Influenza Vaccine Acceptance, Hesitancy, and Their Psychological Determinants Among Healthcare Workers in a Malaysian Public Hospital

Lay Theng Ong[1*], Lim Yehan @ Evelyn Lim[1], Kae Lin Looi[1], Nurfariha Ahmad Razali[1], Siti Nurul Farah Farhani Nowawi[1], Mohamad Zulhizree Abdul Rahim[1], Soik Fun Lee[2], Nurun A'tirah Zaini[3]

[1]*Pharmacy Department, Balik Pulau Hospital*
[2]*Pharmacy Department, Penang Hospital*
[3]*Perlis State Health Department*

Correspondence to: Ong Lay Theng (laytheng98@gmail.com)

Received: 15 March 2025
Accepted: 16 July 2026

ABSTRACT

Introduction:

Healthcare workers (HCWs) are potential vectors for nosocomial influenza transmission, which can adversely affect vulnerable populations. Influenza vaccination among HCWs is therefore vital for effective infection control. This study aimed to assess influenza vaccine acceptance and hesitancy among HCWs and to identify sociodemographic and psychological determinants influencing vaccine acceptance using the 5C model.

Methods:

A cross-sectional survey was conducted at Balik Pulau Hospital (BPH) from July 1 to October 31, 2023. Eligible HCWs who understood English or Malay and were able to provide a written informed consent were included. Sociodemographic characteristics, psychological determinants, and vaccine acceptance were summarised descriptively. Multiple logistic regression was performed to examine the associations between sociodemographic variables and the psychological determinants in the 5C model—confidence, complacency, constraints, calculation, and collective responsibility—in relation to influenza vaccine acceptance.

Results:

Among the 203 HCWs surveyed, 87.2% expressed acceptance of receiving the influenza vaccine. Confidence in the influenza vaccine was the only significant predictor of acceptance (adjusted OR=1.67; 95% CI: 1.23-2.27; *P*=0.001), while sociodemographic variables—including age, gender, religion, profession, and education level—were not significantly associated with vaccine acceptance.

Conclusion:

High influenza vaccine acceptance among HCWs at BPH was primarily driven by strong confidence in the vaccine. Most respondents perceived the vaccine as safe, effective, and compatible with their religious beliefs. Enhancing education and trust towards vaccines may further improve uptake and strengthen public health initiatives.

Keywords:

Influenza vaccine, vaccine uptake, healthcare workers

INTRODUCTION

Influenza, a respiratory illness caused by ribonucleic acid (RNA) viruses from the *Orthomyxoviridae* family, is a leading cause of respiratory infections globally.[1] There are four types of influenza viruses, A, B, C, and D, that can lead to various respiratory conditions, ranging from mild upper respiratory infections to severe pneumonia. The World Health Organisation (WHO) estimates that influenza causes between three to five million cases of severe illness and leads to 290,000 to 645,000 respiratory-related deaths annually.[2]

The influenza virus has a one to four-day incubation period and spreads easily, posing risks to healthcare workers (HCWs) and patients. HCWs may be one of the key vectors for transmission within healthcare settings, making vaccination essential. Nosocomial transmission has a significant impact on high-risk groups of the elderly, children, and immunocompromised individuals.[3] The Centres for Disease Control and Prevention (CDC) advises yearly influenza vaccination for all HCWs to mitigate these risks.

Influenza vaccination offers benefits, including reduced risk of infection, decreased absenteeism, and protection against hospital-acquired influenza, along with its patient morbidity and mortality.[4] One study demonstrated a significant negative correlation between HCWs' influenza vaccination rates and the occurrence of nosocomial influenza-like illness in hospitalised patients.[5] A study done by Costantino et al. at Palermo's University Hospital demonstrated increasing vaccination rates from pre-intervention influenza seasons (average rate of 5.0% from 2009/2010 to 2014/2015) to post-intervention influenza seasons (37.2% in 2018/2019). In the post-intervention period, absenteeism decreased by 8.8%, overall working days lost during influenza seasons fell by 12.9%, and the number of working days lost per individual HCWs affected by acute illness dropped by 11.1%.[6]

Influenza vaccination rates among HCWs at Balik Pulau Hospital (BPH) in 2019 and 2020 have plateaued at 62.6%, falling short of the Healthy People 2020 target of 90.0%. Various barriers to influenza vaccine uptake have been identified in the literature, including concerns about vaccine safety

and efficacy, fear of side effects, low perceived risk of contracting influenza, time constraints, and limited accessibility.[7,8] In the Malaysian context, similar barriers such as misinformation, complacency, and logistical challenges have been reported.[9]

To better understand these factors, the 5C model of vaccine hesitancy, comprising Confidence, Complacency, Constraints, Calculation, and Collective Responsibility, has been widely adopted in vaccination studies.[10] Confidence refers to trust in the safety of vaccines and the systems that deliver them. Complacency reflects a low perceived need for vaccination. Constraints represent practical barriers, such as time limitations or limited accessibility. Calculation denotes an individual's engagement in thorough information seeking, whereas collective responsibility refers to the willingness to protect others through herd immunity. This study aimed to assess influenza vaccine acceptance and hesitancy among HCWs and to identify sociodemographic and psychological determinants influencing vaccine acceptance in BPH using the 5C model.

METHODS

Study design, setting and population

A cross-sectional survey was conducted among HCWs at BPH from July 1 to October 31, 2023. Respondents included doctors, nurses, pharmacists, medical assistants, dieticians, laboratory personnel, physiotherapists, occupational therapists, administrative and support staff, were recruited using convenience sampling. Eligibility criteria comprised the ability to understand the English or Malay questionnaire and provide written informed consent; HCWs on leave were excluded.

Study tool

The survey utilised a validated, structured questionnaire disseminated as a Google Form link through departmental WhatsApp groups. Distribution was coordinated through department heads or designated personnel, with prior permission. No sign-in was required. The questionnaires consisted of two sections: Section 1 assessed sociodemographic details (age, gender, religion, role, education), while Section 2, consisting of 16 questions, employed the 5C model described by Alobwede and colleagues, measuring confidence, complacency, constraints, risk calculation, and sense of collective responsibility.[13] The 5C model is a validated framework originally developed by Betsch et al. to assess psychological antecedents to vaccination.[10] The sociodemographic details in section 1 were categorised by age groups (21-30, 31-40, ≥41 years), gender, religion (Islam, Buddhism, others), HCWs' role, and educational attainment (primary, secondary, tertiary education). Section 2 included statements about vaccines, with responses measured using a seven-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (7). Domain scores were calculated by summing the responses to the respective items within each domain, yielding total scores ranging from 3 to 21, except for the confidence domain, which ranged from 4 to 28. These total domain scores were treated as continuous variables in the logistic regression analyses.

The study assessed HCWs' acceptance of the influenza vaccine by evaluating responses to the statement: "During the next influenza season, I will take the influenza vaccine" on a seven-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (7). The seven response options were recoded into binary responses, with scores from 1 to 4 classified as "Hesitancy" and scores from 5 to 7 classified as "Acceptance" to facilitate logistic regression analysis. The binary classification is appropriate given the meaningful distinction between vaccine hesitancy and acceptance as ultimate outcomes. The dichotomisation of Likert scale responses for influenza vaccine acceptance is also consistent with prior literature, which employed similar thresholds.[13]

Sample size calculation

The sample size was determined using the Finite Population Correction (FPC) formula, with a 20% prevalence of influenza vaccine acceptance based on prior literature, 95% confidence level, 5% precision, and a 70% response rate.[11,12] Given a finite target population of 388 HCWs in BPH, the minimum sample size was 151 respondents. To account for potential non-response, a target of 200 respondents was set.

Statistical analysis

Data was analysed using SPSS version 22. Sociodemographic variables, psychological determinants, and vaccine acceptance were reported as frequencies and percentages. Univariable logistic regression was performed to estimate crude odds ratios with 95% confidence intervals. A multivariable logistic regression model was subsequently used to evaluate the independent effects of sociodemographic factors and the 5C psychological antecedents of vaccination on vaccine acceptance. *P*-values <0.05 were considered statistically significant.

RESULTS

Sociodemographic characteristics of respondents and their acceptance for influenza vaccination

A total of 203 responses were received in this study. Table 1 summarises the sociodemographic characteristics of the participating HCWs and their acceptance of influenza vaccination. The majority were female (66.0%), aged 31-40 years (54.7%), and identified as Muslim (74.4%). Overall, 177 HCWs (87.2%) indicated acceptance of the influenza vaccine, whereas 26 (12.8%) were hesitant.

Influenza vaccine acceptance was highest among females (91.0%), respondents aged 31-40 years (89.2%), and those with primary or tertiary education. By professional role, acceptance was highest among pharmacists (92.2%), followed by nurses (90.9%).

Table 1. Sociodemographic characteristics of study respondents and their acceptance for influenza vaccination (n=203)

Variables	Acceptance for Influenza Vaccination, n (%)		
	Acceptance	Hesitancy*	Total
Age group (years)			
21 - 30	57 (86.4)	9 (13.6)	66 (32.5)
31 - 40	99 (89.2)	12 (10.8)	111 (54.7)
≥41	21 (80.8)	5 (19.2)	26 (12.8)
Gender			
Male	55 (79.7)	14 (20.3)	69 (34.0)
Female	122 (91.0)	12 (9.0)	134 (66.0)
Religion			
Islam	132 (87.4)	19 (12.6)	151 (74.4)
Buddha	29 (85.3)	5 (14.7)	34 (16.8)
Others	16 (88.9)	2 (11.1)	18 (8.9)
Healthcare worker's role			
Doctor	20 (83.3)	4 (16.7)	24 (11.8)
Nurse	59 (90.9)	6 (9.2)	65 (32.0)
Pharmacist	47 (92.2)	4 (7.9)	51 (25.1)
Others	51 (81.0)	12 (19.0)	63 (31.0)
Education level			
Primary education	8 (88.9)	1 (11.1)	9 (4.4)
Secondary education	35 (83.3)	7 (16.7)	42 (20.7)
Tertiary education	134 (88.2)	18 (11.8)	152 (74.9)

Acceptance for influenza vaccination based on psychological determinants using the 5C model

Table 2 presents HCWs' acceptance of influenza vaccination based on psychological determinants using the 5C model. In the confidence domain, among the 177 respondents who showed acceptance towards influenza vaccination, 173 (97.7%) agreed that the vaccine is compatible with their religious beliefs. A majority also believed in the vaccine's safety (93.2%) and effectiveness (89.8%). Additionally, 166 (93.8%) respondents expressed confidence that public authorities act in the best interest of the general community.

In the complacency domain, most of both acceptance and hesitance groups disagreed that the vaccine is unnecessary due to the perceived low prevalence of influenza. Similarly, 144 (81.4%) respondents who showed vaccination acceptance disagreed that their immune systems were strong enough to provide protection, however, 92.3% of hesitant respondents also disagree with this statement despite remaining unwilling to vaccinate. Additionally, 160 (90.4%) respondents in the acceptance group disagreed that influenza is too mild to warrant vaccination.

In the constraint domain, several respondents who expressed vaccine acceptance nonetheless reported barriers to vaccination. Sixteen (9.0%) cited daily stress as a hindrance, 22 (12.4%) reported inconvenience, and 21 (11.9%) expressed discomfort with visiting the vaccination clinic.

In the risk calculation domain, most respondents who indicated acceptance reported actively weighing the benefits and risks before deciding to vaccinate (83.6%), with 152 (85.9%) emphasising the need to assess the vaccine's usefulness. Notably, 166 (93.8%) highlighted the importance of fully understanding the purpose of vaccination prior to accepting it.

In the collective responsibility domain, only 18 (10.2%) respondents in the acceptance group stated they saw no need to get vaccinated if others were vaccinated, compared with 3.9% in the hesitant group. In contrast, 145 respondents (81.9%) expressed acceptance to vaccinate to protect immunocompromised individuals, and 158 (89.3%) viewed vaccination as a collective responsibility to reduce disease transmission.

Association of sociodemographics and psychological determinants using 5C model with the acceptance for influenza vaccination

The multivariable analysis of sociodemographics and psychological determinants using 5C model with the acceptance for influenza vaccination (Table 3) shows that confidence in influenza vaccines remained the only significant predictor of acceptance in the final multivariable model (adjusted OR=1.67; 95% CI: 1.23-2.27). Specifically, each one-point increase in confidence score was associated with an increase in the odds of vaccination acceptance by 67%. Confidence in this context encompassed four aspects: belief in the vaccine's compatibility with religious beliefs, safety, effectiveness, and trust in public health authorities. Other 5C domains—complacency, constraints, risk calculation, and collective responsibility—were not statistically significant in the multivariable model.

Overall, high acceptance of influenza vaccination among HCWs was associated with strong confidence in the influenza vaccine, reflected in beliefs about its safety, efficacy, religious compatibility, and trust in public health authorities. Complacency, perceived constraints, risk calculation and collective responsibility had minimal influence on vaccine acceptance.

Table 2. Acceptance for influenza vaccination based on psychological determinants using the 5C model (n=203)

Variables		Acceptance for Influenza Vaccination, n (%)	
		Acceptance (n=177)	Hesitancy (n=26)
Confidence in influenza vaccines			
1. Influenza vaccination is compatible with my religion	Agree	173 (97.7)	13 (50.0)
	Disagree*	4 (2.3)	13 (50.0)
2. I am completely confident that influenza vaccines are safe	Agree	165 (93.2)	5 (19.2)
	Disagree*	12 (6.8)	21 (80.8)
3. Influenza vaccinations are effective	Agree	159 (89.8)	8 (30.8)
	Disagree*	18 (10.1)	18 (69.2)
4. Regarding influenza vaccines, I am confident that public authorities decide in the best interest of the community	Agree	166 (93.8)	11 (42.3)
	Disagree*	11 (6.2)	15 (57.7)
Complacency towards influenza vaccines			
5. Influenza vaccination is unnecessary because influenza is not common anymore	Agree	16 (9.0)	1 (3.9)
	Disagree*	161 (91.0)	25 (96.1)
6. My immune system is so strong, it also protects me against influenza	Agree	33 (18.6)	2 (7.8)
	Disagree*	144 (81.4)	24 (92.3)
7. Influenza is not so severe that I should get vaccinated	Agree	17 (9.6)	1 (3.9)
	Disagree*	160 (90.4)	25 (96.2)
Constraints affecting uptake of influenza vaccines			
8. Everyday stress prevents me from getting the influenza vaccine	Agree	16 (9.0)	1 (3.9)
	Disagree*	161 (91.0)	25 (96.2)
9. For me, it is inconvenient to receive influenza vaccinations	Agree	22 (12.4)	3 (11.5)
	Disagree*	155 (87.6)	23 (88.5)
10. Visiting a vaccination clinic makes me feel uncomfortable; this keeps me from getting vaccinated against influenza	Agree	21 (11.9)	4 (15.4)
	Disagree*	156 (88.1)	22 (84.6)
Risk calculation with respect to influenza vaccines			
11. When I think about getting vaccinated against influenza, I weigh benefits and risks to make the best decision possible	Agree	148 (83.6)	12 (46.2)
	Disagree*	29 (16.4)	14 (53.9)
12. For every influenza vaccine dose, I closely consider whether it is useful for me	Agree	152 (85.9)	12 (46.2)
	Disagree*	25 (14.1)	14 (53.9)
13. It is important for me to fully understand the topic of vaccination, before I get vaccinated against influenza	Agree	166 (93.8)	16 (61.5)
	Disagree*	11 (6.2)	10 (38.5)
Collective responsibility for influenza vaccines			
14. When everyone is vaccinated against influenza, I don't have to get vaccinated too	Agree	18 (10.2)	1 (3.9)
	Disagree*	159 (89.8)	25 (96.2)
15. I get vaccinated against influenza because I can also protect people with a weaker immune system	Agree	145 (81.9)	6 (23.1)
	Disagree*	32 (18.1)	20 (76.9)
16. Vaccination is a collective action to prevent the spread of diseases like influenza	Agree	158 (89.3)	10 (38.5)
	Disagree*	19 (10.7)	16 (61.5)

*Includes respondents who showed neutral attitudes toward influenza vaccination

Table 3: Association of sociodemographics and psychological determinants using 5C model with the acceptance for influenza vaccination

Variables	Simple logistic regression		Multiple logistic regression	
	Crude Odd Ratio (95% CI)	*P*-value	Adjusted Odd Ratio (95% CI)	*P*-value
Age group				
21 - 30 years	Reference			
31 - 40 years	1.30 (0.52-3.28)	0.575		
≥41 years	0.66 (0.20-2.21)	0.503		
Gender				
Male	Reference			
Female	2.59 (1.12-5.96)	0.025		
Religion				
Islam	Reference			
Buddha	0.84 (0.29-2.42)	0.740		
Others	1.15 (0.25-5.41)	0.858		
Healthcare worker's role				
Doctor	Reference			
Nurse	1.97 (0.50-7.69)	0.331		
Pharmacist	2.35 (0.53-10.34)	0.258		
Others	0.85 (0.25-2.95)	0.798		

Table 3. Continued

Variables	Simple logistic regression		Multiple logistic regression	
	Crude Odd Ratio (95% CI)	*P*-value	Adjusted Odd Ratio (95% CI)	*P*-value
Education level				
Primary education	Reference			
Secondary education	0.63 (0.07-5.82)	0.680		
Tertiary education	0.93 (0.11-7.88)	0.947		
Confidence in influenza vaccines	1.55 (1.29-1.87)	<0.001	1.67 (1.23-2.27)	0.001
Complacency towards influenza vaccines	1.00 (0.91-1.10)	0.972		
Constraints affecting uptake of influenza vaccines	0.96 (0.88-1.06)	0.446		
Risk calculation with respect to influenza vaccines	1.24 (1.14-1.34)	<0.001		
Collective responsibility for influenza vaccines	1.58 (1.36-1.83)	<0.001		

Backward likelihood ratio method was used for variable selection in the multiple logistic regression model, followed by re-estimation using the enter method. The final model had a constant (intercept) of -13.04, representing the log-odds of the outcome when all predictors are zero.

No multicollinearity or significant interaction terms were detected.

Model fit was adequate (Hosmer Lemeshow test: *P*=0.817), with strong predictive performance (classification accuracy: 93.1%) and excellent discrimination (AUC=0.95; 95% CI: 0.91-0.99).

Pseudo-R^2 values indicated strong explanatory power (Cox & Snell R^2 = 0.37; Nagelkerke R^2 = 0.68).

DISCUSSION

This study demonstrated a high level of influenza vaccine acceptance among HCWs in a Malaysian public hospital, compared to lower rates reported in other low and middle-income countries, such as 54.9% in South Africa.[13] Surveys in Malaysian hospitals have shown that on-site vaccination programs and awareness initiatives significantly improve coverage[14], while systematic reviews confirm that institutional policies and convenience are among the strongest predictors of HCWs acceptance globally.[15] In contrast, studies from South Africa and other low and middle-income countries report lower uptake where logistical barriers and limited institutional promotion persist.[16,17] This suggests that institutional support, accessibility, and public health campaigns may have contributed positively to the uptake.

Using the 5C model, confidence in the influenza vaccine emerged as the primary factor driving HCWs' acceptance. Most respondents in this study perceived the vaccine as safe, effective, and compatible with their religious beliefs, consistent with findings from South Africa, Norway, and other international settings.[13,18] Framing vaccination within religious and cultural values can enhance uptake. Additionally, high levels of trust in public authorities further contributed to acceptance, as respondents believed health decisions prioritise community well-being—a factor known to positively influence vaccination behaviour.[10] Studies also show that positive efficacy perceptions, often shaped by public health messaging, strongly influence uptake.[19-22] These findings underscore the importance of strengthening transparent and consistent public health communication and tailored educational strategies to sustain vaccine confidence and address emerging concerns.

In this study, age, religion, and education were not significantly associated with influenza vaccine acceptance, contrasting with United States findings of higher uptake among older adults,[23-25] and with studies from South Africa and Italy that reported education-related differences[13,26,27], though our predominance of tertiary-educated HCWs may have limited variability. Female HCWs were more likely to accept vaccination, diverging from earlier reports of male predominance[28-30], likely reflecting site-specific demographics. Clinical staff, including nurses and pharmacists, showed higher acceptance, consistent with South African and Malaysian studies[13,31], while medical professionals reported greater uptake than students, citing perceived risk and belief in efficacy.[32] Nonetheless, hesitancy persisted, as highlighted by Saade et al., who found reluctance among nurses due to concerns about effectiveness and side effects.[33] Taken together, these findings suggest that vaccine acceptance among HCWs is shaped less by demographic or educational factors than by perceptions of risk, trust in efficacy, and safety concerns, underscoring the need for strategies that build confidence and address hesitancy across diverse healthcare settings.

Respondents in our study generally rejected the notion that natural immunity was sufficient or that influenza was no longer a threat, reflecting low complacency and broad acceptance of vaccination. However, these beliefs did not significantly predict uptake, contrasting with previous findings where complacent attitudes were linked to hesitancy. This divergence may be attributable to high baseline awareness or recent institutional campaigns that effectively addressed misconceptions. Similarly, logistical barriers such as time and access were not significant, likely due to the convenience of in-hospital vaccination, differing from reports where time constraints, stress, and unfamiliarity with procedures hindered uptake, particularly among younger HCWs.[34-37] Risk-benefit considerations were evident but not strongly associated with uptake, suggesting high health literacy and occupational risk awareness, consistent with earlier findings that perceived personal and public health benefits influence acceptance. Finally, a strong sense of collective responsibility to protect vulnerable patients emerged as a key motivator, aligning with studies from Italy and Slovenia that highlighted

HCWs' dual commitment to personal risk awareness and safeguarding patients, families, and colleagues.[38,39]

Despite high acceptance, actual influenza vaccination coverage at BPH remained at 62.6% in 2019 and 2020, falling short of the Healthy People 2020 target of 90%. This gap highlights the need for targeted education and reassurance to address residual concerns, such as side effects, perceived risk, or doubts about vaccine effectiveness, as highlighted in previous studies, beyond simply promoting access.[40]

Limitations

This study has several limitations. First, reliance on self-reported data may introduce recall bias due to the lack of official vaccination records.[41] Although the focus of this study was on vaccination acceptance and psychometric constructs, recall bias could still affect the accuracy of responses regarding prior vaccination history, which could influence subsequent perceptions and acceptance. Secondly, this was a single-centred study, limiting the generalisability of the findings. Lastly, although the 5C model itself is a validated framework for assessing psychological antecedents to vaccination[10], the specific 16-item version of the scale adapted from Alobwede et al. was not formally validated.[13] This may impact the internal consistency or construct validity of the measurements and should be considered when interpreting the findings.

CONCLUSION

This study revealed a high level of vaccination acceptance among HCWs at BPH, primarily driven by strong confidence in vaccine safety, efficacy, alignment with religious beliefs, and that public authorities act in the best interest of the community. Thus, targeted education efforts aimed at boosting vaccine confidence and addressing misconceptions can further enhance vaccine uptake, ensuring better protection during influenza epidemics and contributing to improved public health.

ACKNOWLEDGEMENT

The authors would like to thank the Director General of Health Malaysia, Ministry of Health (MOH), for the permission to publish this article. The authors also thanked the Director of Balik Pulau Hospital and all participating staff for their support in this study.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ETHICAL APPROVAL

This study was registered in the National Medical Research Register [NMRR ID-22-02763-7SZ] and approved by the Medical Research Ethics Committee (MREC) of the Ministry of Health Malaysia (MOH).

REFERENCES

1. World Health Organization. Vaccines against influenza: WHO position paper - May 2022. Week Epidl Rec. 2022;97(19):185-208.
2. World Health Organization. Influenza (Seasonal) [Internet]. 2018 [cited 2025 April 25]. Available from: https://www.who.int/news-room/fact-sheets/detail/influenza-(seasonal)
3. Salgado CD, Farr BM, Hall KK, Hayden FG. Influenza in the acute hospital setting. Lanc Inf Dis. 2002;2(3):145-55.
4. Salgado CD, Giannetta ET, Hayden FG, Farr BM. Preventing nosocomial influenza by improving the vaccine acceptance rate of clinicians. Inf Cont Hosp Epid. 2004;25(11):923-8.
5. Amodio E, Restivo V, Firenze A, Mammina C, Tramuto F, Vitale F. Can influenza vaccination coverage among healthcare workers influence the risk of nosocomial influenza-like illness in hospitalized patients? J Hosp Inf. 2014;86(3):182-7.
6. Constantino C, Casuccio A, Caracci F, Bono S, Calamusa G, Ventura G, et al. Impact of communicative and informative strategies on influenza vaccination adherence and absenteeism from work of health care professionals working at the University Hospital of Palermo, Italy: A quasi-experimental field trial on twelve influenza seasons. Vaccines. 2019;8(1):5.
7. World Health Organization. Report of the SAGE Working Group on Vaccine Hesitancy [Internet]. 2014 [cited 2025 April 25]. Available from: https://www.who.int/immunization/sage/meetings/2014/october/1_Report_WORKING_GROUP_vaccine_hesitancy_final.pdf
8. Nguyen T, Henningsen KH, Brehaut JC, Wilson K. Acceptance of a pandemic influenza vaccine: a systematic review of surveys of the general public. Vaccines. 2011;29(35):4473-81.
9. Hussain S, Mohd Hairi F, Ghazali SM, Nawawi KNM. Determinants of influenza vaccine uptake among healthcare workers in a Malaysian teaching hospital: a cross-sectional study. Hum Vac Imm. 2022;18(6):1-8.
10. Betsch C, Schmid P, Heinemeier D, Korn L, Holtmann C, Böhm R. Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. PLoS One. 2018;13(12):e0208601.
11. Cochran WG. Sampling Techniques. 3rd ed. New York: John Wiley & Sons; 1977.
12. Hudu SA, Harmal NS, Malina O, Sekawi Z. Influenza vaccination among Malaysian healthcare workers: a survey of coverage and attitudes. Med J Malaysia. 2016;71(5):231-7.
13. Alobwede SM, Kidzeru EB, Katoto PDM, Lumngwena EN, Cooper S, Goliath R, et al. Influenza vaccination uptake and hesitancy among healthcare workers in early 2021 at the start of the COVID-19 vaccine rollout in Cape Town, South Africa. Vaccines. 2022;10(8):1176.

14. Hudu SA, Harmal NS, Malina O, Sekawi Z. Influenza vaccination among Malaysian healthcare workers: a survey of acceptance and associated factors. Med J Malaysia. 2016;71(5):231-37.
15. Fan J, Xu S, Liu Y, Ma X, Cao J, Fan C, Bao S. Influenza vaccination rates among healthcare workers: a systematic review and meta-analysis investigating influencing factors. Fr Pub Heal. 2023;11:1295464.
16. Alam P, Tsotetsi L, Msibi T, Mashamba M, Dietrich J. Current evidence on improving influenza vaccine uptake in low- and middle-income countries: a scoping review of determinants and interventions. Vac: X. 2025;24:100634.
17. McCarron M, Marcenac P, Yau TS, Lafond KE, Ebama MS, Duca LM, et al. Healthcare personnel acceptance and recommendations for influenza vaccine in twelve low- and middle-income countries: a pooled analysis from 2018 to 2020. Vac. 2024;42(Suppl 4):125670.
18. Klüwer B, Gleditsch R, Rydland KM, Mamelund SE, Laake I. Higher educational attainment associated with higher confidence in influenza vaccination in Norway. Vac. 2024;42(11):2837-47.
19. Frew PM, Santibañez SS. Perceptions of vaccine efficacy and safety as predictors of vaccination uptake: A review. Vac. 2019;37(50):7577-84.
20. Reddy SB, Hsia J. Effectiveness of influenza vaccination in various populations: A systematic review and meta-analysis. Am J Pub Heal. 2020;110(12):1834-43.
21. Miller JS, Steptoe A. The impact of public health messaging on vaccine perceptions: Evidence from recent influenza vaccination studies. Heal Edu Res. 2021;36(4):396-405.
22. Restivo V, Costantino C, Bono S, Maniglia M, Marchese V, Ventura G, et al. Influenza vaccine effectiveness among high-risk groups: A systematic literature review and meta-analysis of case-control and cohort studies. Hum Vac Imm. 2017;13(1):1-10.
23. King WD, Woolhandler SJ, Brown AF, Jiang L, Kevorkian K, Himmelstein DU, et al. Brief report: Influenza vaccination and healthcare workers in the United States. J Gen Int Med. 2006;21(2):181-4.
24. Takayama M, Wetmore CM, Mokdad AH. Characteristics associated with the uptake of influenza vaccination among adults in the United States. Prev Med. 2012;54(5):358-62.
25. Centers for Disease Control and Prevention (CDC). Influenza vaccination coverage among healthcare personnel: 2011-12 influenza season, United States. MMWR Morb Mort Week Rep. 2012;61:753-7.
26. Antinolfi F, Battistella C, Brunelli L, Malacarne F, Bucci FG, Celotto D, et al. Absences from work among healthcare workers: Are they related to influenza shot adherence? BMC Heal Ser Res. 2020;20(1):1-9.
27. Rabaan AA, Wyse R, Al-Tawfiq JA, Alahmed SH, Aljeldah MM, Bazzi AM, et al. Influenza vaccine acceptance by healthcare workers in Saudi Arabia: a questionnaire-based analysis. Le Inf in Med. 2020;28(1):48-54.
28. Aguilar I, Reyes M, Martinez-Baz I, Guevara M, Albeniz E, Belza M, et al. Use of the vaccination register to evaluate influenza vaccine coverage in seniors in the 2010/11 influenza season, Navarre, Spain. Euro Surv. 2012;17(17):20154.
29. O'Reilly FW, Cran GW, Stevens AB. Factors affecting influenza vaccine uptake among healthcare workers. Occ Med (Lond). 2005;55(6):474-9.
30. Amodio E, Anastasi G, Di Pasquale M, Gelsomino V, Morici M, Romano N, et al. Influenza vaccination among healthcare workers and absenteeism from work due to influenza-like illness in a teaching hospital in Palermo. Ital J Pub Heal. 2010;7(3):306-310.
31. Rashid ZZ, Jasme H, Liang HJ, Yusof MM, Sharani ZZ, Mohamad M, et al. Influenza vaccination uptake among healthcare workers at a Malaysian teaching hospital. Southeast As J Trop Med Pub Heal. 2015;46(2):215-25.
32. Hogan V, Lenehan M, Hogan M, Natin DP. Influenza vaccine uptake and attitudes of healthcare workers in Ireland. Occ Med (Lond). 2019;69(7):494-99.
33. Saade A, Rasoloarivalona F, Poinsignon J, Garlantezec R, Tattevin P, Paris C. Influenza vaccine coverage among healthcare workers: A cluster analysis from a cross-sectional survey. Inf Dis Now. 2023 Oct;53(7):104740.
34. Zetti ZR, Humaira J, Ho JL, Mardiyah MY, Zatil ZMS, Marlyn M, et al. Influenza vaccination uptake among healthcare workers at a Malaysian teaching hospital. Sou As J Trop Med Pub Heal. 2015;46(2):215-25.
35. Abu-Gharbieh E, Fahmi S, Rasool BA, Khan S. Influenza vaccination: healthcare workers' attitude in three Middle East countries. Int J Med Sci. 2010;7(5):319-25.
36. Schrimpf A, Jentzsch A, Bleckwenn M, Geier A-K. How stressful was the COVID-19 vaccination procedure? Comparison between mass centers and general practices. Vac X. 2024;19:100524.
37. Taylor S, Asmundson GJG. Immunization stress-related responses: Implications for vaccination hesitancy and vaccination processes during the COVID-19 pandemic. J Anx Dis. 2021;84:102489.
38. Costantino C, Ledda C, Squeri R, Restivo V, Casuccio A, Rapisarda V, et al. Attitudes and perception of healthcare workers concerning influenza vaccination during the 2019/2020 season: A survey of Sicilian university hospitals. Vaccines. 2020;8(4):686.
39. Petek D, Kamnik-Jug K. Motivators and barriers to vaccination of health professionals against seasonal influenza in primary healthcare. BMC Heal Serv Res. 2018;18(1):1-9.

40. Ines C, Ghassen K, Leila B, Adel G, Aicha BA, Nissaf BA, et al. Knowledge, attitude and uptake related to influenza vaccine among healthcare workers during the 2018-2019 influenza season in Tunisia. BMC Pub Heal. 2021;21:907.
41. Anwar MMU, Sumon SA, Mohona TM, Rahman A, Md Abdullah SAH, Islam MS, et al. Uptake of influenza vaccine and factors associated with influenza vaccination among healthcare workers in tertiary care hospitals in Bangladesh: A multicenter cross-sectional study. Vac. 2023;11(2):360.