ORIGINAL ARTICLE

Investigating Emergency Department Healthcare Professionals' Intention to Use the Poison Information System

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ABSTRACT

Introduction: The objective of this paper is to investigate the behavioural intention to use the Poison Information System (PIS) among healthcare professionals based on the extension of the Technology Acceptance Model. **Methods:** A quantitative approach used a five-point Likert scale questionnaire adapted from previous research. Data were obtained from 136 health professionals working in the Emergency Department of public hospitals in Malaysia. **Results:** A multiple linear regression model showed that approximately 40% of the variation in intention to use was related to positive attitude, staff category, and inversely to computer anxiety. Perceived usefulness, perceived ease of use, and computer usage were related to intention to use, but their correlation was accounted for by positive attitude, staff category, and computer anxiety. A factor analysis grouped positive attitude, intention to use, and perceived usefulness on Factor I and perceived ease of use, inverse computer anxiety, and computer habit on Factor II. Cluster analysis indicated three clusters. Gender, age, experience, and staff category were strongly inter-related; intention to use clustered with perceived ease of use and perceived usefulness; positive attitude clustered with computer habit; and the latter two clustered together. **Conclusion:** These findings show that positive attitude, staff category, and computer anxiety of healthcare professionals, working in emergency departments, may have the greatest effect on PIS usage.

Keywords: Intention, Poison Information System, Health Care Professionals, Emergency Departments

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INTRODUCTION

Poisoning means exposure to natural or synthetic substances that contribute to structural or functional damage to the body. The incidence of poisoning is a global issue affecting people of all ages and a wide range of chemicals. Since the occurrence of poisoning, particularly those caused by accidental exposure, is likely to be inevitable, the most likely safety measure to be studied in each case is to provide information and advice on the diagnosis, identification, treatment and prevention of human and animal poisoning and associated toxic agents (1).

Emergency poisoning is a frequent cause of admission in Emergency Departments (EDs) and, in some circumstances, dealing with cases can be very challenging. Health care providers attending to poisoned patients may experience life-threatening conditions when medical attention and emergency response are needed to stabilise their patients but do not at the same time protect them from potential poisoning or exposure. In some cases, the substance involved in the incidence of poisoning has not been identified, and reliable and accurate sources or services for further investigation, recognition, or confirmation of the substance need to be consulted. Reliable toxicity and clinical knowledge is needed to guide clinicians in the management of each poisoning case. Efficient chemical databases offer an added advantage to all toxicological emergency services.

The health environment is now having a significant impact on health professionals and patients. A doctor's resentment may be based on their view of administrative and high patient loads and their loss of control over patient care decisions (2). The Internet and digital platforms are examples of information technology that promise improved patient care services and enhance the healthcare process, such as patient assessment and therapeutic care. Zakaria and Mohd Yusof (3) have shown that acceptance and implementation of the hospital information system (HIS) can improve medical quality, efficiency, and the reduction of errors.

A Poison Information System (PIS) is part of an essential health information system for maximum toxico-vigilance capacity. The national poison centre mainly uses PIS to collect, organised and analyse poisoning cases. Toxicity and exposure data in every country are obtained mainly from poisoning poison centres that offer diagnosis, prognosis, treatment, and prevention of toxicity to chemical and other agents, as well as to human and animal hazards. As the poisoning cases are managed locally within the country and lead by the national poison centre, the poison centre has its own PIS. Even though the PIS are varied by poison centres or country, the development of PIS usually based on the guideline by WHO for data harmonisation. Examples of existing PIS are SINITOX in Brasil, TOXBASE in UK, AfriTox in South Africa and INTOX database management system by World Health Organisation. Some of the poison centres do not have their own PIS and depend on external sources. PIS could function as a data registry, database references or information retrieval.

However, the implementation of a PIS is still in the early stage of development in Malaysia. Even though most of the hospitals in Malaysia use HIS for delivering their services, this mostly focuses on health services like clinical, laboratory, pharmacy, nursing, or radiology (4). For poisoning cases, doctors usually will contact the poison centre for consultation and information to manage their cases. A PIS is expected to be used by pharmacists to improve the early management of poisoning cases, before expanding to be used by other health care professionals in the hospital. Recent information on surveillance of poisoning is not widely distributed (5). Health professionals are somewhat less exposed to the complete distribution of poison in the country, and in cases where the situation is undesirable, patients may take legal action. The data collected through the PIS will help analyse poisoning occurrences, identify the toxic risk among the community and the current trend or new poison/agent. With this information, the poisoning database are always updated and improved throughout the time. Hence, the HPs could retrieve the latest poisoning information for the case management. It will improve the HPs knowledge on handling the poisoning cases during emergencies.

Although numerous studies have been conducted on hospital health information systems, there are few PIS studies. McLean et al. (6) stated that the British Columbia Drug and Poison Information Centre provides information using an electronic database system to track case data and case information as a possible source of population-based information on health services and their health status. The role of the centre, its presence, efficiency, and recognition are at the heart of the performance of the poison information centre (7). Most of the studies of poisoning explain the technical aspects, indicating the number of cases recorded, the methods used to manage cases of poisoning, the effects of medications, and the admission of poisoning (8, 9).

The aim of this paper is therefore to examine factors affecting the use of PIS among ED health professionals, in particular in Malaysia. The extensions of the Technology Acceptance Model (TAM) were used as the underlying theory for the analysis. The original TAM comprises four constructs: perceived ease of use, perceived usefulness, attitude to use, and behavioural intent to use. Two factors related to computer anxiety and computer habit have been added in this investigation. Griebel et al. (10) suggested these factors as relevant to acceptance of health research technology systems. Understanding behavioural intention to use by healthcare professionals should provide evidence to guide the evolution and increased value of PIS of the Malaysian National Poison Centre (NPC).

MATERIALS AND METHODS

Ethical approval

Ethical approval of the study was granted by the Universiti Sains Malaysia Ethics Committee under the protocol code USM/JEPem/1804210.

Study location

The locations of the research were (1) Pulau Pinang Hospital, (2) Seberang Jaya Hospital, (3) Balik Pulau Hospital, (3) Kepala Batas Hospital and (4) Bukit Mertajam Hospital. The rationale for selecting the locations of the study was based on the fact that the majority of cases of poisoning reported to the Malaysian Poison Centre derive from public hospitals. In this study, the Penang State was chosen as the area of inquiry, as it is one of the states with the highest number of cases of poisoning in Malaysia (11).

Sample size estimation

The sample size was estimated using G*Power version 3.1.3 with the following parameters: linear multiple regression a priori test, one tail, 0.15 effect size, 5% level of significance, 95% power, and 4 predictors. The minimum sample size required was 74 participants.

Sampling method

This study adopted a non-probability sampling method with purposive sampling, allowing the identification of participants likely to provide detailed and relevant data. For this study, only health professionals and pharmacists involved in poisoning cases were selected.

Survey questionnaire

Section A consisted of six demographic questions including gender, age, staff category, and work experience.

Section B consisted of items adapted from previous studies. Questions concerning intent to use, perceived usefulness, and perceived ease of use were adapted from Wu et al (12). Questions concerning attitude towards PIS, computer habits, and computer anxiety were adapted from Ifinedo (13). Each item was measured using a 5-point Likert scale (14) from “Strongly Disagree” to

Strongly Agree". Responding to the questionnaire took about 10 minutes for each participant. Table I shows 24 measurement items adapted in this study.

Table I: Questionnaire items

Intention to Use (IU)	
1.	I intend to use PIS in my practice as often as needed.
2.	Whenever possible, I intend to use PIS in my practice.
3.	I estimate that my chances of using PIS in my practice are frequent.
Perceived Usefulness (PU)	
1.	Using PIS would improve my performance in the healthcare practice.
2.	Using PIS would enhance my effectiveness in the healthcare practice.
3.	I would find PIS useful in the healthcare practice.
Perceived Ease of Use (PEOU)	
1.	Learning to use PIS would be easy for me.
2.	I would find it easy to get PIS to do what I want it to do.
3.	It would be easy for me to become skilful at using PIS.
QB2: Attitude (ATT)	
1.	Using PIS is a good idea.
2.	PIS make work more interesting.
3.	Working with PIS is fun.
4.	In general, I like working with PIS.
QB6: Computer habit (HAB)	
1.	I use computers as a matter of habit.
2.	Using computers has become automatic to me.
3.	Using computers come naturally to me.
4.	Using computers has become a habit for me.
QB7: Computer Anxiety (AXT)	
1.	I feel apprehensive about using computers.
2.	It scares me to think that I could lose vital information using computers by hitting the wrong key.
3.	I have a fear of computers.
4.	I hesitate to use computers for fear of making mistakes that I cannot correct.
5.	In general, computers are intimidating to me.
6.	I am nervous anytime I find myself sitting behind computers.
7.	Computers make me feel uneasy.

Data collection

Voluntary participants were recruited through selected hospital representatives. A letter of support from Universiti Sains Malaysia, Penang, and details of the study including an explanation of PIS and questionnaires were sent to the hospital management of the respective hospitals in Penang. The explanation of the PIS provided a brief introduction about PIS as none of the participants had ever use PIS. The participating hospitals distributed a paper copy of the questionnaire directly to their health professionals and pharmacists involved in poisoning cases. It was considered that a paper, rather than an electronic, questionnaire was more beneficial for this study due to the small, specific target population, and that the response rate would be higher. The time allotted was approximately three weeks to complete and collect questionnaires from all hospitals.

Each participant gave informed written consent after being advised of the confidentiality, privacy, storage, and processing of their data in terms of the study's ethical approval.

Data analysis

The data was analysed using the IBM Statistical Package for Social Sciences (SPSS) software version 24. The Type I error rate was set at the conventional 5% level.

RESULTS

Profile of the participants

Completed questionnaire were collected from 150 health professionals in selected Malaysian public hospitals who were doctors and health professionals responsible for poisoning cases in the Emergency Department. Those without experience in managing poisoning cases (n = 14) were excluded, leaving 136 (90.6%).

Table II shows the demographic profile of the 136 participants. Overall, 73 of them were male (53.7%), while 63 of them were female (46.3%). The majority were 21-30 years of age (58.1%), 39.0% were 31-40 years of age, and only 2.9% were 41-50 years of age. There was no participant above 50 years of age. The staff category analysis showed 62 medical doctors/officers (45.6%), 1 medical specialist (0.7%), 38 houseman doctors/officers (27.9%), 19 medical assistants (11.4%), 12 nurses (8.8%), and 4 others (2.9%). Ninety-six participants reported work experience of fewer than five years (70.6%); and 40 had five years or more (29.4%).

Reliability

Reliability analysis showed that Cronbach Alpha for intent to use was 0.899, positive attitude was 0.892, computer habit was 0.922, perceived usefulness was 0.881, perceived ease of use was 0.876, and computer

Table II: Demographic profile of respondents

Demographic Variables		Frequency	Percentage
Gender	Male	73	53.7
	Female	63	46.3
	Total	136	
Age	21-30	79	58.1
	31-40	53	39.0
	41-50	4	2.9
	Total	136	
Staff Category	Medical specialist	1	.7
	Medical doctor / officer	62	45.6
	Houseman doctor / officer	38	27.9
	Nurse	12	8.8
	Medical Assistant	19	14.0
	Others	4	2.9
	Total	136	
Working Experience	Less than five years	96	70.6
	Equal or more than five years	40	29.4
	Total	136	

anxiety was 0.962. These values suggested that these variables were consistent and accurate, exceeding the appropriate value of 0.7.

Correlations between variables

Table III shows the correlation matrix between the variables. In particular, intention to use correlated with positive attitude ($r = .54$, $p < .01$), perceived usefulness ($r = .37$, $p < .01$), computer habit ($r = .28$, $p < .01$), computer anxiety ($r = -.27$, $p < .01$), perceived ease of use ($r = .25$, $p < .01$), and age ($r = .19$, $p < .05$), while there was no significant correlation with gender, staff category, or work experience.

Multiple linear regression analysis

A forward multiple linear regression (MLR) model, shown in Tables IV, V, and VI, used the study variables as predictors for intention to use. The three variables of positive attitude, staff category, and inverse computer anxiety contributed significantly to intention to use, $F(3, 130) = 28.3$, $p < .001$), representing 38% of its variance (adjusted R square .38). None of the remaining variables entered the MLR model as significant predictors of intention to use.

Factor analysis

While MLR showed staff category, positive attitude, and computer anxiety as significant predictors, perceived usefulness, computer habit, perceived ease of use, and age were also significantly associated with intention to use. Factor analysis and hierarchical cluster analysis were carried out with the aim of expanding the understanding of these variables in influencing intention to use.

Table VII shows the results of a principal axes factor analysis with two factors extracted and rotated. Factor I showed loadings above 0.4 of intention to use along with positive attitude and perceived usefulness, while

Table IV: MLR Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
3	.628c	.395	.381	1.087

c. Predictors: (Constant), Attitude, Staff Category, Computer Anxiety
Dependent Variable: Intention to Use

Table V: MLR ANOVA Summary

	Model	Sum of Squares	df	Mean Square	F	p
	Regression	100.335	3	33.445	28.287	.000[d]
3	Residual	153.705	130	1.182		
	Total	254.040	133			

d. Predictors: (Constant), Attitude, Staff Category, Computer Anxiety

Table VI: MLR coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	p.
	b	Std. Error	Beta		
(Constant)	3.488	.883		3.948	.000
Attitude	.425	.051	.581	8.278	.000
Staff Category	.191	.067	.215	2.867	.005
Computer Anxiety	-.039	.017	-.172	-2.337	.021

a. Dependent Variable: Intention to Use

Table VII: Rotated factor matrix

Variables	Factor	
	I	II
Attitude	.965	.061
Perceived Usefulness	.484	.330
Perceived Ease of Use	.329	.622
Computer Habit	.249	.624
Computer Anxiety	-.034	-.405
Intention to Use	.528	.260

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations

Table III: Pearson product-moment correlation coefficients for intention to use with nine predictor variables

Variables	Gender	Age	Staff Category	Working Experience	Intention to Use	Attitude	Perceived Usefulness	Perceived Ease of Use	Computer Habit	Computer Anxiety
Gender	1	-.202*	.013	-.115	-.128	-.198*	-.144	-.012	.020	.095
Age	-.202*	1	.122	.646**	.188*	.232**	.266**	.274**	.003	-.023
Staff Category	.013	.122	1	.118	.157	-.205*	-.026	-.059	.031	-.355**
Working Experience	-.115	.646**	.118	1	.057	.163	.302**	.148	-.118	.021
Intention to Use	-.128	.188*	.157	.057	1	.543**	.369**	.247**	.280**	-.268**
Attitude	-.198*	.232**	-.205*	.163	.543**	1	.504**	.339**	.310**	-.034
Perceived Usefulness	-.144	.266**	-.026	.302**	.369**	.504**	1	.493**	.274**	-.076
Perceived Ease of Use	-.012	.274**	-.059	.148	.247**	.339**	.493**	1	.482**	-.217*
Computer Habit	.020	.003	.031	-.118	.280**	.310**	.274**	.482**	1	-.295**
Computer Anxiety	.095	-.023	-.355**	.021	-.268**	-.034	-.076	-.217*	-.295**	1

**. Correlation is significant at the 0.01 level (2-tailed), *. Correlation is significant at the 0.05 level (2-tailed).

the orthogonal Factor II showed loadings of perceived ease of use, computer habit, and inverse computer anxiety.

Cluster analysis

A hierarchical cluster analysis of average linkage between groups indicated three clusters of variables. Gender, age, experience, and staff category formed one cluster. Intention to use clustered with perceived ease of use and perceived usefulness to form a second cluster. Positive attitude and computer habit formed a third cluster, and this then joined the second cluster. Computer anxiety joined the second and third clusters at a relatively larger linkage distance.

DISCUSSION

All five predictor variables were significantly associated with intention to use and, with the exception of gender, staff category and work experience, were all significantly interrelated. This result was supported by the proven theoretical underpinning of TAM and complemented by Griebel et al (10). All of the considerations suggested in this study demonstrate the interaction of ED health professionals with the intention to use PIS. Results also indicate that the demographic variable age is significantly associated with intention to use. The association of factor age and intention to use was also shown in the previous studies investigating the intention of use new technology and considered as moderating effect (15). The findings are supported by Vasantha et al (16). While their research indicated that age was not substantially associated with intention to use, they argued that different age groups have different levels of acceptance of new technology. This indicates that MPC should consider the design and affordability of PIS to maximise use by different age groups.

Furthermore, MLR showed that three variables were the most significant contributors to intention to use, accounting for almost 40% of the intention to use variance; positive attitude, staff category, and inverse computer anxiety.

Positive attitude is a conviction that the performance of actions will contribute to a particular outcome (17). This study showed that ED health professionals believe that using PIS may lead to functional outcomes in the management of poisoning cases. These results endorse Albarracнn et al. (18) as a mindset that is central to understanding and explaining the use of behavioural intention, and suggests that MPC should highlight the following aspects in the implementation of a PIS: making adequate information accessible, integrating multi-functional and challenging features, providing user-friendly interface design, and ensuring system information changes in a timely manner so that it contributes towards a positive feeling about the efficiency and usefulness of the PIS.

Staff category was found to significantly affect healthcare professionals' intention to use PIS, where staff category such as doctors was more likely to report higher intention to use than another staff category such as nurses and medical assistants. This suggests that various backgrounds and professional cultures may play a significant role in influencing intention to use PIS in an ED setting. This finding is supported by Vitari and Ologeanu-Taddei (19). The relationship between the staff category and intention to use PIS is related to the staff role since the ED setting reflects a hectic environment in which complex evaluations and decisions must be taken rapidly. While most cases of hospital poisoning are still commonly referred to as MPC by telephone calls (20), the development of a PIS will promote and accelerate communication between and amongst MPC and healthcare professionals, and this would be needed regardless of their staff category and role.

The study revealed that intention to use PIS was significantly associated with inverse computer anxiety, where less anxious participants were more likely to report higher intention to use than those who reported more anxiety. Computer anxiety refers to emotional reactions such as trepidation, concern, hesitation about damaging the device, or humiliation (21). Keikhosrokiani et al (22) found that use of computer technology may not trigger computer anxiety in stressful working situations, but this does not directly contradict the study findings. The study findings suggest that particular attention may need to be given to the PIS user interface and training in its use in order for it to lead to a positive outcome for all professionals in the healthcare industry.

Interestingly, a more nuanced view of the variables associated with intention to use was given by the factor analysis. Factor I represented intention to use and showed high loadings with positive attitude, and perceived usefulness. As with the MLR, intention to use was thus associated with positive attitude, but perceived usefulness was now added. Unsurprisingly, positive attitude was consistently associated with positive behavioural change (23), which suggests that increased and more intensive use of PIS would make PIS more useful among the healthcare professionals as long as their maintained a positive attitude towards a PIS.

On the other hand, computer anxiety loaded negatively on Factor II which represented perceived ease of use and computer habit. This may better reflect the functional importance of computer anxiety as being more related to lack of computer usage and a perception of difficulty of use.

The cluster analysis showed gender, age, and experience grouped together. While studies by Alam et al. (24) and Venkatesh et al. (25) have confirmed that demographic differences have an impact on the intention to use technology, this was not very clearly signalled in the results of this study, where these three demographic variables did not cluster with the TAM and expanded TAM variables. Given the challenging work conditions of the EDs, it may be helpful to know that gender, age, and experience do not seem to be particularly important factors in the development of a personalised PIS.

The cluster analysis showed intention to use clustered with perceived ease of use and perceived usefulness. The TAM theory is supported by this finding. Therefore, the intention to use can be associated with the usefulness and ease of use of the PIS, and this indicates that the PIS should be developed accordingly.

The cluster analysis showed positive attitude clustered with computer habit, suggesting that positive attitudes are associated with higher computer use in the way they influence behaviour change and intention to use, in turn leading to towards using technology (26). As with the other results, this suggest that the more health professionals have positive attitude towards PIS, the more frequently they will use it (27).

A final finding of the cluster analysis was the apparent failure of computer anxiety to join any of the clusters, in apparent contraction to the MLR and factor analysis findings. The failure is resolved, however, by the observation that computer anxiety was inversely related to most of the other variables in the study, and that cluster analysis using distance measures does not accommodate negative correlations very well.

The uniqueness of this research is its focus on a PIS. TAM was used to investigate the factors influencing the behavioural intention to use PIS among health professionals in Penang. This research can help policy makers establish practical security and control policies that would strengthen government portals and websites that health professionals use. The research can also help PIS developers identify areas that need particular attention in design, programming, and testing. Ultimately, these contributions would be expected to increase the acceptance and use of PIS by health professionals in the future.

CONCLUSION

A PIS may be expected to facilitate the search by health agencies, medical officers, pharmacists and other personnel of healthcare to find appropriate toxicology information, monitor and report poisoning cases, and improve the quality and efficacy of toxicological data management and poisoning case management. The study shows that positive attitude, more senior staff category, and lower computer anxiety are the most significant predictors of the use of a PIS by health professionals. This research provides empirical evidence to support the development and implementation of any new PIS. Initiatives to raise awareness and transfer knowledge based on these findings may help users to understand the importance of a new PIS. These results provide an opportunity for potential new PIS users, including the Ministry of Health, the Ministry of Safety and Health and other health industries, to implement innovative policies and strategies to enhance PIS adoption in ED settings.

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