

# Assessment of healthcare workers' behavior in implementing a newborn screening program for congenital hypothyroidism in Perak, Malaysia

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## Abstract

**Purpose** – The aim of this study is to assess healthcare workers' behavior on the congenital hypothyroidism screening program implementation based on a framework protocol and its associated factors.

**Design/methodology/approach** – A cross-sectional study was conducted using the multistage random sampling method in recruiting health clinic workers and purposive sampling techniques for hospital workers. The demographics, providers' characteristic, occupational profile, attitude, perceived behavior control (PBC), knowledge, behavioral intention and adherence to protocol were gathered using validated and reliable self-administered questionnaires.

**Findings** – Partial intention to adhere to protocol was 25.7%. Weak attitude (adjusted odds ratio [AOR]: 5.48, 95% confidence interval [CI]: 3.32–9.06), low PBC score (AOR: 0.91, 95% CI: 0.86–0.95) and low knowledge score (AOR: 0.85, 95% CI: 0.75–0.96) were associated with partial intention to adhere to protocol. In the self-rated adherence assessment, 92.6% of participants from health clinics, 79.1% from pediatric and 61.1% from pathology were found not adhering to protocol. There was a significant association between intention and adherence to protocol.

**Research limitations/implications** – Documentations and observations in assessing program implementation were limited to perform in the present study. Using self-rated instruments and focusing on healthcare workers alone did not provide a comprehensive assessment.

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**Practical implications** – Availability of a training module at site and regular refreshing course training should be made available to harness knowledge, attitude and behavioral perception in implementing the program activities.

**Originality/value** – Integrating the Logical Framework Approach in assessing program implementation and application of the Theory of Planned Behavior and Attitude, Subjective Norms, Self-Efficacy Model in this study were beneficial.

**Keywords** Congenital hypothyroidism, Newborn screening, Malaysia

**Paper type** Research paper

## Introduction

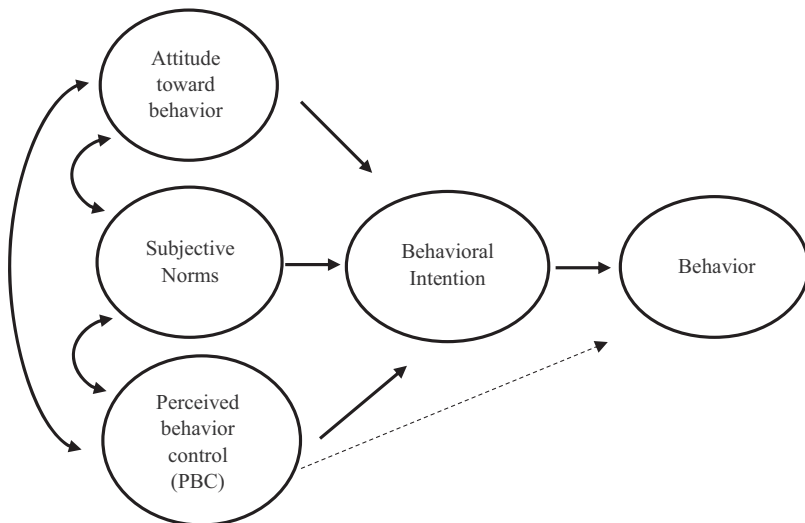
Congenital hypothyroidism (CH) can be defined as a thyroid hormone deficiency occurring at birth. This causes inadequate thyroxine hormone production and subsequently leads to a child's brain capabilities being less developed [1]. Generally, global statistics have found that the incidence of the disease is estimated as 1 per 2,000–4,000 live births [2–6]. Recent studies have reported that in some countries, the incidence is higher than the global statistics. In Iran for example, rates are estimated to be one in 1000 live births [7, 8]. In China, CH occurs at one in 2,500 live births [9], and a recent study in India has shown that the incidence of CH is quite high (1:1000 live births) compared to previous years [10]. As for Malaysia, previous studies have shown that the incidence of CH occurrence ranges from 1:3,666 to 1:1,170 live births [11–14]. CH is the most common preventable cause of mental retardation among children [15–17]. Screening for CH allows early diagnosis and treatment, which in turn can prevent mental retardation, developmental delay and growth restriction. Studies have shown that if the disease is treated early within the first two weeks of life, the child will have a normal or nearly normal intellectual performance by the age of 6–12 years [16, 17]. In fact, recent studies among developing countries have found that the CH screening program is cost-effective in most countries [18].

In Malaysia, the CH screening program has been fully implemented nationwide since 2003 for all newborns in government hospitals [12]. This program aims to ensure that all newborns with CH can be diagnosed early and treated appropriately to prevent mental disability [1]. Implementation of program activities began with a sample collection until the initiation of treatment and follow-up, which involved the departments of obstetrics, pathology and pediatrics with assistance from health clinics. There are seven predetermined program indicators to monitor program performance. However, the program was reported as not achieving its quality assurance performance in terms of percentage of patients seen for confirmation and percentage of confirmed cases that received treatment within 14 days. Both indicators were set to be 100%. A recent study completed at Sarawak General Hospital achieved up to 94.8% for the first indicator and 33.3% for the second indicator [14]. A study conducted in UKM Medical Center a decade ago revealed the same finding [11]. Both studies agreed that the delay can be explained by the turnaround time at three different points. These were laboratory services level (time frame from when the cord blood samples were taken to the time the results were available), clinical service (pediatrics) level (time frame from when the cord blood results were available to the time reviewed by the pediatrics team) and subject level (time taken for a recalled case to return for retesting) [11, 14].

Program performance is influenced by the providers, clients or patients and program support environment. Poor performance at the national level can be due to poor program implementation. A survey carried out among healthcare professionals in Asian countries found that government prioritization, public education and acceptance, cooperation and involvement of healthcare providers are key factors for a successful screening program [19]. It is important to evaluate a healthcare provider's practice in implementing program activities. As far as is known, there are no studies available in terms of assessing the behavior of healthcare providers pertaining to the CH screening program implementation based on the behavior theories.

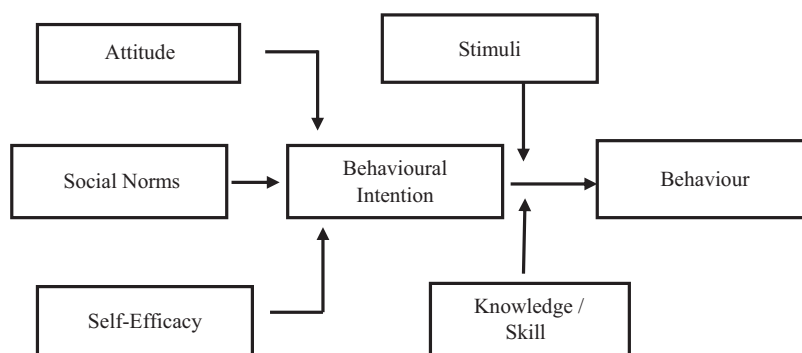
The Theory of Planned Behavior (TPB) can be applied to understanding the behavior of providers during program implementation. The TPB proposes a model regarding how human action is guided. It predicts the occurrence of specific behavior, provided that the behavior is intentional [20, 21]. TPB suggests that the intention of the individual to behave is determined by three main factors, namely, attitude towards behavior, subjective norms and perceived behavior control (PBC) [21]. The model for this theory is illustrated in Figure 1 where the factors mentioned above act as factors in determining behavioral intention, which subsequently affects the individual's actual behavior. Attitude is an individual's favorable or unfavorable feeling towards the behavior. Subjective norms are an individual's estimate of social pressure to perform or not to the target behavior. PBC is the extent to which a person feels capable of exhibiting such behavior. Several studies have applied this model to the behavior of health professionals, for example, to explore the behavior of doctors' adherence to clinical guidelines [22–26]. There are also studies that specifically assess the behavior of general practitioners in a primary care setting on using general clinical guidelines [27], prescribing and referral behavior [28, 29] and asthma guidelines [30]. Studies among nurses mostly focused on the nurses' intention to implement smoking cessation intervention [31–33], the intention of adherence to clinical guidelines and clinical practices [34–39] as well as health promotion programs [40, 41]. Two studies among pharmacists were found, focusing on prescription medication [42, 43].

The Attitude, Social Norms, Self-Efficacy (ASE) Model was based on the TPB model and supplemented with elements of the Social Cognitive Theory [21, 44–46]. Apart from the three determinants of behavioral intention, factors such as knowledge, skills and stimuli may play a role. ASE model suggests that individuals with greater knowledge, higher self-efficacy and positive attitude regarding an outcome of behavior are more likely to engage in the behavior as shown in Figure 2. The ASE model with TPB constructs is relevant for behavioral study. These models are widely used in the implementation of research to study the behavioral aspects of the use of guidelines by healthcare professionals [47–51]. The present study used TPB and ASE models to explain the behavior of healthcare providers in implementing newborn screening for CH. The present study aims to assess behavior toward program



**Figure 1.**  
Theory of planned  
behavior

Source(s): Ajzen in 1991 [21]



Source(s): De Vries, et al in 1988 [45]

Figure 2.  
Model ASE

implementation based on a framework protocol and its associated factors among healthcare workers in government hospitals and health clinics.

## Methodology

### *Study design and participants*

A cross-sectional study was conducted among healthcare workers in 12 government hospitals and 20 health clinics in the Perak state who were involved from receipt of sample stage to the initiation of treatment. It involved healthcare workers in hospitals (pathology and pediatric departments) and health clinics. For pediatrics and health clinics, the participants involved were medical officers and nursing staff, while in the pathology department, science officers and medical laboratory technicians (MLTs) were involved. In order to have enough participants in all of the job categories based on sample size calculation, two sampling methods were applied. Participants from hospitals were selected using the purposive sampling method, whereas the multistage random sampling method was used for the recruitment of health clinic workers. A total of 421 healthcare workers who implemented the program participated in this study.

### *Instruments and measures*

Research data were gathered using a validated and reliable self-administered questionnaire. It consisted of 75 items and was constructed based on literature reviews [52–55], TPB [21, 56] and the ASE Model [44–46]. The questionnaire was developed to assess attitude, PBC, knowledge, behavior intention and adherence to protocol. The reliability test based on Cronbach's alpha ranged from 0.72 to 0.89. The questionnaire consisted of demographic data, providers' characteristics and the occupational profile of participants. Attitude referred to workers' feelings or opinions toward adherence to the implementation of the program and its importance. The attitude domain consisted of 14 items and ranged from (1) least important to (7) highly important. PBC was defined as the overall evaluation of the degree to which workers believed that a screening program for CH can be implemented as recommended. It consisted of six items and ranged from (1) strongly disagree to (7) strongly agree. Regarding knowledge, this aspect referred to the score of knowledge items related to the screening program, symptoms and consequences of CH. It consisted of five items assessing knowledge of the screening program, four items on symptoms of the disease and four items on consequences of the disease. Behavioral intention referred to how likely workers intended to adhere to protocol in implementing the program activities. It measured the general intention of workers that led to

adherence. It included four items including compliance to time frame, case management, guideline implementation and cooperation and ranged from (1) least likely to (7) most likely. Adherence to protocol measured compliance to protocol based on the framework protocol of the program. Framework protocol was developed to assist in the implementation of the guideline. It consisted of four main activities in pathology, pediatric and health clinics. There were two items that measured the adherence of each activity in terms of compliance with case management and time frame. In total, there were eight items for each of the facilities and participants provided their answers according to their own workplace.

#### *Ethical consideration*

Approval for this study was obtained from the following: (1) Research and Ethics Committee, Medical Faculty, National University of Malaysia (FF-2017-222, 22 May 2017); (2) Medical Research and Ethics Committee, Ministry of Health Malaysia (NMRR-16-2775-33531 IIR, 14 August 2017); (3) Deputy State Health Director (Public Health) of Perak State; (4) Deputy State Health Director (Medical) of Perak State; (5) respective Hospital Director in Perak State and (6) respective District Health Officer in Perak State.

#### *Data collection*

Data collection was carried out from October to December 2018. A brief description and the purpose of the study were given to the participants. Written consent was taken from participants who agreed to participate. Validated and reliable self-administered questionnaires were then distributed to the participants after agreement was received. All participants had to complete the questionnaires individually and then submit it to the researcher or focal person in the organization on the same day.

#### *Data analysis*

The first part of the analysis included an item analysis section for the full-scale study. Thereafter we analyzed the data to measure intention to adhere and determine its associated factors. Following that, was the analysis of adherence to protocol in order to determine the relationship between intention and adherence to protocol. Data were analyzed by using SPSS, version 21. For descriptive analysis, nominal data were presented as frequency and percentage. All parametric data were presented with mean and standard deviation. Meanwhile, non-parametric data were presented as the median and interquartile range (IQR). For categorical independent variables, the Chi-square test was used. For independent variables presented in continuous data, the independent *t*-test was used if there was a normal distribution. The Mann–Whitney test was used for independent variables that had abnormal distribution. Multiple logistic regression analysis was used to describe the strength of association between outcome and factors of interest, adjustment of covariates or confounders and to determine predictor variables for intention to adhere. A significant level was set at  $p < 0.05$ . However, for bivariate analysis on intention and adherence to protocol according to facilities, a significant value of  $p < 0.1$  was set for pathology based on the calculated sample size.

## **Results**

421 healthcare workers participated with a response rate of 93.6%. For the attitude construct, PBC and behavioral intention, the Cronbach's alpha (CA) was 0.88, 0.80 and 0.98, respectively. For the knowledge construct, the calculated Difficulty Index was 78.6, which was easy, and the Discriminant Index was 0.36, which was useful in differentiating those who were knowledgeable and those who were uninformed. This gave the value of Kuder–Richardson at 0.64, which was reliable.

**Table I**, the majority of participants were women (93.6%) and aged between 24 years and 61 years (mean age: 36 years). Of them, 45.1% were from health clinics, 42.0% from pediatrics and 12.8% from the pathology unit. The prevalence of having a determined attitude was 57.2% with mean scores for PBC at 34.39. Regarding knowledge, the overall mean score was 10.22. The mean score for knowledge on the screening program, symptoms and consequences of the disease were 4.77, 2.74 and 2.71, respectively. Knowledge of the participants on the screening program was slightly better compared to knowledge on symptoms and consequences of the disease.

*Intention to adhere*

In terms of the intention to adhere, most participants (74.3%) had shown full intention (**Table I**). Bivariate analysis showed significant relationships with intention to adhere for training or CME ( $p = 0.009$ ), attitude ( $p = 0.001$ ), PBC score ( $p < 0.001$ ) and knowledge score ( $p = 0.003$ ) as shown in **Table II**. Multivariate analysis (**Table III**) showed that a weak attitude (AOR: 5.48, 95% CI: 3.32–9.06), low PBC score (AOR: 0.91, 95% CI: 0.86–0.95) and having a low knowledge score (AOR: 0.85, 95% CI: 0.75–0.96) were associated with partial intention to adhere to protocol.

*Adherence to protocol*

**Table IV**, all four activities used to assess adherence in pediatrics showed that more than 25% did not adhere, and the recall for confirmation test had the highest percentage of nonadherence (59.3%). Overall, 20.9% of participants showed adherence to all four activities (score 4). Thus, 79.1% of participants were considered as not adhering to the protocol. The

Variables		n (%)	Mean (SD)	Min, max
Age (Years)			36.49 (7.03)	24, 61
Gender	Female	394 (93.6)		
	Male	27 (6.4)		
Education level	Degree & master	71 (16.9)		
	Diploma	240 (57.0)		
	Certificate	110 (26.1)		
Type of facilities	Health clinic	190 (45.1)		
	Pathology	54 (12.8)		
	Pediatric	177 (42.0)		
Training / CME	Yes	130 (30.9)		
	No	291 (69.1)		
Awareness on availability of guideline	Yes	373 (88.6)		
	No	48 (11.4)		
Used of guideline	Yes	351 (83.4)		
	No	70 (16.6)		
Awareness of monitoring by coordinator	Yes	318 (75.5)		
	No	103 (24.5)		
Attitude (14 items)	Strong	241 (57.2)		
	Weak	180 (42.8)		
PBC score (6 items) (range score: 6–42)			34.39 (4.52)	18, 42
Knowledge score (13 items) (range score: 0–13)			10.22 (1.96)	3, 13
(1) Screening program (5 items) (range score: 0–5)			4.77 (0.58)	1, 5
(2) Symptoms (4 items) (range score: 0–4)			2.74 (1.042)	0, 4
(3) Consequences (4 items) (range score: 0–4)			2.71 (1.065)	0, 4
Intention (4 items)	Full	313 (74.3)		
	Partial	108 (25.7)		

**Table I.**  
Descriptive data for sociodemographic, occupational, providers' characteristics, attitude, PBC, knowledge and intention to adhere

**Table II.**  
Bivariate analysis  
between study  
variables with  
intention to adhere

Variables	Intention to adhere		$\chi^2$ (df)	<i>t</i>	<i>p</i> -value
	Full (%)	Partial (%)			
Age (Years)*	35.99 (6.562)	36.66 (7.182)		0.848	0.397
Gender	Female	292 (74.1)	102 (25.9)	0.134 (1)	0.715
	Male	21 (77.8)	6 (22.2)		
Education Level	Diploma & above	236 (75.9)	75 (24.1)	1.838 (1)	0.175
Type of facilities	certificate	77 (70.0)	33 (30.0)	0.783 (2)	0.676
	Health clinic	144 (75.8)	46 (24.2)		
	Pathology	39 (72.2)	15 (27.8)		
Training / CME	Pediatric	130 (73.4)	47 (26.6)	6.803 (1)	0.009
	Yes	106 (81.5)	24 (18.5)		
Awareness on availability of guideline	No	207 (71.1)	84 (28.9)	1.060 (1)	0.303
	Yes	280 (75.1)	93 (24.9)		
Used of guideline	No	33 (68.8)	15 (31.2)	0.513 (1)	0.474
	Yes	263 (74.9)	88 (25.1)		
Awareness of monitoring by coordinator	No	50 (71.4)	20 (28.6)	1.751 (1)	0.186
	Yes	241 (75.8)	77 (24.2)		
Attitude	No	72 (69.9)	31 (30.1)	51.7 (1)	<0.001
	Strong	210 (87.1)	31 (12.9)		
Weak	Strong	103 (57.2)	77 (42.8)		
	Weak	103 (57.2)	77 (42.8)		
PBC score*	34.93 (4.122)	32.78 (5.252)		3.825	<0.001
Knowledge score*	10.39 (1.946)	9.73 (1.905)		3.041	0.003

**Note(s):** \*Independent *t*-test: Mean (SD)

**Table III.**  
Multiple logistic  
regression for  
determinant of  
intention to adhere

Variables	<i>B</i>	SE	AOR	95% CI
Constant	3.035	1.120	20.802	
<i>Attitude</i>				
Strong	1			
Weak	1.701	0.256	5.480	3.32–9.06
PBC score	–0.100	0.027	0.905	0.86–0.95
Knowledge score	–0.163	0.063	0.850	0.75–0.96
Nagelkerk R square	0.239			
Hosmer lemeshow test	0.070			
Overall percentage	77.2			

assessment in pathology showed that the activity of the sample analysis had the highest percentage of nonadherence (51.9%). Overall, 38.9% of participants showed adherence to all four activities (score 4). Thus, 61.1% of participants were considered to have not adhered to the protocol. As for the health clinics, the activity of referring those who missed the confirmation test had the highest percentage of nonadherence (61.6%). Overall, 7.4% of participants showed adherence to all four activities (score 4). Thus, 92.6% of participants were considered as not adhering to the protocol. Bivariate analysis (Table IV) showed there were significant relationships between intention to adhere and adherence to protocol for health clinics ( $p = 0.033$ ) and pathology ( $p = 0.077$ ) (Table V).

### Discussion

The present study found that a fourth of healthcare workers (25.7%) partially intended to adhere to protocol of CH screening implementation. According to the facilities, partial intention was 11.2, 10.9 and 3.6% for pediatric, health clinics and pathology departments,

Activities	Case management <sup>a</sup>		Time frame <sup>b</sup>		Adherence <sup>c</sup>		Total score <sup>d</sup> n (%)
	1	0	1	0	1	0	
<i>Pediatric</i>							
1. Screening for missed newborns	144 (81.4)	33 (18.6)	133 (75.1)	44 (24.9)	130 (73.4)	47 (26.6)	Score 0: 24 (13.6)
2. Recall for confirmation test	134 (75.7)	43 (24.3)	76 (42.9)	101 (57.1)	72 (40.7)	105 (59.3)	Score 1: 48 (27.1)
3. Performed confirmation test	141 (79.2)	36 (20.8)	92 (52.0)	85 (48.0)	92 (52.0)	85 (48.0)	Score 2: 21 (11.9)
4. Initiation of treatment	136 (76.8)	41 (23.2)	85 (48.0)	92 (52.0)	85 (48.0)	92 (52.0)	Score 3: 47 (26.6)
<i>Pathology</i>							
1. Informed regarding rejected sample	49 (90.7)	5 (9.3)	43 (79.6)	11 (20.4)	43 (79.6)	11 (20.4)	Score 0: 4 (7.4)
2. Sample analysis	52 (96.3)	2 (3.7)	26 (48.1)	28 (51.9)	26 (48.1)	28 (51.9)	Score 1: 2 (3.7)
3. Validation of result	50 (92.6)	4 (7.4)	38 (70.4)	16 (29.6)	38 (70.4)	16 (29.6)	Score 2: 13 (24.1)
4. Informed abnormal screening result	52 (96.3)	2 (3.7)	47 (87.0)	7 (13.0)	47 (87.0)	7 (13.0)	Score 3: 14 (25.9)
<i>Health clinics</i>							
1. Verify TSH result	120 (63.7)	70 (36.3)	83 (43.7)	107 (56.3)	81 (57.4)	109 (42.6)	Score 0: 43 (22.6)
2. Screening for missed newborns	146 (76.8)	44 (23.2)	83 (43.7)	107 (56.3)	83 (43.7)	107 (56.3)	Score 1: 56 (29.5)
3. Referring those missed confirmation test	142 (74.7)	48 (25.3)	73 (38.4)	117 (61.6)	73 (38.4)	117 (61.6)	Score 2: 32 (16.8)
4. Ensure initiation of treatment	145 (76.3)	45 (23.7)	77 (40.5)	113 (59.5)	74 (38.9)	116 (61.1)	Score 3: 45 (23.7)

**Note(s):** <sup>a</sup>Compliance to Case Management: 1 (compliance), 0 (not compliance)

<sup>b</sup>Compliance to Time Frame: 1 (compliance), 0 (not compliance)

<sup>c</sup>Adherence by Activity: 1 (<sup>a</sup> + <sup>b</sup> = 2), 0 (<sup>a</sup> + <sup>b</sup> < 2)

<sup>d</sup>Total Adherence Score for Four Activities

**Table IV.**  
Pattern of adherence  
among participants



respectively. A higher prevalence of partial intention was documented for both pediatrics and health clinics compared to pathology. This is probably due to the fact that respondents for both pediatric and health clinic departments are doctors and nursing staff as compared to pathology where the respondents comprised science officers and MLTs. In addition to that, the pediatric and health clinic departments had almost identical scopes or roles in this screening program [1]. Specific comparisons could not be drawn as there was no previous study assessing the behavior of healthcare providers in implementing the CH screening program. Some previous studies, nevertheless, had looked into healthcare professionals' behavior in clinical practices and public health programs based on the TPB and ASE model. In a study conducted by Gagnon *et al.* [36] among nursing staff to examine their behavior in clinical practices, they found that respondents had a high intention of adherence to the tested clinical practice. Their findings are in tandem with the study conducted by Puffer and Rashidian [39] among British nursing staff. Puffer and Rashidian [39] evaluated the nursing staff's behavior in implementing the guideline of a smoking cessation program and found that 74.5% of the respondents had a high intention of adherence. Another study conducted on a group of doctors in Florida, USA, aimed to predict their behavior in complying with the clinical practice guidelines that are also consistent with the current research findings [22].

Multivariate analysis demonstrated that the variables in the final model explained that 24% of the variances in terms of intention to adhere and attitude were found to be the most significant determinant. This finding is in line with the TPB and ASE models in which attitude, PBC towards behavior and the individual's knowledge were factors determining the individual's behavioral intention. There are several other studies that have investigated healthcare professionals' behavior in implementing guidelines. For example, a research study carried out among doctors in Florida to predict their behavior in clinical practice guidelines found that PBC and attitude were the main determinants with regards to their intention [22]. Other research conducted in Thailand [57], Finland [26], USA [24], Iran [30], England [58, 59], Wales [29] and Canada [28] evaluated doctors' behavior in relation to health and clinical practices and showed similar findings. In contrast, Schellart *et al.* [60] who investigated Dutch doctors found that there was no significant relationship between attitude and behavioral intention. This is perhaps due to the behavioral intention items that were used. Moreover, the majority of research carried out among nursing staff expounded the extent the TPB model predicted the nurses' behavior. Similar to those studies that examined doctors, most of these studies found that attitude and PBC toward behavior were the main determinants among nurses.

In terms of adherence to protocol, this research found that percentages of nonadherence were higher among respondents from health clinics (92.6%), followed by pediatrics (79.1%) and then pathology (61.1%). This is similar to the initial hypothesis that formulated a high nonadherence to protocol among health clinic staff compared to hospital staff. As mentioned

**Table V.**  
Bivariate analysis  
between intention to  
adhere with adherence  
to protocol

Intention to adhere	Total adherence score		$\chi^2$ (df)	p-value
	Score <4 (%)	Score = 4 (%)		
<i>Pediatrics</i>				
Partial	39 (83)	8 (17)	0.583 (1)	0.445
Full	101 (77.7)	29 (22.3)		
<i>Pathology</i>				
Partial	12 (80.0)	3 (20.0)	3.118 (1)	0.077
Full	21 (53.8)	18 (46.2)		
<i>Health clinics</i>				
Partial	44 (95.7)	2 (4.3)	4.555 (1)	0.033
Full				

earlier, the prevalence of partial intention to adhere was 25.7%. There was a huge difference compared to the percentage of nonadherence to protocols. There are two possibilities that could explain the difference. First is the method used to measure behavioral intention. In this research, the general behavioral intention method was employed. This method is often used by researchers as it is simpler to implement and does not entail a longer time period and higher costs. Secondly, in evaluating the adherence of respondents, two components were tested, namely compliance of case management and compliance of the time frame for each activity. Four activities were evaluated. Respondents are considered to adhere to protocol if they obtained four adherence scores, which complied with both components for all four activities. This measurement has resulted in a higher percentage of nonadherence and is more prominent compared to the prevalence of partial intention to adhere.

In the present study, the targeted behavior is adherence to the framework protocol. Bivariate analysis revealed that there was a significant relationship between partial intention and adherence to protocol for health clinics and pathology. In implementing appropriate interventions, priority could be given to them. This is consistent with a study conducted by Liabsuetrakul *et al.* [57] among a group of obstetricians at three major hospitals in Thailand to assess the determinants of intention to use prophylaxis antibiotics during the postcesarean phase. They found that the respondents' behavioral intention was low and attitude was the most distinctive determinant of behavioral intention. Low behavioral intention contributed to the poor use of antibiotics. However, this research finding is different from the research carried out by Maue *et al.* [22] on a group of doctors in Florida, to predict their behavior in clinical practice guidelines. Although there was a significant relationship between attitude and PBC of behavioral intention, there was no significant relationship between behavioral intention and self-reported behavior. This was due to the use of a smaller sample size, namely 33 respondents, in the second phase of that research study.

Another important aspect of this research is the suitability of the tool used in measuring behavior. Using a self-reported behavioral measurement is quicker and easier. However, the healthcare system is not keen to change the behavior of self-reported healthcare providers. They are interested in changing the healthcare providers' actual behavior with the hope that this will increase their performance. The main advantage of using theory in the development of instruments to evaluate the behavior of healthcare providers is that outcomes such as intention and self-reported behavior could become a valuable proxy in evaluating actual behavior [61–63]. Behavioral intention is a valid proxy measurement for targeted behavior that could be employed in intervention development. Nevertheless, this depends mainly on the evaluated targeted behavior.

#### *Limitation of study*

In this study, self-rated adherence assessment was used in view of time constraints and budget allocation to make additional observations and documentation assessment. However, the items developed have been validated and were proven reliable. Additionally, this study focused only on healthcare providers without evaluating the perceptions and behavior of the patients. However, this did not affect the study as a basis for evaluating the implementation of the program activities.

#### **Conclusion**

The prevalence of partial intention to adhere to the framework protocol was at 25.7% with attitude, PBC and knowledge as the determinants. A high prevalence of nonadherence to the framework protocol was found in all the facilities with a significant association between intention and adherence to the protocol in the health clinics and pathology.

### Recommendations

Application of the TPB and ASE Models in assessing the behavior of healthcare providers in this study proved to be beneficial. For this reason, a training module should be made available to focus on improving knowledge, attitude and behavioral perception in implementing the program activities in order to improve program performance.

For future research, it is recommended that involving other Malaysian states using this validated instrument would be beneficial in order to understand the program implementation across Malaysia. To improve the validity of the data, additional observations and documentation assessment would be helpful. Evaluating the perceptions and behavior of the parents of patients is a further recommendation that would provide a more comprehensive assessment.

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