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RESEARCH ARTICLE

Understanding knowledge, attitudes, and practices of Iraqi academics and health professionals regarding influenza vaccine

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Abstract

Background: Despite its availability, the uptake of the flu vaccine remains below expectation. The study aimed to explore the knowledge, attitudes, and practices regarding influenza vaccine across a sample of Iraqi academics and healthcare professionals. **Methods:** A cross-sectional study was conducted between January and July 2024 using a questionnaire distributed online to healthcare professionals and academics in Kerbala City, Iraq. **Results:** Of 121 participants, 12.40% were pharmacists, 14.88% were nurses, 4.96% were lab technicians, 19.83% were pharmacy professors, and 47.93% were students. Negative perceptions and lack of recommendations are the factors that contribute to the high ranks of participants' attitudes. Participants significantly reported their readiness to get the vaccine if it is recommended by the healthcare professional (P=0.049), and if in the National Immunisation Program (P=0.035). The adjusted odd's ratio showed that being married (OR 3.811, 95%CI 1.108-13.107, P = 0.034), not receiving the flu vaccine during childhood (OR 0.174, 95%CI 0.062-0.486, P = 0.01) was significantly associated with reduced flu vaccine uptake. **Conclusion:** The study revealed that insufficient knowledge about the vaccine, coupled with negative perceptions, resulted in low vaccine uptake. Furthermore, the lack of recommendations from healthcare professionals played a critical role in shaping participants' attitudes, contributing to their reluctance to receive the vaccine. Additionally, a prior history of receiving childhood vaccines emerged as a potential predictor for future flu vaccine uptake.

Introduction

Influenza, commonly known as the flu, remains a significant public health concern worldwide, causing substantial morbidity and mortality, with an estimated one million cases annually worldwide according to the World Health Organization (WHO) (Soudani *et al.*, 2022). Vaccination is widely regarded as the most effective strategy for preventing the flu and reducing its associated burden (Bridges *et al.*, 2000). The influenza vaccine has demonstrated a considerable ability to prevent laboratory-confirmed cases of influenza, with its effectiveness varying from year to year. Nonetheless, it is crucial in preventing numerous illnesses, hospitalisations, and deaths annually (Belongia *et al.*, 2016; Chung *et al.*, 2020). Previous studies have emphasized that annual influenza vaccination helps reduce both mortality and morbidity among healthcare workers and patients (Pless *et al.*, 2017). It helps reduce employee illness and absenteeism (SAXÉN & VIRTANEN, 1999).

However, despite the availability of safe and effective vaccines, global influenza vaccination coverage remains suboptimal especially among healthcare workers (Hansen *et al.*, 2007). The reasons behind low vaccination rates are multifaceted and often rooted in individuals' knowledge, attitudes, and practices (KAP) concerning the flu vaccine (Rabensteiner *et al.*, 2018),

and data on vaccination uptake in low- and middle-income countries are limited (Lietz *et al.*, 2016). In addition, ensuring consistent adherence to seasonal influenza vaccination remains a challenge (Wheeler & Buttenheim, 2013). Several factors contribute to this, including poor risk perception, insufficient knowledge, concerns and misconceptions about vaccine safety and efficacy, misinformation and unfounded rumours, vaccine hesitancy, and a gap between perceptions and actual practices (Jiménez-García *et al.*, 2006). Therefore, this study was planned to explore the knowledge, attitudes, and practices regarding influenza vaccination across a sample of Iraqi academics and healthcare professionals.

Methods

Design and setting

A cross-sectional study, conducted in the city of Kerbala, Iraq, between January and July 2024, included a sample from two public hospitals (AL-Husseini Hospital and ImamAL-Hasan Teaching Hospital) and the Faculty of College of Pharmacy at the University of Kerbala.

Participants

The study included adults aged 18 or older who were health workers (pharmacists, nurses, lab technicians, or medical doctors), pharmacy students, or academic professors living and working in the specified institutions in Kerbala Province and willing to complete the questionnaire. Individuals were excluded if they were under 18, not health workers, professors, or pharmacy students, did not work in the mentioned institutions, did not reside in Kerbala Province, or were unwilling to complete the questionnaire

Sample size

The following formula used to calculate the sample size: n = N*X / (X + N – 1) (Metcalfe, 2001), with a margin of error of 5%, a confidence level of 95%, and a population proportion of 90% from previous studies (Alshammari *et al.*, 2019; Ahmed *et al.*, 2023). Given a population size of approximately 1,500, the expected sample size was 127.

Ethical approval

The study was carried out after the approval by the scientific and ethical committee of the College of Pharmacy, University of Kerbala, (Project No: 2023HU17). The questionnaire was sent to the institutions above through a Google form, and a consent statement was included at the beginning of the questionnaire.

Study instrument

The questionnaire was adopted from a previously validated questionnaire(Mallhi *et al.*, 2022) with some modifications to apply to the medical and academic community.

The questionnaire consists of four sections. Section one involves demographic data including age, gender, marital status, occupation, education, and influenza vaccination status. Section two involves 12 statements regarding the knowledge of influenza vaccination, giving 1 for “correct” answers and 0 for “wrong” statements with a maximum knowledge score of 12. The knowledge score was categorized into three levels, poor knowledge (score 1-5), moderate knowledge (score 6-9), and good knowledge (score 10-12) (Srichan *et al.*, 2020; Salman *et al.*, 2020; Sheraba *et al.*, 2022).

Section three involves 11 questions regarding attitudes toward receiving influenza vaccination with the responses collected on a 5-point Likert scale (“Agree”, “Strongly agree”, “Neutral”, “Disagree”, to “Strongly disagree”), with reverse scoring from 1 given to strongly disagree to 5 for strongly agree, with a range between 11-55 points. It further classifies it into positive and negative responses based on the answers considering positive (those who answered strongly agree and agree) and negative for those who answered (neutral, disagree, and strongly disagree). The relative importance index (RII) was used to determine the relationship between the statements and the attitudes toward vaccine uptake. The value of RII ranges between 0 and 1; the value closest to 1 corresponds to the highest rank.

Section four consists of statements regarding practices toward readiness to receive the influenza vaccine using 7 questions with “Yes” or “No” or “Don’t know” answers, giving 1 for those who answered “yes” and zero for those who answered “no” or “don’t know”. Those who got a score between (0-2) were considered to have poor readiness to receive the flu vaccine, those with (3-5) were considered to have moderate readiness to receive the flu vaccine, and those between (6-7) had good readiness to receive the flu vaccine (Eppes *et al.*, 2013; Srichan *et al.*, 2020).

Data analysis

Continuous data were expressed as mean (±SD), while categorical data were summarized as frequency (%). Categorical data were compared using the Chi-square test. The association between demographic variables, knowledge, attitudes, and practices with vaccine

uptake was evaluated using Pearson correlation, simple linear regression, or chi-square, where appropriate.

The association between knowledge, attitudes, and practice was evaluated using the Spearman correlation. Spearman's correlation is preferred in KAP studies because it is more flexible with the type of data commonly used in these studies (ordinal and non-normally distributed) and can capture monotonic relationships without assuming linearity or normality (de Winter *et al.*, 2016)

Multivariate logistic regression analysis determined the association between the independent demographic variables and the flu vaccine uptake. Variables included in the model were age, gender, marital status, occupation, education, knowledge, attitudes, and practices. A 95% confidence interval (CI) was calculated to reveal the adjusted odds ratio (OR) with a *P*-value of <0.05. Data were analysed using the statistical package for social science (SPSS) version 25 (SPSS Inc., Chicago, IL, USA).

Results

Of the total (121) participants in the study, 12.40% (n=15) were pharmacists, 14.88% (n=18) were nurses, 4.96% (n=6) were lab technicians, 19.83% (n=24) were pharmacy professors, and 47.93% (n=58) were pharmacy students. Participants in this study were mostly females (P=0.022), of young age between 20-30 years (P<0.0001), single (P<0.0001), and half of them did not receive the flu vaccine in childhood (P=0.004) or majority did not receive before winter (P=0.024) (Table I).

Table I: General characteristics of the included participants in the study

	Pharmacists (n=15)	Nurses (n=18)	Lab Technicians (n=6)	Pharmacy Professors (n=24)	Pharmacy Students (n=58)	P value
Gender						P=0.022
Male	5 (33.33)	14 (77.78)	2 (33.33)	11 (45.83)	20 (34.48)	
Female	10 (66.67)	4 (22.22)	4 (66.67)	13 (54.17)	38 (65.52)	
Age						P<0.0001
20-30	6 (40)	8 (44.44)	4 (66.67)	1 (4.17)	58 (100)	
31-40	8 (53.33)	7 (38.89)	2 (33.33)	19 (79.17)	0 (0)	
41-50	1 (6.67)	3 (16.67)	0 (0)	4 (16.67)	0 (0)	
Education						P<0.0001
BSc	11 (73.33)	12 (66.67)	6 (100)	0 (0)	0 (0)	
Master	4 (26.67)	5 (27.78)	0 (0)	12 (50)	0 (0)	
PhD	0 (0)	1 (5.56)	0 (0)	12 (50)	0 (0)	
Student	0 (0)	0 (0)	0 (0)	0 (0)	58 (100)	
Marital Status						P<0.0001
Single	11 (73.33)	3 (16.67)	3 (50)	3 (12.50)	54 (93.10)	
Married	4 (26.67)	15 (83.33)	3 (50)	21 (87.50)	4 (6.90)	
Received Flu Vaccination at any time in Childhood						P=0.004
Yes	6 (40)	14 (77.78)	2 (33.33)	5 (20.83)	32 (55.17)	
No	9 (60)	4 (22.22)	4 (66.67)	19 (79.17)	26 (44.83)	
Received Flu Vaccination before the arrival of winter						P=0.024
Yes	5 (33.33)	12 (66.67)	2 (33.33)	6 (25)	15 (25.87)	
No	10 (66.67)	6 (33.33)	4 (66.67)	18 (75)	43 (74.13)	

BSc: Bachelor of Science; PhD: Doctor of Philosophy

Regarding the knowledge section, only 22.31% of study participants had good knowledge and more than 75% had moderate knowledge with a mean score of 8.52 ± 1.30, with no significant difference among the study groups (P=0.594). A high score of good knowledge was found in 33.33% of the pharmacy professors group, followed by 24.14% in the pharmacy students group (Table II).

Moreover, the knowledge score was not significantly associated with gender (P=0.279), age (P=0.888), education (P=0.569), marital status (P=0.958), receiving the flu vaccine before winter (P=0.139), or during childhood (P=0.648).

Table II: Knowledge of participants about the Flu vaccination

	Pharmacist (n=15)		Nurse (n=18)		Lab Technician (n=6)		Pharmacy Professor (n=24)		Pharmacy Student (n=58)		P value
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
All persons aged 6 months and above should get influenza vaccination annually	8 (53.33)	7 (46.67)	13 (72.22)	5 (27.78)	4 (66.67)	2 (33.33)	18 (75)	6 (25)	42 (72.41)	16 (27.58)	P=0.642
Influenza vaccination causes mild flu-like symptoms	13 (86.67)	2 (13.33)	17 (94.44)	1 (5.56)	5 (83.33)	1 (16.67)	23 (95.83)	1 (4.17)	53 (91.38)	5 (8.62)	P=0.776
Being vaccinated reduces the severity and duration of flu	15 (100)	0 (0)	17 (94.44)	1 (5.56)	6 (100)	0 (0)	23 (95.83)	1 (4.17)	57 (98.28)	1 (1.72)	P=0.798
Being vaccinated improves immunity	12 (80)	3 (20)	15 (83.33)	3 (16.67)	6 (100)	0 (0)	22 (91.67)	2 (8.33)	55 (94.83)	3 (5.17)	P=0.277
Infants and immuno-compromised populations cannot get influenza vaccination	11 (73.33)	4 (26.67)	15 (83.33)	3 (16.67)	6 (100)	0 (0)	16 (66.67)	8 (33.33)	34 (58.62)	24 (41.38)	P=0.121
The complications of influenza can be severe leading to absence from schools and the workplace, affecting the quality of work	14 (93.33)	1 (6.67)	15 (83.33)	3 (16.67)	6 (100)	0 (0)	19 (79.17)	5 (20.83)	54 (93.10)	4 (6.90)	P=0.279
Severe influenza can lead to hospitalization and even death	11 (73.33)	4 (26.67)	13 (72.22)	5 (27.78)	4 (66.67)	2 (33.33)	20 (83.33)	4 (16.67)	39 (67.24)	19 (32.76)	P=0.686
Influenza vaccine provides coverage for all types of strains that cause flu	5 (33.33)	10 (66.67)	13 (72.22)	5 (27.78)	2 (33.33)	4 (66.67)	4 (16.67)	20 (83.33)	27 (46.55)	31 (53.45)	P=0.007
Influenza vaccine reduces the severity and duration of flu for all types of strains	6 (40)	9 (60)	14 (77.78)	4 (22.22)	2 (33.33)	4 (66.67)	5 (20.83)	19 (79.17)	27 (46.55)	31 (53.45)	P=0.007
The influenza vaccine is not effective if I already have flu	14 (93.33)	1 (6.67)	17 (94.44)	1 (5.56)	5 (83.33)	1 (16.67)	16 (66.67)	8 (33.33)	44 (75.86)	14 (24.14)	P=0.129
There are two types of influenza vaccine; intramuscular shot, intra nasal spray	8 (53.33)	7 (46.67)	10 (55.56)	8 (44.44)	3 (50)	3 (50)	14 (58.33)	10 (41.67)	42 (72.41)	16 (27.59)	P=0.420
The intramuscular influenza "shot" vaccine contains inactivated (killed) virus.	14 (93.33)	1 (6.67)	13 (72.22)	5 (27.78)	5 (83.33)	1 (16.67)	22 (91.67)	2 (8.33)	51 (87.93)	7 (12.07)	P=0.341
Knowledge Score Mean ± SD	8.20 ± 1.14		8.22 ± 1.26		8.67 ± 0.81		8.70 ± 1.51		8.60 ± 1.31		
Knowledge category											P=0.594
Poor Knowledge	0 (0)		0 (0)		0 (0)		1 (4.17)		2 (3.45)		
Moderate Knowledge	13 (86.67)		15 (83.33)		6 (100)		15 (62.50)		42 (72.41)		
Good Knowledge	2 (13.33)		3 (16.67)		0 (0)		8 (33.33)		14 (24.14)		

In the participants' attitudes section toward receiving the flu vaccine, negative perceptions toward receiving the flu vaccine were manifested by the pharmacists' and pharmacy professors' groups that the "flu vaccine is seasonal, it will recover on its own", which was associated with the highest rank (RII 0.800) and (RII 0.758) respectively. In the nurses' and pharmacy students' group, the highest rank (RII 0.722) and (RII 0.758) about that the flu vaccine causes flu and fever. In the lab technicians group, the lack of recommendations from health centres was the highest rank (RII 0.700) (Table III). In addition, the majority of the participants believed that vaccines are not expensive, time and place are not obstacles to getting the flu vaccine, the vaccine is effective and considerably safe, and they have no cultural or religious constraints to get the vaccine. However, pharmacists, pharmacy professors, and students believe that influenza is seasonal and will go on (Table IV).

Table III: Attitudes toward receiving flu vaccine

	Vaccines are expensive	I do not have time to get a flu vaccination	I do not know where to receive a flu vaccination	I do not believe that vaccines are effective	I believe that vaccines may have dangerous side effects	I believe that the flu vaccine causes flu and fever	I believe I will not get the flu	I did not see any publicity (poster/ social media) from health centres about getting a flu vaccination	Flu is seasonal, it will recover on its own	I do not want to get a flu vaccination because of religious reasons	I do not want to get a flu vaccination because of cultural reasons
Pharmacist											
Strongly agree	0 (0)	0 (0)	1 (6.67)	2 (13.33)	2 (13.33)	3 (20)	0 (0)	3 (20)	5 (33.33)	2 (13.33)	1 (6.67)
Agree	3 (20)	4 (26.67)	1 (6.67)	3 (20)	2 (13.33)	5 (33.33)	1 (6.67)	3 (20)	6 (40)	1 (6.67)	3 (20)
Neutral	3 (20)	4 (26.67)	2 (13.33)	4 (26.67)	4 (26.67)	4 (26.67)	4 (26.67)	3 (20)	3 (20)	0 (0)	2 (13.33)
Disagree	6 (40)	7 (46.67)	7 (46.67)	3 (20)	4 (26.67)	1 (6.67)	5 (33.33)	5 (33.33)	1 (6.67)	7 (46.67)	6 (40)
Strongly disagree	3 (20)	0 (0)	4 (26.67)	3 (20)	3 (20)	2 (13.33)	5 (33.33)	1 (6.67)	0 (0)	5 (33.33)	3 (20)
RII	0.48	0.56	0.44	0.573	0.547	0.68	0.413	0.627	0.8	0.44	0.507
Nurse											
Strongly agree	3 (16.67)	2 (11.11)	4 (22.22)	3 (16.67)	3 (16.67)	4 (22.22)	3 (16.67)	3 (16.67)	3 (16.67)	4 (22.22)	4 (22.22)
Agree	5 (27.78)	6 (33.33)	2 (11.11)	6 (33.33)	6 (33.33)	5 (27.78)	2 (11.11)	5 (27.78)	3 (16.67)	1 (5.56)	2 (11.11)
Neutral	5 (27.78)	5 (27.78)	3 (16.67)	4 (22.22)	3 (16.67)	6 (33.33)	6 (33.33)	6 (33.33)	6 (33.33)	5 (27.78)	5 (27.78)
Disagree	3 (16.67)	4 (22.22)	5 (27.78)	3 (16.67)	4 (22.22)	2 (11.11)	3 (16.67)	2 (11.11)	4 (22.22)	4 (22.22)	4 (22.22)
Strongly disagree	2 (11.11)	1 (5.56)	4 (22.22)	2 (11.11)	2 (11.11)	1 (5.56)	4 (22.22)	2 (11.11)	2 (11.11)	4 (22.22)	3 (16.67)
RII	0.644	0.644	0.633	0.655	0.644	0.722	0.567	0.656	0.611	0.544	0.6
Lab Technician											
Strongly agree	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (16.67)	0 (0)	0 (0)	0 (0)
Agree	0 (0)	1 (16.67)	2 (33.33)	0 (0)	1 (16.67)	3 (50)	1 (16.67)	2 (33.33)	3 (50)	0 (0)	0 (0)
Neutral	2 (33.33)	2 (33.33)	1 (16.67)	2 (33.33)	0 (0)	1 (16.67)	1 (16.67)	2 (33.33)	3 (50)	1 (16.67)	0 (0)
Disagree	3 (50)	2 (33.33)	1 (16.67)	3 (50)	5 (83.33)	2 (33.33)	3 (50)	1 (16.67)	0 (0)	1 (16.67)	2 (33.33)
Strongly disagree	1 (16.67)	1 (16.67)	2 (33.33)	1 (16.67)	0 (0)	0 (0)	1 (16.67)	0 (0)	0 (0)	4 (66.67)	4 (66.67)
RII	0.433	0.5	0.5	0.433	0.467	0.633	0.467	0.7	0.6	0.333	0.267
Pharmacy Professor											
Strongly agree	1 (4.17)	3 (12.50)	1 (4.17)	0 (0)	2 (8.33)	2 (8.33)	2 (8.33)	7 (29.17)	5 (20.83)	1 (4.17)	1 (4.17)
Agree	3 (12.50)	1 (4.17)	3 (12.50)	3 (12.50)	6 (25)	12 (50)	0 (0)	9 (37.50)	12 (50)	2 (8.33)	1 (4.17)
Neutral	7 (29.17)	12 (50)	4 (16.67)	6 (25)	3 (12.50)	7 (29.17)	4 (16.67)	4 (16.67)	4 (16.67)	2 (8.33)	2 (8.33)
Disagree	9 (37.50)	6 (25)	12 (50)	8 (33.33)	9 (37.50)	2 (8.33)	12 (50)	3 (12.50)	3 (12.50)	10 (41.67)	13 (54.16)
Strongly disagree	4 (16.67)	2 (8.33)	4 (16.67)	7 (29.17)	4 (16.67)	1 (4.17)	6 (25)	1 (4.17)	0 (0)	9 (37.50)	7 (29.17)
RII	0.5	0.575	0.475	0.441	0.542	0.7	0.433	0.75	0.758	0.392	0.4
Pharmacy Student											
Strongly agree	3 (5.17)	5 (8.62)	5 (8.62)	1 (1.72)	1 (1.72)	12 (20.69)	3 (5.17)	14 (24.14)	9 (15.52)	1 (1.72)	0 (0)
Agree	5 (8.62)	15 (25.86)	10 (17.24)	4 (6.90)	16 (27.59)	29 (50)	2 (3.45)	18 (31.03)	28 (48.28)	5 (8.62)	6 (10.34)
Neutral	21 (36.20)	12 (20.69)	8 (13.79)	10 (17.24)	18 (31.03)	10 (17.24)	7 (12.07)	10 (17.24)	10 (17.24)	6 (10.34)	11 (18.97)
Disagree	20 (34.49)	18 (31.03)	22 (37.93)	24 (41.38)	19 (32.76)	7 (12.07)	34 (58.62)	13 (22.41)	10 (17.24)	31 (53.45)	29 (50)
Strongly disagree	9 (15.52)	8 (13.79)	13 (22.41)	19 (32.76)	4 (6.90)	0 (0)	12 (20.69)	3 (5.17)	1 (1.72)	15 (25.86)	12 (20.69)

RII	0.506	0.568	0.503	0.406	0.572	0.758	0.427	0.693	0.717	0.413	0.437
P Value	P=0.592	P=0.347	P=0.836	P=0.048	P=0.167	P=0.370	P=0.224	P=0.928	P=0.204	P=0.065	P=0.021

RII: Relative Importance Index.

Table IV: Positive and negative attitudes of study participants toward flu vaccine

	Vaccines are expensive	I do not have time to get a flu vaccination	I do not know where to receive a flu vaccination	I do not believe that vaccines are effective	I believe that vaccines may have dangerous side effects	I believe that the flu vaccine causes flu and fever	I believe I will not get the flu	I did not see any publicity (poster/ social media) from health centres about getting a flu vaccination	Flu is seasonal, it will recover on its own	I do not want to get a flu vaccination because of religious reasons	I do not want to get a flu vaccination because of cultural reasons
Pharmacist											
Positive response %	20	26.67	13.34	33.33	26.66	53.33	6.67	40	73.33	20	26.67
Negative response %	80	73.33	86.66	66.67	73.37	46.67	93.33	60	26.67	80	73.33
Nurse											
Positive response %	44.45	44.44	33.33	50	50	50	27.78	44.45	33.34	27.78	33.33
Negative response %	55.55	55.56	66.67	50	50	50	72.22	55.55	66.66	72.22	66.67
Lab Technician											
Positive response %	0	16.67	33.33	0	16.67	50	16.67	50	50	0	0
Negative response %	100	83.33	66.67	100	83.33	50	83.33	50	50	100	100
Pharmacy Professor											
Positive response %	16.67	16.67	16.67	12.5	33.33	58.33	8.33	66.67	70.83	12.5	8.34
Negative response %	83.33	83.33	83.33	87.5	66.67	41.67	91.67	33.33	29.17	87.5	91.66
Pharmacy Student											
Positive response %	13.79	34.48	25.86	8.62	29.31	70.69	8.62	55.17	63.80	10.34	10.34
Negative response %	86.21	65.52	74.14	91.38	70.69	29.31	91.38	44.83	36.20	89.66	89.66

In the practices section toward readiness to receive the flu vaccine, the study participants significantly reported their readiness to get the flu vaccine if it is recommended by the pharmacist or doctor (P=0.049), and if vaccination is made compulsory in the National Immunisation Programme (P=0.035) (Table V). Generally, most of the study groups were associated with moderate readiness to receive flu vaccine (Table 6), with the mean readiness score of the study participants being 2.76 ± 1.69.

Table V: Practices toward willingness to receive Flu vaccine

	I will regularly get a flu vaccine every year	I would get a flu vaccine only if I or any of my family members got the flu	I will get a flu vaccine only if my doctor/ pharmacist recommends me	I will get a flu vaccine only if yearly flu vaccination is made compulsory in the National Immunisation Program	I will get a flu vaccine if it is provided at the hospital free of cost	I will get a flu vaccination via intramuscular shot (injection)	I will not get a flu vaccine in any case
Pharmacist							
Yes	3 (20)	2 (13.33)	4 (26.67)	4 (26.67)	4 (26.67)	5 (33.33)	5 (33.33)
No	8 (53.33)	12 (80)	10 (66.66)	10 (66.66)	10 (66.66)	9 (60)	8 (53.33)
Don't know	4 (26.67)	1 (6.67)	1 (6.67)	1 (6.67)	1 (6.67)	1 (6.67)	2 (13.33)
Nurse							
Yes	8 (44.44)	7 (38.89)	6 (33.33)	11 (61.11)	10 (55.56)	9 (50)	7 (38.89)
No	4 (22.22)	9 (50)	9 (50)	5 (27.78)	6 (33.33)	4 (22.22)	7 (38.89)

Don't know	6 (33.33)	2 (11.11)	3 (16.67)	2 (11.11)	2 (11.11)	5 (27.78)	4 (22.22)
Lab technician							
Yes	1 (16.67)	1 (16.67)	2 (33.33)	4 (66.66)	2 (33.33)	2 (33.33)	3 (50)
No	4 (66.66)	4 (66.66)	4 (66.66)	2 (33.33)	3 (50)	3 (50)	1 (16.67)
Don't know	1 (16.67)	1 (16.67)	0 (0)	0 (0)	1 (16.67)	1 (16.67)	2 (33.33)
Pharmacy professor							
Yes	7 (29.17)	5 (20.83)	14 (58.33)	17 (70.83)	9 (37.50)	12 (50)	5 (20.83)
No	9 (37.50)	16 (66.67)	7 (29.17)	3 (12.50)	10 (41.67)	7 (29.17)	15 (62.50)
Don't know	8 (33.33)	3 (12.50)	3 (12.50)	4 (16.67)	5 (20.83)	5 (20.83)	4 (16.67)
Pharmacy student							
Yes	15 (25.86)	16 (27.59)	38 (65.52)	26 (44.83)	31 (53.45)	34 (58.62)	7 (12.07)
No	18 (31.03)	35 (60.34)	17 (29.31)	19 (32.76)	18 (31.03)	17 (29.31)	41 (70.69)
Don't know	25 (43.10)	7 (12.07)	3 (5.17)	13 (22.41)	9 (15.52)	7 (12.07)	10 (17.24)
P value	**P=0.383**	**P=0.820**	**P=0.049**	**P=0.035**	**P=0.379**	**P=0.258**	**P=0.096**

Table VI: Readiness category according to the readiness score of the study participants

	Pharmacist	Nurse	Lab Technician	Pharmacy Professor	Pharmacy Student
Readiness score					
Mean ± SD	1.80 ± 1.56	3.22 ± 2.36	2.50 ± 2.07	2.83 ± 1.46	2.86 ± 1.48
Readiness Category					
Poor readiness	11 (73.33)	10 (55.56)	3 (50)	6 (25)	25 (43.10)
Moderate readiness	4 (26.67)	6 (33.33)	1 (16.67)	18 (75)	30 (51.72)
Good readiness	0 (0)	2 (11.11)	2 (33.33)	0 (0)	3 (5.17)

A positive statistically significant correlation (correlation coefficient 0.260, $P < 0.05$) was found between the knowledge and attitude among the pharmacy students group (Table VII).

Table VII: Correlation between knowledge, attitude, and practice among study participants

Pharmacist (n=15)				
Variables		**Knowledge**	**Attitude**	**Practice**
Knowledge	Correlation Coefficient	1.000	-0.046	-0.211
	P-value		0.872	0.451
Attitude	Correlation Coefficient	-0.046	1.000	0.476
	P-value	0.872		0.073
Practice	Correlation Coefficient	-0.211	0.476	1.000
	P-value	0.451	0.073	
Nurse (n=18)				
Variables		**Knowledge**	**Attitude**	**Practice**
Knowledge	Correlation Coefficient	1.000	0.058	-0.088
	P-value		0.820	0.728
Attitude	Correlation Coefficient	0.058	1.000	-0.083
	P-value	0.820		0.745
Practice	Correlation Coefficient	-0.088	-0.083	1.000
	P-value	0.728	0.745	
Lab Technician (n=6)				
Variables		**Knowledge**	**Attitude**	**Practice**
Knowledge	Correlation Coefficient			
	P-value			
Attitude	Correlation Coefficient		1.000	-0.371
	P-value			0.468
Practice	Correlation Coefficient		-0.371	1.000
	P-value		0.468	
Pharmacy Professors (n=24)				
Variables		**Knowledge**	**Attitude**	**Practice**
Knowledge	Correlation Coefficient	1.000	-0.207	0.398
	P-value		0.331	0.054
Attitude	Correlation Coefficient	-0.207	1.000	-0.202
	P-value	0.331		0.344
Practice	Correlation Coefficient	0.398	-0.202	1.000
	P-value	0.054	0.344	

Pharmacy Student (n=58)				
Variables		**Knowledge**	**Attitude**	**Practice**
Knowledge	Correlation Coefficient	1.000	0.260	-0.184
	P-value		0.048	0.167
Attitude	Correlation Coefficient	0.260	1.000	0.031
	P-value	0.048		0.819
Practice	Correlation Coefficient	-0.184	0.031	1.000
	P-value	0.167	0.819	

In the multivariate logistic regression analysis, the adjusted odd's ratio (OR) showed that being married (OR 3.811, 95%CI 1.108-13.107, P = 0.034), and not receiving the flu vaccine during childhood (OR 0.174, 95%CI 0.062-0.486, P = 0.01) were significantly associated with reduced flu vaccine uptake (Table VIII).

Table VIII: Factors that potentially influence flu vaccine uptake

	Adjusted OR	95%CI	P value
Gender			
Male (Ref)			
Female	0.825	0.328-2.075	P=0.683
Age category			
20-30	2.104	0.145-30.614	P=0.586
31-40	4.359	0.344-56.821	P=0.261
41-50 (Ref)			
Education			
Student	5.110	0.540-48.331	P=0.155
BSC	6.311	0.913-43.629	P=0.062
Master	5.618	0.845-37.370	P=0.074
PhD (Ref)			
Marital Status			
Single (Ref)			
Married	3.811	1.108-13.107	P=0.034
Knowledge score			
Poor Knowledge	4.020	0.233-69.363	P=0.338
Moderate knowledge	0.440	0.158-1.227	P=0.117
Good Knowledge (Ref)			
Receiving Flu Vaccine during childhood			
Yes (Ref)			
No	0.174	0.062-0.486	P=0.001

OR: odd ratio, CI: confidence interval

Discussion

This study assessed the knowledge, attitudes, and practices of academic and healthcare professionals with varying educational backgrounds regarding the flu vaccine. The results revealed that more than half of the participants had not received the vaccine, either in childhood or before the winter season. A small proportion exhibited a good understanding of the vaccine with no association of demographic data with knowledge of study participants, but their attitudes were largely negative, influenced by a lack of recommendations, perceptions of mild disease severity, and concerns about vaccine side effects. Furthermore, participants' decisions to get the flu vaccine were primarily shaped by advice from healthcare providers and national immunisation programs. The study also highlighted that knowledge significantly affects attitudes toward the flu vaccine, particularly among students, and that not receiving the vaccine during childhood or being married may reduce the likelihood of future uptake.

The low uptake of the flu vaccine during childhood aligns with findings from previous studies. Sampson et al. identified several factors contributing to this, including uncertainty about the need for vaccination, issues of choice, access challenges, lack of parental prioritization, and health belief barriers (Sampson *et al.*, 2011). Additionally, Smith et al. highlighted the significant role of psychological factors in shaping perceptions of side effects following vaccination (Smith *et al.*, 2017).

The low uptake of the flu vaccine among healthcare professionals before the winter season is consistent with findings from previous studies. Guillari et al. identified several factors contributing to this, including

concerns about contracting influenza from the vaccine, a belief that they are not at risk, the perception that their immune system can handle a mild disease, laziness, and false beliefs about the vaccine (Guillari *et al.*, 2021). This may underscore the influence of attitudes and knowledge in shaping vaccine practices and suggests that improving knowledge and attitudes could lead to higher uptake

The findings revealed that most participants had limited knowledge about the influenza vaccine. James et al. found that the primary reasons for not getting vaccinated included a lack of awareness about the influenza vaccine among healthcare professionals, a belief that they are less susceptible to influenza than others, and unawareness of the influenza immunisation guidelines (James *et al.*, 2017). This suggests that educational interventions may be necessary to improve knowledge about influenza vaccination in these professional groups.

Additionally, the findings indicate no association between knowledge and demographic factors such as age, gender, marital status, or education, which contrasts with the results of previously published studies (Klein & Pekosz, 2014; Aljamili, 2020; Watson & Oancea, 2020; Penţa *et al.*, 2020; Guzman-Holst *et al.*, 2020). Several factors may explain the lack of association. One possibility is that all individuals have relatively equal access to educational resources, despite differences in their demographic backgrounds. Since they share a similar level of medical education, their access to information remains uniform, resulting in comparable levels of knowledge regardless of age, gender, marital status, or education level. Knowledge of the flu vaccine could be influenced by factors beyond basic demographics, such as personal experiences with illness, healthcare access, or exposure to healthcare professionals. While knowledge about the flu vaccine may be widespread, attitudes and beliefs toward vaccination (such as hesitancy or mistrust) can be influenced by psychological, social, or political factors that are not directly tied to demographic characteristics.

The study found that participants held negative perceptions of the influenza vaccine. Welch et al. identified negative attitudes toward healthcare services as a major barrier to low vaccine uptake (Welch *et al.*, 2023). Additionally, Challenger et al. suggested that underestimating the risks associated with influenza and overestimating the risks of minor adverse reactions could contribute to this reluctance (Challenger *et al.*, 2023). This negative perception highlights an area where further research and public health campaigns could be beneficial

The study also indicated that healthcare advice and immunisation campaigns can significantly influence participants' decisions regarding the flu vaccine. Oguz found that onsite vaccination interventions were strongly associated with increased influenza vaccination rates among healthcare workers (Oguz, 2019). Similarly, Koning et al. identified that educational initiatives, reminder systems, incentives, improved access, feedback mechanisms, and policy implementation are effective strategies for addressing vaccine hesitancy and enhancing vaccine confidence and uptake among healthcare providers (de Koning *et al.*, 2024).

The current study also found that knowledge can influence attitudes toward the flu vaccine among pharmacy students. Similarly, Kałucka et al. identified that factors such as knowledge about the flu vaccine, place of residence, and vaccination status also played a role in shaping individuals' attitudes toward flu vaccination among pharmacy students in Poland (Kałucka *et al.*, 2021).

The findings also indicated that not receiving the flu vaccine during childhood can influence future vaccine uptake. Han et al. found that childhood influenza vaccination was positively associated with factors such as caregivers' knowledge of the vaccine, positive attitudes toward vaccination, self-efficacy, perceived susceptibility and severity of influenza, belief in the vaccine's efficacy, concern about getting sick, healthcare workers' recommendations, and prior vaccination experiences (Han *et al.*, 2024). On the other hand, those who had received flu shots in childhood were more likely to be willing to accept the vaccine in the future. This highlights the potential long-term impact of early immunisation experiences on later vaccine uptake and could guide future vaccination strategies.

Additionally, the study's findings indicated that marital status could be a predictor of flu vaccine uptake. While some research has suggested that married individuals are more likely to receive the vaccine (Crawford *et al.*, 2011; Javed & AL-Mohaithef, 2023), other studies have found no significant association between marital status and vaccine uptake (Sarria-Santamera, 2003; de Andres *et al.*, 2007).

Limitations

The current study has some limitations, primarily related to its design. As a cross-sectional study, it provides a snapshot of the medical population, making it difficult to establish causal inferences, even though associations between variables may exist. The small sample size may not be representative of the broader medical and academic community, which limits the

generalizability of the findings. Additionally, the participants who did not take part in the study may differ from those who did, potentially leading to an overestimation or underestimation of knowledge, attitudes, and readiness toward the flu vaccine. Some individuals may not have had internet access or may have encountered technical difficulties that prevented them from completing the questionnaire, which could have impacted the representativeness of the study sample.

Nevertheless, the study's strength lies in its diverse sample, which included individuals from various institutions and with varying levels of education within the medical and academic community. The implications of this study highlight the need for continuous medical education for academic and healthcare institutions about influenza illness and vaccination to reduce the economic and social burden. In addition, there is a need to increase awareness about the influenza vaccine through different channels such as newspapers, public posters, social media, and so on.

Future recommendations can have several key areas that can include but are not limited to targeted education campaigns, enhancing healthcare provider recommendations, improving access and convenience to flu vaccination, addressing vaccine Hesitancy, and future research with longitudinal studies and larger sample size.

Conclusion

In exploring the knowledge, attitudes, and practices regarding the influenza vaccine among Iraqi academics and healthcare professionals, this study found that most participants exhibited low vaccine uptake and expertise. Negative perceptions about the vaccine and a lack of recommendations from health professionals played a significant role in shaping their attitudes toward vaccination. These factors, along with the influence of having received flu shots in childhood, were key determinants that may predict their willingness to accept the vaccine in the future.

Conflict of interest

The authors declare no conflict of interest.

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References

Ahmed, W. S., Abu Farha, R., Halboup, A. M., Alshargabi, A., Al-mohamadi, A., Abu-rish, E. Y., Zawiah, M., Al-Ashbat, Y. K., & Al-Jamei, S. (2023). Knowledge, attitudes, perceptions, and practice toward seasonal influenza and its vaccine: A cross-sectional study from a country of conflict. *Frontiers in Public Health*, **11**. https://doi.org/10.3389/fpubh.2023.1030391

Aljamili, A. (2020). Knowledge and practice toward seasonal influenza vaccine and its barriers at the community level in Riyadh, Saudi Arabia. *Journal of Family Medicine and Primary Care*, **9**(3), 1331. https://doi.org/10.4103/jfmpc.jfmpc_1011_19

Alshammari, T. M., Yusuff, K. B., Aziz, M. M., & Subaie, G. M. (2019). Healthcare professionals' knowledge, attitude and acceptance of influenza vaccination in Saudi Arabia: a multicenter cross-sectional study. *BMC Health Services Research*, **19**(1), 229. https://doi.org/10.1186/s12913-019-4054-9

Belongia, E. A., Simpson, M. D., King, J. P., Sundaram, M. E., Kelley, N. S., Osterholm, M. T., & McLean, H. Q. (2016). Variable influenza vaccine effectiveness by subtype: a systematic review and meta-analysis of test-negative design studies. *The Lancet Infectious Diseases*, **16**(8), 942–951. https://doi.org/10.1016/S1473-3099(16)00129-8

Bridges, C. B., Thompson, W. W., Meltzer, M. I., Reeve, G. R., Talamonti, W. J., Cox, N. J., Lilac, H. A., Hall, H., Klimov, A., & Fukuda, K. (2000). Effectiveness and cost-benefit of influenza vaccination of healthy working adults: a randomized controlled trial. *JAMA*, **284**(13), 1655. https://doi.org/10.1001/jama.284.13.1655

Challenger, A., Sumner, P., Powell, E., & Bott, L. (2023). Identifying reasons for non-acceptance of influenza vaccine in healthcare workers: an observational study using declination form data. *BMC Health Services Research*, **23**(1), 1167. https://doi.org/10.1186/s12913-023-10141-2

Chung, J. R., Rolfes, M. A., Flannery, B., Prasad, P., O'Halloran, A., Garg, S., Fry, A. M., Singleton, J. A., Patel, M., Reed, C., US Influenza Vaccine Effectiveness Network, Influenza Hospitalization Surveillance Network, & Assessment Branch, Immunization Services Division, Centers for Disease Control and Prevention. (2020). Effects of influenza vaccination in the United States during the 2018–2019 influenza season. *Clinical Infectious Diseases*, **71**(8), e368–e376. https://doi.org/10.1093/cid/ciz1244

Crawford, V. L. S., O'Hanlon, A., & McGee, H. (2011). The effect of patient characteristics upon uptake of the influenza vaccination: a study comparing community-based older adults in two healthcare systems. *Age and Ageing*, **40**(1), 35–41. https://doi.org/10.1093/ageing/afq152

de Andres, A. L., Garrido, P. C., Hernandez-Barrera, V., del Pozo, S. V.-F., de Miguel, A. G., & Jimenez-Garcia, R. (2007). Influenza vaccination among the elderly Spanish population: trend from 1993 to 2003 and vaccination-related factors*. *The European Journal of Public Health*, **17**(3), 272–277. https://doi.org/10.1093/eurpub/ckl242

de Koning, R., Gonzalez Utrilla, M., Spanaus, E., Moore, M., & Lomazzi, M. (2024). Strategies used to improve vaccine uptake among healthcare providers: A systematic review. *Vaccine*: X, **19**, 100519. https://doi.org/10.1016/j.jvacx.2024.100519

de Winter, J. C. F., Gosling, S. D., & Potter, J. (2016). Comparing the Pearson and Spearman correlation coefficients across distributions and sample sizes: A tutorial using simulations and empirical data. *Psychological Methods*, **21**(3), 273–290. https://doi.org/10.1037/met0000079

Eppes, C., Wu, A., You, W., Cameron, K. A., Garcia, P., & Grobman, W. (2013). Barriers to influenza vaccination among pregnant women. *Vaccine*, **31**(27), 2874–2878. https://doi.org/10.1016/j.vaccine.2013.04.031

Guillari, A., Polito, F., Pucciarelli, G., Serra, N., Gargiulo, G., Esposito, M. R., Botti, S., Rea, T., & Simeone, S. (2021). Influenza vaccination and healthcare workers: barriers and predisposing factors: A literature review. *Acta Bio-Medica*, **92**(S2), e2021004. https://doi.org/10.23750/abm.v92iS2.11106

Guzman-Holst, A., DeAntonio, R., Prado-Cohrs, D., & Juliao, P. (2020). Barriers to vaccination in Latin America: A systematic literature review. *Vaccine*, **38**(3), 470–481. https://doi.org/10.1016/j.vaccine.2019.10.088

Han, K., Hou, Z., Tu, S., Liu, M., Chantler, T., & Larson, H. (2024). Factors influencing childhood influenza vaccination: A systematic review. *Vaccines*, **12**(3), 233. https://doi.org/10.3390/vaccines12030233

Hansen, S., Stamm-Balderjahn, S., Zuschneid, I., Behnke, M., Rüden, H., Vonberg, R.-P., & Gastmeier, P. (2007). Closure of medical departments during nosocomial outbreaks: data from a systematic analysis of the literature. *Journal of Hospital Infection*, **65**(4), 348–353. https://doi.org/10.1016/j.jhin.2006.12.018

James, P. B., Rehman, I. U., Bah, A. J., Lahai, M., Cole, C. P., & Khan, T. M. (2017). An assessment of healthcare professionals' knowledge about and attitude towards influenza vaccination in Freetown Sierra Leone: a cross-sectional study. *BMC Public Health*, **17**(1), 692. https://doi.org/10.1186/s12889-017-4700-2

Javed, N. B., & AL-Mohaithef, M. (2023). Socio-demographic determinants of influenza vaccination uptake behaviour. *Saudi Medical Journal*, **44**(11), 1132–1138. https://doi.org/10.15537/smj.2023.44.11.20230399

Jiménez-García, R., Hernández-Barrera, V., Carrasco-Garrido, P., Sierra-Moros, M. J., Martinez-Hernandez, D., & de Miguel, A. G. (2006). Influenza vaccination coverages among Spanish children, adults and health care workers. *Infection*, 34(3), 135–141. https://doi.org/10.1007/s15010-006-5627-1

Kałucka, S., Głowacka, A., Dziankowska-Zaborszczyk, E., & Grzegorczyk-Karolak, I. (2021). Knowledge, beliefs and attitudes towards the influenza vaccine among future healthcare workers in Poland. *International Journal of Environmental Research and Public Health*, **18**(4), 2105. https://doi.org/10.3390/ijerph18042105

Klein, S. L., & Pekosz, A. (2014). Sex-based biology and the rational design of influenza vaccination strategies. *Journal of Infectious Diseases*, **209**(suppl 3), S114–S119. https://doi.org/10.1093/infdis/jiu066

Lietz, J., Westermann, C., Nienhaus, A., & Schablon, A. (2016). The occupational risk of Influenza A (H1N1) infection among healthcare personnel during the 2009 pandemic: A systematic review and meta-analysis of observational studies. *PLOS ONE*, **11**(8), e0162061. https://doi.org/10.1371/journal.pone.0162061

Mallhi, T. H., Bokharee, N., Bukhsh, M., Khan, Y. H., Alzarea, A. I., Khan, F. U., Khan, S.-U.-D., Alotaibi, N. H., Alanazi, A. S., Butt, M. H., Alatawi, A. D., & Iqbal, M. S. (2022). Evaluation of knowledge and barriers of influenza vaccine uptake among university students in Saudi Arabia; a cross-sectional analysis. *PeerJ*, **10**, e13959. https://doi.org/10.7717/peerj.13959

Metcalfe, C. (2001). Biostatistics: A foundation for analysis in the health sciences. 7th edn. Wayne W. Daniel, Wiley, 1999. No. of. pages: xiv+755+appendices. Price: ₤28.95. ISBN 0-471-16386-4. *Statistics in Medicine*, **20**(2), 324–326. https://doi.org/10.1002/1097-0258(20010130)20:2<324::AID-SIM635>3.0.CO;2-O

Oguz, M. M. (2019). Improving influenza vaccination uptake among healthcare workers by on-site influenza vaccination campaign in a tertiary children hospital. *Human Vaccines & Immunotherapeutics*, **15**(5), 1060–1065. https://doi.org/10.1080/21645515.2019.1575164

Penţa, M. A., Crăciun, I. C., & Băban, A. (2020). The power of anticipated regret: Predictors of HPV vaccination and seasonal influenza vaccination acceptability among young Romanians. *Vaccine*, 38(6), 1572–1578. https://doi.org/10.1016/j.vaccine.2019.11.042

Pless, A., McLennan, S. R., Nicca, D., Shaw, D. M., & Elger, B. S. (2017). Reasons why nurses decline influenza vaccination: a qualitative study. *BMC Nursing*, **16**(1), 20. https://doi.org/10.1186/s12912-017-0215-5

Rabensteiner, A., Buja, A., Regele, D., Fischer, M., & Baldo, V. (2018). Healthcare worker's attitude to seasonal influenza vaccination in the South Tyrolean province of Italy: barriers and facilitators. *Vaccine*, **36**(4), 535–544. https://doi.org/10.1016/j.vaccine.2017.12.007

Salman, M., Mustafa, Z. U., Asif, N., Zaidi, H. A., Hussain, K., Shehzadi, N., Khan, T. M., & Saleem, Z. (2020). Knowledge, attitude and preventive practices related to COVID-19: a cross-sectional study in two Pakistani university populations. *Drugs & Therapy Perspectives*, **36**(7), 319–325. https://doi.org/10.1007/s40267-020-00737-7

Sampson, R., Wong, L., & MacVicar, R. (2011). Parental reasons for non-uptake of influenza vaccination in young at-risk groups: a qualitative study. *British Journal of General*

Practice, **61**(588), e386–e391. https://doi.org/10.3399/bjgp11X583155

Sarria-Santamera, A. (2003). Influenza vaccination in old adults in Spain. *European Journal of Public Health*, **13**(2), 133–137. https://doi.org/10.1093/eurpub/13.2.133

SAXÉN, H., & VIRTANEN, M. (1999). Randomized, placebo-controlled double blind study on the efficacy of influenza immunization on absenteeism of health care workers. *The Pediatric Infectious Disease Journal*, **18**(9), 779–783. https://doi.org/10.1097/00006454-199909000-00007

Sheraba, N. S., Orayj, K., Alqahtani, A., El-sokkary, R. H., & Khalid, M. (2022). A questionnaire-based cross-sectional survey of knowledge, attitudes, and practices toward COVID-19 among students and staff in Asir, Saudi Arabia during the second wave of the pandemic. *Vaccines*, **10**(12), 2014. https://doi.org/10.3390/vaccines10122014

Smith, L. E., Webster, R. K., Weinman, J., Amlôt, R., Yiend, J., & Rubin, G. J. (2017). Psychological factors associated with uptake of the childhood influenza vaccine and perception of post-vaccination side-effects: A cross-sectional survey in England. *Vaccine*, **35**(15), 1936–1945. https://doi.org/10.1016/j.vaccine.2017.02.031

Soudani, S., Mafi, A., Al Mayahi, Z., Al Balushi, S., Dbaibo, G., Al Awaidy, S., & Amiche, A. (2022). A systematic review of influenza epidemiology and surveillance in the Eastern Mediterranean and North African region. *Infectious Diseases and Therapy*, **11**(1), 15–52. https://doi.org/10.1007/s40121-021-00534-3

Srichan, P., Apidechkul, T., Tamornpark, R., Yeemard, F., Khunthason, S., Kitchanapaiboon, S., Wongnuch, P., Wongphaet, A., & Upala, P. (2020). Knowledge, attitudes and preparedness to respond to COVID-19 among the border population of northern Thailand in the early period of the pandemic: a cross-sectional study. *WHO South-East Asia journal of public health*, **9**(2), 118–125. https://doi.org/10.4103/2224-3151.294305

Watson, I. W., & Oancea, S. C. (2020). Does health plan type influence receipt of an annual influenza vaccination? *Journal of Epidemiology and Community Health*, **74**(1), 57–63. https://doi.org/10.1136/jech-2019-212488

Welch, V. L., Metcalf, T., Macey, R., Markus, K., Sears, A. J., Enstone, A., Langer, J., Srivastava, A., Cane, A., & Wiemken, T. L. (2023). Understanding the barriers and attitudes toward influenza vaccine uptake in the adult general population: A rapid review. *Vaccines*, **11**(1), 180. https://doi.org/10.3390/vaccines11010180

Wheeler, M., & Buttenheim, A. M. (2013). Parental vaccine concerns, information source, and choice of alternative immunization schedules. *Human Vaccines & Immunotherapeutics*, **9**(8), 1782–1789. https://doi.org/10.4161/hv.25959