ORIGINAL ARTICLE

Risk Perceptions and Acceptance Towards the Uptake of Pertussis Vaccine Amongst the Healthcare Workers in Sabah and Sarawak

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ABSTRACT

Introduction: The incidence of pertussis is increasing amongst adolescents and adults. Therefore, adults require booster vaccination for protection against pertussis infection. Vaccination among healthcare workers (HCW) should be prioritized when a country implements an adult vaccine. However, the coverage of pertussis vaccination is still deficient among HCW due to low-risk perception. **Method:** This was a cross-sectional study using Survey Monkey (online). A total of 920 HCWs comprising of doctors, assistant medical officers (AMO), nurses, and environmental health officers (EHO) working at the hospitals and district health offices in Sabah and Sarawak were selected to partake in the study using a multistage sampling method. The website containing the questionnaire was given to the participants using either email or WhatsApp. **Results:** A total of 853 responders of whom 22.2% were doctors, 58.1% were nurses, 10.1% were medical assistants, and 9.6% were environmental health officers responded to the questionnaire. Most of the respondents (81.5%) are willing to receive the pertussis vaccine. The Protection Motivation score was significantly different between those willing and those not willing to take the vaccine (p-value<0.001). Robust path analysis showed that sociodemographic factors (age, the institution of working and prior pertussis vaccination) (p=0.004), threat (p<0.001) and coping pathway (p<0.001) were linked with the willingness to uptake vaccine. **Conclusion:** The sociodemographic factors of the HCW can affect the willingness of the HCW to uptake the pertussis vaccine directly and indirectly through their risk perception towards pertussis.

Keywords: Healthcare workers, Risk perception, Acceptance, Pertussis vaccine

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INTRODUCTION

Pertussis is a vaccine-preventable disease (VPD) caused by *Bordetella pertussis*. Pertussis is still a significant public health concern despite high vaccine coverage. Pertussis has been re-emerging in many countries (1). World Health Organization (WHO) reported that there are 151 074 cases of pertussis worldwide in 2018, despite having 86% of DTP3 vaccine coverage (2). The number of reported incidents in the Western Pacific Region increased to 53 208 cases in 2018, with nearly 93% increase compared to the number of cases reported in 2017 (3). An increase of the reported pertussis cases is also seen in Malaysia in 2018, whereby 298 cases were reported in 2016, while 353 cases reported in 2017 and 892 cases published in 2018 even though Malaysia has maintained high vaccine coverage for pertussis since 2000 (4).

The resurgence of pertussis could be due to the waning of immunity in the population, improvement in diagnostic tests, better recognition of the pertussis symptoms by health care workers (HCWs) and mutation of *B. pertussis* (5). A study in China showed that the level of the antibody of pertussis Immunoglobulin G among children (age day 1 to 13 years old) is generally at a low level throughout all age groups, indicating the waning of immunity post-vaccination (6). The waning of immunity either following immunization or natural infection contributes to the persistent circulation of *B. pertussis* (7). The most important way to prevent infant pertussis is by encouraging adult vaccination (8).

When a country implements adult vaccination, vaccination of healthcare workers (HCWs) should be prioritized especially those with direct contact with pregnant mothers and infant patients (9). The Centres for Disease Control and Preventions (CDC) Advisory Committee on Immunization Practices (ACIP) recommends that all HCWs with direct patient contact should receive tetanus, diphtheria and acellular pertussis (Tdap) vaccination (10). Despite lack of data to support

the effectiveness of pertussis vaccine in HCWs, recent studies showed that a booster dose of acellular pertussis vaccine would reduce pertussis transmission (11) with the pertussis vaccine efficacy ranges from 66% to 92% (12).

Immunization of pertussis has shown to cause a significant reduction in nosocomial infection (13). A study even showed that secondary transmission of pertussis could be decreased from 49% to 2 % if booster vaccination of pertussis is given to HCW (14). However, there aren't any published articles on the incidence of pertussis among HCW in Malaysia. The current pertussis guideline only requires adults with symptoms according to 'Case Definitions For Infectious Diseases in Malaysia' to be taken nasopharyngeal aspirate for confirmation of pertussis infection (15). Therefore, the actual incidence of pertussis cases in Malaysia is unavailable due to many undiagnosed pertussis cases among asymptomatic adults and adolescents. However, taking the pertussis vaccine as prevention of pertussis among HCW is more convenient than taking antibiotics for 14 days as recommended in the current pertussis guideline. As Malaysia has not implemented pertussis vaccination among the HCW yet, therefore there isn't any published data available to show the coverage and barriers to uptake the vaccine. But, a study on the uptake of influenza vaccine amongst HCWs in Malaysia demonstrated that many HCW has not receive influenza vaccine even when it is given free to all HCWs working as 'front liners' (16).

Although vaccination is a cost-effective and life-saving intervention, it is essential to understand the barrier and facilitating factors that may have an impact on the implementation of vaccine programs amongst the HCWs before embarking the vaccination program. Studies have been done to assess the barriers to receive pertussis vaccine amongst HCW and adults. Risk perception is an essential reason for the decision to the uptake of vaccine (17–19). The percentages to the uptake of pertussis vaccine are found to be higher than the influenza vaccine amongst the HCW because the pertussis is perceived as severe illness (19). Besides, it has been proposed that more assessment study to be conducted to assess the staff's attitudes and risk perception towards the pertussis disease (19).

Risk perception is an individual's susceptibility to a threat (20). Protection Motivation Theory (PMT) is one of the most cited theories to explain risk perception and intention to change (21) whereby it explains that there is a relationship between risk perception on injuries and incidents, and the plan to take protective action. This study focused on finding the risk perception of pertussis infection amongst the HCWs based on the PMT and their acceptance to take pertussis vaccination. All previous studies based on the PMT constructs including smoking, cancer screening, alcohol consumption, vitamin E and C consumption and many more in different population backgrounds (22). This study will be the first study to address the HCW's willingness to uptake pertussis vaccination based on the PMT theory in Sabah and Sarawak, Malaysia.

MATERIALS AND METHODS

Study design and population

This was a cross-sectional study, conducted in government hospitals and district health offices in the states of Sabah and Sarawak. The study population were the HCWs that are currently working in the government healthcare facilities (in hospitals, clinics and district health offices) that composed of Specialists, Medical Officers, Housemen, Assistant Medical Officers (AMO), Matrons, Sister, Nurses, Environmental Health Officers (EHO) and Assistant Environmental Health Officers (AEHO).The study has received the approval from the Medical Research Ethic Committee to conduct the study (NMRR -18-3263-45103).

A total of 764 samples were estimated based on the objective to compare the mean/median score of the PMT sub-constructs between the one willing and not willing to uptake the pertussis vaccine. For the standard deviation of 34.53 and mean detectable difference of 7, which was obtained from the pilot study were used for the sample size calculation. So, considering 20% of non-response rates, a total of 920 cases was chosen as the sample size for this study. The number of samples was divided equally (460 samples) to be collected from each state. The samples were selected based on a multistage sampling method (Fig. 1 and Fig. 2).

Data collection instrument

A questionnaire was developed and validated to be the study instrument for this study. The questionnaire was divided into three parts; Part 1 consists of socio-demographic characteristics, part 2 was to assess the threat appraisal and coping appraisal pathway using Likert scale where else part 3 consists of three questions assessing on acceptance of HCW to receive pertussis vaccine from a scale one to five.

Method of Data collection

Data was collected by using a self-administered questionnaire via an online survey (Monkey Survey) from January 2019 to March 2019. The online survey was done, taking into consideration the limitation of time and budget.

Data Analysis

All missing data were screened using the survey website. The responses with incomplete answers shown as incomplete data on the website. All the responses with an incomplete answer were deleted immediately before downloading the Microsoft Excel document with the complete responses from the website. The Microsoft

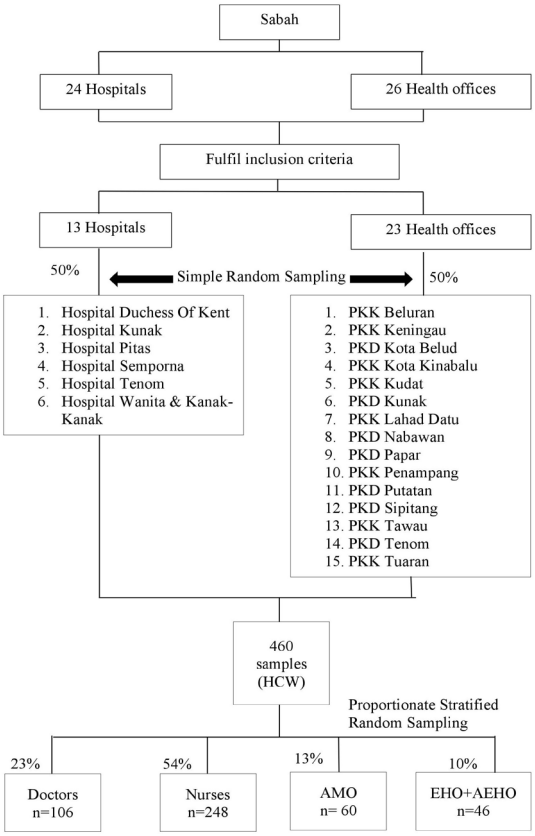

Figure 1: Summary of multistage sampling for Sabah

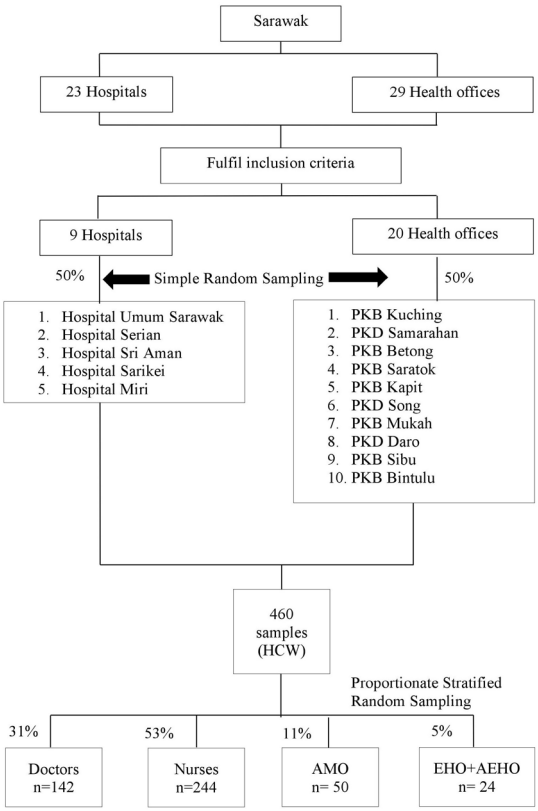

Figure 2: Summary of multistage sampling for Sarawak

Excel document was then exported to Statistical Package for Social Science (SPSS) software version 23.0 immediately to prevent data entry errors.

All the numerical data were checked for normal distribution using a histogram, box plot, skewness and kurtosis (+1 to -1 shows relatively symmetric distribution) and finally, the normality test using Shapiro-Wilk and the Kolmogorov-Smirnov (p-value more than 0.05 indicate normal in shape) (23). Level of significance of the test is taken of any value less than 0.05 and a 95% confidence interval demonstrated to know the range of the value in a population.

Descriptive statistics using the mean/median, and the percentage was done for the 12 questions in part 1 (socio demography characteristics) section. For the items in part 2, the mean of items according to each sub-construct was determined. The mean/median score for the seven PMT constructs will indicate that the higher the score, the greater the intention to take the pertussis vaccine. For the questions in part III, all the items were described using percentage. The association of the mean/median score of overall PMT was compared with the acceptance of HCW to receive the pertussis vaccine (score of four and five consider willing and score one to three is considered not willing) by using Independent t-test. Simple Logistic Regression (SLR) was done to find the factors associated with willingness to uptake pertussis vaccine using SPSS version 23.0.

A robust path analysis was done using WarpPLS version 6.0 (24) to find the mediating effect of PMT. WarpPLS is commonly used to do nonlinear structural equation modelling. It can calculate p values, model fit, quality indices, and full collinearity coefficients. Model fit is measured by using Average path coefficient (APC) (p-value < 0.05 indicate good fit), Average R-squared (ARS) (p-value < 0.05 indicate good fit), Average adjusted R-squared (AARS) (p-value < 0.05 indicate good fit), Average block VIF (AVIF) (acceptable if ≤ 5, ideally ≤ 3.3) and Average full collinearity VIF (AFVIF) (acceptable if ≤ 5, ideally ≤ 3.3) (25). Robust path analysis also used to find indirect effects for paths with more than two segments as well as the total effect. Robust path analysis was used in this study due to two main reasons. First is because it can be used to test the model, including the mediating effect of PMT. The second reason was that p values are obtained through a non-parametric method, which allows us to test for variables that are non-linear and categorical variables (26). Analysis of a moment structures (AMOS) SPSS version 23.0 or other statistical software were not used to find the mediating effect because the independent and dependent variables were categorical, which requires Bayesian distribution analysis method.

RESULTS

A total of 950 responses were collected during the study period. The final samples for analysis were comprised of 853 respondents after excluding the incomplete responses and respondents who did not fulfil the selection criteria. The socio-demographic characteristics of the respondents are summarized in Table I. Mean age of the HCW were 35.81 (8.28) years old. The HCWs has worked about a median of 8.20 (IQR 9.0) years in their current working place. Out of 853 responders, only 95 HCW (11%) have taken pertussis vaccine in these ten years. Approximately 31% of the HCW who has taken the pertussis vaccine in the past ten years, work at the Maternal and Child Unit followed by the HCW working at the Paediatrics (5.8%).

Table I: Sociodemographic characteristics of the participants

Variable	n, (%)	Median (IQR)
Age (in years)		35.81 (8.28)
Gender		
Male	217 (25.4)	
Female	636 (74.6)	
Race/Ethnicity		
Malay / Melayu	202 (23.7)	
Kadazan-Dusun	172 (20.2)	
Dayak (Iban and Bidayuh)	161 (18.9)	
Other Bumiputera Sabah	128 (15)	
Other Bumiputera Sarawak	78 (9.1)	
Others	112 (13.1)	
Religion		
Islam	419 (49.1)	
Christianity	383 (44.9)	
Buddhist	23 (2.7)	
Hindu	17 (2.0)	
Others	11 (1.3)	
Designation		
Specialist	13 (1.5)	
Medical Officer	168 (19.7)	
House Officer	8 (0.9)	
Medical Assistant	86 (10.1)	
Matron	26(3.0)	
Sister	72 (8.4)	
Nurse	398 (46.7)	
Environment Health Officer	82 (9.6)	
Department / Unit		
Internal Medicine	50 (5.9)	
Paediatrics	52 (6.1)	
Obstetrics and Gynaecology	33 (3.9)	
Surgery	16 (1.9)	
Accident and Emergency	85 (10.0)	
Anaesthesiology	15 (1.8)	
Outpatient	109 (12.8)	
Maternal and Child Health Unit	277 (32.5)	
Divisional /District Health Office	145 (17.0)	
Others	71 (8.3)	
History of contact with pertussis Patient		
Yes	224 (26.3)	
No	629 (73.3)	
Hours in contact with patients in a day		
5 hours	155 (18.2)	
6 hours – 10 hours	315 (36.9)	
≥ 11 hours	37 (4.3)	
None	346 (40.6)	
Awareness of Malaysia policy on pertussis		
Yes	470 (55.1)	
No	383 (44.9)	
Pertussis Vaccine within the past ten years		
Yes	95 (11.1)	
No	758 (88.9)	

Most of the respondents (81.5%) are willing to receive the pertussis vaccine. However, with the question of willingness to take the vaccine if needed to pay, only 55% agreed to take the vaccine. There is an increase of 5.4% in the willingness group if the Ministry of Health (MOH) recommends that all healthcare workers must be vaccinated against pertussis. The mean age of those HCW willing to take the vaccine was 35.27 (8.15) while the mean age of the one who was unwilling was 38.17 (8.47). When we compare the willingness among each religion group, the Hindu HCW was more willing to take the pertussis vaccine (94.1%) followed by Buddhist (91.3%), Others (81.8%), Islam (81.1%) and Christianity (80.7%). The HCW working in Anaesthesiology and District Health Offices were more willing to take the vaccine compared to HCWs working in the other departments/units, with 93.3% and 89.7% respectively. By profession, the doctors were more acceptable towards taking pertussis vaccine (86.2%), followed by the environmental health officers (85.4%), medical assistants (80.2%) and nurses (79.2%). The doctor profession was more willing to pay as well to take the vaccine (86.2%) when compared to other occupations.

The total mean score of the Protection Motivation Theory subconstructs is 29.44 (14.26). The mean score of each subconstruct ranges from 3 to 18. The Protection Motivation score was significantly different between those willing and not willing to take the vaccine ($p < 0.001$). Independent t-test shows that the mean score among the willing group to receive the vaccine is 30.84 (14.69) which was higher compared to the unwilling group with a mean score of 23.25 (10.16) with the $p < 0.001$ and t statistics (df) was 7.729 (325).

Simple logistic regression (SLR) was conducted to identify factors that predict the with HCW's willingness to uptake the pertussis vaccine. The dependent variables were coded into the dichotomous variable. The willing group were coded as 1 and not willing were coded as 0. To predict which factors associated with the willingness, those factors with $p< 0.15$ from SLR which are the age, job designation, institution of working, prior contact with pertussis patient, awareness of the Malaysian pertussis policy and prior pertussis vaccination were selected for multiple (Binary) logistic regression. Three independent factors which are the age ($p < 0.001$), institution ($p= 0.006$) and prior history of pertussis vaccination in the past ten years ($p= 0.009$) remain significant association with the HCW's willingness to take the vaccine (Table II). The variables were selected based on forward likelihood ratio (LR) method; there was no interaction found between the variables. The VIF was 1.01, Hosmer Lemeshow Goodness of the fit test, p values = 0.200, AUC was 64.2%, and the highest point of the outlier was 0.13. The model predicts the variables correctly by 81.5%. The willingness to take the vaccine increases as the age gets younger. Those working at the district health offices have 2.6 times more odds of taking the pertussis

Table II: Factors associated with acceptance to receive the pertussis vaccine (Binary Logistic Regression)

Variable	Adj OR	(95% CI OR)	Wald (df)[a]	P value
Age	0.97	0.95;0.99	12.09 (1)	0.001
Institution				
Hospital	1.00		10.14 (2)	0.006
Clinic	1.40	0.96; 2.03		
DHO	2.57	1.41; 4.68		
Prior pertussis vaccination			6.74 (1)	0.009
No	1.00			
Yes	2.71	1.28; 5.77		

[a] Likelihood Ratio (LR) test Adj. OR = Adjusted odds ratio

Table III: Robust Path Analysis of Sociodemography Variables, Protection Motivation Theory Constructs with Willingness to Uptake the Pertussis Vaccine

Variables	Threat Pathway (β)	Coping Pathway (β)	Willingness to uptake the pertussis vaccine (β)
Sociodemography variables (age, institution of working and prior pertussis vaccination)	-0.10*	-0.09*	-0.09*
Threat Pathway	-	-	-0.12**
Coping Pathway	-	-	0.35**

*p<0.05; **p<0.001

vaccine compared to those working in hospitals. Those who have taken immunization against pertussis in these ten years were more willing to take the vaccine.

Robust path analysis was done using WarpPLS 6.0 to identify the mediating effect of PMT score towards the uptake of the pertussis vaccine. The factors that were significant in multiple logistic regression were analysed in the sociodemographic factors, while the PMT constructs were divided into threat and coping pathway. The threat pathway contains the score of severity, vulnerability, intrinsic reward and extrinsic reward where else the coping pathway consists of the score of response efficacy, self-efficacy and response cost. The willingness of the HCW to receive pertussis vaccine from the score of one to five was used as the dependent variable. The result shows that all the three sociodemographic factors (age, the institution of working, and prior pertussis vaccination) are significantly associated with the threat and coping pathway (p<0.05). Threat pathway is negatively associated with the willingness to uptake the pertussis vaccine (p<0.001), and the coping pathway is positively associated with the HCWs willingness to uptake the pertussis vaccine (p<0.001) (Fig. 3 and Table III). The model fit analysis shows that the model fit well (APC=0.149 with p<0.001; ARS=0.066 with p=0.013, AARS=0.065 with p=0.015, AVIF=1.14, AFVIF= 1.23).

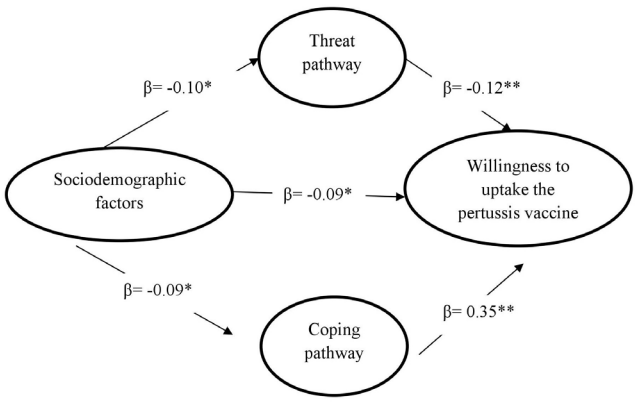

Figure 3: Robust Path Analysis of Socio-Demography Variables, Protection Motivation Theory Constructs with Willingness to Uptake the Pertussis Vaccine. Note: * p<0.05; **p<0.001

Data in Table IV shows that all three demographic factors are interrelated with each other (p<0.05). All the PMT subconstructs were significantly correlated with each other except severity with intrinsic reward, extrinsic reward, and response efficacy and finally self-efficacy with extrinsic reward, and response cost. Besides intrinsic rewards, extrinsic reward and response cost, all the other four PMT subconstructs, age, institution and history of pertussis vaccination were correlated with willingness to uptake the pertussis vaccine either at p<0.05 or p<0.001 level.

DISCUSSION

In this study, the age had a significant association with the desire to uptake the pertussis vaccine by the HCW. A systematic review mentions that most of the studies on Tdap vaccination among the HCW showed that the immunization of Tdap coverage was higher among those from 19-64 years old compared to the those more than 65 years old (5). Our study findings have been supported by other studies, whereby a study showed that the younger generation is an independent factor associated with an increased likelihood of Tdap vaccination (18). In another survey of factors affecting the uptake of the vaccine among HCW revealed that the younger HCWs were significantly more likely to receive influenza and pertussis vaccine (27). In another vaccine also age was found to be a significant factor associated with hepatitis B vaccination among the HCW (28).

Place of working of the HCWs also found to be a factor that influences the willingness of the HCWs towards receiving the pertussis vaccine. There are virtually no other published studies to compare the willingness based on different healthcare institution. Our study included HCWs working at the hospital, clinic, and district health office. The study findings found that those working in the district health offices are 2.6 times in odds more likely to take the vaccine compared to those working in hospitals and clinics. This could be because the district health officers who were involved in the study are the front liners in managing the cases and outbreak of pertussis in the community. Their experience in dealing with the prevention and controlling of the disease in

Table IV: Correlation of Protection Motivation Theory subconstructs with sociodemographic factors and willingness to uptake the vaccine

Variable	2	3	4	5	6	7	8	9	10	11
1. Age	-0.07*	-0.07*	-0.22**	-0.10*	-0.05	-0.13**	-0.05	-0.12**	-0.16**	-0.17**
2. Institution		-0.08*	0.07*	0.06	-0.14**	-0.16**	0.06	0.06	-0.14**	0.14**
3. Prior pertussis vaccination			-0.04	0.04	0.08*	0.07*	0.07*	0.11*	0.07	0.10*
4. Severity				0.59**	-0.04	-0.05	0.32**	0.36**	-0.03	0.28**
5. Vulnerability					-0.13**	-0.17**	0.43**	0.42**	-0.12**	0.29**
6. Intrinsic Reward						0.63**	-0.08*	-0.07*	0.54**	-0.06
7. Extrinsic Reward							-0.07*	-0.05	0.69**	-0.02
8. Response Efficacy								0.62**	-0.07*	0.29**
9. Self-Efficacy									-0.01	0.42**
10. Response Cost										0.03

*p<0.05; **p<0.001
Note: 2- Institution of working; 3- Prior pertussis vaccination; 4- Severity; 5- Vulnerability; 6- Intrinsic Reward; 7- Extrinsic Reward; 8- Response Efficacy; 9- Self-Efficacy; 10- Response Cost; 11- Willingness to uptake the vaccine

the community might influence directly or indirectly their acceptance. Although this study did not assess the knowledge of HCW on pertussis, La Torre et al. (29) said that gaps in knowledge and false perception about the risk for exposure to vaccine-preventable diseases among the HCW affects the acceptance of HCW to take the vaccine. The Protection Motivation Theory integrates all the cognitive process of knowledge, attitude, and practice (30), therefore by using PMT, this study has assessed all the three cognitive processes towards the uptake of the vaccine among the HCW. A significant finding of the place of working can indicate that the daily practice and work experience may affect the acceptance towards the uptake of the pertussis vaccine.

The previous history of pertussis vaccination is also found to be a significant independent factor that predicts the acceptance of HCW towards the uptake of pertussis vaccination in this study. Other studies show that receipt of influenza vaccine predicts the willingness to take the pertussis vaccine (18,19). A systematic review says that previous immunization to other recommended vaccines such as measles, mumps rubella, and hepatitis B was positively associated with pertussis vaccination among HCWs (5). History of immunization may reflect health-seeking behaviour and acceptance to vaccinations or preventive services (18).

The doctors working in Sabah and Sarawak were more willing to take and pay for the vaccine compared to other healthcare worker's group. This could be because physicians are aware of the circulation of pertussis among adults who can turn to be the source of infection to infants (31). Another reason could be because the physician has good knowledge of pertussis as they are actively involved in reading scientific literature and even participate in a journal club in hospitals. That is why studies have shown that the vaccination coverage for the influenza vaccine and pertussis vaccine is usually higher among the physicians compared to other healthcare workers (18,32). A systematic review also shows that physicians to be one of the variables that are highly associated with Tdap vaccination (5). A study result showed that even though 76% of the HCWs in the study were willing to receive the pertussis vaccine, however only 15% presented to the clinic to take the vaccine (13). Thus, efforts to encourage the HCWs to take the pertussis vaccine should be focused on multiple factors and perspectives.

In this study, 86.9% of the HCW agreed to take the vaccine if the Ministry of Health, Malaysia recommended them to take the vaccine. If such policy implemented, the vaccine coverage may be higher among the HCW. Studies have shown that hepatitis B vaccine coverage is higher among the HCW as the vaccine is compulsory for all HCWs compared to other non-mandatory vaccination such as influenza, measles, mumps, and rubella (32). Tdap coverage among HCW has been managed to increase over the years in many countries by making pertussis as a mandatory vaccination for HCWs (5). Some hospitals in Australia gives pertussis booster vaccination for all HCW who have not been vaccinated in the past ten years (33) which further enhances the importance of pertussis vaccination among HCWs. Some of the HCWs prefer having autonomy in deciding on the vaccination (18), but a study in Greece shows that more than half (65.1%) of the HCWs prefer the compulsory vaccination under the occupational program (34). The same author also suggested for consideration of compulsory vaccination of diseases that can be transmitted to vulnerable patients such as pertussis for HCW (35). There is evidence that the recommendation of vaccination works better if the policy is focused on specific HCW groups (29), for example, pertussis vaccine should be highly recommended for those HCWs in contact with infants and pregnant ladies such as in paediatrics, obstetrics and gynaecology and emergency departments.

The willingness to take the vaccine among the HCW is found to be influenced by the cost of the vaccine. Another study also mentioned that the cost borne by the HCW to get the pertussis vaccine is a barrier for pertussis vaccination (31). However, in certain countries, for

example, in Canada, despite public funding of the pertussis vaccine, the vaccine coverage remains low because of low perception towards pertussis (31).

Protection Motivation Theory is one of the fundamental theories that assess the intention to change behaviour based on risk perception. In this study, we found that those who were willing to uptake the vaccine has a higher mean score of the overall subconstruct of the theory when compared to those unwilling to take the vaccine. Another study has supported this finding whereby risk perception of pertussis has known to be the single most critical factor that influences the intention to accept the vaccine (36). One of the studies on HCW perception on the pertussis vaccine, the reasons for the uptake of pertussis vaccine is to protect the patients that they care for and to protect self and their family (19). Another study also said that maternity assistants and paediatric nurses were willing to take the pertussis vaccine due to their risk perception of perceived susceptibility to pertussis (37). Therefore, behaviour change theories such as the Protection Motivation Theory could be used as a framework to guide on vaccine promotion activities to motivate the HCW to take pertussis vaccine since studies have shown that immunizing HCW is challenging as they have low perception towards pertussis infection (5). There has been much nosocomial outbreak of pertussis infections among the HCWs and patients have been reported in many countries due to low coverage of pertussis vaccine. (5). Low coverage of pertussis vaccine is due to the low perception of the disease. Managing an outbreak of pertussis in a hospital can be expensive, and with vaccinating the HCWs towards pertussis as primary prevention is much more cost-effective (38).

In our study, both the threat and coping pathway were found to be significant predictors for willingness to take the vaccine as it explains the extent to which the HCWs feel that taking the vaccine will protect them from pertussis. A study on smoking preventions showed that both the threat appraisal pathway and coping appraisal pathway were significantly correlated with intentions to smoke (39). In another study, all the seven subconstructs of the PMT were associated with engaging in protective behaviour against Schistosomiasis (30). However, a study of physical activity promotion showed that only the coping appraisal variables have consistently been stronger predictors of physical activity intention and behaviour (40). If interventions are made to increase the pertussis vaccine coverage among the HCW, both the threat and coping messages should be provided to make them believe that taking vaccines provides health benefits not only for the HCW but also for the vulnerable patient and even their family members.

This is the first effort to apply PMT in the understanding of an HCW's willingness towards the uptake of pertussis vaccine in Sabah and Sarawak. This study participated by a large population of HCWs from Sabah and Sarawak and may be representative of HCW working in Sabah and Sarawak. There are many advantages of doing online survey. The response is obtained by the researcher immediately. It is easy to be used by the participants as they can access whenever and wherever they want. Researchers have found that the respondents are more honest in answering the questions online than the traditional method. As for limitations, first, the data collection was done online; therefore, it is impossible to verify the respondents if they are genuinely healthcare workers. However, the link to the survey was only given to HCWs working in government healthcare facilities via their respective email and WhatsApp. Since it is an online survey, the time and date of the responses received can be monitored. The survey was done mostly by the respondents during weekdays and office hours therefore, this can ensure that the HCW themselves did the survey. The interpretation of the result must be made cautiously because of the lack of quality random sampling. Secondly, the data was collected via the cross-sectional study. Therefore, longitudinal studies should be conducted to confirm the relationship between PMT subconstruct to other variables. The third limitation is that the information was self-reported, thus can lead to recall bias; for example, they might be unsure about the timing of the last pertussis vaccination and contact with pertussis patient.

CONCLUSION

Many of the HCWs were willing to take the pertussis vaccine. However, the percentage of the willing group reduced when they were requested to pay for the pertussis vaccine. The willing group had a higher mean score of PMT compared to the unwilling group. Age, place of working, previous history of pertussis vaccination, threat, and coping pathway are found to be the independent factors that influence the HCW's willingness to accept pertussis vaccination. Younger age group were more willing to take the vaccine compared to the older age group. HCWs working in the district health office were more willing to take the vaccine to compare to those working in the hospital. A person's risk perception is determined by the risk they perceive (threat) and their coping mechanism to handle the threat. Age, the institution of work, and prior pertussis vaccination of the HCW were associated with the risk perception towards pertussis. Intervention program to promote pertussis vaccination among the HCWs should consider all these study findings in addition to cognitive components of PMT.

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