protect them and their families against types of diseases (75%). Around two-thirds of them considered vaccines as one of the

**Table 1** Demographics for responding participants ( $n = 366$ )

Characteristics	Sub-group	%
Area	Amman	53.0
	Irbid	23.8
	Zarqa	23.2
Gender	Male	51.9
	Female	48.1
Age group (years)	18–30	32.0
	31–40	24.9
	41–50	19.7
	51–60	13.1
	Above 60	10.4
Marital status	Single	29.8
	Married	61.7
	Other <sup>a</sup>	8.5
	Number of children ( $n = 206$ )	0
	1	7.1
	2	10.9
	3	10.7
	4	12.0
	5	6.3
	6	3.3
	7	3.0
	8	1.6
	9	0.5
	10	0.3
	12	0.3
Education level	No formal education	4.1
	Elementary\Junior\Primary	5.5
	High School Education	38.5
	College	16.7
Occupation	University\Tertiary	35.2
	Unemployed	41.0
	Employed in private sector	34.2
	Employed in public sector	8.2
	Employed in military	7.1
Income (JOD)	Retired	9.6
	Less than 300	14.2
	300–500	35.2
	501–700	27.6
	701–1000	10.9
	1001–1500	6.3
	1501–2000	2.2
2001–2500	1.4	
Insurance	Refused to say	2.2
	Public Sector	30.3
	Private Sector	24.0
	Ministry of Health	9.6
	Non	36.1

<sup>a</sup>Divorced, widowed.... etc.

greatest medical achievements of mankind. In addition, most participants disagreed that vaccines are not effective (70%) and that they are fake products so corporations can make money (77%). To reflect on respondents' perception of current vaccination status in Jordan, they were asked about whether they feel vaccination is good as is, and does not need any enhancement, requires some enhancements or requires a lot of enhancements and their answers were as following: 49%, 49% and 2%, respectively.

Only around half of the sample agreed that the current vaccination system in Jordan is good as is and respondents had some suggestions which include the following: increase vaccines efficiency and continuous development of vaccines (31%), creating

**Table 2** Current vaccines practices and general perceptions of participants

Vaccination practice	Sub-group	%
Takes vaccines occasionally ( <i>n</i> = 366)	No	78.1
	Yes	21.9
Location of vaccine purchase ( <i>n</i> = 80)	Pharmacy	32.5
	Doctor's clinic	26.3
	Hospital	22.5
	Healthcare centre	18.8
Checks the vaccines storage at the place of purchase before the actual purchase ( <i>n</i> = 80)	Never	55.0
	Sometimes	22.5
	Always	22.5
Location of vaccine administration ( <i>n</i> = 80)	Doctor's clinic	30.0
	Pharmacy	27.5
	Hospital	22.5
	Healthcare centre	18.8
	Home	1.3
Children currently take or will be taking vaccines ( <i>n</i> = 206)	Yes	85.1
	No	14.9
Children vaccination ( <i>n</i> = 175)	MoH vaccines only	92.6
	MoH and others	7.4
Agreement with the statement: 'Vaccines protects me and my family against types of diseases' ( <i>n</i> = 366)	Strongly agree	74.6
	Agree	16.7
	Neutral	2.5
	Disagree	2.2
	Strongly disagree	4.1
Agreement with the statement: 'Vaccination is considered one of the greatest medical achievement of mankind' ( <i>n</i> = 366)	Strongly agree	66.7
	Agree	16.4
	Neutral	8.7
	Disagree	1.9
	Strongly disagree	6.3
Agreement with the statement: 'In general vaccines are not effective' ( <i>n</i> = 366)	Strongly disagree	69.7
	Disagree	15.3
	Neutral	4.1
	Agree	3.6
	Strongly agree	7.4
Agreement with the statement: 'Vaccines are fake products so corporates can make money' ( <i>n</i> = 366)	Strongly disagree	77.0
	Disagree	9.3
	Neutral	3.0
	Agree	2.5
Beliefs on the status of vaccination system in Jordan ( <i>n</i> = 366)	Strongly agree	8.2
	Good as is, and does not need any enhancement	49.2
	Requires some enhancement	48.9
Suggested enhancements to be made to the vaccination system in Jordan ( <i>n</i> = 186)	Requires a lot of enhancement	1.9
	Administer vaccines at some schools	1.1
	Allow pharmacists to administer vaccines	0.5
	Availability/Coverage	11.8
	Availability of all vaccines types	7.0
	Bring the best of vaccines	2.7
	Cleanliness of vaccines administration place	2.7
	Create awareness on vaccination	12.9
	Decrease costs of vaccines	6.5
	Development of vaccination system	1.6
	Dispensing and storage of vaccines	4.3
	Government role	0.5
	Increase number of vaccines types given to people	0.5
	Increase vaccines efficiency/Continues development of vaccines	31.2
	Keeping up with latest advancements of vaccines/diseases	0.5
	Make seasonal vaccines available every season	0.5
	Post evaluation of vaccines given	0.5
Provide information on each type of vaccines	4.3	
Provide vaccines for all age groups	0.5	
Reduce pain of injections	0.5	
Send out vaccines reminders	0.5	
To be free	0.5	
To be taken only orally	0.5	
Vaccine monitoring	8.1	

**Table 3** Perceptions towards pharmacists as vaccine providers in Jordan

Characteristics	Sub-group	%
Believes that community pharmacists should administer vaccines at their pharmacies ( <i>n</i> = 366)	Yes	52.5
	No	47.5
Reasons for not believing community pharmacists should administer vaccines at their pharmacies ( <i>n</i> = 174)	Pharmacists not qualified/experienced	28.7
	Physicians' role	22.4
	Not a pharmacist's role	16.7
	MOH role	15.5
	Lack of proper storage conditions in the pharmacy	4.6
	Others	4.6
	Trust issues	3.4
	Not allowed/needs a license	1.1
	Patients allergy reaction	1.1
	Pharmacists not qualified/experienced	1.1
	Lack of proper storage conditions in the pharmacy/facilities	0.6
Agreement with the statement: 'Pharmacists should be trained and certified to administer vaccines at pharmacies' ( <i>n</i> = 366)	Strongly agree	75.7
	Agree	15.6
	Neutral	3.0
	Disagree	1.9
Agreement with the statement: 'If the pharmacist is certified to administer vaccines I would be willing to have the pharmacist give me vaccines' ( <i>n</i> = 366)	Strongly disagree	3.8
	Strongly agree	63.1
	Agree	10.7
	Neutral	1.6
Agreement with the statement: 'If the pharmacist is certified to administer vaccines I would be willing to have the pharmacist give my children' ( <i>n</i> = 218)	Disagree	2.2
	Strongly disagree	22.4
	Strongly agree	51.8
	Agree	14.2
Agreement with the statement: 'It would save customers time and efforts if pharmacists are certified to administer vaccines' ( <i>n</i> = 366)	Neutral	3.7
	Disagree	4.1
	Strongly disagree	26.1
	Strongly agree	59.3
Agreement with the statement: 'All pharmacies in Jordan should be certified to administer vaccines' ( <i>n</i> = 366)	Agree	18.9
	Neutral	10.7
	Disagree	3.3
	Strongly disagree	7.9
Agreement with the statement: 'In general, pharmacies in Jordan do not have the facilities allowing them to administer vaccines' ( <i>n</i> = 366)	Strongly agree	52.5
	Agree	16.1
	Neutral	12.0
	Disagree	6.8
Suggested amount to pay the pharmacy for vaccine administration in Jordanian Dinars ( <i>n</i> = 271)	Strongly disagree	12.6
	Strongly agree	51.8
	Agree	14.2
	Neutral	3.7
	Disagree	4.1
	Strongly disagree	26.1
	1	21.0
	2	28.0
	3	17.0
	4	6.6
	5	21.0
6	1.8	
7	4.4	

awareness on vaccination process (13%), increase availability and coverage (12%), enhance vaccines monitoring (8%), work on the availability of all vaccines types (7%), decreasing costs of vaccines (6%), enhancing dispensing and storage of vaccines (4%), providing information on each type of vaccines (4%), bringing the best of vaccines (3%), cleanliness of vaccines administration place (3%) and development of a vaccination system (2%).

As given in Table 4, significant independent correlations appeared among the current vaccine practices and general perceptions including gender; females had a significantly higher agreement that vaccines are not fake products, so corporates can make money

( $R = 0.112$ ); age groups; older groups were more likely to consider vaccination one of the greatest medical achievement of mankind ( $R = 0.140$ ), have a more positive perception on vaccines ( $R = 0.136$ ), and of the vaccination system in Jordan ( $R = 0.138$ ) than younger age groups; number of children; people with a higher number of children were more likely to consider vaccination effective ( $R = 0.106$ ), one of the greatest medical achievement of mankind ( $R = 0.194$ ), and have a positive perception on vaccines ( $R = 0.171$ ). However, people with a higher number of children were less likely to check the vaccine's storage at the place of purchase before the actual purchase ( $R = -0.269$ ).

**Table 4** Significant independent correlations of respondents ( $n = 366$ )

	Gender	Age group	Number of children	Education level
Number of children		0.485**		-0.325**
Education level		-0.202**	-0.325**	
Income				0.302**
Checking vaccine's storage before purchase ( $n = 80$ )			-0.269*	
Belief in vaccines as a medical achievement		0.140**	0.194**	
Belief in vaccines efficiency			0.106*	
Belief in vaccine's authenticity	0.112*			
Average of positive vaccine perception		0.136**	0.171**	
Perception on vaccination system in Jordan		0.138**		
Willingness for a pharmacist to administer vaccines	-0.135**		-0.220**	
Pharmacist's training need for vaccine administration				
Willingness for pharmacists to administer vaccines if certified		0.132*		
Average of positive perception on pharmacists administering vaccines when trained		0.129*		
Administration cost ( $n = 271$ )		-0.135*		

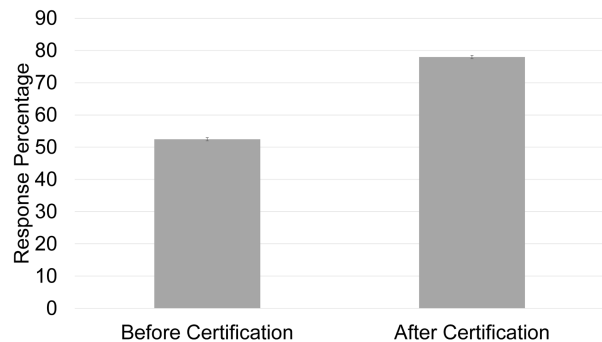
\*Correlation is significant at the 0.05 level (two-tailed).

\*\*Correlation is significant at the 0.01 level (two-tailed).

### Perceptions and attitudes towards pharmacists as immunizers in Jordan

As given in Table 3, 52% of our sample agreed that pharmacists should administer vaccines. However, the remaining 48% concerns include pharmacists' qualifications (30%), overstepping other healthcare providers' roles (17%), overstepping physicians (22%) or MOH (16%) roles. Also, concerns due to lack of knowledge of the drug storage conditions (5%), general trust issues (3%), patient's allergic reactions (1.1%) and pharmacists' immunization licensing (1.1%). To further evaluate how the public may feel about pharmacists as immunizers, participants were asked about their opinion, however, with the addition of further vaccination training and proper certification. Respondents felt that pharmacists should be certified to be immunizers, and if so, a high number of people would agree to take vaccines from a certified and trained pharmacist. Their opinions were as follows: majority strongly agreed that pharmacists should be trained and certified to administer vaccines at pharmacies (76%). In fact 63% strongly felt if their pharmacists are certified to administer vaccines they would be willing to have the pharmacist immunize them. Similarly, 59% felt this would in general save customers time and efforts on the condition that pharmacists are certified to administer vaccines. On the other hand, there has been a concern regarding current pharmacies in Jordan not having the facilities allowing pharmacists to administer vaccines (57%). Finally, participants strongly felt that all pharmacies in Jordan should be certified to administer vaccines (52%).

As given in Table 4, significant independent correlations appeared among perceptions and attitudes towards pharmacists as immunizers in Jordan including gender; females were significantly less likely to believe that community pharmacists should administer vaccines at their pharmacies ( $R = -0.135$ ); with age groups; older groups were significantly more willing to have the pharmacist give them vaccines if the pharmacist is certified ( $R = 0.132$ ), and had a significantly higher average of positive perception on pharmacists as immunizers when certified ( $R = 0.129$ ), however, they would pay less at a pharmacy for giving a vaccine ( $R = -0.135$ ) than younger age groups; number of children; people with a higher number of children were less likely to believe that pharmacists should administer vaccines at their pharmacies ( $R = -0.220$ ).



**Figure 1** Illustration of the difference in response rate in willingness to accept pharmacist immunization services among participants before and after pharmacy immunization certification. Data presented as mean + SD,  $P$ -value  $< 0.001$ .

### Assessing the effect of vaccination certification on public opinion regarding pharmacists as immunizers

A paired samples  $t$ -test (Figure 1) succeeded to reveal a statistically significant difference between the mean of 'willingness to have pharmacist immunizers' ( $M = 0.52$ ,  $s = 0.5$ ) and the mean of 'willingness to have certified pharmacist immunizers' ( $M = 0.78$ ,  $s = 0.3$ ), (mean difference =  $-0.26$ ,  $s = 0.23$ ,  $t = -11.15$ ,  $P$ -value  $< 0.05$ ).

### Discussion

This study provided, for the first time in Jordan, an overview on current practices and general perceptions of the public on vaccines and pharmacists as immunizers. The impact of these novel findings will lay-out the foundational base for expanding the scope of pharmacy practice in Jordan to meet global pharmaceutical care standards which incorporates pharmacists in the process of immunization. This will be conducted through working hand in hand with other healthcare professionals involved such as MOH physicians and nurses.

Our study had a national scope in Jordan; it included samples from the public randomly selected from Amman, Zarqa and Irbid. These areas contain geographically diverse populations and would serve as a well-blended representation of Jordanians. According

to the Jordanian Department of Statistics report of the estimated population in Jordan for 2019, the population density in Amman is 42.0%, Irbid is 18.5% and Zarqa is 14.3%, covering a total of 74.8% of total Jordanians.<sup>[17]</sup> Therefore, the data have the potential to provide practice changing recommendations to immunization in Jordan.

Most participants agree vaccines are one of the greatest inventions, and they believe in its effectiveness; however, half of the sample agree that the vaccination system in Jordan requires enhancements, mainly by increasing vaccine efficiency and creating awareness among the community. Our data show a general deficiency of public awareness towards seasonal vaccination in adults. Contrary to practice guidelines,<sup>[18, 19]</sup> only around 20% of adults stated that they currently take vaccinations (including seasonal flu vaccine). On the other hand, vaccination percentages among respondents' children were as high as above 80%. Also, there is a difference in the site of purchase between children vaccines compared to adult vaccines, with the former being obtained mainly from pharmacies, doctor's clinics and hospitals and the later from MOH. This sheds light on the importance of enhancing awareness for the need of having public immunity against major seasonal infections. Because pharmacies are targeted for vaccination purchase, it would only be logical to have pharmacists provide immunization education, as preventative medicine is considered one of the main pharmacists' responsibilities.

Pharmacy-based immunization services (PBIS) have long been implemented world wide. However, recently, the role of such projects has become of critical importance.<sup>[20]</sup> For instance, in all of the 50 United States, Washington DC and Puerto Rico, pharmacists are allowed to at least administer the influenza vaccine and in 46 of those states they can administer all adult vaccines.<sup>[21, 22]</sup> Similarly, the Pharmacy Regulator in Ireland has implemented similar legislation.<sup>[23]</sup> This has been noted by the European Interdisciplinary Council for Ageing stakeholders meeting which has concluded this may increase the number of available opportunities for vaccination.<sup>[15, 24]</sup> Such change had a significant impact as noted from a study in Ontario-Canada where the implementation of PBIS resulted in an increase of almost 450,000 immunization and economic savings up to \$2.3 million annually in direct healthcare costs and lost productivity<sup>[23]</sup>. Unfortunately, out of the 25 low- to middle-income countries, such as Jordan, only eight countries included the role of a pharmacist as immunizers.<sup>[13]</sup> Therefore, further studies on the active role of pharmacists in immunization are lacking in Jordan, although, several studies have been conducted for other Jordanian healthcare professionals.<sup>[6, 25-30]</sup>

In the current style of pharmacy practice in Jordan, almost half of the respondents believed that pharmacists should not be involved in immunization, mainly because, to them, it is not considered part of pharmacists' role. Here, it would be a great opportunity to re-emphasize that the international experience with pharmacists as immunizers has led to more effective vaccination rates and consequently reduced vaccine preventable infections.<sup>[6, 25-30]</sup>

Interesting correlations have appeared in our statistical analysis for instance; females had higher agreement that pharmacists should be involved in immunization, however, had lower beliefs in vaccine authenticity. Females trust the vaccination system in Jordan is crucial to increase vaccination rates and minimize risk, especially since they are looked upon as major care providers to the paediatric population. Therefore, targeting them in educational programmes focused on increasing their trust and comfort in vaccination would ensure better outcomes. It would be appropriate that pharmacists be involved in providing such education, since they are considered drug

experts and are available and accountable. Additionally, older individuals had a more positive perception on vaccination and its system in Jordan. They were more willing to have a certified pharmacist administer them. However, they would pay less at a pharmacy for receiving a vaccine than younger individuals. This is an important aspect to consider when going through pharmacist reimbursement policies for vaccination. Moreover, people with more children had a more positive perception of vaccines. However, they had lower education levels and were less likely to check the vaccines' storage at the place of purchase. Also, they were less likely to believe that pharmacists should administer vaccines at their pharmacies, another important aspect to consider when constructing educational material tailored to such a population.

In order to increase the trust among the public we included the option of having the pharmacist undergo a special training and formal vaccination certification. Respondents agreed that a pharmacist should be certified to administer vaccines as immunizers, with a high percentage of people willing to take a vaccine by a certified pharmacist.

In conclusion, respondents represented from Jordan support the role of vaccination as a preventative tool to attenuate serious infectious diseases. However, to their opinion, current vaccination systems in Jordan need to be revised and improved to increase vaccination effectiveness. Additionally, respondents highly support the idea of allowing pharmacists to become immunizers with certain concerns regarding training, certification and administration facilities. All in all, under the current circumstances and based on the data from this study, we highly recommend expanding the scope of pharmacy practice in Jordan to include pharmacists immunizers as an essential part of community pharmacies point of care services. Future studies focusing on the perception of pharmacists on this matter are necessary to proceed in this direction.

### Study limitation

One limitation was the low response rate of the targeted population. This was due to several factors such as the availability of time, participant's interest and lack of incentive. Also, we did not go into details of paediatric, adult and geriatric vaccination regimens, our study focused on the perception of the public on pharmacists as immunizers. However, further studies on specific vaccination regimens are needed.

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### Author contributions

All authors have contributed to this study, reviewed and approved the final version of the manuscript. Y.S.B., F.W.D., S.S. and R.M.D. participated in the study design. R.F., M.A., A.A. and L.J. participated in data collection and interpretation of results. Y.S.B. and R.F. prepared the manuscript draft, and performed analytical testing and manuscript review.

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### Conflict of Interest

The authors declare no conflict of interest in this work.

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