การพัฒนาและตรวจสอบเครื่องมือการสำรวจความลังเลใจต่อวัคซีนไข้หวัดใหญ่ในบุคลากรทางการแพทย์ไทย

สุทธิชัย นักผูก[1], เกรียงไกร ประเสริฐ[1,2*], สุริยา เนาศรี[1,2],
ณัฏฐ์ฏาพร ศรีประดิษฐ์[1], กัลยา ศรวงค์[1], รัชฎาภรณ์ อึ้งเจริญ[2]
[1]โรงพยาบาลนครพนม, [2]คณะสาธารณสุขศาสตร์ มหาวิทยาลัยเกษตรศาสตร์ วิทยาเขตเฉลิมพระเกียรติจังหวัดสกลนคร

บทคัดย่อ

ความเป็นมา: การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อพัฒนาและตรวจสอบเครื่องมือการสำรวจเพื่อวัดความลังเลใจต่อวัคซีนไข้หวัดใหญ่และปัจจัยที่เกี่ยวข้องในบุคลากรทางการแพทย์ในประเทศไทย

วิธีการศึกษา: เครื่องมือสำรวจในการศึกษานี้ได้รับการพัฒนาหลังจากการทบทวนวรรณกรรมโดยใช้เมทริกซ์ปัจจัยกำหนดความลังเลต่อวัคซีนที่ปรับปรุงจากการสนทนากลุ่ม การตรวจสอบเครื่องมือ ประกอบด้วย การตรวจสอบความถูกต้องของเนื้อหาโดยผู้เชี่ยวชาญเกี่ยวกับ มีการทดสอบนำร่องเพื่อประเมินความเป็นไปได้ การยอมรับ และความตรงตามที่เห็น และทำการสำรวจขนาดใหญ่ขึ้นเพื่อประเมินความน่าเชื่อถือและความเที่ยงตรงเชิงโครงสร้าง วัดความถูกต้องของโครงสร้างโดยใช้การวิเคราะห์องค์ประกอบเชิงสำรวจ และความสอดคล้องภายในโดยใช้สถิติทดสอบความเชื่อมั่นของครอนบาค

ผลการศึกษา: มีผู้เข้าร่วมประเมินกังวลเรื่องรูปแบบและความยาวของแบบสอบถาม แต่โดยร่วมการยอมรับแบบสอบถามอยู่ในระดับดี โดยร่วมความตรงตามที่เห็นและความถูกต้องของเนื้อหาถือว่าดี การวิเคราะห์องค์ประกอบเชิงสำรวจ มีโครงสร้างของปัจจัยอยู่สามองค์ประกอบซึ่งสอดคล้องกับปัจจัยกำหนดกว้างๆ สามประการ ได้แก่ ปัจจัยเชิงบริบท ปัจจัยเฉพาะของวัคซีนไข้หวัดใหญ่ และอิทธิพลของแต่ละบุคคล/กลุ่ม โครงสร้างปัจจัยกำหนด 15 ตัวสามารถอธิบายความแปรปรวนทั้งหมดได้ร้อยละ 53 และค่าสัมประสิทธิ์อัลฟ่าของครอนบาคสำหรับชุดโครงสร้างสามปัจจัยองค์ประกอบมีค่าอยู่ในช่วง 0.77-0.80

สรุป: สามารถพัฒนาเครื่องมือสำรวจที่ถูกต้องและเชื่อถือได้เพื่อใช้ในบุคลากรทางการแพทย์ของไทยในการวัดความลังเลต่อวัคซีนไข้หวัดใหญ่และปัจจัยที่เกี่ยวข้อง

คำสำคัญ: ความลังเลใจต่อวัคซีนไข้หวัดใหญ่, บุคลากรทางการแพทย์, เครื่องมือสำรวจ, การตรวจสอบ

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Development and Validation of a Survey Instrument for Exploring Influenza Vaccine Hesitancy among Thai Healthcare Workers

Sutthichai Nakphook[1], Kriengkrai Prasert[1,2], Suriya Naosri[1,2], Nuddaporn Sripradit[1], Kanlaya Sornwong[1], Ratchadaporn Ungcharoen[2]*

[1]Nakhon Phanom Hospital [2]Faculty of Public Health, Kasetsart University Chalermphrakiat Sakhon Nakhon Province Campus

Abstract

Background: The objective of this study was to develop and validate a survey instrument for measuring influenza vaccine hesitancy and its associated factors among HCW in Thailand.

Methods: The survey instrument was developed after a literature review using the adapted version of vaccine hesitancy determinant matrix and finalized after completing qualitative focus group discussions. The validation process included expert review for content validity, pilot testing for assessing feasibility, acceptability, and face validity, and a larger survey for evaluating construct validity and reliability. Construct validity was measured using an exploratory factor analysis (EFA) and internal consistency was assessed by Cronbach's alpha.

Results: Although some participants complained of the length and design of the questionnaire, their acceptability of the questionnaire was good. Overall face validity and content validity was considered good. In the EFA, three factor-structure was obtained which aligned closely with the three broad determinants - contextual factors, influenza vaccine-specific factors, and individual/group influences. The final 15-determinants structure explained 53% of the total variance. The Cronbach's alpha for the newly identified set of three-factor structure ranged from 0.770 to 0.803.

Conclusions: In conclusion, we developed a valid and reliable survey instrument to be used among Thai HCW for measuring influenza vaccine hesitancy and its associated factors.

Keywords: Influenza vaccine hesitancy, healthcare workers, survey instrument, validation

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Introduction

Despite several recommendations, the uptake of annual influenza vaccines among healthcare workers (HCW) has remained low globally.[1] Many studies indicate that despite vaccine availability, some HCW may be hesitant about vaccines themselves.[2-4] Vaccine hesitancy is a behavioral phenomenon, defined by WHO's Strategic Advisory Group of Experts (SAGE) as "a delay in acceptance or refusal of vaccines despite availability of vaccination services".[5] While people may have complex reasons for not getting vaccinated, SAGE identified a "3C" model in which "complacency", "inconvenience in accessing vaccines", and "lack of confidence" were the three key reasons for this hesitancy.[5] SAGE also recognized that vaccine hesitancy was specific to context and individual vaccines.

Considering the complexity and multitude of possible factors,[6] SAGE expanded the 3C model with the vaccine determinant matrix which included contextual, individual and group, and vaccine/vaccination-specific influences.[5] Contextual influences are those that arise due to historical, socio-cultural, environmental, health systemic, institutional, economic or political factors. At the individual or group level, factors that may affect hesitancy include experience with past vaccination; beliefs, attitudes about health and prevention; knowledge/awareness; health system and provider trust and personal experience; risk/benefit (perceived, heuristic); and immunization as a social norm. Vaccine/ vaccination specific factors include scientific evidence of risk/ benefit; design of vaccination program; reliability and/or source of vaccine supply; vaccination schedule; costs; recommendation of healthcare professionals; and mode of administration (oral/injected/nasal spray). In 2016, a review by Paterson et al. adapted the model for HCW and added a few more determinants.[7]

In Thailand, little has been researched about influenza vaccine hesitancy among HCW. Previous studies indicate that Thai HCW may have low-moderate acceptance of seasonal and pandemic influenza vaccines, and may not always recommend influenza vaccines to their patients.[8-10] Since HCW are probably the most informed group of people about the benefits of vaccines and have more access to vaccine than others,[11] these patterns indicate that there may be deeper, underlying cultural or personal concerns that could relate to vaccine hesitancy. We designed a sequential exploratory mixed-methods study to understand and measure influenza vaccine hesitancy among HCW in Thailand.

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While a vaccine hesitancy scale (VHS) has been introduced by SAGE as a survey tool,[12] it is not specific to influenza vaccines nor developed for use among healthcare workers. In addition, validation studies have found that the VHS does not cover all the dimensions of vaccine hesitancy and may be interpreted differently in different cultural settings.[13-14] We, therefore adapted the vaccine hesitancy determinant matrix for empirically using to measure influenza vaccine hesitancy in our study among Thai HCW. Here, we report the development and validation process of the survey instrument.

Materials and Methods

Study design

This study was part of a sequential exploratory mixed-methods study in which a qualitative phase was followed by a quantitative phase.[15] The survey instrument was developed after a literature review and finalized after completing the qualitative phase, to be used in a national survey among Thai HCW.

The study questionnaire was first piloted among 30 HCW at a hospital in Bangkok on 13-17th September 2019 and then tested among a larger sample of 2,352 HCW selected by a stratified multi-stage cluster sampling at 48 hospitals from the 12 public health regions in Thailand. The survey was conducted at each selected hospital with the help of designated focal person (hospital staff) from May to September 2020. The survey questionnaires and name list of randomly selected HCW were sent by post to the focal persons at each hospital. Filled questionnaires were returned via post to Department of Medical Services, MOPH.

Participants

The HCW were included in the study if they were Thai nationals, currently working at a public hospital, aged above 18 years (both male and female), and with a good command of written and spoken Thai language. Those who were not present in the hospital at the time of data collection and those not willing to voluntarily participate in the study were excluded.

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Survey instrument

Using the vaccine hesitancy determinant matrix as a framework,[5] a pool of potential questions was identified and adapted for influenza vaccines. The survey instrument was a questionnaire that was developed in English and then translated into the Thai language by a bilingual research staff person. Quality control was ensured by the back-translation of the Thai version of the questionnaire into English by an independent bilingual translator to check for accuracy and reduce discrepancies. The qualitative phase aided in the development of the survey instrument by solidifying relevant questions to be included in the questionnaire and guiding in refining the questionnaire.

The survey instrument included demographic and work characteristics; history of influenza vaccine uptake; and influenza vaccine hesitancy questions. For identifying vaccine hesitancy, three different types of survey questions were used: core closed questions, Likert scale questions, and open-ended questions. Levels of influenza vaccine hesitancy were inquired in terms of those who refused the vaccine but were still unsure, those who delayed getting vaccinated, and those who accepted influenza vaccines but still had doubts. The survey participants were asked to indicate their level of agreement or disagreement with the items of the constructs on a 5-point Likert scale with '1' meaning strongly disagree and '5' strongly agree. Both positively and negatively worded statements were used.

Instrument validation

a) Feasibility and acceptability

Feasibility and acceptability of the instrument were assessed during the pilot testing in terms of the clarity of questions, the length of time needed to respond to the survey, and the participants' acceptance and willingness to respond.

b) Validity

Face validity of the questionnaire was also assessed during the pilot testing by the HCW participants who evaluated the apparent logic of the questions for which the questions were intended.

Content validity, the degree to which the instrument fully measures most of the dimensions of the vaccine hesitancy, was assessed prior to the pilot testing by a literature

review and qualitative assessment by two experts with extensive experience in public health research and influenza vaccination program in Thailand and one nurse as target audience.

Construct validity was measured by an exploratory factor analysis (EFA) by determining the factor structure of the scale from the larger survey sample.

c) Reliability

For reliability, the internal consistency of the factors identified by EFA was assessed by Cronbach's alpha. Alpha scores of 0.7 or higher was considered as acceptable for the internal consistency.

Data analysis

The data was entered in a database using Epidata version 4.6 (Denmark) by two different research staff to improve data accuracy. Missing data was recognized as missing completely at random by Little's MCAR test (p value >0.05) and were substituted using expectation- maximization (EM) algorithm. Items under each determinant of influenza vaccine hesitancy were averaged to create mean scores for the determinant. Direction of negatively worded questions were reversed for data analysis such that higher scores meant more hesitancy.

All statistical analysis was conducted using SPSS version 23 (IBM Corp., Armonk, NY, USA). Standardized scores of the vaccine hesitancy determinants (with mean 0 and standard deviation 1) were used to determine the structural pattern of the instrument with a scree plot and eigenvalue.[16] Kaiser-Meyer-Olkin (KMO) was used to measure the adequacy of sampling and Bartlett's Test of Sphericity was used to determine if correlations between items were sufficiently large for EFA (i.e. $p<0.05$). Factors with eigenvalues greater than one were determined for the factor solution.[17] Cronbach's alpha was used to determine internal consistency of the factors.

Results

Participant characteristics and descriptive statistics

In the pilot testing, the participants had a mean age of 41.6 years and a majority of them were female (22; 73.3%) and Buddhists (29; 96.7%). In the larger survey, a total of 2328 HCWs from 48 hospitals in 12 provinces returned the filled the questionnaires (response rate: 98.9%). The mean age of the participants was 39.5±10.6 years, with a minimum of 18 years and maximum of 66 years. Most participants were female (1787; 76.9%), Buddhists (2207; 95.4%), nurses (747; 32.3%), working in district hospitals (1683; 72.3%), with bachelor's degree (1322; 57.5%), and without any pre-existing chronic medical conditions (1780; 78.1%). The mean scores and standard deviation of each item of the vaccine hesitancy determinants are shown in Table 1.

Table 1. Means and standard deviations of the items and dimensions comprising the original scale.

Factors	Mean	SD
a) Contextual Factors		
Communication and media environment		
33. The reports in the media/on social media have made me reconsider the choice to receive influenza vaccine.	3.64	0.95
34. I trust the negative rumors about vaccines in the social media or other sites on the internet.	2.55	0.88
Influential leaders, gatekeepers and anti- or pro-vaccination lobbies		
35. In general, I agree with those groups and leaders who do not agree to influenza vaccination for different reasons.	2.81	0.89
36. It would it trigger doubts if a celebrity advocates against influenza vaccine.	2.25	0.87
37. My priest/spiritual leader has advocated against influenza vaccination.	2.13	0.85

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Factors	Mean	SD
Historical influences		
38. I remember some past events in Thailand or other places that discourage me from getting an influenza vaccine for myself?	2.34	0.79
39. My community in the past refused to accept influenza vaccines.	2.32	0.86
Religion/culture/socio-economic		
40. My religion/ philosophy/ culture recommends against influenza vaccination	2.05	0.91
41. I have refused an influenza vaccine as I consider it to include porcine or other animal derived ingredients.	1.85	0.78
Politics/policies		
42. I have disagreed with the choice of influenza vaccine or vaccination recommendation provided by the government	2.49	0.95
43. I think governments are “pushed” by lobbyists or industry to recommend influenza vaccines.	2.57	0.89
44. I have felt that healthcare professional, government, and hospital authorities are pushing me into influenza vaccination decision I do not fully support.	2.13	0.88
Pharmaceutical industry influences		
45. I trust the motives of pharmaceutical industry.	3.01	0.93
46. I trust pharmaceutical companies to provide safe and effective influenza vaccines.	2.18	0.82
b) Individual/ group experiences		
Experience with past vaccination		
47. I have, at times, not accepted an influenza vaccination for myself when it was offered.	2.56	0.96
48. I or someone I know had a bad reaction to influenza vaccine in the past which made me reconsider getting influenza vaccine.	2.68	0.96
49. My experiences with pain with past immunization prevent me from being vaccinated against influenza.	2.63	0.97

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Factors	Mean	SD
Beliefs, attitudes about influenza and vaccination		
50. Influenza infection is needed to build natural immunity and that vaccines destroy the important natural immunity against influenza.	2.38	0.94
51. Influenza vaccine can overload the immune system.	2.37	0.80
52. There are better ways to prevent influenza infection than by an influenza vaccine.	2.66	0.84
Trust in Health system		
53. I trust the information I receive about influenza vaccine?	2.30	0.69
54. The information on side-effects following influenza vaccination is discussed openly by the authorities.	2.33	0.79
Risk/benefit (perceived, heuristic)		
55. Influenza is not a serious or severe enough disease that requires annual vaccination for prevention.	2.67	0.93
56. I am concerned that I might have a serious side effect from an influenza vaccine?	2.49	0.77
57. I have decided against influenza vaccine because I think I am not at a high risk of influenza infection.	2.19	0.84
58. Influenza vaccine can prevent severe episodes of influenza.	2.23	0.85
Immunization as a social norm vs. not needed/harmful		
59. It is important for every HCW to get the recommended influenza vaccines for themselves every year.	1.98	0.81
60. It's important for HCW to be vaccinated against influenza to protect those high-risk patients that cannot get vaccinated	2.04	0.79
61. I feel social pressure to receive an annual influenza vaccine.	2.58	0.90

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Factors	Mean	SD
C) Influenza Vaccine/vaccination - specific issues		
Risk/ Benefit (scientific evidence)		
62. Influenza vaccine is safe for myself and for other high risk groups.	2.14	0.66
63. There is adequate safety information regarding annual influenza vaccines.	2.32	0.70
64. The system in Thailand can track adverse reactions or side effects to influenza vaccinations	2.49	0.74
Reliability of a new vaccine		
65. I have delayed influenza vaccination with a newly introduced/ recommended influenza vaccine.	2.79	0.80
66. New influenza vaccines are not trialed to the same rigorous standard as any normally prescribed drug.	2.76	0.80
67. I believe that influenza vaccine made in Europe or America is safer than those made in middle income countries like Thailand.	2.76	0.74
Mode of administration		
68. The fear of pain or fear of needles make me hesitant to receive influenza vaccine.	2.48	1.01
69. I trust my vaccinator can safely administer influenza vaccine to me.	2.12	0.77
Design of vaccination program/Mode of delivery		
70. Access to influenza vaccination easy/convenient in my hospital	2.02	0.75
71. There are adequate number of influenza vaccines in my hospital during vaccine campaign to cover all high-risk population in the area.	2.42	0.96
72. There are barriers for receiving influenza vaccine in time at my hospital.	2.69	0.79
73. The vaccines that I need to pay for myself are more effective than the free-of-charge vaccines provided at my hospital by the government	2.32	0.80

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Factors	Mean	SD
Costs		
74. I am willing to pay for an influenza vaccine privately, if needed.	2.97	0.96
75. I would not mind taking time off from work to get influenza vaccine if needed.	2.78	0.91
Role of healthcare professionals		
76. My healthcare provider/vaccinator had ever advised that influenza vaccine was not necessary or had too many side effects.	2.41	0.86
77. I have hesitated to recommend or administer influenza vaccines to high-risk people due to my own doubts regarding the influenza vaccine.	2.48	0.86

Instrument validation

a) Feasibility and acceptability

Although some participants complained of the length and design of the questionnaire, their acceptability of the questionnaire was good. Some participants suggested minor changes in language for clarity. One additional question which emerged as feedback from some FGD participants was about whether the HCW were ever instructed to recommend or provide influenza vaccines to the target groups. The language was simplified, and the additional question was included in the revised questionnaire.

b) Face validity

The overall face validity was good, and the participants generally agreed with the questions, the constructs, and the main objective of the research. There were, however, some confusion among some participants regarding the wording of some survey questions. Some participants did not understand some questions fully and suggested changes in the language to make it clearer to them. The design of the questionnaire also needed to be improved to attract the HCW participants.

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c) Content validity

After the literature review and experts' assessment, the questionnaire was found to cover all dimensions of the vaccine hesitancy. Experts' opinions on relevancy and clarity of the items were noted and their recommendations were adopted on observing grammar, using appropriate and correct words, applying correct and proper order of words in items and appropriate scoring.

d) Construct validity

An exploratory factor analysis was conducted on the 17 vaccine hesitancy determinants with a varimax (orthogonal) rotation. An initial analysis was run to obtain eigenvalues for each determinant. The KMO was 0.918, which verified the sampling adequacy for the analysis as it was higher than the recommended level of 0.6. Bartlett's Test of Sphericity was significant at $p<0.001$ which indicated sufficiently large correlations between items to conduct EFA.

In the EFA, three factors emerged with eigenvalues greater than one (Table 2; Fig 1). Two determinants were deleted from the final three-factor structure – "costs" because it did not load into any factor and "pharmaceutical influences" because removing it improved the internal consistency of the third factor. The three-factor structure aligned closely with the three broad determinants - contextual factors (6 determinants), influenza vaccine-specific factors (6 determinants), and individual/group influences (3 determinants) (Table 3). The final 15-determinants structure explained almost 53% of the total variance (Table 2).

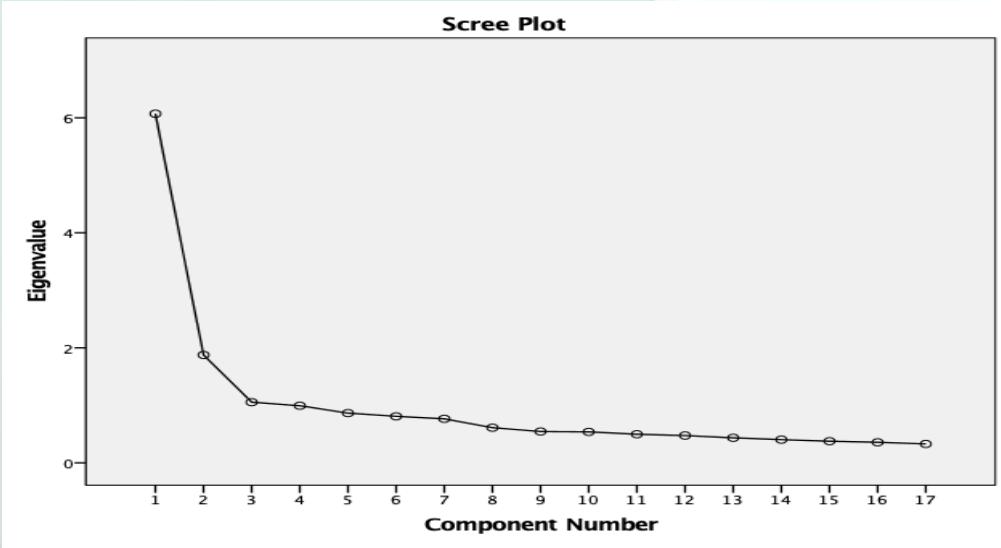

Fig 1. Screen plot for the survey instrument

Table 2: Eigenvalues, total variances explained for the final three-factor structure

Factor	Initial Eigenvalues			Rotation sum of squared loadings		
	Total	% Variance	Cumulative %	Total	% Variance	Cumulative %
1	6.07	35.71	35.71	3.98	23.46	23.46
2	1.87	11.03	46.75	3.32	19.57	43.04
3	1.05	6.20	52.95	1.68	9.91	52.95

Note: extraction method - principal component analysis; rotation method - varimax with Kaiser normalization.

Table 3. The determinants and the final three-factor structure of the survey instrument

Factor	Factor		
	1	2	3
Factor 1: Contextual factors			
1. Influential leaders, gatekeepers and anti- or pro vaccination lobbies	0.78		
2. Religion/culture/socio-economic	0.75		
3. Historical influences	0.70		
4. Communication and media environment	0.64		
5. Role of healthcare professionals	0.59		
6. Reliability of a new vaccine	0.50		
Factor 2: Influenza vaccine-specific factors			
7. Risk/ Benefit (scientific evidence)		0.72	
8. Trust in Health system		0.72	
9. Immunization as a social norm vs. not needed/harm		0.68	
10. Risk/benefit (perceived, heuristic)		0.58	

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Factor	Factor		
	1	2	3
11. Mode of administration		0.58	
12. Design of vaccination program/mode of delivery		0.49	
Factor 3: Individual/group influences			
13. Experience with past vaccination			0.56
14. Politics/policies			0.49
15. Beliefs, attitudes about health and prevention			0.48

Note: extraction method - principal component analysis; rotation method - varimax with Kaiser normalization.

a) Reliability

The Cronbach's alpha for the newly identified set of contextual factors, influenza vaccine- specific factors, and individual/group influences were 0.803, 0.794, and 0.770, respectively (Table 4). The overall internal consistency of the instrument was measured at Cronbach's alpha value 0.889.

Table 4. Internal consistency of the survey instrument

Factor	Number of determinants	Cronbach's Alpha	Cronbach's Alpha based on standardized determinants
Contextual factors	6	0.804	0.803
Influenza vaccine-specific factors	6	0.792	0.794
Individual/Group influences	3	0.765	0.770
Overall questionnaire	15	0.889	0.889

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Discussion

Since vaccine hesitancy can be context and vaccine-specific, we developed and validated a survey instrument for measuring influenza vaccine hesitancy and its associated factors among HCW in Thailand. The final version of the survey instrument displayed good validity and acceptable reliability.

The survey instrument was borne out of a necessity as there was no recognized survey-ready tool to use for measuring HCW's hesitancy toward influenza vaccines specifically. The main gaps in vaccine hesitancy literature using WHO's definition and 3 C model is the lack of clarity and operationalization in empirical use. SAGE's vaccine hesitancy determinant matrix provided a holistic approach and a solid framework which covered many bases. Converting the questions and narrowing them down to influenza vaccines and HCWs, provided the survey instrument with a specificity that other generic questionnaires lacked.[18] The instrument underwent different steps during its development and validation which ensured adequate scientific rigor and attention.

The final survey instrument for Thai HCW ended up with 15 determinants in a three-factor structure that broadly aligned with the SAGE's vaccine hesitancy determinant matrix. Context and influenza vaccine-specific factors got heavily represented in the final version, which may be indicative of the nature of the hesitancy.[5] While costs can be a major barrier to access to vaccines in many low-and middle-income countries,[19] Thailand provides annual influenza vaccines free of cost to the HCWs in the public hospital settings.[20] This might be reason why costs was not an important determinant in the final version of the questionnaire. Similarly, we did not have the determinant of influence of pharmaceutical companies in the final version. It is highly likely that the intent of pharmaceutical companies may not be seen as malicious in Thailand as compared to some western countries,[21] and therefore may not be a significant predictor of vaccine hesitancy among Thai HCW.

The strength of this research lies in the use of the vaccine hesitancy matrix as a theoretical framework, using qualitative methods in the development of the questionnaire, having rigorous steps such as pilot testing and a larger representative survey for validation, and testing the reliability of the final version of the questionnaire. However, there are a few limitations in the study. First, the content validity was only assessed using a subjective

expert review and not objective tools such as content validity index. Second, we could only conduct an EFA which explained 53% of the total variance. A confirmatory factor analysis may be needed to fully test the theoretical constructs of influenza vaccine hesitancy. Third, the questionnaire was developed in the pre-COVID-19 period but had to be deployed during the pandemic in Thailand which might have affected in not being able to capture some of the key concerns of the HCW that may alter their decision-making regarding influenza vaccination.

In conclusion, we developed and validated a survey instrument to be used among Thai HCW for measuring influenza vaccine hesitancy. Use of this validated survey instrument will help in obtaining a nuanced understanding of the influenza vaccine hesitancy, to guide further strategies to address hesitant HCW and develop health communications campaigns to support influenza vaccine uptake and pandemic preparedness in Thailand.

Corresponding : e-mail : gpsiam28@gmail.com
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