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ORIGINAL ARTICLE

Knowledge, Attitude and Practice Regarding Pertussis among a Public University Students in Malaysia

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Abstract

Objective: To study the knowledge, attitude, and practice (KAP) regarding pertussis among students in a public university in Malaysia. **Material and Methods:** This study was a cross-sectional study using convenience sampling to recruit 171 respondents. The data was collected using a self-administered questionnaire comprised of four different parts: the socio-demographic data, the knowledge, the attitude and the practice towards the prevention of pertussis. The data were analyzed using correlation, independent t-test, and ANOVA according to the different study objectives and types of data. **Results:** More than half of the respondents (67.8%) indicated that they had heard about pertussis. The school or university (59.6%) was the most common source of information, followed by Internet (46.2%). The most of the respondents (43.9%) possessed moderate knowledge regarding pertussis and knew that Bordetella pertussis is the causative agent of pertussis (76.0%). A significant positive correlation between knowledge regarding pertussis with age (p=0.023) was observed, however, there was no association between age with attitude and practice (p=0.272 and 0.131, respectively). Gender and marital status did not influence the KAP regarding pertussis; nevertheless, significantly different between different faculties. **Conclusion:** Students from the Faculty of Medicine had the highest knowledge scores, while the students from the Faculty of Nursing had the most top attitude and practice scores compared to students from another faculty. The students from the public university generally had a good level of KAP regarding pertussis.

Keywords: Health Knowledge, Attitudes, Practice; Bordetella pertussis; Universities.

Introduction

Pertussis or whooping cough is an infectious respiratory disease, which is caused mainly by the infection of gram-negative bacteria, Bordetella pertussis, in humans [1]. This disease has mostly affected the human population, primarily young infants and children, which constitutes a high number of infant deaths before the introduction of its vaccination. Vaccination against Bordetella pertussis infection has been made available since 1940 with the aim to protect infants and children against the deadly pertussis disease [2,3]. Regardless of the comprehensive coverage of vaccination against pertussis worldwide, it remains as a major public health concern because of its serious morbidity and mortality effects towards humans, especially infants and children [4,5]. Besides, the elevation of pertussis cases nowadays has been a significant problem in the healthcare field, which needs widespread attention and solution. As being reported by WHO, there is an estimate of 16 million pertussis cases worldwide that arise in 2008, and this consequently has caused 195 000 children deaths mainly in the developing countries [6]. In addition, the number of pertussis cases has also been reported the highest in California in 2010, which recorded 5978 cases with 10 infant deaths [7].

The recent trend of pertussis has significantly increased in many countries, specifically among adolescents and adults due to several factors such as advanced detection method and impermanence of immunity against Bordetella pertussis infection [1,8,9]. However, unrecognized adult pertussis is also a significant factor contributing to the rise of pertussis cases among infants and children who are at more significant risks in developing more serious complications and even fatal infection [3,4,10,11]. The resurgence trend of pertussis incidence in all age groups, especially among adolescents and adults, were observed in most European countries and the USA for the past several years [12-15]. Older age individuals are often an asymptomatic carrier of pertussis; consequently, high transmission of pertussis to the vulnerable group and cause potential outbreak [16,17]. Asymptomatic pertussis carriers are commonly among vaccinated individuals as the protection conferred through childhood immunization wanes [18,19]. It is also highlighted that pertussis infection in infants frequently comes from adults and adolescents through close contact with infants [20].

According to the WHO monitoring system for vaccine-preventable diseases in Malaysia, the number of pertussis cases has started to increase significantly after the year of 2009 (Figure 1) [21].

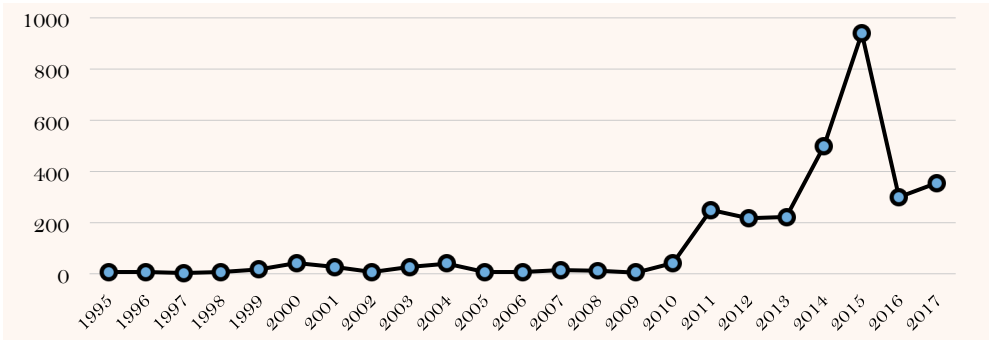

Figure 1. The incidence of pertussis in Malaysia (1995 – 2017).

Before 1995, there were 24, 150, and 97 pertussis cases in the year 1990, 1985, and 1980, respectively [21]. Compounding the increase in several pertussis cases, multiple studies stated that the level of knowledge among common people, Asian travelers, physicians, and family medicine practitioners regarding pertussis was deficient [22,23].

This study intended to provide information on the level of knowledge, attitude, and practice (KAP) regarding pertussis among students in a public university in Malaysia.

Material and Methods

Study Design and Population

This was a cross-sectional involved all the six science and health-based faculties in the university campus, namely Dentistry, Medicine, Nursing, Pharmacy, Allied Health Sciences (AHS) and Science. All students in year I-V of study from the first two faculties and year I-IV in the other faculties were included in the study population. This study was conducted from April to May 2017.

Sampling Method

The sample size calculation was done by using the single proportion formula to determine the minimum number of respondents required for this study. The following values used in the calculation: z = 1.96 (for 95% confidence interval; precision=0.06; p=0.20) [24]. Thus, the calculated sample size was 188, including the 10% non-response rate. This study used a convenience sampling method whereby any students available and accessible were invited to participate in the study.

The following inclusion criteria were established: a) Undergraduate students of IIUM, Kuantan; b) Both male and female, and c) All year of study. As exclusion criteria were adopted: a) Postgraduate students or staff; and b) Students on study leave.

Data Collection and Study Instrument

The data was collected using a self-administered questionnaire. The questionnaire of this study comprised of four different parts where the first part collected the socio-demographic data of the respondents involved, which include gender, faculty, year of study, age, and marital status. The second part of the questionnaire focused on the knowledge of the respondents related to pertussis. It consists of several general questions regarding pertussis such as the causes, transmission, symptoms, treatment, and routine pertussis vaccination in Malaysia. There were 30 questions in total, with three answer options, which were 'true,' 'false' or 'not sure' for each question. The third part of the questionnaire was about the attitude of the respondents towards pertussis, which consisted of 10 statements concerning pertussis. The Likert scale was utilized in the attitude part, consisting of five different answer options for each statement which include 'strongly disagree,' 'disagree,' 'neither disagree nor agree,' 'agree' and 'strongly disagree.' The final part of the questionnaire used to evaluate the practice of the respondents towards the prevention of pertussis. There were five statements regarding the preventive measures for pertussis with four answer options which were 'never,' 'seldom,' 'often' and 'always.'

The questionnaire was designed in the English language because it is the official language medium used in the university. Furthermore, the questionnaire sections demonstrated acceptable values, with a range between 0.672 and 0.882, which indicated that both instruments possessed good internal consistency and reliability. Convergent validity was shown by the significant correlations between the items of each section and the total mean in each part (rs=0.332–0.718; p=0.05). The study pretested result corresponds with earlier studies [25,26].

The scoring system used for KAP regarding pertussis has been summarized in Table 1. The percentage range for each category was referred to as one earlier study [27]. The percentage range for the

poor category was less than 50% (<50%), for the moderate category was 51-69% and for the good category was more than 70% (>70%).

Table 1. Scoring system for knowledge, attitude, and practice regarding pertussis.

Part	Knowledge	Attitude	Practice
	Correct Answer = 2	Strongly Agree = 5	Always = 4
	Not Sure Answer = 1	Agree = 4	Often = 3
	Wrong Answer = 0	Neither Disagree Nor Agree = 3	Seldom = 2
		Disagree = 2	Never = 1
		Strongly Disagree = 1	
Total Score	0-60 Marks	10-50 Marks	5-20 Marks
Category	Poor (≤50%); Moderate (51%-69%) and Good (≥70%)		

Data Analysis

The data analysis was carried out SPSS 23.0 (IBM, Armonk, NY, USA). Frequency and percentage were used to describe the categorical variables, while numerical variables were described using mean and standard deviation (SD). The relationship between KAP regarding pertussis was assessed using correlation test, specifically the Pearson correlation test when its assumptions were fulfilled, also between KAP and age. In comparing the KAP between two independent groups, an independent t-test was used if the assumptions for the test were fulfilled. Otherwise, its important non-parametric test of the Mann-Whitney U test was used instead. If the number of groups to be compared were more than two, the One-Way ANOVA test was used accordingly to find the difference in the KAP regarding pertussis if the assumptions for the test were fulfilled. Otherwise, its relevant non-parametric test of Kruskal-Wallis test was used.

Ethical Consideration and Approval

The ethical clearance and approval to carry out this study were obtained from the faculty postgraduate and research committee (KPGRC) (Reference No.: IIUM/310/g/13/4/4-199). In addition, the data from the students were collected after they agreed to participate by signing the consent form of this study to ensure that the participation was voluntary. The participants could withdraw at any point in time, and confidentiality of the data was also ensured.

Results

There were five socio-demographic characteristics, which include age, gender, faculty, year of study, and marital status in this study. There was a total of 171 respondents participated, with the age range of between 20-26 years old. The mean age of the participants in this study was 23.4 years old with the standard deviation (SD) of 1.17. The highest number of respondents was 24 years old (50.9%), while the lowest number of respondents was 26 years old, with only 1.8% respondents. There were 64.9% female and 35.1% male students participated in this study. In addition, the respondents from AHS, medicine, dentistry, pharmacy, science, and nursing were 24.6%, 24.0%, 19.3%, 18.1%, 9.9%, and 4.1%, respectively. There was a limited number of nursing students recruited because by proportion; it is the smallest program in the university. The distribution based on Year-I, II, III, IV, and V of the study was 7.0%, 9.9%, 19.3%, 57.3%, and 6.4%, respectively. There were only three respondents who were already married (1.8%), making the majority (98.2%) of them were still single, possibly because the respondents were only undergraduate students.

More than half of the respondents (67.8%) indicated that they had heard about pertussis. The school or university (59.6%) was the most common source of information, followed by Internet (46.2%), and

newspaper (13.5%). According to the different score categories as indicated in Table 1, most of the respondents (43.9%) possessed moderate knowledge; followed by 42.7% and 13.5% of good and poor knowledge regarding pertussis, respectively.

Most respondents (76.0%) knew that Bordetella pertussis is the causative agent of pertussis. However, 52.0% were not sure that Bordetella parapertussis also causes pertussis. Apart from that, 69.6%, 78.4% and 61.4% correctly answered that pertussis could be transmitted through coughing, sneezing and close contacts with the infected persons, respectively. In addition, 51.5%, 57.3%, 67.8% and 62.6% also correctly answered that the symptoms of pertussis are a runny nose, low-grade fever, rapid cough, and high-pitch cough, respectively. However, regarding vomiting following cough as one of the symptoms, 50.3% were not sure of the answer. A large number (48.5% to 63.2%) were not sure about the different treatment choices and different age for routine vaccination of pertussis for children in Malaysia (Table 2).

Table 2. Knowledge regarding pertussis among respondents.

Questions	True N (%)	False N (%)	Not Sure N (%)
Cause(s) of Pertussis in Human			
Bordetella pertussis	**130 (76.0)**	0 (0)	41 (24.0)
Bordetella parapertussis	**33 (19.3)**	49 (28.7)	89 (52.0)
Bordetella bronchiseptica	5 (2.9)	**64 (37.4)**	102 (59.6)
Mycobacterium tuberculosis	14 (8.2)	**96 (56.1)**	61 (35.7)
Streptococcus pneumoniae	8 (4.7)	**97 (56.7)**	66 (38.6)
Transmission of Pertussis			
Blood Transfusion	25 (14.6)	**85 (49.7)**	61 (35.7)
Sneezing	**119 (69.6)**	8 (4.7)	44 (25.7)
Coughing	**134 (78.4)**	3 (1.8)	34 (19.9)
Close Contacts with Infected Persons	**105 (61.4)**	12 (7.0)	54 (31.6)
Sexual Intercourse	17 (9.9)	**95 (55.6)**	59 (34.5)
Contaminated Food or Drinks	31 (18.1)	**63 (36.8)**	77 (45.0)
Symptoms of Pertussis			
Runny Nose	**88 (51.5)**	19 (11.1)	64 (37.4)
Low-grade Fever	**98 (57.3)**	11 (6.4)	62 (36.3)
Rapid Cough	**116 (67.8)**	9 (5.3)	46 (26.9)
High Pitch Cough	**107 (62.6)**	10 (5.8)	54 (31.6)
Vomiting Following Cough	**67 (39.2)**	18 (10.5)	86 (50.3)
Abdominal Pain	35 (20.5)	**45 (26.3)**	91 (53.2)
Headache	37 (21.6)	**42 (24.6)**	92 (53.8)
Skin Rash	14 (8.2)	**66 (38.6)**	91 (53.2)
Treatment of Pertussis			
Erythromycin	**82 (48.0)**	6 (3.5)	83 (48.5)
Mebendazole	14 (8.2)	**52 (30.4)**	105 (61.4)
Ivermectin	10 (5.8)	**36 (21.1)**	125 (73.1)
Azithromycin	**82 (48.0)**	4 (2.3)	85 (49.7)
Clarithromycin	**72 (42.1)**	6 (3.5)	93 (54.4)
Routine Pertussis Vaccination in Malaysia			
1-Month Old	17 (9.9)	**55 (32.2)**	99 (57.9)
2-Month Old	**55 (32.2)**	12 (7.0)	104 (60.8)
3-Month Old	**62 (36.3)**	8 (4.7)	101 (59.1)
5-Month Old	**46 (26.9)**	17 (9.9)	108 (63.2)
6-Month Old	27 (15.8)	**42 (24.6)**	102 (59.6)
18-Month Old	**41 (24.0)**	22 (12.9)	108 (63.2)

*Correct answers are in bold.

Most respondents (81.3%) had a good attitude towards pertussis, whereas another 18.7% had a moderate attitude. This denotes that the respondents had a good attitude to several statements concerning

pertussis. Pertussis was perceived by most respondents as a serious contagious and life-threatening disease especially in infants, whereby 76% and 75.5%, respectively, agreed and strongly agreed to the statements. Thus, the action of keeping distance pertussis other patients from others and to isolate the pertussis patients was agreed and strongly agreed by most respondents (71.9% and 63.1%, respectively). Besides, the majority of respondents also agreed and strongly agreed to have immediate treatment whenever they develop the symptoms of pertussis (84.8%), and pertussis cases must be reported to health authorities (79.6%). In addition, pertussis vaccination is deemed very important by most respondents (85.4%) to prevent the spread of pertussis. Table 3 illustrates the full results of the attitude of the respondents regarding pertussis.

Table 3. Responses on attitude questions regarding pertussis.

Statement	Strongly Disagree N (%)	Disagree N (%)	Neutral N (%)	Agree N (%)	Strongly Agree N (%)
Pertussis is a very contagious disease.	0 (0.0)	4 (2.3)	37 (21.6)	54 (31.6)	**76 (44.4)**
Pertussis is a severe life-threatening disease, especially in infants.	1 (0.6)	4 (2.3)	37 (21.6)	49 (28.7)	**80 (46.8)**
Vaccination is important to prevent the spread of pertussis.	0 (0.0)	1 (0.6)	24 (14.0)	42 (24.6)	**104 (60.8)**
Patients with pertussis should keep their distance from other people.	0 (0.0)	1 (0.6)	47 (27.5)	58 (33.9)	**65 (38.0)**
Patients with active pertussis should be isolated until they are cured.	0 (0.0)	5 (2.9)	58 (33.9)	51 (29.8)	**57 (33.3)**
People refusing pertussis vaccination should be legally forced to.	1 (0.6)	7 (4.1)	63 (36.8)	42 (24.6)	**58 (33.9)**
Pertussis cases must be notified to health authority.	1 (0.6)	1 (0.6)	33(19.3)	48 (28.1)	**88 (51.5)**
I am risk of being infected with pertussis.	30 (17.5)	32 (18.7)	75 (43.9)	25 (14.6)	**9 (5.3)**
If I have the symptoms of pertussis, I will seek treatment immediately.	1 (0.6)	1 (0.6)	24 (14.0)	57 (33.3)	**88 (51.5)**
Every individual 19 - 64 years old should receive pertussis booster vaccination.	5 (2.9)	4 (2.3)	82 (48.0)	48 (28.1)	**32 (18.7)**

*Expected responses are in bold.

Meanwhile, the respondents' practice scores regarding pertussis were categorized into good, moderate, or poor practice. An equal number of respondents, which was 44.4% had good and moderate practice. Only, 11.1% had poor practice toward pertussis prevention. Most of the respondents (46.2%) always covered their mouth and nose with a tissue as well as kept their distance from babies (64.3%) when they coughed or sneezed. However, almost half of the respondents seldom washed their hands after coughing and sneezing (48.5%) or wore a facemask when they developed the symptoms (46.2%). On the other hand, half of the respondents (50.3%) never participated in any health programs related to pertussis (Table 4).

Table 4. Responses on practice statements regarding pertussis prevention.

Statement	Never N (%)	Seldom N (%)	Often N (%)	Always N (%)
I cover my mouth and nose with a tissue when I cough or sneeze.	4 (2.3)	33 (19.3)	55 (32.2)	**79 (46.2)**
I wash my hands with hand wash after coughing or sneezing.	9 (5.3)	83 (48.5)	53 (31.0)	**26 (15.2)**
I keep a distance from infants or babies when I cough or sneeze.	2 (1.2)	8 (4.7)	51 (29.8)	**110 (64.3)**
I wear facemask whenever I have symptoms such as cough, runny nose, and sneezing.	35 (20.5)	79 (46.2)	38 (22.2)	**19 (11.1)**
I participate in health education programs related to pertussis.	86 (50.3)	51 (29.8)	21 (12.3)	**13 (7.6)**

*Expected responses are in bold.

A highly statistically significant correlation (p<0.001) for the association between knowledge with attitude, knowledge with practice, and attitude with practice regarding pertussis was found (Table 5). The results also described the r-value, which explained the strength of the correlation of the pairs. The association between knowledge and attitude has the highest r-value, which is 0.511, denoting positive moderate to good correlation between knowledge and attitude of the respondents. Meanwhile, the pairs of knowledge with practice and attitude with practice have the r-values of 0.344 and 0.293, respectively, both denoting positive fair correlations.

Table 5. The correlation between knowledge, attitude, and practice.

Variables	r-value	p-value	Interpretation [28]
Knowledge and Attitude	0.511	<0.001	Positive Moderate Correlation
Knowledge and Practice	0.344	<0.001	Positive Weak Correlation
Attitude and Practice	0.293	<0.001	Positive Weak Correlation

The factors considered in this study were the socio-demographic variables of the respondents, namely age, gender, faculties, and marital status. The Pearson correlation test used found a significant little positive correlation between knowledge regarding pertussis with age (p=0.023, r=0.174). However, there was no association between age with attitude and practice (p=0.272 and 0.131, respectively). Table 6 shows that there was also no significant difference in comparing the KAP regarding pertussis between male and female respondents using independent samples t-test with the p-values of 0.647, 0.569 and 0.270, respectively. Similarly, the Mann-Whitney U test found no significant difference in the KAP regarding pertussis between single and married respondents where the p-values were 0.532, 0.313 and 0.541, respectively.

On the other hand, a comparison of KAP regarding pertussis between different faculties using the ANOVA test showed significant results as illustrated in Table 6, where the subsequent post-hoc analysis using the Bonferroni concept is shown in Table 7.

Table 6. Comparison of total scores of KAP regarding pertussis between different genders, faculties, and marital statuses.

Groups Compared	N	Knowledge Scores		Attitude Scores		Practice Scores	
		Mean (SD)	p-value	Mean (SD)	p-value	Mean (SD)	p-value
Gender[a]							
Male	60	40.2 (8.12)	0.647	38.5 (5.09)	0.569	12.8 (3.01)	0.270
Female	111	40.8 (7.75)		40.3 (5.29)		13.7 (2.58)	
Faculty[b]							
Medicine	41	48.7 (5.24)	<0.001	42.2 (3.64)	<0.001	14.3 (2.57)	0.016
Dentistry	33	38.0 (5.60)		37.2 (4.64)		12.6 (2.79)	
Pharmacy	31	40.0 (7.26)		39.7 (4.68)		12.9 (2.78)	
AHS	42	37.1 (5.53)		39.6 (6.56)		13.2 (2.57)	
Nursing	7	45.6 (6.45)		44.0 (3.16)		15.7 (2.50)	
Science	17	32.6 (5.14)		36.8 (4.37)		13.1 (2.98)	
Marital Status[c]		Median (IQR)	p-value	Median (IQR)	p-value	Median (IQR)	p-value
Single	168	41.0 (11)	0.532	40.0 (9)	0.313	13.0 (3)	0.541
Married	3	43.0 (0)		42.0 (0)		17.0 (0)	

[a]Comparison using Independent t-test; [b]Comparison using Anova test; [c]Comparison using Mann-Whitney U test; SD=Standard deviation; AHS=Allied Health Sciences.

The knowledge scores were highest among Medical students with a mean of 48.7 (SD=5.24) and second highest among Nursing students with a mean of 45.6 (SD=6.45), and these were significantly higher

compared to students from Dentistry, Pharmacy, AHS and Science (Table 7). On the other hand, the highest attitude scores were among the Nursing students with a mean of 44.0 (SD=3.16) while the second highest is Medicine with the mean of 42.2 (SD=3.64), and these were significantly higher compared to Dentistry and Science (Table 7). Similarly, the highest practice scores were among the Nursing students with a mean of 15.7 (SD=2.50) while the second highest is Medicine, with a mean of 14.3 (SD=2.57). However, the practice scores of Nursing students were significantly higher compared to Dentistry, Pharmacy, AHS, and Science, while the practice scores of Medical students were only significantly higher compared to Dentistry and Pharmacy students (Table 7).

Table 7. Post-hoc test using Bonferroni concept for comparison of knowledge, attitude and practice regarding pertussis between different faculties.

Faculty 1	Faculty 2	p-value		
		Knowledge	Attitude	Practice
Medicine v.s.	Dentistry	<.001	<0.001	0.007
	Pharmacy	<0.001	0.524	0.030
	AHS	<0.001	0.246	0.076
	Nursing	1.000	1.000	0.191
	Science	<0.001	0.003	0.140
Dentistry v.s.	Pharmacy	1.000	0.667	0.629
	AHS	1.000	0.668	0.287
	Nursing	0.002	0.016	0.005
	Science	0.035	1.000	0.477
Pharmacy v.s.	AHS	0.523	1.000	0.591
	Nursing	0.035	0.563	0.012
	Science	0.001	0.777	0.762
AHS v.s.	Nursing	<0.001	0.423	0.024
	Science	0.118	0.766	0.901
Nursing v.s.	Science	<0.001	0.020	0.033

AHS=Allied Health Sciences.

Discussion

Pertussis is one of the vaccine-preventable diseases. The number of pertussis cases is significantly increasing in many countries, including Malaysia, despite the implementation of a vaccination program for infants. This study was conducted to bring forward the topic of pertussis among students in tertiary education level and to relate it with several socio-demographic factors that might have an association with the KAP regarding pertussis among the students.

The results of this study showed that most respondents were well informed about pertussis. The awareness level of this study was in line with a previous study conducted among parents in Victoria, Australia [29] and but reverse scenario observed among healthcare university students in Brazil [30] regarding pertussis. The current respondents' several sources of information principally were school, or university followed the Internet about pertussis. The Internet plays a significant role in today's world, especially in sharing and spreading information worldwide. This finding was corresponding with a manuscript, which highlighted several advantages of using the Internet in promoting health education [31]. Additionally, another study also mentioned that there were 70% of Canadian used the Internet for health and medical information [32]. Most of the respondents had a good level about basic knowledge related to pertussis. A previous study among travelers indicated that most travelers also have a good understanding regarding basic issues related to pertussis [22], but the reverse situation of poor knowledge level observed among Korean

women of childbearing age [33]. Correspondingly, most of the Pakistani university students possess a low level of knowledge regarding tuberculosis, although this infectious disease incidence level was high in Pakistan [34]. The poor knowledge among current study respondents regarding pertussis treatment might be because pertussis is commonly perceived as a childhood disease that rarely occurs in adults even though immunized adults are frequently the asymptomatic pertussis carrier. One earlier study reported that the knowledge of medication among Malaysian common people was significantly influenced by several demographic factors [35]. Thus, the lack of knowledge regarding pertussis treatment can be explained by the zero experience of the respondents with pertussis in their life.

Additionally, knowledge of routine pertussis vaccination in Malaysia was also deficient among the respondents, can be explained as the majority were not married, and had family and children. Although, another study high lightened that vaccination and antibiotic treatment of pertussis is most effective when administered at the early catarrhal stage [3]. Hence, healthcare students should have comprehensive knowledge of occupational infectious diseases such as pertussis.

In addition, this study also showed that most of the respondents had a good attitude regarding pertussis. Good attitude of the respondents might be due to the higher education level of the respondents. Nevertheless, most of the respondents had neither disagreed nor agreed about receiving adult pertussis booster vaccination, even though respondents agreed that pertussis is a contagious disease. This might be due to the poor knowledge and awareness about adult pertussis. This finding was supported by one earlier overseas study [33]. In addition, another study conducted among healthcare workers demonstrated a poor attitude towards pertussis vaccination [36]. One Malaysian study reported that reduced availability of information and awareness about adult booster dose of pertussis vaccination might be because such a vaccine program has not funded and subsidized by the Malaysian government [37]. On the contrary, there are several rich countries subsidizes adult pertussis booster vaccine programs [38-40], as subsidy for vaccine ensures vaccine awareness and vaccination.

This study revealed that most of the respondents had well to moderate practice towards pertussis prevention, as respondents always cover their mouth and maintain a distance from infants and children while sneezing or coughing. However, most of the respondents rarely wash their hands after coughing and sneezing and rarely wear facemask even have symptoms such as cough, running nose, and sneeze. This finding was found to be consistent with a previous study regarding hand hygiene among university students [41]. This was explained, as handwashing requires access to the water supply, which is impractical at certain circumstances. Hence, the alcohol-based hand sanitizer, which contains at least 60% alcohol, is a preferable alternative [41]. Centers for Disease Control and Prevention has also outlined all the preventive actions that can be done by all individuals in different settings, such as at school, work, gathering, and others [42,43]. The purpose of practicing preventive measures is not only to prevent an individual from getting the infection but also to prevent the transmission of infection to others.

The Pearson's correlation test demonstrated that there was a significant positive correlation between knowledge and attitude, knowledge and practice as well as attitude and practice regarding pertussis, but the strength of the correlation between the variables was different. Nevertheless, generally, it explains that good and moderate knowledge regarding pertussis can result in a good and positive attitude towards pertussis. However, this conflicts with a previous study conducted among healthcare workers in Nashville, the United States [36] where most of the healthcare occupational groups who had a good level of knowledge regarding pertussis, did not have good attitude towards the idea of receiving adult pertussis booster vaccination. Another

study demonstrated that healthcare practitioners and professionals with sound knowledge regarding pertussis infection, incidence, and burden also did not have a good attitude towards the disease [44]. The findings of this study also demonstrated a positive and fair correlation between knowledge and practice regarding pertussis, suggesting that the respondents' knowledge regarding pertussis can affect and influence the respondents' practice in preventing the transmission of pertussis. One previous study demonstrated that women with limited knowledge regarding pertussis did not receive booster vaccination as part of the recommended immunization [33]. In addition, this study also showed a positive and fair correlation between attitude and practice regarding pertussis, denoting that a good level of attitude and behavior towards pertussis leads to good practice in preventing pertussis transmission.

Gender and marital status did not contribute to the knowledge of respondents regarding pertussis, as there was no statistically significant difference. The absence of difference in knowledge between sex and marital status of respondents might be because all the respondents have a similar education background and from the same university. These findings were corresponding with a previous overseas study [30]. However, this study also revealed a statistically significant difference in knowledge scores between respondents from different faculties. This finding is not corresponding to another earlier Korean study [45]. However, the results in the current study can be explained that medical students were more acquainted with the topic of pertussis because of their educational issues. Apart from this study, there was a significant positive correlation between knowledge regarding pertussis and age. This may be because of maturity and experience.

The current study also demonstrated that there was no statistically significant difference in terms of attitude regarding pertussis between sex and marital status. Hence, it can be said that the students have a good attitude and behavior towards pertussis irrespective of sex and marital status. Nevertheless, a significant difference in attitude towards pertussis was also observed among respondents from different faculties. This can be explained as nursing students are more exposed to patients during their clinical attachment. Besides that, the low level of attitude towards pertussis among students of the Faculty of Science can be explained as not exposed to health-related issues.

The results again revealed no significant difference in practice scores regarding pertussis between sex and marital status. This also shows that prevention of pertussis should be a responsibility for every individual. Apart from that, a significant difference in practice score regarding pertussis among respondents from different faculties. Respondents from the Faculty of Nursing had the highest mean of practice scores. However, this finding was not consistent with an earlier study [46]. Besides that, another survey regarding universal precautions also demonstrated the same results as the current study where nursing students had a good practice of universal precautions compared to medical students [43]. Again, the age factor does not possess any significant correlation between practice scores.

There were several limitations identified in the current study. Firstly, the sampling method used in this study was a convenience sampling method, which can possibly result in sampling bias, such as underrepresentation or overrepresentation of any groups involved in this study. Thus, the results might not be valid to represent the general study population. Furthermore, the cross-sectional study design used does not permit the causal-inference to be made from the results of the study.

Conclusion

This study, which is on KAP regarding pertussis, generally demonstrated that most of the participants had heard and known about pertussis. It also revealed that many students had moderate

knowledge regarding pertussis and good attitude and practice regarding pertussis. Thus, it can be concluded that the participants had general knowledge related to pertussis, such as its causes, transmission, signs and symptoms, treatment, and routine pertussis vaccination in Malaysia. The results of this study also indicated that there was a positive correlation or association between KAP regarding pertussis, denoting that good and higher levels of knowledge can result in a good attitude as well as good practice regarding pertussis. Besides that, based on the results, it can be concluded that gender and marital status did not influence or contribute to KAP regarding pertussis. However, a significant difference in terms of KAP regarding pertussis between students from different faculties was observed. This shows that faculty factor plays a significant role in improving the students' KAP regarding pertussis. In addition, this study also revealed a positive correlation between the age of respondents and knowledge regarding pertussis.

Authors' Contributions

NABAB	0000-0003-2603-2062	Conception and planning of the study, performed the data collection, data analysis and interpretation, wrote the manuscript and reviewed the manuscript.
NAAR	0000-0002-9046-6183	Critical review of the literature, data analysis and interpretation, critical review of the manuscript.
MH	0000-0002-6124-7993	Elaboration and drafting of the manuscript, data analysis and interpretation, and reviewed the manuscript.

All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

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