The University Of Sheffield.

Factors Influencing Attitudes towards, and the Use of, Information Technology in the Emergency Department

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Ph.D. Thesis

Department of Information Studies

March 2010

Volume 2

systems in the future. The results of the current study also revealed that a number of factors might influence users' attitudes towards using information systems, and subsequent IT utilisation in the ED. Figure 4.5 illustrates the proposed model based on the results of the study.

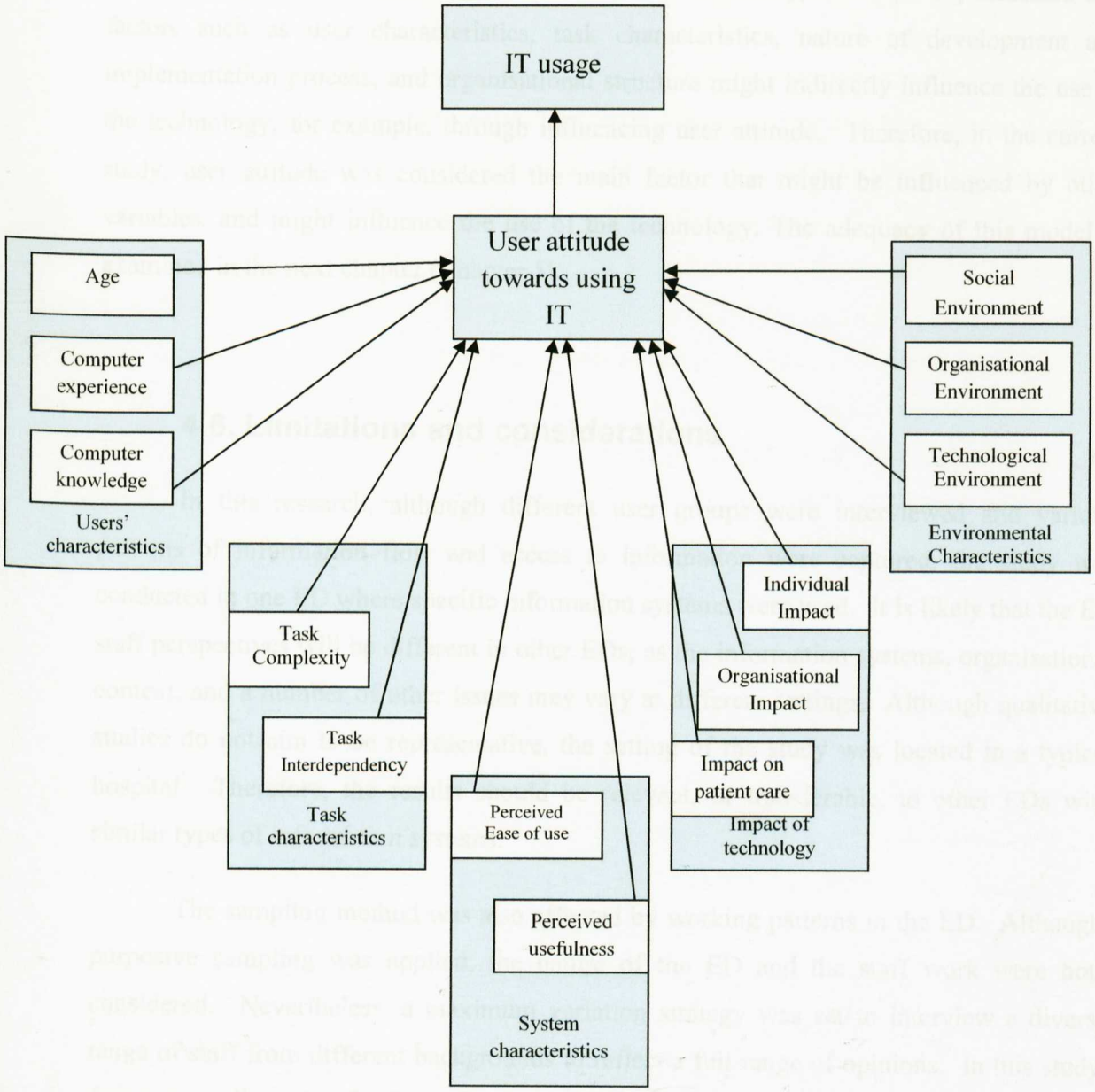

Figure 4.5- A proposed model for factors influencing users' attitudes towards, and the use of, IT in the ED

Figure 4.5 was constructed based on the Technology Acceptance Model (TAM) (discussed in Chapter 2). However, TAM model only shows how the use of technology can be influenced by system characteristics and user attitude (Davis, 1993) and does not consider other influential factors. The results of the qualitative study showed that users' attitudes might be affected by many other factors. Similarly, Davis (1989) indicated that factors such as user characteristics, task characteristics, nature of development and implementation process, and organisational structure might indirectly influence the use of the technology, for example, through influencing user attitude. Therefore, in the current study, user attitude was considered the main factor that might be influenced by other variables, and might influence the use of the technology. The adequacy of this model is examined in the next chapter (Chapter 5).

4.6. Limitations and considerations

In this research, although different user groups were interviewed and various patterns of information flow and access to information were captured, the study was conducted in one ED where specific information systems were used. It is likely that the ED staff perspectives will be different in other EDs, as the information systems, organisational context, and a number of other issues may vary at different settings. Although qualitative studies do not aim to be representative, the setting of the study was located in a typical hospital. Therefore, the results should be relevant, or transferable, to other EDs with similar types of information systems.

The sampling method was also affected by working patterns in the ED. Although, purposive sampling was applied, the nature of the ED and the staff work were both considered. Nevertheless, a maximum variation strategy was set to interview a diverse range of staff from different backgrounds to reflect a full range of opinions. In this study, data were collected and analysed only by the researcher, as this was the nature of doing Ph.D. and the resources were limited. However, to reduce the risk of bias and the effect of the researcher's own background and knowledge, the process of data collection and data analysis were discussed with the research supervisors who were more experienced. The

validity of results was also checked by sending a summary of the findings to the participants and obtaining their comments on that, as noted in section 4.2.9.

4.7. Further research

In order to test the generalisability of the findings to the population of ED staff, a larger-scale quantitative study using a representative sample would be needed. Applying quantitative methods in a wider population can help to validate the study findings. While this study showed that a number of factors might influence users' attitudes towards, and the use of, IT in the ED further research could be conducted to verify the association between, and the importance of, these factors in the proposed model (Figure 4.5). These will help to gain an in-depth understanding of the subject of study. In addition, repeating this study in other EDs could identify important issues that were not relevant to the setting of the current study. Moreover, by introducing new systems to the ED, new issues may raise. For example, when conducting this research, E-film had only just been introduced. Further research is needed to investigate different aspects of this system from users' perspectives.

4.8. Conclusion

In this chapter, the details of the first phase of the research were described. For this part of the research, a qualitative approach was chosen to gain a better understanding of users' perspectives about using IT in the ED. Semi-structured interviews were chosen as an appropriate method, and data were analysed using the framework analysis method. Apart from the main themes that emerged from data analysis, the main findings were summarised as a model consisting of several constructs including the characteristics of users, their tasks, systems, environment, and the impact of technology. However, further research was needed to verify the association between different factors, users' attitudes, and subsequent IT usage in other EDs. Therefore, in the second phase of the research, a quantitative study was conducted which is presented in the next chapter.

CHAPTER 5: QUANTITATIVE STUDY

5.1. Introduction

The findings of the qualitative study (Chapter 4) showed that a number of factors might influence users' attitudes and the subsequent use of information systems in the ED. These factors were the users', task, system, and environmental characteristics and the impact of technology. To determine associations between the above-mentioned factors and users' attitudes towards using computerised information systems in the EDs, and to investigate the most influential factors, a quantitative study was conducted. The aim of this study was to confirm the findings that emerged from the first stage, and to generalise them to a wider population using a representative sample of ED staff.

In this chapter, the research questions and the process of designing a questionnaire are discussed in sections 5.2 and 5.3 respectively. Section 5.4 presents a pilot study and its results. The settings and sampling methods, and the details related to conducting the survey are respectively discussed in sections 5.5 and 5.6. The coding process, data analysis methods, and the reliability and validity of the questionnaire are presented in sections 5.7 to 5.9. The results of the quantitative study are presented in section 5.10 and discussed in section 5.11. The limitations of the study and a conclusion for the chapter are presented in sections 5.12 and 5.13 respectively.

5.2. Research questions

Although the results of the qualitative study (discussed in Chapter 4) suggested that several factors could influence users' attitudes towards using IT in the ED, a quantitative study was needed to confirm and quantify these associations. Therefore, three main research questions were set to identify the associations between different factors emerged from the qualitative study and users' attitudes towards using IT in the ED, to identify the most important factors influencing users' attitudes, and to identify the association between users' attitudes and systems use in the ED. These questions are as follows.

1- What are the associations between the factors identified in the qualitative study and users' attitudes towards using IT in the ED?

2- What are the most important factors that influence users' attitudes towards using IT in the ED?

3- What is the association between users' attitudes and use of IT in the ED?

5.3. Instrument design

As discussed in Chapter 3, in order to decide whether the existing questionnaires should be used, or whether a new one needs to be designed, the related literature should be reviewed. In this study, having reviewed the literature, no standard questionnaire was found that investigates users' views about using information systems in clinical settings, such as the ED. Therefore, the researcher had to design a new questionnaire. To design a questionnaire the following procedures were undertaken.

Initially, the main results of the qualitative study (presented in Figure 4.5) were used to prepare a list of subjects for the questionnaire. The literature was then reviewed, and the quantitative studies which could inform the current study were selected (Chin et al., 1988; Davis, 1993; Gardner and Lundsgaarde, 1994; Goodhue and Thompson, 1995; Henderson and Dean, 1996; Morris and Dillon, 1997; Dillon et al., 1998; Getty et al., 1999; Chau and Hu, 2002; Nicholas et al., 2002a,b; Lee, 2004; Moody et al., 2004; Kirshbaum, 2004; Likourezos et al., 2004; Palm et al., 2006; Ray et al., 2006; Shapiro et al., 2007; Boyle et al., 2007).

If the questionnaire was not included, the corresponding author was contacted to provide the researcher with a copy of the questionnaire, if it was available. Using these questionnaires and the findings of the qualitative study, an item pool, or an initial list of questions/statements, was developed. This included 107 questions. This list was refined, items with similar meanings were excluded, and 63 questions remained. The process of item reduction continued, and overlapping questions were excluded to make the questionnaire more concise, and to try to maximise the response rate. Among the

remaining list of questions, those which were common in different studies were prioritised to be selected. In order to decrease the chance of bias in participants' responses, the positive and negative statements were both selected to be used in the questionnaire. Before conducting the pilot study, the final version of the questionnaire included 42 items. Tables 5.1a to 5.1e show the questionnaire specification.

As can be seen in Tables 5.1a-5.1e, questions were grouped according to the topic areas, for example, individual characteristics, user attitude questions, etc. The individual characteristics were asked at the beginning as these could be easier to answer for the participants, and the characteristics of the participants could be analysed. Different sections of the questionnaire were designed to be interrelated to achieve the objectives of the study. The questionnaire started with straightforward questions, followed by the more complex ones. The questionnaire items supported each of the constructs of the research proposed model (Chapter 4). In order to measure users' attitudes, Likert scale responses were used. Positive statements, such as 'using computerised information systems in the ED is a good idea' were scored as follows, strongly agree (2), agree (1), neither agree nor disagree (0), disagree (-1), and strongly disagree (-2). The scoring of the negative items, such as 'if I had a choice, I would not use computerised information systems in the ED' was reversed, and the score of strongly agree was (-2), agree (-1), neither agree nor disagree (0), disagree (1), and strongly disagree (2). The maximum possible score of the scale was +64 and the minimum possible score was -64.

Table 5.1a- Questionnaire specification

Question NO.	Section	Question	Findings of Phase I	Related Literature
1-5	Individual characteristics	Questions about gender, job, age, work experience in Emergency Medicine, and the Emergency Department	Theme 1	Lee (2004) Moody et al. (2004)
6-8	Computer experience	How often do you use a computer in the ED? Approximately, how long do you spend time using a computer in the ED in a week? Have you ever used any other information systems in other healthcare settings?	Theme 1	Lee (2004) Kirshbaum (2004)
9-10	Computer knowledge	What are the computer applications that you are able to use? How do you rate your computer knowledge?	Theme 1	Lee (2004)
11	User attitude towards using IT in the ED	Using computerised information systems in the ED is a good idea.	Theme 1	Morris and Dillon (1997) Chau and Hu (2002)
12		Using computerised information systems in the ED is better than using manual methods.		Kirshbaum (2004)
13		Using computerised information systems in the ED is more helpful than a hindrance.		Moody et al. (2004)
14		If I had a choice, I would not use computerised information systems in the ED.		Lee (2004)

Table 5.1b- Questionnaire specification

Question NO.	Section	Question	Findings of Phase I	Related Literature
15	Task Characteristics (Complexity)	In the ED, I frequently deal with patients who are difficult to manage.	Theme 2	Goodhue and Thompson (1995)
16		In my work, I frequently deal with non-routine circumstances.		Goodhue and Thompson (1995)
17	Task Characteristics (Interdependency)	To do my job, I often need to consult with my colleagues.		Goodhue and Thompson (1995)
18		My work involves communicating with organisations outside of the hospital.		Goodhue and Thompson (1995)
19	System Characteristics (Ease of use)	The current information systems in the ED are easy to use.	Themes 3,6	Davis (1993) Chau and Hu (2002)
20		Learning to operate the current ED computerised systems is easy for me.		Davis (1993) Chau and Hu (2002)
21		I have found using computers in the ED quite difficult.		Davis (1993) Chin et al. (1988)

Table 5.1c- Questionnaire specification

Question NO.	Section	Question	Findings Of Phase I	Related Literature
22	System Characteristics (Usefulness)	There is no clinical benefit in using computerised information systems in the ED.	Themes 3,6	Chau and Hu (2002) Shapiro et al. (2007)
23		Patient care is more effective when using a computer in the ED.		Chau and Hu (2002)
24		Using a computer in the ED has improved the quality of work that I do.		Davis (1993)
25	Impact of technology (Individual impact)	Using a computer in the ED makes my day-to-day work easier.	Theme 5	Davis (1993)
26		I feel stressed when I am using a computer in the ED.		Moody et al. (2004) Kirshbaum (2004)
27		Using a computer in the ED, my work takes longer than using manual methods.		Getty et al. (1999)

Table 5.1d- Questionnaire specification

Question NO.	Section	Question	Findings Of Phase I	Related Literature
28	Impact of technology (Organisational impact)	Using computerised information systems in the ED has helped to improve staff communication.	Theme 5	Lee (2004) Henderson and Dean (1996)
29		Using computerised information systems in the ED has improved work efficiency in the department.		Lee (2004)
30		Using computerised information systems in the ED has eliminated a lot of paperwork.		Likourezos et al. (2004)
31	Impact of technology (Impact on Patient care)	Using computerised information systems in the ED helps to improve the quality of patient care.	Theme 5	Moody et al. (2004) Likourezos et al. (2004)
32		Using computerised information systems in the ED helps to decrease medical errors.		Shapiro et al. (2007)
33		Using computerised information systems in the ED helps to decrease the number of unnecessary medical tests.		Shapiro et al. (2007)

Table 5.1e- Questionnaire specification

Question NO.	Section	Question	Findings Of Phase I	Related Literature
34	Environmental characteristics (Social issues)	People, who are important to me in my work place, think that I should use information systems in the ED.	Themes 4,6	Chau and Hu (2002)
35		In the ED, senior staff have been helpful in the use of the information systems.		Chau and Hu (2002)
36	Environmental characteristics (Organisational issues)	Adequate training in the use of information systems has been provided for the staff.	Themes 4,6	Gardner and Lundsgaarde (1994) Chau and Hu (2002)
37		Currently, the computers are not adequate in the ED.		Palm et al. (2006)
38		Users should be involved in the process of developing information systems for the ED.		Edsall and Adler (2005)
39	Environmental characteristics (technological issues)	Using bedside computer terminals in the ED is a good idea.	Themes 2,6	Dillon et al. (1998)
40		Portable computers, such as handheld devices are suitable to be used in the ED.		Moody et al. (2004) Ray et al. (2006)
41		The location of the current computers terminals is not appropriate.		Nicholas et al. (2002a,b)
42		Computer terminals in the ED can be damaged by violent patients or their relatives.		Boyle et al. (2007)

5.4. Pilot study

As Bourque and Fielder (1995) indicated, the first draft of a questionnaire is not yet ready to be administered, and needs to be pre-tested, or piloted. In accordance with the University of Sheffield Research Ethics Policy, University Research Ethics Approval was required, as the NHS Local Research Ethics Committee deemed the research was evaluating a system rather than research. After obtaining University Research Ethics Approval (Appendix V) through the Department of Information Studies, a pilot study was conducted. In the pilot study, 20 ED staff who worked in a large urban university hospital in northern England were asked to complete the questionnaire. They were also asked to suggest any parts of the questionnaire that needed to be changed. The participants were selected using convenience sampling. The participants of the pilot study included 11 doctors, four nurses, and five administrative staff at different grades and levels. Twelve participants were male and eight were female. Their ages ranged from 28 to 62.

The package distributed in the pilot study included a covering letter on a headed paper, a questionnaire, a participant information sheet, and an extra envelope for returning the completed questionnaire. The covering letter emphasised that the aim of the survey was not to assess participants' computer knowledge, but that the main aim was to investigate the ED staff views about using computerised information systems in the ED. The covering letter was signed by the researcher and the research supervisors.

In the participant information sheet, the purpose of the study was described, and information regarding how and why the participants were selected was presented. The questionnaire was divided into seven sections including demographic questions, computer knowledge and experiences, user attitude, task characteristics, system characteristics, impact of technology, and environmental characteristics (Tables 5.1a-e). The questionnaire was printed on A3 light green paper as a booklet folding in the middle lengthwise to form an A4-sized booklet. At the end of the questionnaire, there was a sentence indicating participant consent for taking part in the study and, finally, the participants were thanked for their time and cooperation. On each extra envelope the return address was printed. To improve the questionnaire, an evaluation sheet was also designed to be completed by the

participants after completing the questionnaire. This evaluation was mainly related to the language and the structure of the questionnaire. The pilot did not aim to assess response rates. However, as the sample had indicated willingness to assist with the pilot, all of the questionnaires were completed by the participants. Hence, the response rate of pilot study was 100%.

After conducting the pilot study, the participants' views were applied to make the following changes to the questionnaire. Question 6, 'How often do you use a computer in the ED?' was considered superfluous and removed, as all of the respondents indicated that they used a computer in the ED several times a day. The wording of questions 7, 8 and 9 were modified. Other changes were mainly related to the order of the positive and negative statements within each section. The final version of the questionnaire consisted of 41 questions grouped in seven sections. Questions 13, 20, 22, 25, 27, 36, and 39 were asked in a negative format (discussed in the previous section).

Apart from the above changes, most of the participants noted that the instructions for completing the questionnaire were clear, questions and sentences were easy to understand, and the response choices were exclusive and exhaustive. The approximate time to complete the questionnaire was less than what expected, that is, 10-15 minutes compared to 15-20 minutes estimated before conducting the pilot study.

5.5. Settings and Sampling method

According to Bourque and Fielder (1995), before selecting the sample, it is important to determine how many completed questionnaires are required to test research hypotheses. In this study, one of the statistical tests would be a multiple regression analysis with up to nine independent variables (section 5.8). This required receiving at least 113 completed questionnaires when the effect size was considered to be medium, B=0.80 and α=0.05 (Cohen, 1992). To increase the number of participants, three regional EDs were selected. In each ED, there was a local contact who could help to facilitate the survey. Additionally, to give the subjects equal opportunity to take part in the study (Fink, 1995)

the whole eligible population of staff in the EDs was invited to participate. Approaching the whole population helped to increase the number of responses and studying three EDs enhanced the generalisability of the findings. Moreover, the extra effort of sampling all staff at each hospital was relatively small, compared to selecting a random sample of staff. The inclusion criteria were that the participants had to be working in the ED as a doctor, a nurse, a member of administrative staff, or other clinical staff and have access to the ED information systems. Setting inclusion and exclusion criteria helped to focus on people who could give more accurate information (Fink, 1995).

5.6. Conducting the Survey

Having designed the self-administered questionnaire and following the pilot study, it was posted to the research facilitators in the three EDs in Barnsley, Leeds, and Leicester. As discussed in Chapter 3, while using a self-administered questionnaire has some advantages, such as lower cost compared to other methods and geographical coverage, its disadvantages also need to be taken into account. These are related to administration, sample-related issues, and questionnaire construction (Bourque and Fielder, 1995). To overcome the potential challenges, the following decisions were made.

To gain more control over the survey administration and to increase the response rate, the local contact in each ED was contacted and informed about the survey. This person was also asked to introduce a facilitator (a registrar) to help with the research by distributing the questionnaires and collecting the completed ones. The facilitators were also responsible for distributing reminder letters, as well as reminding participants verbally to complete the questionnaires. To involve the facilitators in the process of data collection, they were asked to sign the covering letters within their department. Bourque and Fielder (1995) suggested that having a covering letter signed by someone with positive name recognition for the respondents could be beneficial to improving the participants' collaboration. This approach could help to provide more support for the research. To encourage the participants to complete the questionnaires, providing them with an incentive, a prize of a box of chocolate in each site was suggested by one of the facilitators.

This is one of the approaches that can help to increase the response rate (Bourque and Fielder, 1995). This suggestion was approved by the Department of Information Studies, Research Ethics Administrator. After completing the survey, one of the respondents in each ED was randomly selected and given the prize by the researcher.

To overcome sample-related issues, the facilitators were asked to send a complete list of ED staff, who had access to the computerised information systems in the ED, to the researcher. Then, a named covering letter was provided for each participant. This could also help 'to increase respondents' sense of their importance as a respondent' (Bourque and Fielder, 1995: 109). The next step was assigning a study number to each participant. This number could help to keep track of the responders and non-responders. This, in turn, helped to limit follow-up efforts to prepare reminder letters only for non-responders, and to avoid troubling people who had already responded. In terms of the questionnaire construction, it was designed to have a clear objective, and to be easy to be completed by different groups of ED staff, namely, doctors, nurses, and administrative staff without assistance from others (Bourque and Fielder, 1995).

The survey was started in early October 2008 and completed by the end of January 2009. The reminder letters were sent to non-responders in mid-November. The package distributed in the main survey was similar to the one used in the pilot study. The main envelope contained a covering letter, a questionnaire, a participant information sheet, and an extra envelope for returning the completed questionnaire (copies of documents are included in Appendix VI). General instructions were provided for the participants in the covering letter. These included the purpose of the questionnaire, what they were asked to do, an estimate of the time required to complete the questionnaire, an explanation of confidentiality and how the data would be handled, the provision of name and phone number to call for information, and when and how participants had to return the questionnaire. Instructions regarding how to answer the questions were provided in the questionnaire. On each extra envelope, the return address including the name of the facilitator, the department, and the project were printed.

5.7. Coding process

Coding is the process of converting written answers into numbers using an established coding scheme or plan (Oppenheim, 1992; Fink, 1995). Initially, the respondents were given a three digit unique number in SPSS to be able to track their responses in the original questionnaire, if needed. Before coding answers, a short label was created for the variables. For example, computer experience was called COMEXP. To facilitate data analysis, the answers of each question were coded numerically. For example, respondents' gender was coded as male (1) and female (2). For the Likert scale, as described in section 5.3, the score of each answer was used as a code. For missing data, where the respondent did not tick any of the boxes or did not answer the question, the code of 999 was used to indicate that the data were missing.

5.8. Data analysis

Before conducting the survey and the data analysis, research variables were identified and defined. As Fink (1995:56) indicated, 'a variable is a measurable characteristic that varies in the population'. Four main types of variables are independent, dependent, controlled, and uncontrolled variables (Oppenheim, 1992). Table 5.3 shows the research variables and their definitions. During data analysis, all data were coded, analysed, and reported anonymously. In order to analyse data, the first step was entering the data into SPSS for Windows version 15.0, in which each column corresponded to a variable, and each row contained the responses from each respondent. Then, data were initially analysed using descriptive statistics. When analysing the Likert scale, each response was scored and then, the sum of the scores was calculated. The total score showed that individuals with higher scores were more positive about using IT in the ED, and individuals with lower scores were less positive about this (McIver and Carmines, 1994).

The Cronbach's alpha coefficient was low for the last subscale, namely, the environmental characteristics (section 5.9.1). Therefore, each question of this subscale was

analysed individually using descriptive statistics rather than as a subscale. The next step was to investigate the association between various variables and users' attitudes towards using IT in the ED using simple linear regression analysis. At this stage, primary hypotheses were set for all subscales except for the environmental characteristics that formed the secondary hypotheses. The primary hypotheses were based directly upon the constructs developed in the qualitative study that were shown to be internally consistent, whereas the secondary hypotheses were based on the individual elements of the environmental characteristics construct. The original plan had been to test the environmental characteristics as a single subscale, but it had been shown to be not internally consistent.

Multiple regression tests were used to investigate the importance of each independent variable relative to the others. This test was initially applied to identify the most important factors among the variables introduced in the primary hypotheses. The second multiple regression test was applied to identify the most important factors among the variables of the secondary hypotheses. The third multiple regression test was used to identify the most important factors among the significant variables of the primary and secondary hypotheses. The details of data analysis are provided in section 5.10.

Table 5.2a- Research variables

Variable	Type	Definition
Reported IT usage	Dependent	The hours that a member of ED staff uses IT in his/her job per week.
User attitude	Dependent	'The degree of evaluative affect that an individual associates with using the target system in his/her job' (Davis, 1993:476).
Individual characteristics	Independent	In this study, individual characteristics included age, computer knowledge and experience of IT.
Task characteristics	Independent	The construct of task characteristics included two subscales non-routineness and interdependence with other organisational units (Goodhue and Thompson, 1995). In this study, these dimensions were called task complexity and task interdependency.
System characteristics	Independent	This construct included perceived ease of use and perceived usefulness. Perceived ease of use is defined as the degree to which a person believes that the use of a system will be effortless. Perceived usefulness refers to the degree to which a person believes that the use of a system will improve her/his performance (Davis, 1993).
Impact of technology	Independent	This refers to the perceived consequences of using IT and includes the individual and organisational impact as well as impact on patient care. The individual impact refers to 'the effects of the system or the information on users' behaviour' and the organisational impact refers to 'the effects of the system on organisational performance' (van der Meijden, 2003b:236). Impact on patient care is related to the indirect impacts on the quality of care, e.g., by reducing medical error.

Table 5.2b- Research variables

Variable	Type	Definition
Environmental characteristics	Independent	This construct included social, organisational and technological issues. In this study, social issues referred to subjective norm and other social factors. Subjective norm is defined as 'the person perception that most people who are important to him think he should or should not perform specific behaviour' (Venkatesh et al., 2003: 452). Social factors refer to 'the specific interpersonal agreements that the individual has made with others in special social situations' (Venkatesh et al., 2003: 452). Organisational issues refer to training, IT support, and user involvement (Ash et al., 2008). In this study, technological issues refer to the type of a system (e.g., a handheld device, mobile workstations), location of the systems, and the probability of physical damage to the computerised systems.

5.9. Instrument reliability and validity

In Chapter 3, a background to the reliability and validity of the quantitative studies was provided. According to Fink (1995: 41), 'a reliable survey instrument is consistent and a valid one is accurate. If an instrument is unreliable it is also invalid'. Another definition of reliability and validity was given by Carmines and Zeller (1994: 3-4). The authors indicate 'reliability concerns the extent to which an experiment, test, or any measuring procedure yields the same results on repeated trials, and validity concerns the crucial relationship between concept and indicator'. The reliability and validity of the survey questionnaire are discussed below.

5.9.1. Reliability

As noted in Chapter 3, four main types of reliability are test-retest, alternative-form, split-half, and internal consistency (Litwin, 1995). In this study, in order to measure the reliability of the questionnaire, the internal consistency was calculated using Cronbach's alpha coefficient after collecting data. The first three methods were not used as the number of sample in the pilot study was limited (n=20), and a larger sample was needed to test the reliability of the questionnaire. Moreover, developing two sets of questions to be used in the above mentioned methods was difficult and time-consuming, as there was a time restriction to complete the research. Table 5.2 shows Cronbach's alpha coefficient for each construct.

Table 5.3- Cronbach's alpha coefficient for the scale

Construct		Item	Cronbach's alpha for the construct	
User attitude		Q10	0.836	
		Q11		
		Q12		
		Q13		
Task characteristics	Complexity	Q14	0.741	0.751
		Q15		
	Interdependency	Q16	0.549	
		Q17		
System characteristics	Ease of use	Q18	0.797	0.758
		Q19		
		Q20		
	Usefulness	Q21	0.773	
		Q22		
		Q23		
Impact of technology	Individual impact	Q24	0.706	0.798
		Q25		
		Q27		
	Organisational impact	Q26	0.570	
		Q28		
		Q29		
	Impact on patient care	Q30	0.686	
		Q31		
		Q32		
Environmental characteristics	Social Environment	Q33	0.461	0.397
		Q34		
	Organisational Environment	Q35	0.137	
		Q36		
		Q37		
	Physical Environment	Q38	0.068	
		Q39		
		Q40		
		Q41		

Reliability is usually shown as correlation coefficient, or r value, which is considered good, if it is equal or more than 0.70 (Litwin, 1995). As Table 5.2 shows, the Cronbach's alpha coefficient was good for four constructs, user attitude, task characteristics, system characteristics, and the impact of technology. The items of these constructs were internally consistent and could be combined and analysed as a single construct. However, the analysis of reliability showed that the individual items of the environmental characteristics construct were not internally consistent and it seemed that the

individual questions were measuring different things. Therefore, it would be inappropriate to combine these individual measures and the questions relating to each environmental characteristic were analysed separately, as an individual variable.

5.9.2. Validity

According to Fink (1995: 49), validity refers to 'the degree to which a survey instrument assesses what it purports to measure'. As discussed in Chapter 3, four types of validity are content, face, criterion, and construct validity.

In this study, the validity of the questionnaire was established using content and face validity. To improve the content validity, the related literature was reviewed and the main concepts and domains were defined. The content of the questionnaire was also discussed with the supervisors. To establish the face validity, the supervisors' views, as well as the views of the participants of the pilot study, were taken into consideration to improve the language, the structure, and the order of the questions. The pilot study also helped to establish face validity, by ensuring that the respondents understood what the questions meant.

5.10. Results

The purpose of this section is to present the results of the quantitative study. In the first part of this section, 5.10.1, a descriptive analysis of the sample characteristics, the current amount of IT use in the settings of study, and the scale items are presented. In the second part, 5.10.2, the research hypotheses and the model proposed in Chapter 4 are tested using simple and multiple linear regression analyses.

5.10.1. Descriptive analysis

Response rate

As mentioned in section 5.5, the survey was undertaken in three EDs. In total, 535 ED staff were eligible to take part in the study. They included 94 ED staff (17.6%) in Barnsley Hospital (BH), 144 members of ED staff (26.9%) in St. James's University Hospital (SJUH) in Leeds, and 297 ED staff (55.5%) in Leicester Royal Infirmary hospital (LRI).

Three hundred and sixty two members of ED staff completed and returned the questionnaires in total, giving an overall response rate of (67.6%) for the survey. During the first wave of the survey, 286 questionnaires (79%) were completed and, after sending reminders a further 76 replies (21%) were received. Table 5.4 shows the response rate of the survey in each wave, according to each site.

Table 5.4- Response rate in each wave

Replies	Hospital						Total	
	BH (n=94)		SJUH (n=144)		LRI (n=297)			
	Count	%	Count	%	Count	%	Count	%
First wave	46	92.0%	45	45.0%	195	92.0%	286	79.0%
Reminders	4	8.0%	55	55.0%	17	8.0%	76	21.0%
Total	50	100.0%	100	100.0%	212	100.0%	362	100.0%

The highest response rate was in the LRI hospital (n=212, 71.3%), followed by SJUH (n=100, 69.4%) and BH (n= 50, 53.1%).

Characteristics of the sample

Demographic data were collected to show the characteristics of the respondents. These data were related to the participants' gender, job title, age, their work experience in Emergency Medicine, and their work experience in the setting of study. Table 5.5 shows respondents' gender across the EDs.

Table 5.5- Respondents' gender categories in the EDs

Gender	Hospital						Total	
	BH		SJUH		LRI			
	Count	%	Count	%	Count	%	Count	%
Male	10	20.0%	29	29.0%	58	27.4%	97	26.8
Female	40	80.0%	71	71.0%	154	72.6%	265	73.2
Total	50	100.0%	100	100.0%	212	100.0%	362	100.0%

As Table 5.5 shows, more than two thirds of respondents were female 73.2% (n=265), and the proportion of the female respondents was more than the male respondents in all of the EDs. In BH, SJUH, and LRI the proportion of the female respondents was 80% (n=40), 71.0% (n=71), and 72.6% (n=154) respectively. The respondents' professions were summarised into four categories: doctors, nurses, administrative staff, and other clinical staff. Table 5.6 shows the distribution of the respondents' professions categories in the EDs.

Table 5.6- Respondents' professions categories in the EDs

Gender	Hospital						Total	
	BH		SJUH		LRI			
	Count	%	Count	%	Count	%	Count	%
Doctor	14	28.0%	34	34.0%	59	28.0%	107	29.6%
Nurse	22	44.0%	50	50.0%	105	49.8%	177	49.0%
Administrative staff	14	28.0%	6	6.0%	30	14.2%	50	13.9%
Other clinical staff	0	0.0%	10	10.0%	17	8.1%	27	7.5%
Total	50	100.0%	100	100.0%	211	100.0%	361	100.0%

As shown in Table 5.6, almost a half of the respondents 49.0% (n= 177) were nurses, and doctors constituted the second highest category 29.6% (n=107). The

administrative staff 13.9% (n=50) included receptionists 56.0% (n=28), secretaries 12.0% (n=6), ED trackers 8.0% (n=4), managers 6.0% (n=3), and patient flow coordinators 4.0% (n=2). In addition, one primary care coordinator, one ward clerk, one personal assistant, one clinic coordinator, one ED support officer, one clerk coordinator, and one ED supervisor each contributed to (2.0%) of the sample in this category. Other clinical staff 7.5% (n=27) included healthcare assistants 40.7% (n=11), clinical support workers 37.0% (n=10), clinical aides 18.5% (n=5), and an orthopaedic technician 3.7% (n=1). Only one of the respondents did not answer this question.

Table 5.7 shows the distribution of the respondents' age in the EDs. Most of the respondents, 70.9% (n=252) were 40 years old or younger and the mean value was 36 years old (ranged from 20 to 66).

Table 5.7- Respondents' age categories in the EDs

Age	Hospital						Total	
	BH		SJUH		LRI			
	Count	%	Count	%	Count	%	Count	%
= 20	0	0.0%	0	0.0%	2	1.0%	2	0.6%
21 - 30	13	26.5%	34	34.3%	76	36.5%	123	34.6%
31 - 40	20	40.8%	38	38.4%	69	33.2%	127	35.7%
41 - 50	6	12.2%	17	17.2%	43	20.7%	66	18.5%
51 - 60	9	18.4%	10	10.1%	16	7.7%	35	9.8%
61+	1	2.0%	0	0.0%	2	1.0%	3	0.8%
Total	49	100.0%	99	100.0%	208	100.0%	356	100.0%

As shown in Table 5.7, in LRI, the highest proportion of respondents (n=76, 36.5%) was in the 21-30 age group, whereas the highest frequency of respondents in BH (n=20, 40.8%) and in SJUH (n=38, 38.4%) was in the 31-40 age group.

Table 5.8 shows the distribution of the respondents' work experience in the field of Emergency Medicine. The respondents' work experience in the field of Emergency Medicine was less than one year for 92 participants (25.6%), and 10 years or more for 85 respondents (23.6%).

Table 5.8- Respondents' work experience in Emergency Medicine

Age	Hospital						Total	
	BH		SJUH		LRI			
	Count	%	Count	%	Count	%	Count	%
<1	15	30.0%	27	27.3%	50	23.7%	92	25.6%
1-3 years	4	8.0%	16	16.2%	39	18.5%	59	16.4
4-6 years	7	14.0%	21	21.2%	52	24.6%	80	22.2
7-9 years	6	12.0%	15	15.2%	23	10.9%	44	12.2
10+	18	36.0%	20	20.2%	47	22.3%	85	23.6
Total	50	100.0%	99	100.0%	211	100.0%	360	100.0%

As Table 5.8 shows, in BH, the highest frequency of respondents (n=18, 36.0%) had work experience of 10 years or more in the field of Emergency Medicine, and 15 participants (30.0%) had work experience of less than one year. In SJUH, the highest frequency of respondents (n=27, 27.3%) had worked less than one year in the field of Emergency Medicine, and the second highest frequency (n=21, 21.2%) was related to the respondents with the work experience of 4-6 years in this field. In LRI, the highest frequency of work experience in Emergency Medicine was 4-6 years (n=52, 24.6%) followed by (n=50, 23.7%) of respondents whose work experience was less than one year in this field.

Table 5.9 shows the work experience of the respondents in each ED. In the settings that the survey was conducted, the highest frequency of respondents (n= 126; 35.2%) had work experience of less than one year in that particular ED.

Table 5.9- Respondents' work experience in the EDs

Work Experience in that particular ED	Hospital						Total	
	BH		SJUH		LRI			
	Count	%	Count	%	Count	%	Count	%
less than 1 year	22	45.8%	39	39.8%	65	30.7%	126	35.2%
1-3 years	4	8.3%	18	18.4%	47	22.2%	69	19.3%
4-6 years	6	12.5%	21	21.4%	57	26.9%	84	23.5%
7-9 years	6	12.5%	8	8.2%	14	6.6%	28	7.8%
10 years or more	10	20.8%	12	12.2%	29	13.7%	51	14.2%
Total	48	100.0%	98	100.0%	212	100.0%	358	100.0%

As Table 5.9 shows, the highest percentage of respondents in all three EDs had experience of working for less than one year in the settings of the study. The second highest frequency category in LRI (n=57, 26.9%) and SJUH (n=21, 21.4%) was related to having work experience of 4-6 years. In BH, the second highest frequency category (n=10, 20.8%) was related to having work experience of 10 years or more in that particular ED.

Overview of IT use

The respondents were asked approximately how many hours they spent using a computer in the ED during a week. Although such a figure was more subjective than providing an exact figure on the use of IT in the ED, the data could be used as an estimate of their use of IT in the ED. While some of the respondents reported the number of hours that they spent using IT in the ED during a week, for example, 16 or 20 hours per week, others indicated a range of hours, for example, 10-15 hours per week. Therefore, a mid-point was calculated for these respondents. To discover whether the distribution of the reported IT use was normal or not, it was shown in a histogram (Figure 5.1).

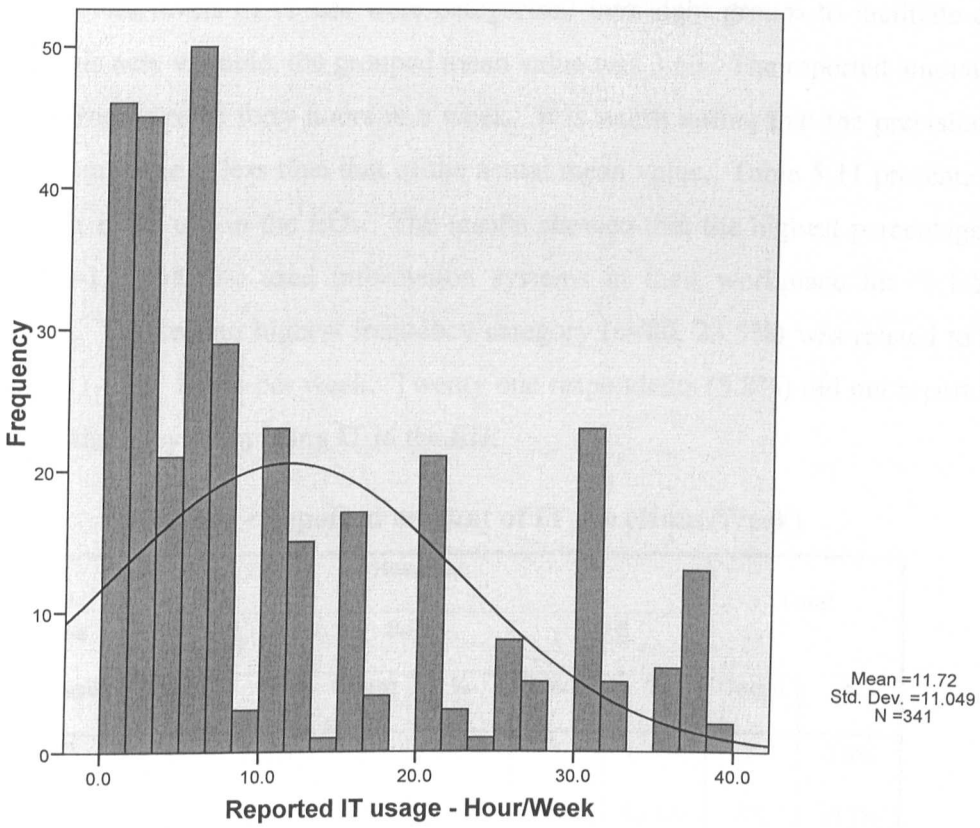

Figure 5.1- Distribution of reported IT usage-hours/week

As Figure 5.1 shows, the reported IT usage was different among the participants and did not show a normal distribution. The Kolmogorov Smirnov test was also used to test whether the use of IT followed a normal distribution. The test of normality (Table 5.10) showed that the reported IT use, $D\ (341) = 0.192$, $p<0.001$ was significant, so that the distribution of data was not normal, and non-parametric tests should be applied for any further analysis related to this variable.

Table 5.10- Test of normality

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
IT usage Hour/week	.192	341	.000

The reported levels of IT use were categorised into eight groups to facilitate data analysis. For this new variable, the grouped mean value was 3.69. The reported amount of IT use ranged from zero to forty hours in a week. It is worth noting that the precision of the grouped mean value is less than that of the actual mean value. Table 5.11 presents the reported amount of IT use in the EDs. The results showed that the highest percentage of respondents (n=132, 38.7%) used information systems in their workplace for '0.1-5.0' hours per week. The second highest frequency category (n=80, 23.5%) was related to the use of IT for '5.1-10.0' hours per week. Twenty one respondents (5.8%) did not report the amount of time that they spent using IT in the ED.

Table 5.11- Reported amount of IT use (Hour/Week)

IT use	Hospital						Total	
	BH		SJUH		LRI			
Hour/week	Count	%	Count	%	Count	%	Count	%
=0.0	1	2.1%	0	0.0%	1	0.5%	2	0.6%
0.1 - 5.0	23	48.9%	24	25.8%	85	42.3%	132	38.7%
5.1 - 10.0	7	14.9%	26	28.0%	47	23.4%	80	23.5%
10.1 - 15.0	2	4.3%	13	14.0%	18	9.0%	33	9.7%
15.1 - 20.0	4	8.5%	13	14.0%	11	5.5%	28	8.2%
20.1 - 25.0	4	8.5%	2	2.2%	5	2.5%	11	3.2%
25.1 - 30.0	4	8.5%	5	5.4%	17	8.5%	26	7.6%
>30	2	4.3%	10	10.8%	17	8.5%	29	8.5%
Total	47	100.0%	93	100.0%	201	100.0%	341	100.0%

As Table 5.11 shows, in SJUH, the highest percentage of the use of IT (n=26, 28.0%) was related to '5.1-10.0' hours per week, whereas in BH (n=23, 48.9%) and LRI (n=85, 42.3%), respondents mainly used IT for '0.1-5.0' hours in a week.

Computer knowledge and experience

The respondents were asked whether they had any experience of using information systems in other hospitals or departments. Table 5.12 shows users' experiences of using IT in other hospitals or departments across the sites. While the majority of respondents (n=203, 57.7%) indicated that they had such experience, 149 participants (42.3%) acknowledged that they did not have any experience of using information systems in other settings.

Table 5.12- Users' experiences of using IT in other hospitals or departments

Experience of using IT in other hospitals or departments	Hospital						Total	
	BH		SJUH		LRI			
	Count	%	Count	%	Count	%	Count	%
Yes	24	49.0%	70	72.2%	109	52.9%	203	57.7%
No	25	51.0%	27	27.8%	97	47.1%	149	42.3%
Total	49	100.0%	97	100.0%	206	100.0%	352	100.0%

As Table 5.12 shows, most of the participants in SJUH (n=70, 72.2%) indicated that they had experience of using IT in other hospitals or departments, whereas in BH, 24 respondents (49.0%) and in LRI, 109 respondents (52.9%) noted that they had such experience.

The respondents were also asked which computer applications they could generally use. According to the results, the Internet (n=340, 96.0%) and MS WORD (n=339, 95.8%) were the applications with the highest reported percentage. Other computer applications which were used by the respondents included PowerPoint (n=236, 66.7%), MS EXCEL (n=215, 60.7%), and MS ACCESS (n=84, 23.7%). Some of the respondents (n=43, 11.9%) reported that they could also use other computer applications, such as Apple applications, Statistical Package for the Social Sciences (SPSS), Photoshop, and Endnote. The use of information systems, such as Emergency Department Information Systems (EDIS), Picture

Archiving and Communication System (PACS), Patient Administration System (PAS), Symphony (patient tracking and clinical process support system), and Agfa (laboratory information system), which were used in the EDs, was also noted by 35 respondents. More information about these systems can be found in Appendix VII.

Table 5.13 presents users' self-rated computer knowledge in the settings of the study and Figure 5.2 shows the distribution of responses for users' computer knowledge. On a self-rated basis, the highest percentage of respondents (n=178, 49.2%) rated their computer knowledge as 'average' and 99 respondents (27.3%) perceived their computer knowledge as 'good'. The results also showed that 51 respondents (14.1%) reported their computer knowledge as 'poor' or 'very poor'.

Table 5.13- Computer knowledge of users in the EDs

Computer knowledge	Hospital						Total	
	BH		SJUH		LRI			
	Count	%	Count	%	Count	%	Count	%
Very poor	2	4.0%	1	1.0%	5	2.4%	8	2.2%
Poor	5	10.0%	11	11.0%	27	12.7%	43	11.9%
Average	24	48.0%	42	42.0%	112	52.8%	178	49.2%
Good	11	22.0%	36	36.0%	52	24.5%	99	27.3%
Very good	8	16.0%	10	10.0%	16	7.5%	34	9.4%
Total	50	100.0%	100	100.0%	212	100.0%	362	100.0%

As Table 5.13 shows, in the settings of the study, most of the participants perceived that their computer knowledge was 'average' or 'good'.

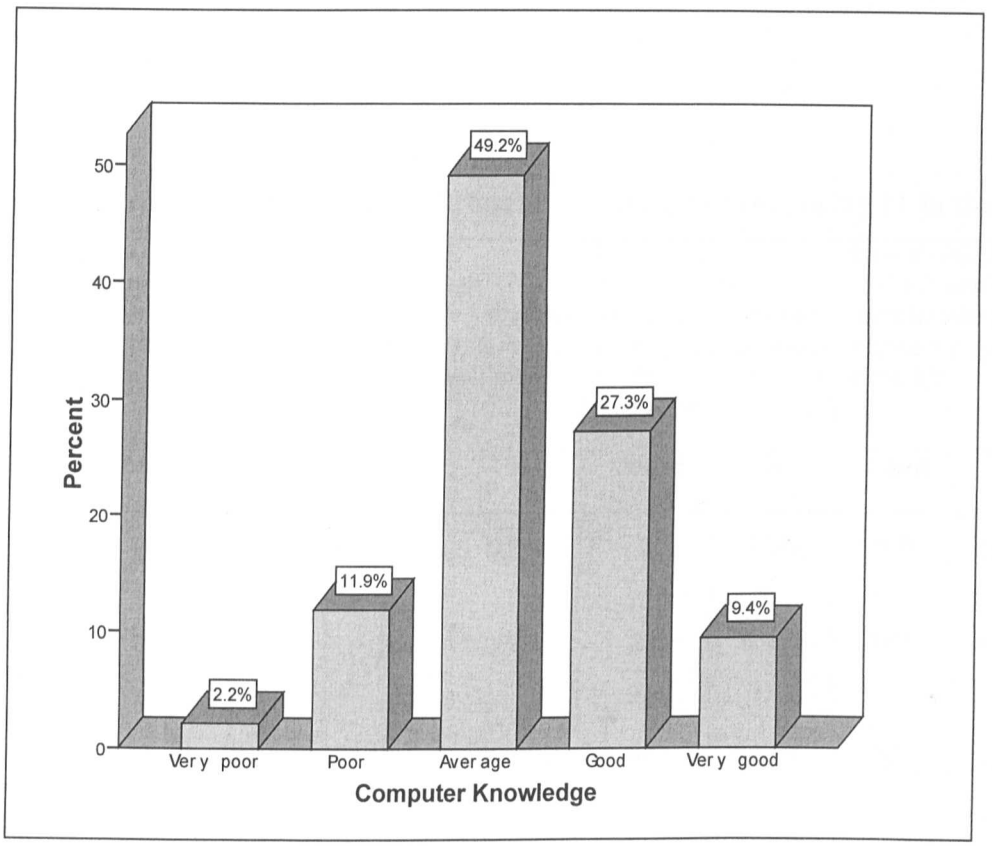

Figure 5.2- Distribution of responses for users' computer knowledge

Users' attitudes towards using IT in the ED

Table 5.14 shows the frequency of responses for users' attitudes towards using IT in the ED. Most of the participants agreed (n=204, 56.4%) or strongly agreed (n=133, 36.7%) that 'using computerised information systems in the ED is a good idea'. Similarly, the highest percentage of respondents agreed (n=162, 44.9%) or strongly agreed (n=125, 34.6%) that using computerised information systems in the ED is better than using manual methods. More than half of the respondents agreed (n=196, 54.3%) or strongly agreed

(n=92, 25.5%) that using computerised information systems in the ED is more helpful than a hindrance. Most of the respondents disagreed (n=162, 45.0%) or strongly disagreed (n=140, 38.9%) with the attitude statement 'If I had a choice, I would not use computerised information systems in the ED'.

Table 5.14- Frequency of responses for users' attitudes towards using IT in the ED

Users' attitudes towards using IT in the ED	**Q10-** Using computerised information systems in the ED is a good idea.		**Q11-**Using computerised information systems in the ED is better than using manual methods.		**Q12-**Using computerised information systems in the ED is more helpful than a hindrance.		**Q13-** If I had a choice, I would not use computerised information systems in the ED.	
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
Strongly disagree	0	0	1	0.3%	2	0.6%	140	38.9%
Disagree	3	0.8%	14	3.9%	23	6.4%	162	45.0%
Neither agree nor disagree	22	6.1%	59	16.3%	48	13.3%	32	8.9%
Agree	204	56.4%	162	44.9%	196	54.3%	21	5.8%
Strongly agree	133	36.7%	125	34.6%	92	25.5%	5	1.4%
Total	362	100.0%	361	100.0%	361	100.0%	360	100.0%

Task characteristics

Table 5.15 presents the frequency of participants' responses for the task characteristics. To investigate how working in the ED was complex and tasks were interdependent, four questions were considered. The highest proportion of respondents agreed (n=177, 48.9%) or strongly agreed (n=104, 28.7%) that in the ED, they frequently dealt with patients who were difficult to manage, and 55.7% agreed (n=201) and 24.1% strongly agreed (n=87) that they frequently dealt with non-routine circumstances. In terms of the interdependency of tasks, 174 respondents agreed (48.1%) and 131 participants strongly agreed (36.2%) that they often needed to consult with their colleagues. More than two thirds of respondents agreed (n=214, 59.3%) or strongly agreed (n=81, 22.4%) that their work involved communicating with organisations outside of the hospital.

Table 5.15- Frequency of responses for task characteristics

Task characteristics	Task Complexity				Task Interdependency			
	Q14- In the ED, I frequently deal with patients who are difficult to manage.		**Q15-** In my work, I frequently deal with non-routine circumstances.		**Q16-** To do my job, I often need to consult with my colleagues.		**Q17-** My work involves communicating with organisations outside of the hospital.	
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
Strongly disagree	2	0.6%	1	0.3%	3	0.8%	4	1.1%
Disagree	31	8.6%	15	4.2%	22	6.1%	23	6.4%
Neither agree nor disagree	48	13.3%	57	15.8%	32	8.8%	39	10.8%
Agree	177	48.9%	201	55.7%	174	48.1%	214	59.3%
Strongly agree	104	28.7%	87	24.1%	131	36.2%	81	22.4%
Total	362	100.0%	361	100.0%	362	100.0%	361	100.0%

System characteristics

Table 5.16 presents the frequency of responses for the system characteristics. This section of the questionnaire aimed to investigate users' perceptions of the ease of use, and usefulness, of information systems that they used in the ED. Generally, the majority of respondents agreed (n=219, 60.5%) or strongly agreed (n=35, 9.7%) that the systems that they used were easy to use, and more than half of the respondents agreed (n=208, 57.5%) or strongly agreed (n=49, 13.5%) that learning to operate the current ED information systems was easy for them. About eleven percent of respondents (n=40) found using computers in the ED quite difficult and 57 respondents (15.8%) neither agreed nor disagreed with this. However, more than half of the respondents either disagreed (n=204, 56.7%) or strongly disagreed (n=59, 16.4%) that using computers in the ED was difficult.

In terms of the usefulness of information systems in the ED, 148 respondents (41.5%) neither agreed nor disagreed with the effectiveness of patient care when using a computer in the ED. However, 122 respondents (34.2%) agreed and 21 respondents (5.9%) strongly agreed that the patient care is more effective when using a computer in the ED. More than half of the respondents disagreed (n=177, 49.4%) or strongly disagreed (n=46, 12.8%) that there is no clinical benefit to using computerised information systems in the ED. In terms of the usefulness of computerised information systems in improving the quality of staff work in the ED, the highest percentage of respondents (n=134, 37.4%) neither agreed nor disagreed with this statement. However, 122 respondents agreed (34.1%) and 30 respondents strongly agreed (8.4%) that using computerised information systems has been useful in improving the quality of their work in the ED (Table 5.16).

Table 5.16- Frequency of responses for system characteristics

System characteristics	Ease of use						Usefulness					
	Q18-The current information systems in the ED are easy to use.		**Q19**-Learning to operate the current ED computerised systems is easy for me.		**Q20**- I have found using computers in the ED quite difficult.		**Q21**-Patient care is more effective when using a computer in the ED.		**Q22**- There is no clinical benefit in using computerised information systems in the ED.		**Q23**-Using a computer in the ED has improved the quality of work that I do.	
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
Strongly disagree	3	0.8%	4	1.1%	59	16.4%	10	2.8%	46	12.8%	14	3.9%
Disagree	49	13.5%	36	9.9%	204	56.7%	56	15.7%	177	49.4%	58	16.2%
Neither agree nor disagree	56	15.5%	65	18.0%	57	15.8%	148	41.5%	98	27.4%	134	37.4%
Agree	219	60.5%	208	57.5%	35	9.7%	122	34.2%	35	9.8%	122	34.1%
Strongly agree	35	9.7%	49	13.5%	5	1.4%	21	5.9%	2	0.6%	30	8.4%
Total	362	100.0%	362	100.0%	360	100.0%	357	100.0%	358	100.0%	358	100.0%

Impact of technology

Table 5.17 shows the frequency of responses for the perceived impact of technology. The impact of technology included the individual and organisational impact and impact on patient care. The individual impact of technology was measured using three questions. More than half of the respondents agreed (n=183, 51.1%) or strongly agreed (n=46, 12.8%) that using a computer in the ED made their day-to-day work easier. The highest percentage of respondents disagreed (n=195, 54.2%) or strongly disagreed (n=69, 19.2%) with feeling stressed when using a computer in the ED. However, this was true for 38 respondents (10.5%) followed by 58 respondents (16.1%) who neither agreed nor disagreed with this. Less than half of the respondents (n=160, 44.7%) disagreed that due to using a computer in the ED their work took longer than using manual methods. In contrast, 70 respondents (19.5%) either agreed or strongly agreed that using a computer in the ED can be more time-consuming than manual methods, and (n=83, 23.2%) neither agreed nor disagreed with this.

The organisational impact was also measured using three questions. As Table 5.17 shows, the highest percentage of respondents agreed (n=169, 47.1%) or strongly agreed (n=18, 5.0%) that using computerised information systems in the ED had helped to improve staff communication, and 183 respondents agreed (51.3%) and 20 respondents strongly agreed (5.6%) that using computerised information systems in the ED had improved work efficiency in their department. However, while more than one third of respondents agreed (n=124, 34.6%) or strongly agreed (n=23, 6.4%) that using computerised information systems in the ED had eliminated a lot of paperwork, 106 respondents (29.6%) disagreed and 41 respondents (11.5%) strongly disagreed with this.

The perceived impact of using computerised systems on patient care was examined using three questions that focused on the quality of patient care, medical errors, and medical tests. The results showed that the highest percentage of respondents neither agreed nor disagreed (n=135, 37.7%) that using computerised information systems in the ED helps to improve the quality of patient care. However, more than one third of the respondents either agreed or strongly agreed (n=146, 43.8%) that using computerised information

systems in the ED helps to improve the quality of patient care. Similarly, 52.0% of respondents neither agreed nor disagreed (n=186) that using computerised information systems in the ED helps to decrease medical errors. In terms of the impact of information technology on reducing the number of unnecessary medical tests, 41.3% of respondents neither agreed nor disagreed (n=148). However, more than one third of the respondents either disagreed or strongly disagreed (n=154, 43.0%) that using computerised information systems in the ED helps to decrease the number of unnecessary medical tests (Table 5.17).

Environmental characteristics

Table 5.18 shows the frequency of responses for the environmental characteristics. As Table 5.18 shows, the first statement of this subscale was 'people, who are important to me in my work place, think that I should use information systems in the ED' and more than one third of the respondents ticked 'neither agree nor disagree' (n=152, 42.8%) to show their perceptions of the influence of subjective norm on the use of IT in the ED. However, more than one third of respondents either agreed (n=151, 42.5%) or strongly agreed (n=24, 6.8%) with this statement. The second statement was 'in the ED, senior staff have been helpful in the use of the information systems' and more than half of the respondents either agreed (n=168, 46.7%) or strongly agreed (n=20, 5.6%) with this.

Table 5.17- Frequency of responses for the impact of technology

Impact of technology	Individual impact						Organisational impact						Impact on patient care					
	Q24- Using a computer in the ED makes my day-to-day work easier		**Q25-** I feel stressed when I am using a computer in the ED.		**Q27-** Using a computer in the ED, my work takes longer than using manual methods.		**Q26-** Using computerised information systems in the ED has helped to improve staff communication.		**Q28-** Using computerised information systems in the ED has improved work efficiency in the department.		**Q29-** Using computerised information systems in the ED has eliminated a lot of paperwork.		**Q30-** Using computerised information systems in the ED helps to improve the quality of patient care.		**Q31-**Using computerised information systems in the ED helps to decrease medical errors.		**Q32-**Using computerised information systems in the ED helps to decrease the number of unnecessary medical tests.	
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
Strongly disagree	7	2.0%	69	19.2%	45	12.6%	11	3.1%	5	1.4%	41	11.5%	17	4.7%	20	5.6%	29	8.1%
Disagree	33	9.2%	195	54.2%	160	44.7%	55	15.3%	23	6.4%	106	29.6%	60	16.8%	81	22.6%	125	34.9%
Neither agree nor disagree	89	24.9%	58	16.1%	83	23.2%	106	29.5%	126	35.3%	64	17.9%	135	37.7%	186	52.0%	148	41.3%
Agree	183	51.1%	31	8.6%	61	17.0%	169	47.1%	183	51.3%	124	34.6%	132	36.9%	67	18.7%	50	14.0%
Strongly agree	46	12.8%	7	1.9%	9	2.5%	18	5.0%	20	5.6%	23	6.4%	14	3.9%	4	1.1%	6	1.7%
Total	358	100.0%	360	100.0%	358	100.0%	359	100.0%	357	100.0%	358	100.0%	358	100.0%	358	100.0%	358	100.0%

In terms of IT training, 127 respondents (35.3%) agreed and 6 respondents (1.7%) strongly agreed that adequate training in the use of information systems had been provided for the staff, and 133 respondents (37.0%) either disagreed or strongly disagreed with this. In terms of the adequacy of computer terminals in the ED, the highest percentage of respondents agreed (n=113, 31.4%) and 49 respondents (13.6%) strongly agreed that computers in the EDs were inadequate. Concerning user involvement, a majority of respondents either agreed (n=226, 63.1%) or strongly agreed (n=73, 20.4%) that users should be involved in the process of developing information systems for the ED. Only six respondents (1.7%) disagreed with this statement.

In terms of the technological environment, 161 respondents (44.7%) agreed or strongly agreed that 'using bedside computer terminals in the ED is a good idea'. In terms of the location of the current computer terminals in the ED, more than one third of respondents either disagreed or strongly disagreed (n=151, 42.1%) that the location of the computer terminals was inappropriate. The highest percentage of respondents (n=124, 34.4%) agreed and 45 respondents (12.5%) strongly agreed with the use of portable computers, such as handheld devices in the ED. Nearly half of the respondents either agreed (n=182, 50.6%) or strongly agreed (n=60, 16.7%) that computer terminals can be damaged by violent patients or their relatives in the ED. A relatively small percentage of respondents either disagreed or strongly disagreed (n=48, 13.3%), and 70 respondents (19.4%) neither agreed nor disagreed with this statement. The frequencies of responses for this subscale are summarised in Table 5.18.

Table 5.18- Frequency of responses for the environmental characteristics

Environmental characteristics	Social Environment				Organisational Environment						Technological Environment							
	Q33- People, who are important to me in my work place, think that I should use information systems in the ED.		Q34- In the ED, the senior staff have been helpful in the use of the information systems.		Q35- Adequate training in the use of information systems has been provided for the staff.		Q36- Currently, the computers are not adequate in the ED.		Q37- Users should be involved in the process of developing information systems for the ED.		Q38- Using bedside computer terminals in the ED is a good idea.		Q39- The location of the current computers terminals is not appropriate.		Q40- Portable computers, such as handheld devices are suitable to be used in the ED.		Q41-Computer terminals in the ED can be damaged by violent patients or their relatives.	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Strongly disagree	3	0.8%	4	1.1%	28	7.8%	8	2.2%	0	0.0%	14	3.9%	15	4.2%	22	6.1%	5	1.4%
Disagree	25	7.0%	51	14.2%	105	29.2%	97	26.9%	6	1.7%	91	25.3%	136	37.9%	81	22.5%	43	11.9%
Neither agree nor disagree	152	42.8%	117	32.5%	94	26.1%	93	25.8%	53	14.8%	94	26.1%	101	28.1%	88	24.4%	70	19.4%
Agree	151	42.5%	168	46.7%	127	35.3%	113	31.4%	226	63.1%	125	34.7%	86	24.0%	124	34.4%	182	50.6%
Strongly agree	24	6.8%	20	5.6%	6	1.7%	49	13.6%	73	20.4%	36	10.0%	21	5.8%	45	12.5%	60	16.7%
Total	355	100.0%	360	100.0%	360	100.0%	360	100.0%	358	100.0%	360	100.0%	359	100.0%	360	100.0%	360	100.0%

Likert scale scores

In the previous section the demographic characteristics of the respondents and the frequency of responses for each question were reported. The overall findings from the last section showed that respondents generally tended towards a positive view of IT. Furthermore, responses for most of the questions were distributed across the scale and did not show a bimodal distribution. The descriptive analysis of the scores is presented in this section.

Users' attitudes towards using IT in the ED - Scores

This subscale consisted of four questions. The last question (Q13) was negative and its score was reversed in order to correspond with the positive questions. The descriptive analysis was undertaken for each question and for the subscale separately. Table 5.19 shows descriptive analysis of users' attitudes scores.

Table 5.19- Descriptive analysis of users' attitudes scores

Users' attitudes towards using IT in the ED	N	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
Q10- Using computerised information systems in the ED is a good idea.	362	-1	2	467	1.29	.615	.378
Q11- Using computerised information systems in the ED is better than using manual methods.	361	-2	2	396	1.10	.826	.682
Q12- Using computerised information systems in the ED is more helpful than a hindrance.	361	-2	2	353	0.98	.833	.694
Q13- If I had a choice, I would not use computerised information systems in the ED.	360	-2	2	411	1.14	.905	.818
Subscale scores (4 questions)	358	-5	8	1613	4.51	2.626	6.895

As Table 5.19 shows, the mean value for all four questions was about or more than one. The mean value of the subscale was 4.51, suggesting that overall, respondents' attitudes towards using IT in the ED were positive. Figure 5.3 shows the distribution of the scores for this subscale.

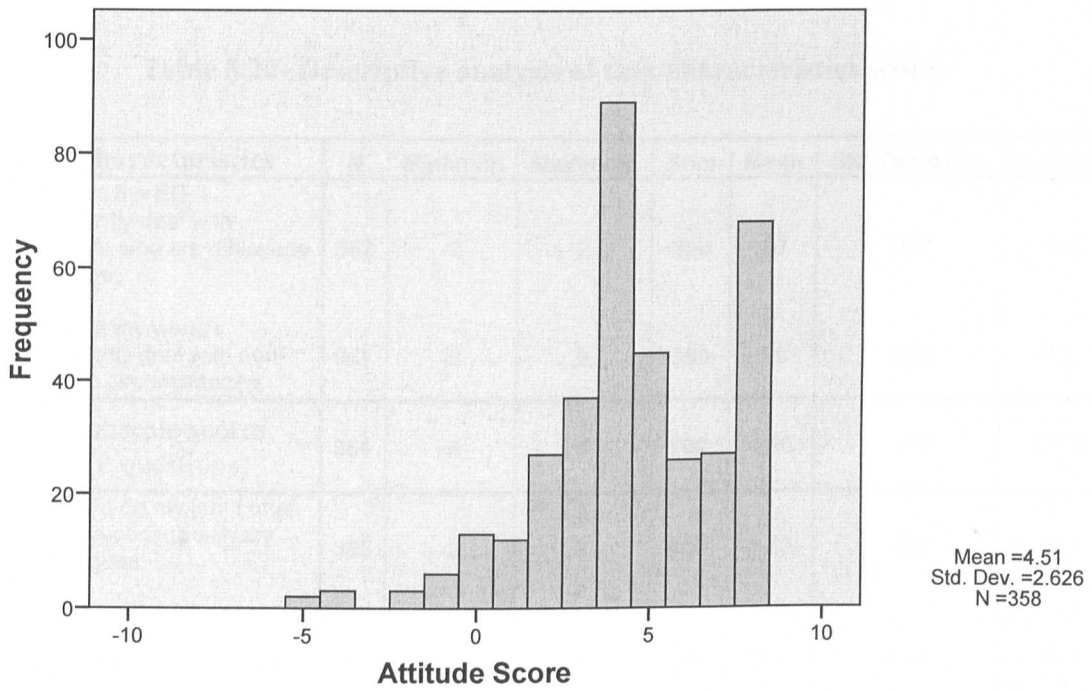

Figure 5.3- Frequency of scores for users' attitudes towards using IT in the ED

Task characteristics - Scores

Similar to the attitude subscale, the subscale of task characteristics included four questions. All questions were asked in a positive format. Table 5.20 shows the descriptive analysis of task characteristics scores.

Table 5.20- Descriptive analysis of task characteristics scores

Task characteristics		N	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
Task Complexity	Q14- In the ED, I frequently deal with patients who are difficult to manage.	362	-2	2	350	.97	.902	.813
	Q15- In my work, I frequently deal with non-routine circumstances.	361	-2	2	358	.99	.769	.592
	Subscale scores (2 questions)	361	-4	4	708	1.96	1.489	2.218
Task Interdependency	Q16- To do my job, I often need to consult with my colleagues.	362	-2	2	408	1.13	.868	.754
	Q17- My work involves communicating with organisations outside of the hospital.	361	-2	2	345	.96	.829	.687
	Subscale scores (2 questions)	361	-4	4	753	2.09	1.409	1.984
Subscale scores (4 questions)		360	-8	8	1460	4.06	2.544	6.470

As Table 5.20 shows, the mean value for three questions was less than one. The highest mean value was 1.13 for question 16. The mean value of the subscale with four questions was 4.06. This showed that the responses were more positive about the complexity and interdependency of tasks in the ED. Figure 5.4 presents the distribution of scores for this subscale.

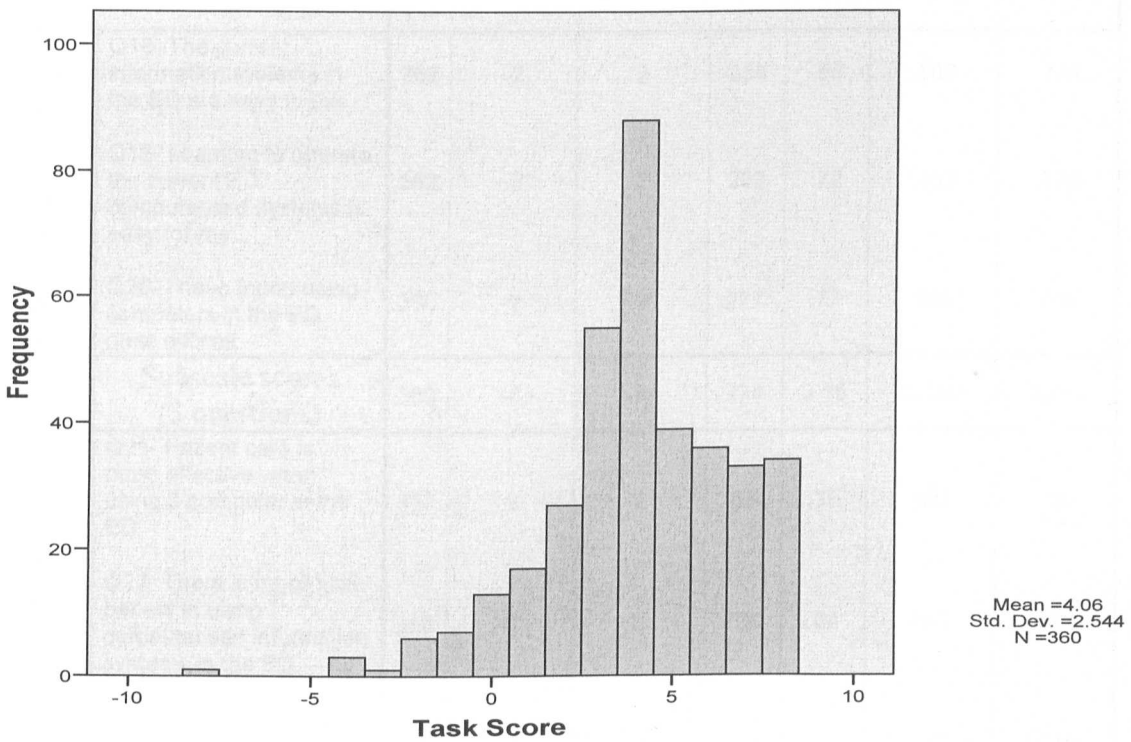

Figure 5.4- Frequency of scores for task characteristics in the ED

System characteristics - Scores

This subscale included two sections, each containing three questions. Two questions, Q20 and Q22, were asked in a negative format; therefore, their scores were reversed. The mean value for all six questions was less than one. Table 5.21 presents the descriptive analysis of system characteristics scores.

Table 5.21- Descriptive analysis of system characteristics scores

System characteristics		N	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
Perceived Ease of use	Q18- The current information systems in the ED are easy to use.	362	-2	2	234	.65	.863	.744
	Q19- Learning to operate the current ED computerised systems is easy for me.	362	-2	2	262	.72	.859	.738
	Q20- I have found using computers in the ED quite difficult.	360	-2	2	277	.77	.886	.785
	Subscale scores (3 questions)	360	-6	6	774	2.15	2.189	4.791
Perceived usefulness	Q21- Patient care is more effective when using a computer in the ED.	357	-2	2	88	.25	.887	.787
	Q22- There is no clinical benefit in using computerised information systems in the ED.	358	-2	2	230	.64	.847	.718
	Q23- Using a computer in the ED has improved the quality of work that I do.	358	-2	2	96	.27	.962	.925
	Subscale scores (3 questions)	357	-6	6	412	1.15	2.240	5.018
Subscale scores (6 questions)		357	-8	12	1184	3.32	3.560	12.672

As Table 5.21 shows, the mean value of perceived ease of use was 2.15 and the mean value of perceived usefulness was 1.15. Overall, the mean value of the subscale with six questions was 3.32, suggesting that the respondents were positive about the ease of use and usefulness of the systems that they used. Figure 5.5 presents the distribution of scores for this subscale.

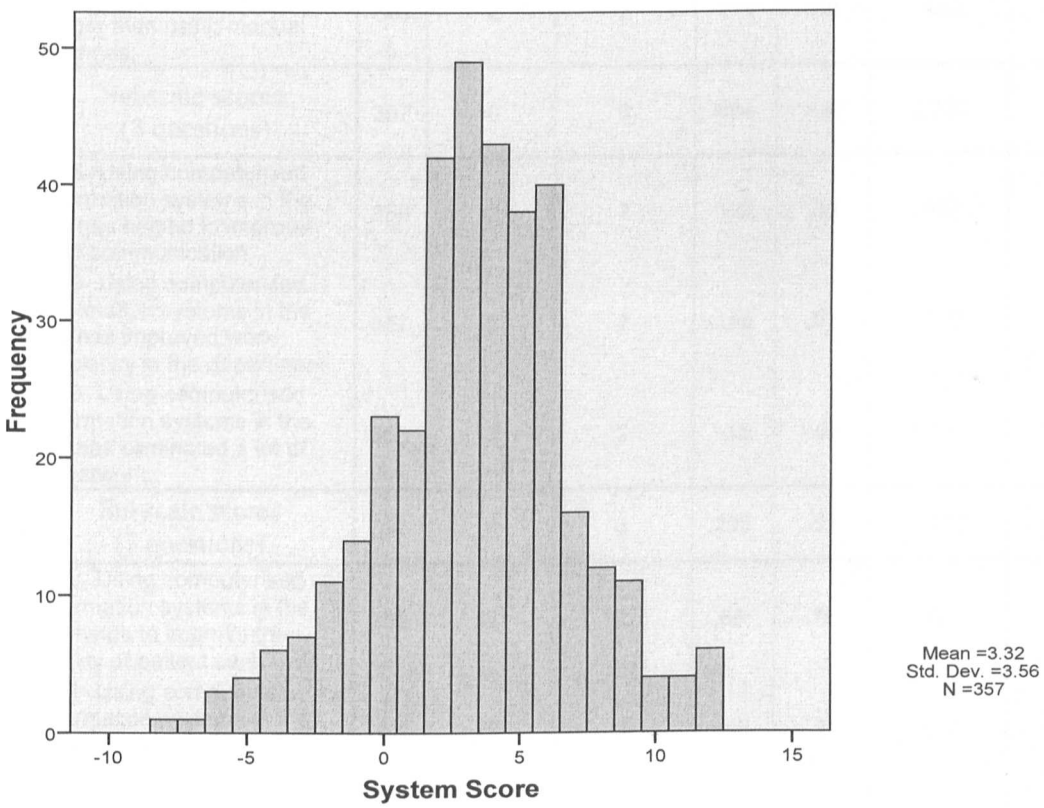

Figure 5.5- Frequency of scores for system characteristics in the ED

Impact of technology - Scores

This subscale included three sections and nine questions. The scores of two questions, Q25 and Q27, were reversed as they were asked in a negative format. Table 5.22 shows the descriptive analysis of scores for the impact of technology.

Table 5.22- Descriptive analysis of scores for the impact of technology

Impact of technology		N	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
Individual impact	Q24- Using a computer in the ED makes my day-to-day work easier	358	-2	2	228	.64	.890	.792
	Q25- I feel stressed when I am using a computer in the ED.	360	-2	2	288	.80	.914	.835
	Q27- Using a computer in the ED, my work takes longer than using manual methods.	358	-2	2	171	.48	.998	.995
	Subscale scores (3 questions)	357	-6	6	684	1.92	2.226	4.954
Organisational impact	Q26- Using computerised information systems in the ED has helped to improve staff communication.	359	-2	2	128	.36	.907	.822
	Q28- Using computerised information systems in the ED has improved work efficiency in the department.	357	-2	2	190	.53	.759	.576
	Q29- Using computerised information systems in the ED has eliminated a lot of paperwork.	358	-2	2	-18	-.05	1.166	1.359
	Subscale scores (3 questions)	357	-6	6	298	.83	2.110	4.453
Impact on patient care	Q30- Using computerised information systems in the ED helps to improve the quality of patient care.	358	-2	2	66	.18	.923	.851
	Q31- Using computerised information systems in the ED helps to decrease medical errors.	358	-2	2	-46	-.13	.817	.667
	Q32- Using computerised information systems in the ED helps to decrease the number of unnecessary medical tests.	358	-2	2	-121	-.34	.876	.768
	Subscale scores (3 questions)	356	-6	6	-103	-.29	2.055	4.223
Subscale scores (9 questions)		354	-16	18	885	2.50	5.133	26.347

As Table 5.22 shows, the mean value for the first three questions (individual impact) was 1.92. The mean value of the organisational impact and impact on patient care was 0.83 and -0.29 respectively. Figure 5.6 shows the distribution of scores for this subscale.

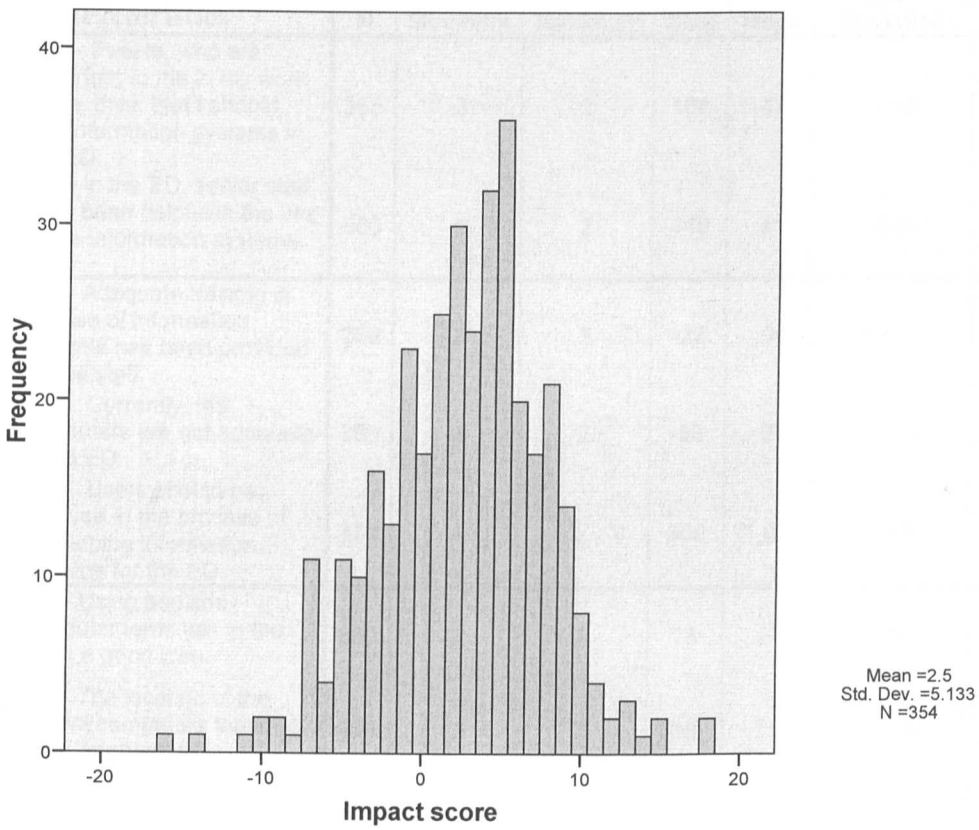

Figure 5.6- Frequency of scores for impact of technology in the ED

Environmental characteristics- Scores

As discussed in section 5.9.1, for the environmental characteristics, the descriptive analysis was separately undertaken for each question. This section contained nine questions. The scores for two questions, Q36 and Q39, were reversed, as these questions

were asked in a negative format. Table 5.23 shows the descriptive analysis of scores for each questions of the environmental characteristics.

Table 5.23- Descriptive analysis of scores for the environmental characteristics

Environmental characteristics		N	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
Social Environment	Q33- People, who are important to me in my work place, think that I should use information systems in the ED.	355	-2	2	168	.47	.760	.578
	Q34- In the ED, senior staff have been helpful in the use of the information systems.	360	-2	2	149	.41	.840	.706
Organisational Environment	Q35- Adequate training in the use of information systems has been provided for the staff.	360	-2	2	-22	-.06	1.011	1.021
	Q36- Currently, the computers are not adequate in the ED.	360	-2	2	-98	-.27	1.070	1.146
	Q37- Users should be involved in the process of developing information systems for the ED.	358	-1	2	366	1.02	.648	.420
Technological Environment	Q38- Using bedside computer terminals in the ED is a good idea.	360	-2	2	78	.22	1.054	1.112
	Q39- The location of the current computers terminals is not appropriate.	359	-2	2	38	.11	1.006	1.011
	Q40- Portable computers, such as handheld devices are suitable to be used in the ED.	360	-2	2	89	.25	1.121	1.256
	Q41- Computer terminals in the ED can be damaged by violent patients or their relatives.	360	-2	2	249	.69	.933	.871

As Table 5.23 shows, the first question was related to the subjective norm discussed in Chapter 2. For this question, the mean score was 0.47. The second question was related to the helpfulness of the senior staff in the use of IT in the ED. The mean score for this question was 0.41. Figures 5.7 and 5.8 show the distribution of scores for these individual questions.

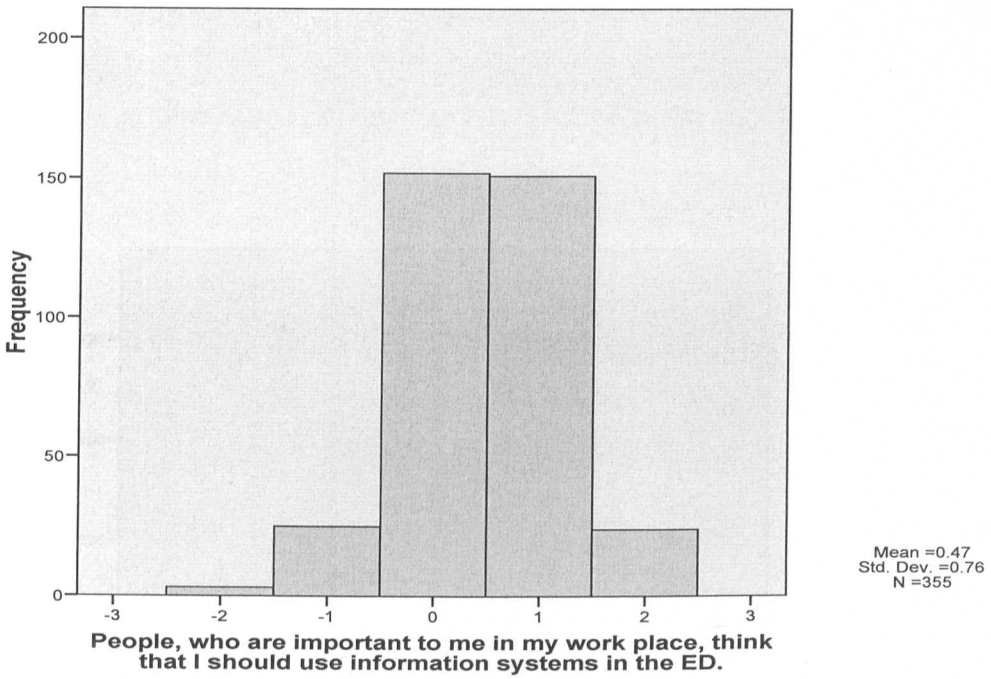

Figure 5.7- Frequency of scores for question 33

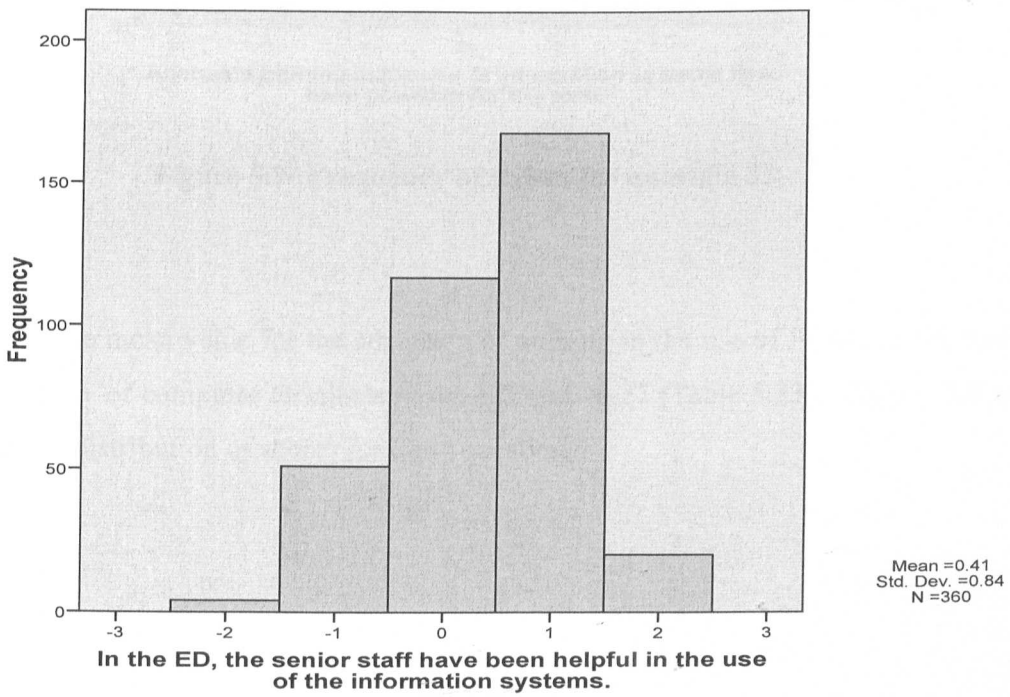

Figure 5.8- Frequency of scores for question 34

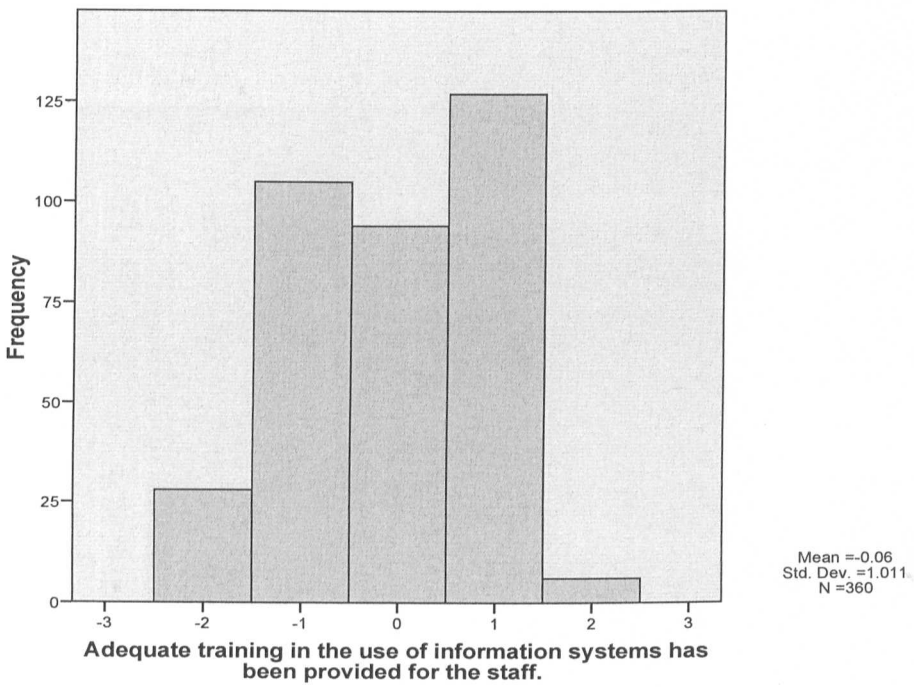

Figure 5.9- Frequency of scores for question 35

The mean value for the adequacy of training in the use of IT was -0.06, and for the inadequacy of computer terminals in the ED was -0.27 (Table 5.23). Figures 5.9 and 5.10 show the distribution of scores for these questions.

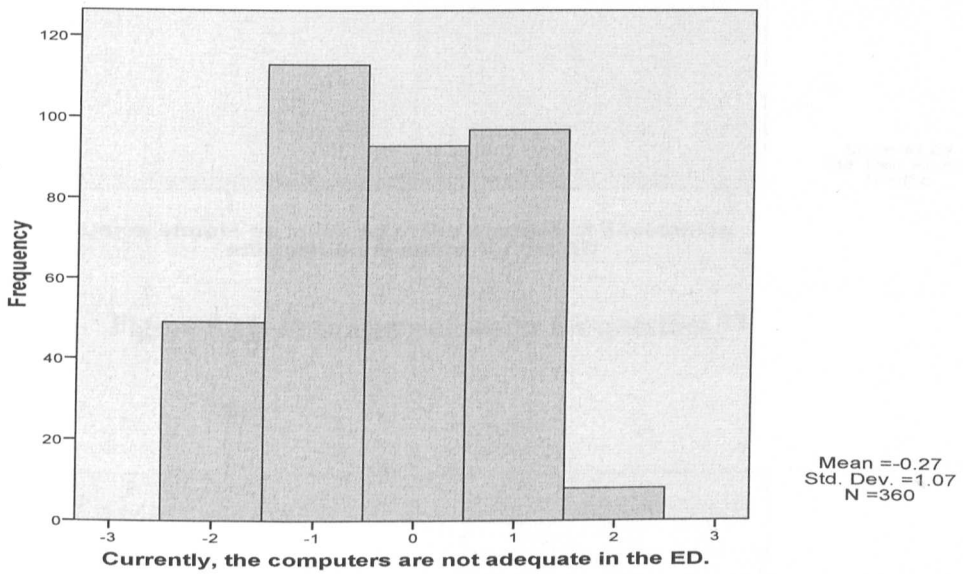

Figure 5.10- Frequency of scores for question 36

The highest mean value was related to the involvement of users in the process of developing information systems for the ED (mean= 1.02). In terms of technological environment, the mean score for using bedside computer terminals in the ED was 0.22. Figures 5.11 and 5.12 show the distribution of scores for these questions.

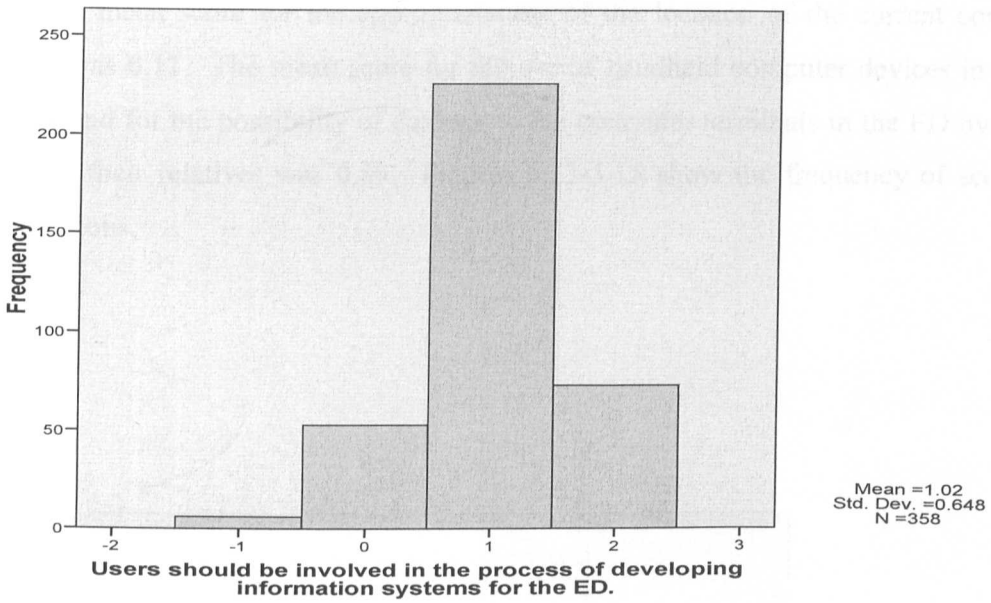

Figure 5.11- Frequency of scores for question 37

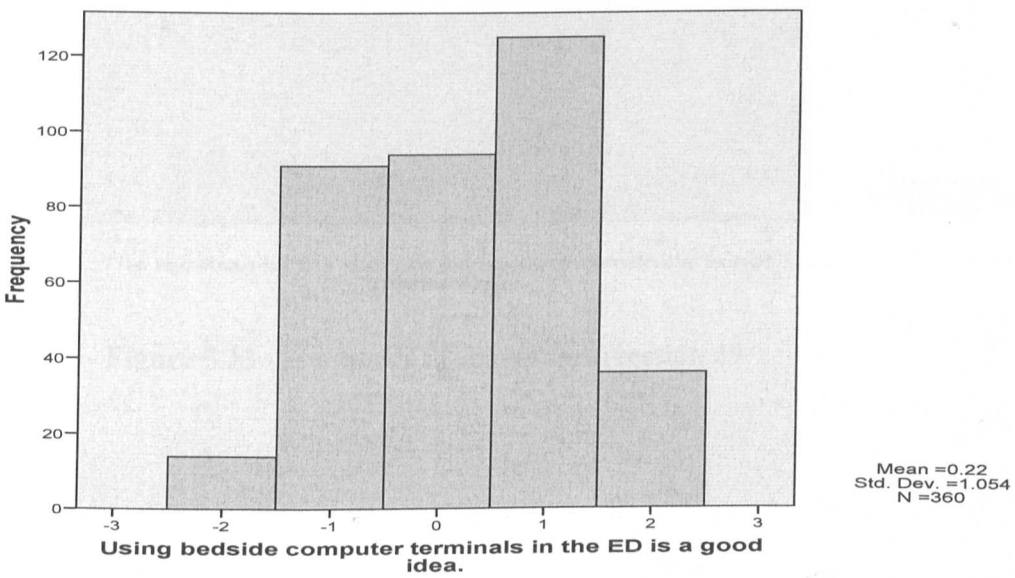

Figure 5.12- Frequency of scores for question 38

The mean score for the appropriateness of the location of the current computers terminals was 0.11. The mean score for the use of handheld computer devices in the ED was 0.25, and for the possibility of damage to the computer terminals in the ED by violent patients or their relatives was 0.69. Figures 5.13-5.15 show the frequency of scores for these questions.

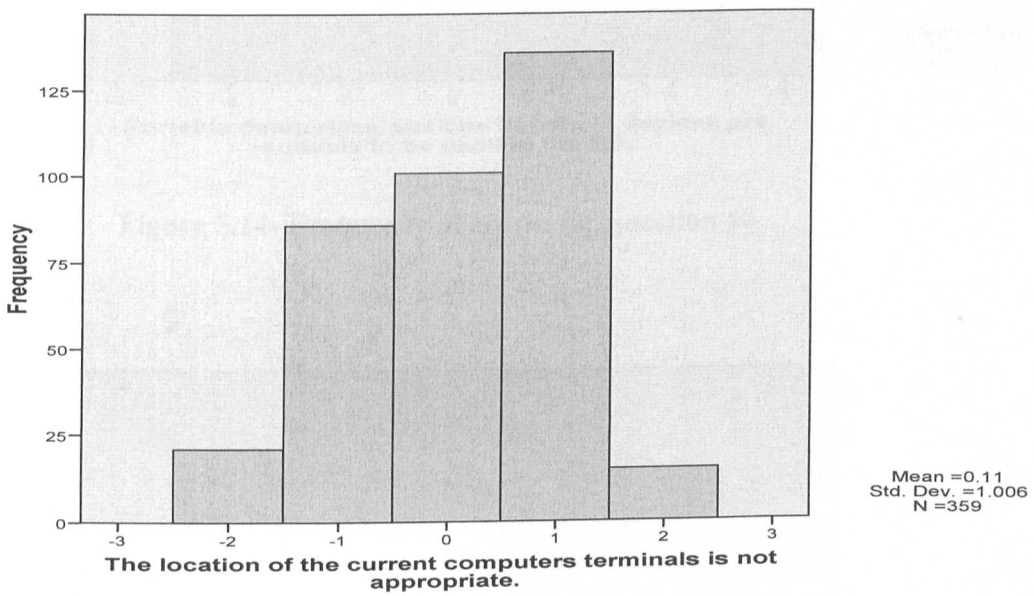

Figure 5.13- Frequency of scores for question 39

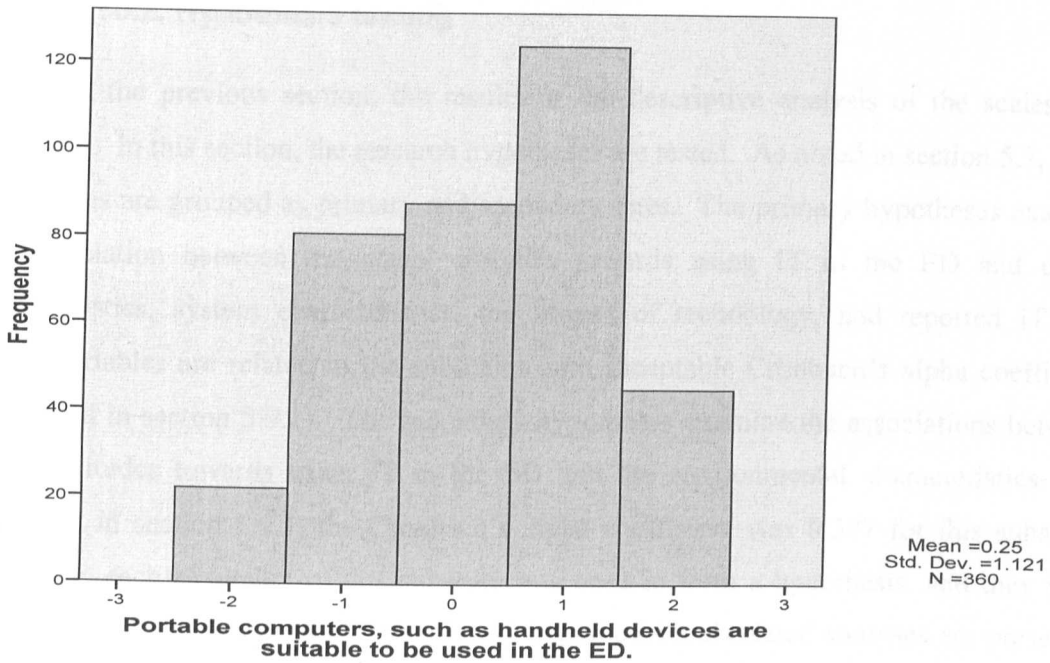

Figure 5.14- Frequency of scores for question 40

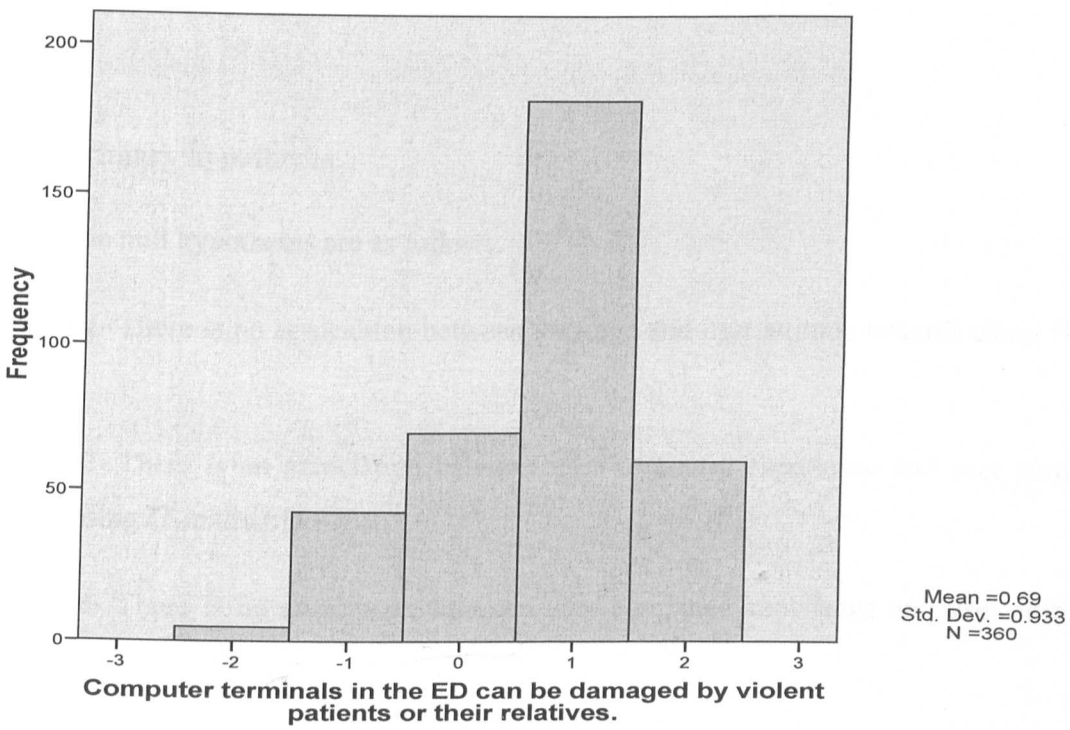

Figure 5.15- Frequency of scores for question 41

5.10.2. Hypothesis testing

In the previous section, the results of the descriptive analysis of the scales was presented. In this section, the research hypotheses are tested. As noted in section 5.7, these hypotheses are grouped as primary and secondary ones. The primary hypotheses examine the association between the users' attitudes towards using IT in the ED and users' characteristics, system characteristics, the impact of technology, and reported IT use. These variables are related to the subscales with acceptable Cronbach's alpha coefficient (discussed in section 5.9.1). The secondary hypotheses examine the associations between users' attitudes towards using IT in the ED and the environmental characteristics. As discussed in section 5.9.1, the Cronbach's alpha coefficient was 0.397 for this subscale. Therefore, each statement of this subscale was used to form a hypothesis, and they were termed secondary hypotheses. The primary hypotheses and related analyses are presented first and the secondary hypotheses are presented later in this section. Figure 5.16 shows the research hypotheses in a diagrammatic form. As Figure 5.16 shows, the proposed model suggests several factors may influence ED staff attitudes towards using IT in the ED and user attitude may influence IT usage.

Primary hypotheses

The null hypotheses are as follows.

H1- There is no association between user age and user attitude towards using IT in the ED.

H2- There is no association between user computer experience and user attitude towards using IT in the ED.

H3- There is no association between user computer knowledge and user attitude towards using IT in the ED.

H4- There is no association between the perceived task complexity and user attitude towards using IT in the ED.

H5- There is no association between the perceived task interdependency and user attitude towards using IT in the ED.

H6- There is no association between the perceived ease of use of the systems and user attitude towards using IT in the ED.

H7- There is no association between the perceived usefulness of the systems and user attitude towards using IT in the ED.

H8- There is no association between the perceived individual impact of the systems and user attitude towards using IT in the ED.

H9- There is no association between the perceived organisational impact of the systems and user attitude towards using IT in the ED.

H10- There is no association between the perceived impact of technology on patient care and user attitude towards using IT in the ED.

H11- There is no association between the user attitude towards using IT in the ED and the reported IT use.

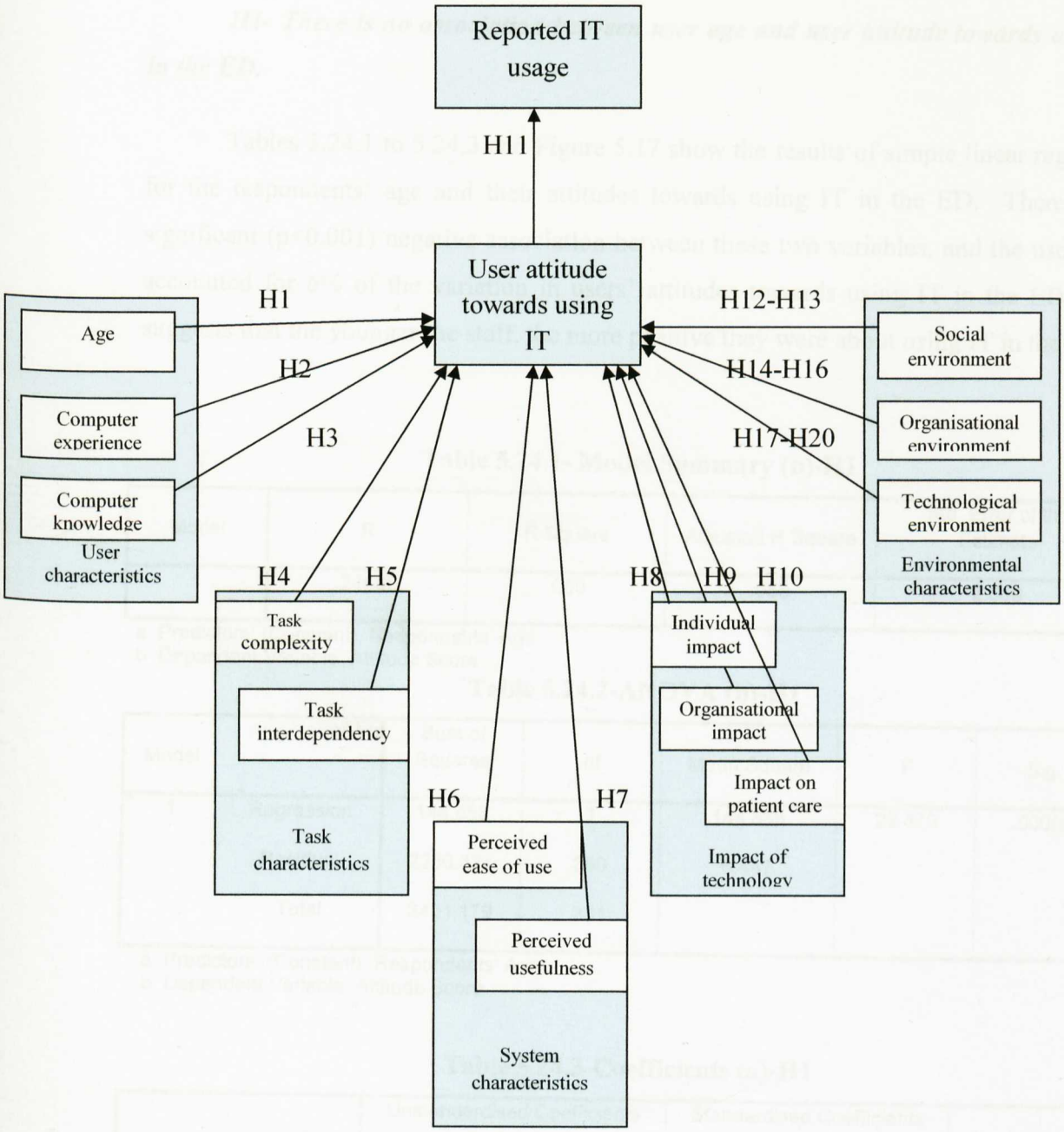

Figure 5.16- A proposed model for factors influencing users' attitudes towards, and the use of, IT in the ED and the hypotheses (H1-H20) that were derived from these.

H1- There is no association between user age and user attitude towards using IT in the ED.

Tables 5.24.1 to 5.24.3 and Figure 5.17 show the results of simple linear regression for the respondents' age and their attitudes towards using IT in the ED. There was a significant ($p<0.001$) negative association between these two variables, and the users' age accounted for 6% of the variation in users' attitudes towards using IT in the ED. This suggests that the younger the staff, the more positive they were about using IT in the ED.

Table 5.24.1- Model Summary (b)-H1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.246(a)	.060	.058	2.539

a Predictors: (Constant), Respondents' Age
b Dependent Variable: Attitude Score

Table 5.24.2-ANOVA (b)-H1

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	144.855	1	144.855	22.470	.000(a)
	Residual	2256.324	350	6.447		
	Total	2401.179	351			

a Predictors: (Constant), Respondents' Age
b Dependent Variable: Attitude Score

Table 5.24.3-Coefficients (a)-H1

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.879	.510		13.490	.000
	Respondent's Age	-.065	.014	-.246	-4.740	.000

a Dependent Variable: Attitude Score

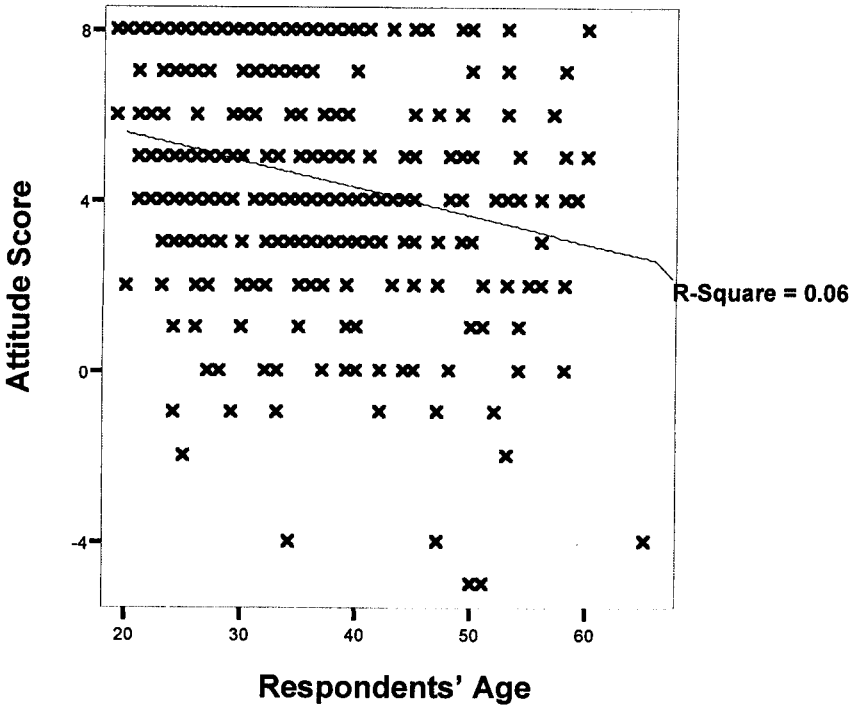

Figure 5.17- Scatter diagram for users' attitudes towards using IT in the ED against users' age

H2- There is no association between user computer experience and user attitude towards using IT in the ED.

Tables 5.25.1 to 5.25.3 and Figure 5.18 show the results of simple linear regression for users' computer experience and their attitudes towards using IT in the ED. There was a significant ($p<0.001$) positive association between these two variables, and the users' computer experience accounted for 9.7% of the variation in users' attitudes towards using IT in the ED. This suggests that the more computer experience that the staff reported, the more positive they were about using IT in the ED.

Table 5.25.1-Model Summary (b)-H2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.311(a)	.097	.094	2.499

a Predictors: (Constant), Computer Experience
b Dependent Variable: Attitude Score

Table 5.25.2-ANOVA (b)-H2

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	238.598	1	238.598	38.212	.000(a)
	Residual	2222.890	356	6.244		
	Total	2461.489	357			

a Predictors: (Constant), Computer Experience
b Dependent Variable: Attitude Score

Table 5.25.3-Coefficients (a)-H2

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.348	.373		6.293	.000
	Computer Experience	.623	.101	.311	6.182	.000

a Dependent Variable: Attitude Score

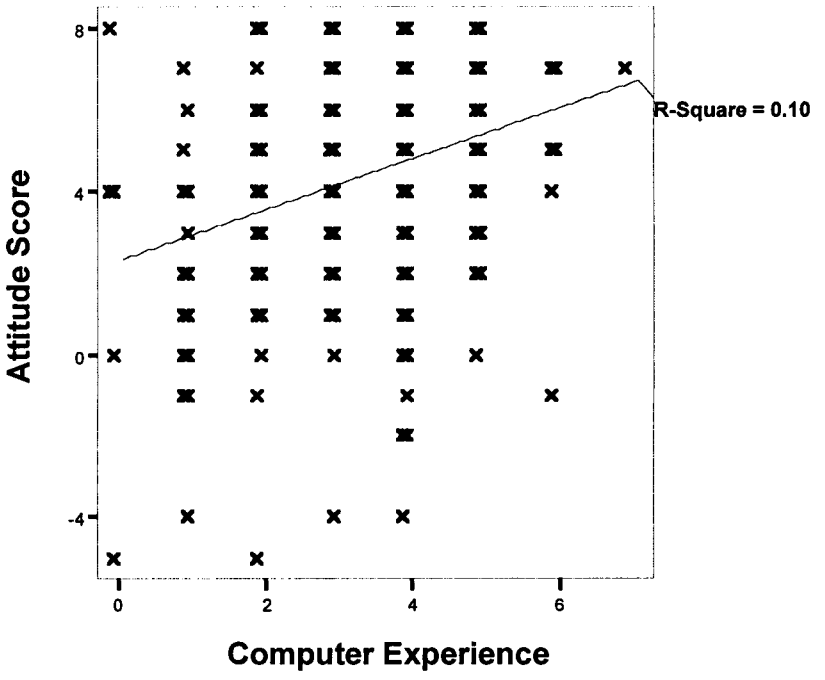

Figure 5.18- Scatter diagram for users' attitudes towards using IT in the ED against users' computer experiences

H3- There is no association between user computer knowledge and user attitude towards using IT in the ED.

Tables 5.26.1 to 5.26.3 and Figure 5.19 show the results of simple linear regression for the users' computer knowledge and their attitudes towards using IT in the ED. There was a significant ($p<0.001$) positive association between these two variables, and the users' computer knowledge accounted for 10.5% of the variation in users' attitudes towards using IT in the ED. This suggests that the more computer knowledge the staff reported, the more positive they were about using IT in the ED.

Table 5.26.1-Model Summary (b)-H3

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.323(a)	.105	.102	2.488

a Predictors: (Constant), Computer Knowledge
b Dependent Variable: Attitude Score

Table 5.26.2-ANOVA (b)-H3

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	257.556	1	257.556	41.603	.000(a)
	Residual	2203.933	356	6.191		
	Total	2461.489	357			

a Predictors: (Constant), Computer Knowledge
b Dependent Variable: Attitude Score

Table 5.26.3- Coefficients (a)-H3

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.289	.516		2.500	.013
	Computer Knowledge	.974	.151	.323	6.450	.000

a Dependent Variable: Attitude Score

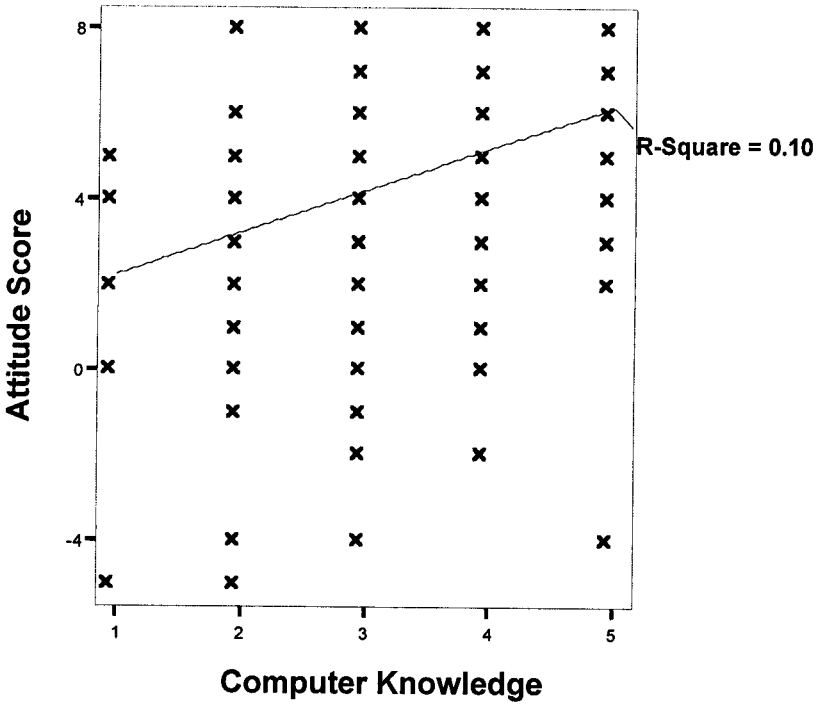

Figure 5.19- Scatter diagram for users' attitudes towards using IT in the ED against users' computer knowledge

H4- There is no association between the perceived task complexity and user attitude towards using IT in the ED.

Tables 5.27.1 to 5.27.3 and Figure 5.20 show the results of simple linear regression for the perceived task complexity and users' attitudes towards using IT in the ED. There was no significant association between these two variables (p=0.258). This suggests that the perceived task complexity in the ED did not influence the users' attitudes towards using IT in the ED.

Table 5.27.1-Model Summary-H4

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.060(a)	.004	.001	2.628

a Predictors: (Constant), Task Complexity

Table 5.27.2-ANOVA (b)-H4

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.871	1	8.871	1.284	.258(a)
	Residual	2452.361	355	6.908		
	Total	2461.232	356			

a Predictors: (Constant), Task Complexity
b Dependent Variable: Attitude Score

Table 5.27.3-Coefficients (a)-H4

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.300	.230		18.720	.000
	Task Complexity	.106	.094	.060	1.133	.258

a Dependent Variable: Attitude Score

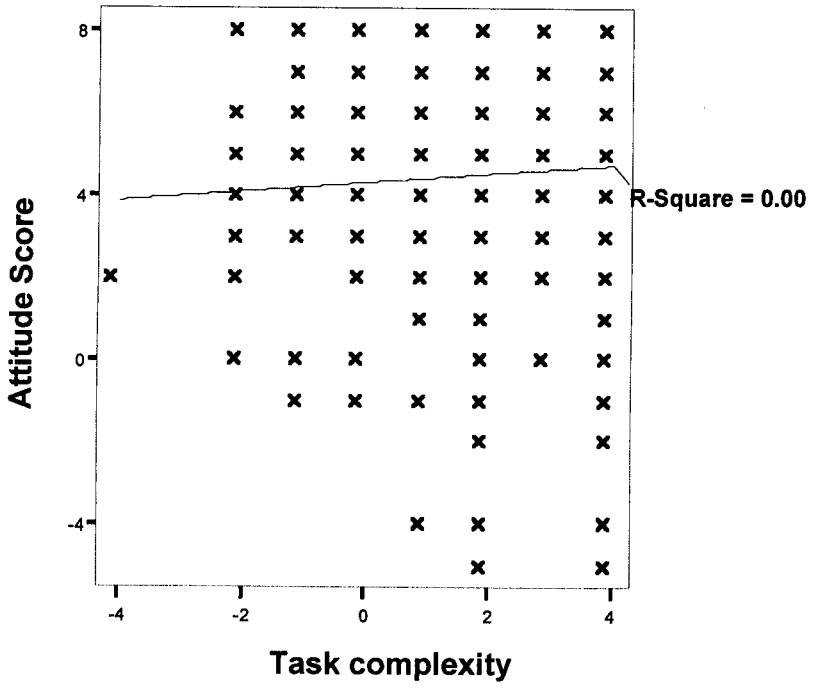

Figure 5.20- Scatter diagram for users' attitudes towards using IT in the ED against perceived task complexity

H5- There is no association between the perceived task interdependency and user attitude towards using IT in the ED.

Tables 5.28.1 to 5.28.3 and Figure 5.21 show the results of simple linear regression for the perceived task interdependency and users' attitudes towards using IT in the ED. There was a significant (p= 0.035) positive association between these two variables, and perceived task interdependency accounted for 1.2% of the variation in users' attitudes towards using IT in the ED. This suggests that the more the staff perceived their tasks to be interdependent, the more positive they were about using IT in the ED.

Table 5.28.1- Model Summary-H5

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.112(a)	.012	.010	2.613

a Predictors: (Constant), Task Interdependency

Table 5.28.2-ANOVA (b)-H5

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30.549	1	30.549	4.473	.035(a)
	Residual	2424.644	355	6.830		
	Total	2455.193	356			

a Predictors: (Constant), Task Interdependency
b Dependent Variable: Attitude Score

Table 5.28.3- Coefficients (a)-H5

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.080	.247		16.538	.000
	Task Interdependency	.208	.098	.112	2.115	.035

a Dependent Variable: Attitude Score

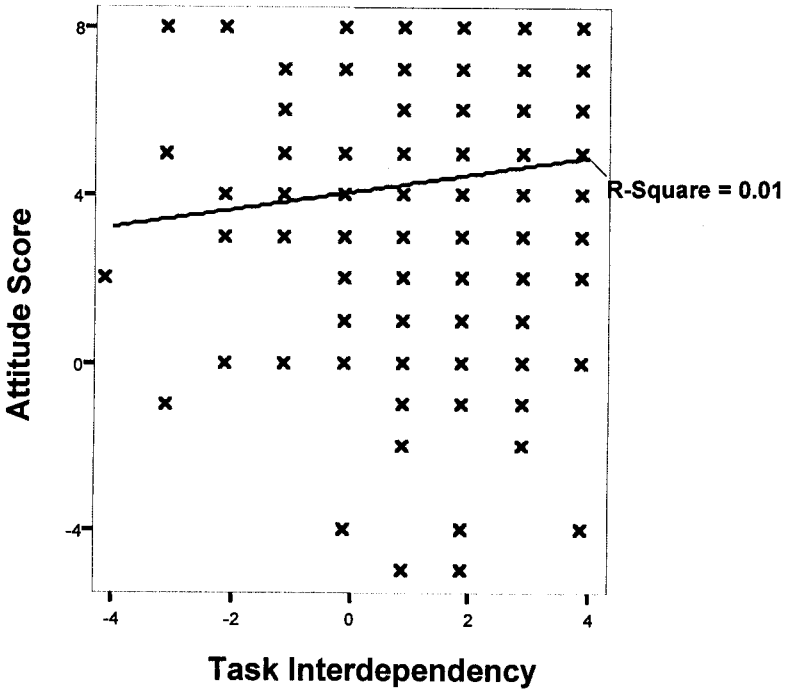

Figure 5.21- Scatter diagram for users' attitudes towards using IT in the ED against perceived task interdependency

H6- There is no association between the perceived ease of use of the systems and user attitude towards using IT in the ED.

Tables 5.29.1 to 5.29.3 and Figure 5.22 show the results of simple linear regression for the perceived ease of use of the computerised systems and users' attitudes towards using IT in the ED. There was a significant ($p<0.001$) positive association between these two variables, and perceived ease of use accounted for 21.5% of the variation in users' attitudes towards using IT in the ED. This suggests that the more the systems were perceived as easy to use, the more positive the staff were about using IT in the ED.

Table 5.29.1-Model Summary-H6

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.463(a)	.215	.212	2.331

a Predictors: (Constant), Ease of use Score

Table 5.29.2-ANOVA (b)-H6

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	526.796	1	526.796	96.975	.000(a)
	Residual	1928.453	355	5.432		
	Total	2455.249	356			

a Predictors: (Constant), Ease of use Score
b Dependent Variable: Attitude Score

Table 5.29.3-Coefficients (a)-H6

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.289	.174		18.891	.000
	Ease of use Score	.558	.057	.463	9.848	.000

a Dependent Variable: Attitude Score

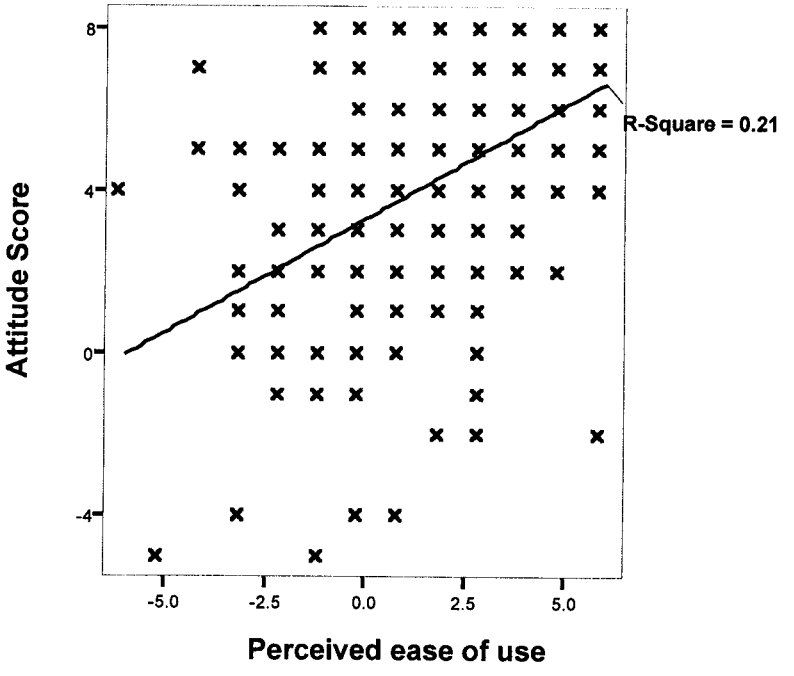

Figure 5.22- Scatter diagram for users' attitudes towards using IT in the ED against perceived ease of use

H7- There is no association between the perceived usefulness of the systems and user attitude towards using IT in the ED.

Tables 5.30.1 to 5.30.3 and Figure 5.23 show the results of simple linear regression for the perceived usefulness of the computerised systems and users' attitudes towards using IT in the ED. There was a significant ($p<0.001$) positive association between these two variables, and perceived usefulness accounted for 33.6% of the variation in users' attitudes towards using IT in the ED. This suggests that the more the systems were perceived to be useful, the more the staff were positive about using IT in the ED.

Table 5.30.1- Model Summary-H7

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.579(a)	.336	.334	2.138

a Predictors: (Constant), Usefulness Score

Table 5.30.2- ANOVA (b)-H7

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	812.981	1	812.981	177.798	.000(a)
	Residual	1609.517	352	4.572		
	Total	2422.497	353			

a Predictors: (Constant), Usefulness Score
b Dependent Variable: Attitude Score

Table 5.30.3 – Coefficients (a)-H7

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.723	.128		29.121	.000
	Usefulness Score	.677	.051	.579	13.334	.000

a Dependent Variable: Attitude Score

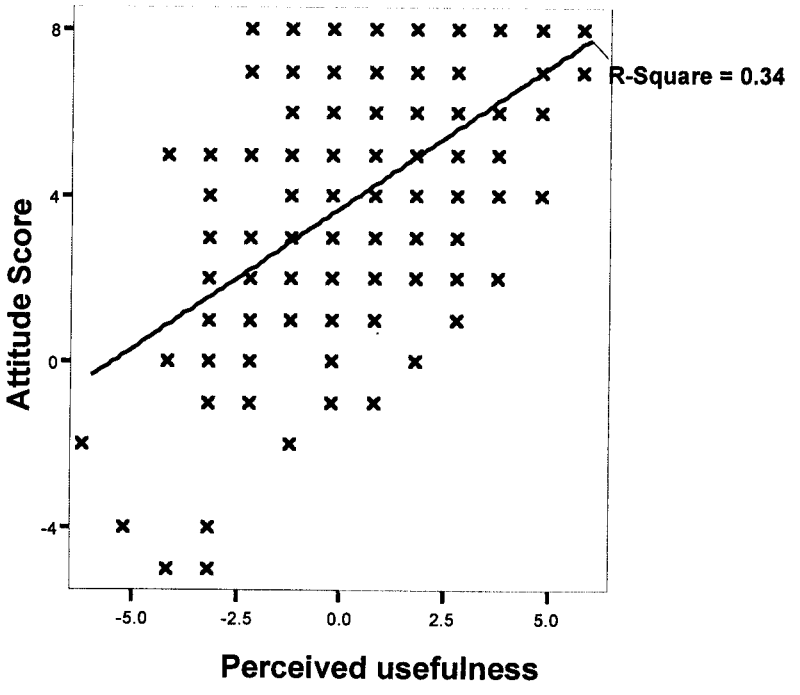

Figure 5.23- Scatter diagram for users' attitudes towards using IT in the ED against perceived usefulness

H8- There is no association between the perceived individual impact of the systems and user attitude towards using IT in the ED.

Tables 5.31.1 to 5.31.3 and Figure 5.24 show the results of simple linear regression for the perceived individual impact of the systems and users' attitudes towards using IT in the ED. There was a significant ($p<0.001$) positive association between these two variables, and perceived individual impact of the systems accounted for 38.7% of the variation in users' attitudes towards using IT in the ED. This suggests that the more positive the perceived individual impact of the systems was perceived, the more positive the staff were about using IT in the ED.

Table 5.31.1-Model Summary-H8

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.622(a)	.387	.385	2.059

a Predictors: (Constant), Individual impact score

Table 5.31.2-ANOVA (b)-H8

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	938.888	1	938.888	221.567	.000(a)
	Residual	1487.356	351	4.237		
	Total	2426.244	352			

a Predictors: (Constant), Individual impact score
b Dependent Variable: Attitude Score

Table 5.31.3-Coefficients (a)-H8

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.075	.146		21.101	.000
	Individual impact score	.739	.050	.622	14.885	.000

a Dependent Variable: Attitude Score

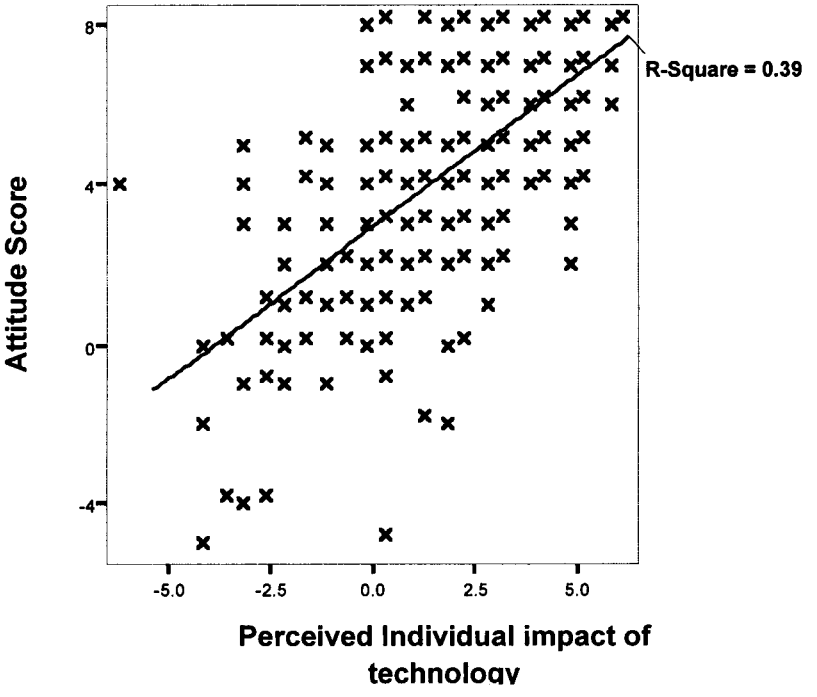

Figure 5.24- Scatter diagram for users' attitudes towards using IT in the ED against perceived individual impact of the systems

H9- There is no association between the perceived organisational impact of the systems and user attitude towards using IT in the ED.

Tables 5.32.1 to 5.32.3 and Figure 5.25 show the results of simple linear regression for the perceived organisational impact of the systems and users' attitudes towards using IT in the ED. There was a significant ($p<0.001$) positive association between these two variables, and perceived organisational impact accounted for 11.6% of the variation in users' attitudes towards using IT in the ED. This suggests that the more positive the perceived organisational impact of the systems, the more positive the staff were about using IT in the ED.

Table 5.32.1-Model Summary-H9

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.341(a)	.116	.113	2.472

a Predictors: (Constant), Organisational Impact Score

Table 5.32.2-ANOVA (b)-H9

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	281.446	1	281.446	46.059	.000(a)
	Residual	2144.798	351	6.111		
	Total	2426.244	352			

a Predictors: (Constant), Organisational Impact Score
b Dependent Variable: Attitude Score

Table 5.32.3-Coefficients (a)-H9

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.149	.142		29.298	.000
	Organisational Impact Score	.422	.062	.341	6.787	.000

a Dependent Variable: Attitude Score

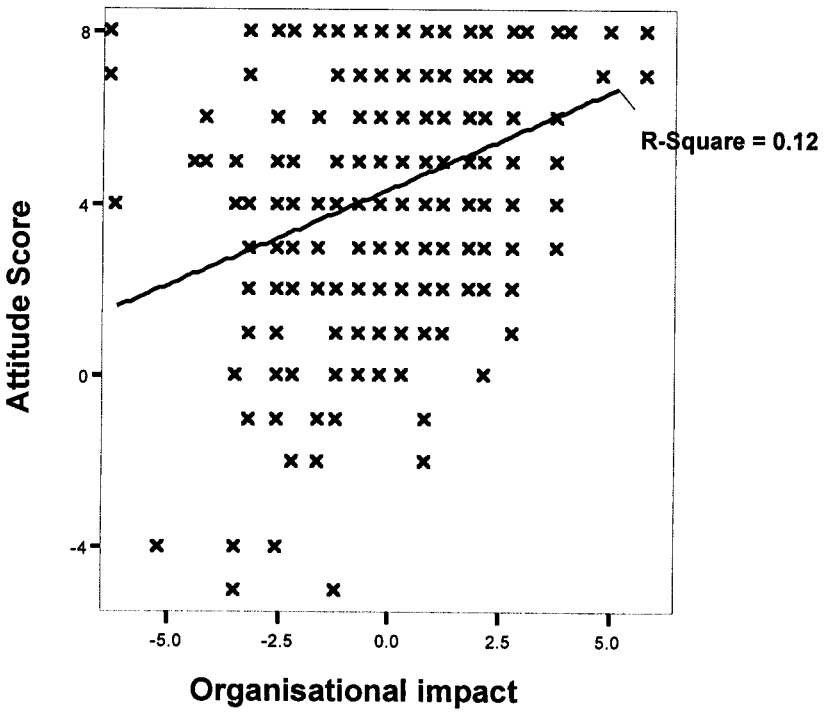

Figure 5.25- Scatter diagram for users' attitudes towards using IT in the ED against perceived organisational impact of the systems

H10- There is no association between the perceived impact of technology on patient care and user attitude towards using IT in the ED.

Tables 5.33.1 to 5.33.3 and Figure 5.26 show the results of simple linear regression for the perceived impact of using the systems on patient care and users' attitudes towards using IT in the ED. There was a significant ($p<0.001$) positive association between these two variables, and perceived impact of using the systems on patient care accounted for 11.8% of the variation in users' attitudes towards using IT in the ED. This suggests that the more positive the perceived impact of IT on patient care, the more positive the staff were about using IT in the ED.

Table 5.33.1-Model Summary-H10

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.344(a)	.118	.116	2.472

a Predictors: (Constant), Impact on patient care

Table 5.33.2-ANOVA (b)-H10

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	286.883	1	286.883	46.940	.000(a)
	Residual	2139.114	350	6.112		
	Total	2425.997	351			

a Predictors: (Constant), Impact on patient care
b Dependent Variable: Attitude Score

Table 5.33.3-Coefficients (a)-H10

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.632	.133		34.797	.000
	Impact on patient care	.440	.064	.344	6.851	.000

a Dependent Variable: Attitude Score

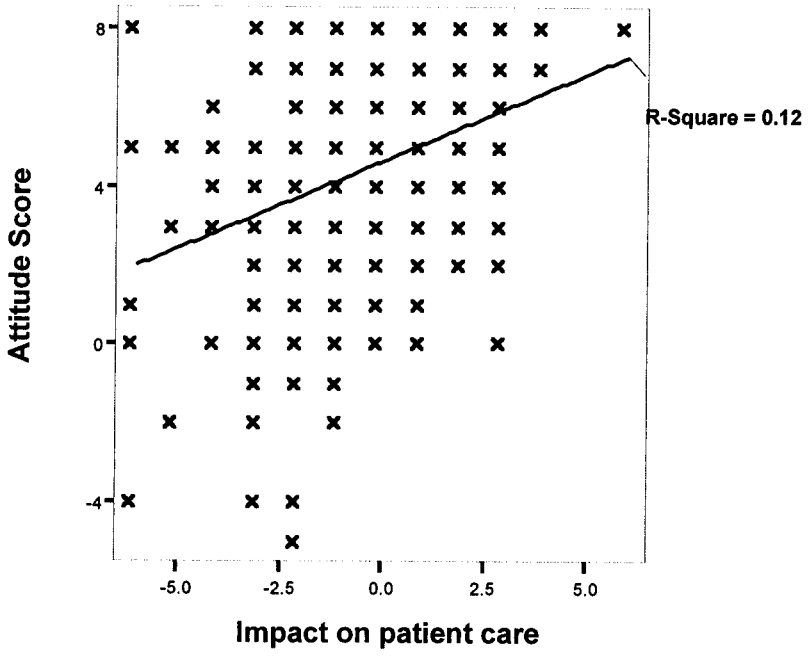

Figure 5.26- Scatter diagram for users' attitudes towards using IT in the ED against perceived impact of using the systems on patient care

H11- There is no association between the user attitude towards using IT in the ED and the reported IT use.

Tables 5.34.1 to 5.34.3 and Figure 5.27 show the results of simple linear regression for users' attitudes towards using IT in the ED and the reported IT use. There was a significant (p=0.016) positive association between these two variables, and the users' attitudes towards using IT in the ED accounted for 1.7% of the variation in users' attitudes towards using IT in the ED. This suggests that the more positive the staff were about using IT in the ED, they reported spending more time using systems in the department; however, this association was rather weak.

Table 5.34.1-Model Summary-H11

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.132(a)	.017	.014	10.9425

a Predictors: (Constant), Attitude Score

Table 5.34.2-ANOVA (b)-H11

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	707.651	1	707.651	5.910	.016(a)
	Residual	40112.040	335	119.737		
	Total	40819.691	336			

a Predictors: (Constant), Attitude Score
b Dependent Variable: Reported IT usage - Hour/Week

Table 5.34.3-Coefficients (a)-H11

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.162	1.198		7.651	.000
	Attitude Score	.555	.228	.132	2.431	.016

a Dependent Variable: Reported IT usage - Hour/Week

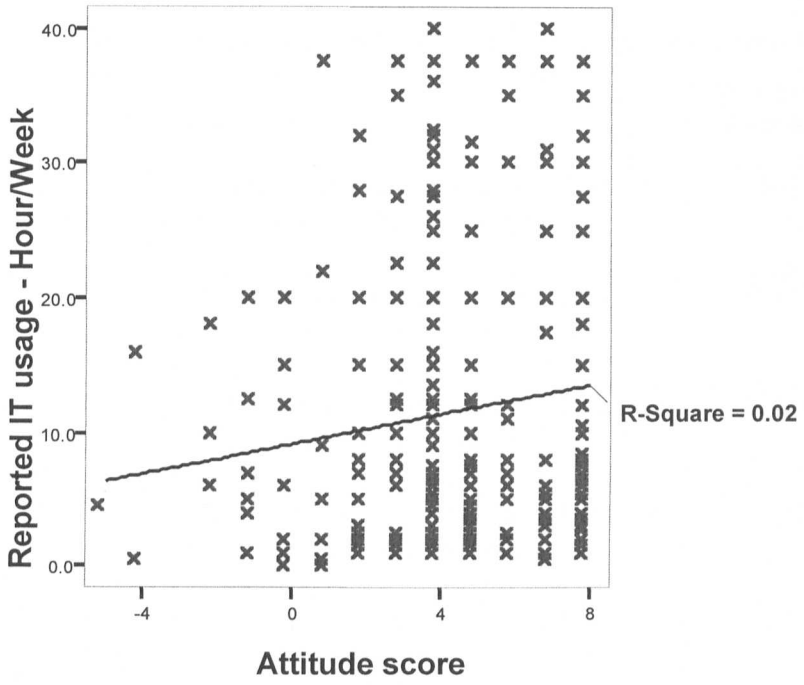

Figure 5.27- Scatter diagram for the reported IT usage against users' attitudes towards using IT in the ED

The results of the regression tests for the primary hypotheses are summarised in Table 5.35. As Table 5.35 shows, nearly all null hypotheses were rejected and the associations between different factors and users' attitudes were confirmed. Only H4 was not rejected.

Table 5.35-The results of the regression tests for the primary null hypotheses

Concept	Primary hypotheses	*P* value	Proportion of variance	Null hypothesis status
Individual characteristics	H1-There is no association between user age and user attitude towards using IT in the ED.	$P<0.001$	6%	*Rejected*
	H2-There is no association between user computer experience and user attitude towards using IT in the ED.	$P<0.001$	9.7%	*Rejected*
	H3-There is no association between user computer knowledge and user attitude towards using IT in the ED.	$P<0.001$	10.5%	*Rejected*
Task characteristics	H4-There is no association between the perceived task complexity and user attitude towards using IT in the ED.	$P=0.258$	0.4%	*Accepted*
	H5-There is no association between the perceived task interdependency and user attitude towards using IT in the ED.	$P=0.035$	1.2%	*Rejected*
System characteristics	H6-There is no association between the perceived ease of use of the systems and user attitude towards using IT in the ED.	$P<0.001$	21.5%	*Rejected*
	H7-There is no association between the perceived usefulness of the systems and user attitude towards using IT in the ED.	$P<0.001$	33.6%	*Rejected*
Impact of technology	H8-There is no association between the perceived individual impact of the systems and user attitude towards using IT in the ED.	$P<0.001$	38.7%	*Rejected*
	H9-There is no association between the perceived organisational impact of the systems and user attitude towards using IT in the ED.	$P<0.001$	11.6%	*Rejected*
	H10-There is no association between the impact of technology on patient care and user attitude towards using IT in the ED.	$P<0.001$	11.8%	*Rejected*
Attitude and reported IT use	H11-There is no association between the user attitude towards using IT in the ED and the reported IT use.	$P=0.016$	1.7%	*Rejected*

Multiple regression analysis (1)

In order to identify which of the primary independent variables had the most influence on predicting users' attitudes towards using IT in the ED, multiple regression analysis was applied using the 'stepwise' method. In stepwise regression, variables from the regression equation are added or dropped, usually one at a time, to see any difference in the proportion of variance explained in the dependent variable. This new figure shows how important the independent variable is (Punch, 1998). In this method, all independent variables were entered using a probability of F to enter ≤ 0.05 and a probability of F to remove at ≥ 0.10. As Table 5.36.1 shows, only four variables remained in the final model. The correlation coefficient between users' attitudes towards using IT in the ED and four selected variables, namely, the individual impact of technology, perceived usefulness, perceived ease of use, and users' computer experiences was 0.705.

Table 5.36.1-Model Summary (e)-MRA (1)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.638(a)	.407	.405	2.028
2	.684(b)	.467	.464	1.925
3	.700(c)	.490	.485	1.887
4	.705(d)	.496	.490	1.878

a Predictors: (Constant), Individual impact score
b Predictors: (Constant), Individual impact score, Usefulness Score
c Predictors: (Constant), Individual impact score, Usefulness Score, Ease of use Score
d Predictors: (Constant), Individual impact score, Usefulness Score, Ease of use Score, Computer Experience
e Dependent Variable: Attitude Score

When all four variables included in the model, the proportion of the variance in the dependent variable (users' attitudes), the R square, that was explained by the independent variables was 0.496, or 49.6%. The contribution of each factor to the variance was as follows: individual impact of technology (40.7%), perceived usefulness (6.0%), perceived ease of use (2.3%), and users' computer experience (0.6%). This shows that the independent variables accounted for almost 50% of the variation in the users' attitudes towards using IT in the ED.

As Table 5.36.2 shows, the regression model with four predictors was significantly related to the users' attitudes, $F_{(4)} = 82.813$, ($p<0.001$).

Table 5.36.2-ANOVA (e)-MRA (1)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	957.698	1	957.698	232.789	.000(a)
	Residual	1394.654	339	4.114		
	Total	2352.352	340			
2	Regression	1099.341	2	549.671	148.274	.000(b)
	Residual	1253.011	338	3.707		
	Total	2352.352	340			
3	Regression	1152.202	3	384.067	107.845	.000(c)
	Residual	1200.150	337	3.561		
	Total	2352.352	340			
4	Regression	1167.805	4	291.951	82.813	.000(d)
	Residual	1184.547	336	3.525		
	Total	2352.352	340			

a Predictors: (Constant), Individual impact score
b Predictors: (Constant), Individual impact score, Usefulness Score
c Predictors: (Constant), Individual impact score, Usefulness Score, Ease of use Score
d Predictors: (Constant), Individual impact score, Usefulness Score, Ease of use Score, Computer Experience
e Dependent Variable: Attitude Score

Table 5.36.3 shows that the *t* test was significant for the predictors ($p<0.001$). However, in model 4, the level of significant was slightly different, 'the perceived individual impact of technology' ($p<0.001$), 'perceived usefulness' ($p<0.001$), 'perceived ease of use' ($p=0.001$), and 'users' computer experiences' ($p=0.036$). The regression model predicted that an increase in each of mentioned variables would improve users' attitudes towards using IT in the ED, and the value of change (Beta) for 'the individual impact of technology' was 0.345, for 'perceived usefulness' was 0.297, for 'perceived ease of use' was 0.160, and for 'users' computer experiences' was 0.087. The standardised Beta

values are measured in standard deviation units, and show the number of standard deviations that the dependent variable will change, as a result of one standard deviation change in independent variable.

Table 5.36.3-Coefficients (a)-MRA (1)

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.068	.147		20.922	.000
	Individual impact score	.758	.050	.638	15.257	.000
2	(Constant)	3.086	.139		22.162	.000
	Individual impact score	.537	.059	.452	9.058	.000
	Usefulness Score	.358	.058	.308	6.181	.000
3	(Constant)	2.842	.151		18.881	.000
	Individual impact score	.406	.067	.342	6.049	.000
	Usefulness Score	.367	.057	.316	6.462	.000
	Ease of use Score	.223	.058	.183	3.853	.000
4	(Constant)	2.301	.298		7.732	.000
	Individual impact score	.410	.067	.345	6.127	.000
	Usefulness Score	.345	.057	.297	6.006	.000
	Ease of use Score	.195	.059	.160	3.311	.001
	Computer Experience	.178	.084	.087	2.104	.036

a Dependent Variable: Attitude Score

Therefore, according to the stepwise regression model, four primary predictors, the perceived individual impact of technology, the perceived usefulness, the perceived ease of use, and users' computer experience could predict users' attitudes towards using IT in the ED. The remaining variables (users' age, computer knowledge, perceived task interdependency, organisational impact, and impact on patient care) were excluded from the model, as their observed significance level was too large to be included in the model (p>0.05).

Secondary hypotheses-Environmental characteristics

In this section, the association between the users' attitudes towards using IT in the ED and each of the questions related to the environmental characteristics are reported using simple linear regression analysis. The null hypotheses are as follows.

Social Environment

H12- There is no association between the subjective norm in a setting and user attitude towards using IT in the ED.

H13- There is no association between the helpfulness of the senior staff in the use of the information systems and user attitude towards using IT in the ED.

Organisational Environment

H14- There is no association between the adequacy of training in the use of information systems and user attitude towards using IT in the ED.

H15- There is no association between the inadequacy of computers in the ED and user attitude towards using IT in the ED.

H16- There is no association between the user involvement in the process of developing information systems for the ED and user attitude towards using IT in the ED.

Technological Environment

H17- There is no association between using bedside computer terminals in the ED and user attitude towards using IT in the ED.

H18- There is no association between the inappropriateness of the location of computer terminals and user attitude towards using IT in the ED.

H19- There is no association between using portable computers, such as handheld devices and user attitude towards using IT in the ED.

H20- There is no association between the possibility of damage to the computer terminals in the ED by violent patients or their relatives and user attitude towards using IT in the ED.

H12- There is no association between the subjective norm in a setting and user attitude towards using IT in the ED.

Tables 5.37.1 to 5.37.3 and Figure 5.28 show the results of simple linear regression for the subjective norm in a setting (discussed in Chapter 2) and users' attitudes towards using IT in the ED. There was a significant ($p<0.001$) positive association between these two variables, and subjective norm in a setting accounted for 6.1% of the variation in users' attitudes towards using IT in the ED. This suggests that the stronger the subjective norm about using the systems, the more positive the staff were about using the systems.

Table 5.37.1-Model Summary-H12

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.246(a)	.061	.058	2.568

a Predictors: (Constant), People, who are important to me in my work place, think that I should use information systems in the ED.

Table 5.37.2-ANOVA (b)-H12

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	148.470	1	148.470	22.516	.000(a)
	Residual	2301.280	349	6.594		
	Total	2449.749	350			

a Predictors: (Constant), People, who are important to me in my work place, think that I should use information systems in the ED.
b Dependent Variable: Attitude Score

Table 5.37.3-Coefficients (a)-H12

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.102	.161		25.507	.000
	People, who are important to me in my work place, think that I should use information systems in the ED.	.854	.180	.246	4.745	.000

a Dependent Variable: Attitude Score

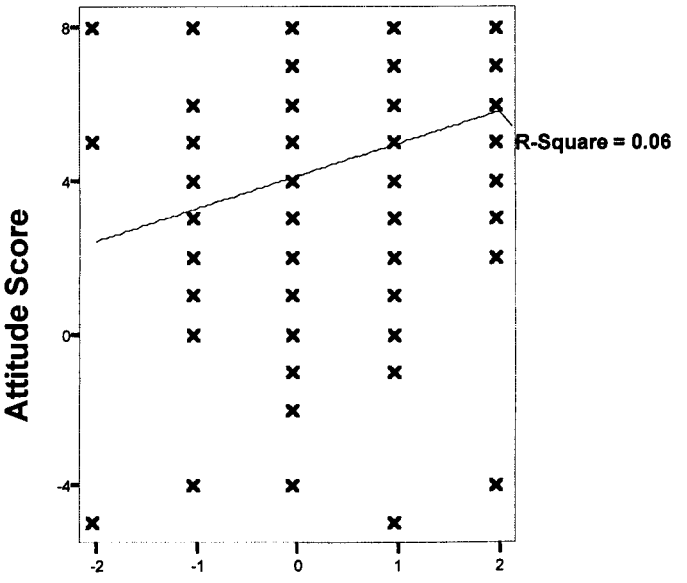

Figure 5.28- Scatter diagram for the users' attitudes towards using IT in the ED against the subjective norm in a setting

H13- There is no association between the helpfulness of the senior staff in the use of the information systems and user attitude towards using IT in the ED.

Tables 5.38.1 to 5.38.3 and Figure 5.29 show the results of simple linear regression for the helpfulness of the senior staff in the use of the information systems and users' attitudes towards using IT in the ED. There was a significant ($p<0.001$) positive association between these two variables, and the helpfulness of the senior staff in the use of the information systems accounted for 3.7% of the variation in users' attitudes towards using IT in the ED. This suggests that the more helpful the senior staff were in the use of the systems, the more positive their colleagues were about using IT in the ED.

Table 5.38.1-Model Summary-H13

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.194(a)	.037	.035	2.586

a Predictors: (Constant), In the ED, the senior staff have been helpful in the use of the information systems.

Table 5.38.2-ANOVA (b)-H13

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	92.096	1	92.096	13.774	.000(a)
	Residual	2366.904	354	6.686		
	Total	2459.000	355			

a Predictors: (Constant), In the ED, the senior staff have been helpful in the use of the information systems.
b Dependent Variable: Attitude Score

Table 5.38.3-Coefficients (a)-H13

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.251	.153		27.853	.000
	In the ED, the senior staff have been helpful in the use of the information systems.	.612	.165	.194	3.711	.000

a Dependent Variable: Attitude Score

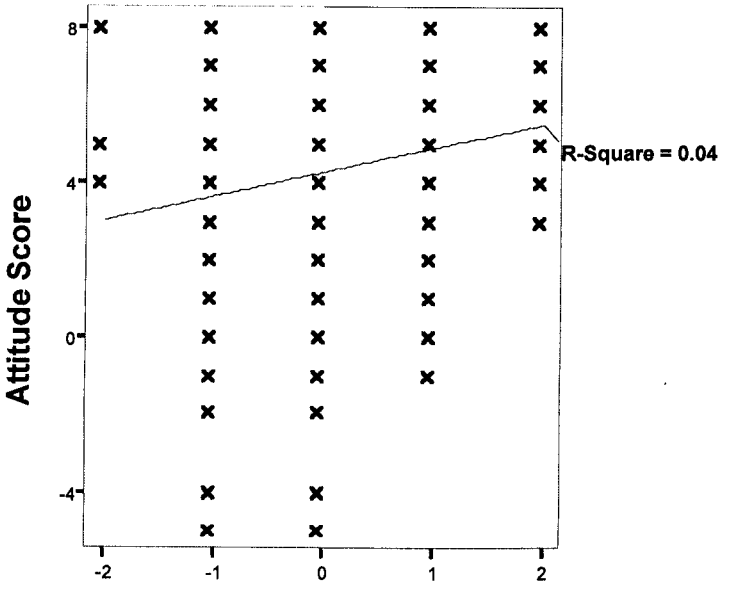

Figure 5.29- Scatter diagram for the users' attitudes towards using IT in the ED against the helpfulness of the senior staff in the use of the information systems.

H14- There is no association between the adequacy of training in the use of information systems and user attitude towards using IT in the ED.

Tables 5.39.1 to 5.39.3 and Figure 5.30 show the results of simple linear regression for the adequacy of training in the use of the information systems and users' attitudes towards using IT in the ED. There was a significant (p=0.002) positive association between these two variables, and the adequacy of training in the use of the information systems accounted for 2.6% of the variation in users' attitudes towards using IT in the ED. This suggests that the more the staff were satisfied with the adequacy of training in the use of information systems, the more positive they were about using the systems

Table 5.39.1-Model Summary-H14

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.160(a)	.026	.023	2.598

a Predictors: (Constant), Adequate training in the use of information systems has been provided for the staff.

Table 5.39.2-ANOVA (b)-H14

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	62.831	1	62.831	9.306	.002(a)
	Residual	2390.158	354	6.752		
	Total	2452.989	355			

a Predictors: (Constant), Adequate training in the use of information systems has been provided for the staff.
b Dependent Variable: Attitude Score

Table 5.39.3-Coefficients (a)-H14

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.517	.138		32.751	.000
	Adequate training in the use of information systems has been provided for the staff.	.418	.137	.160	3.051	.002

a Dependent Variable: Attitude Score

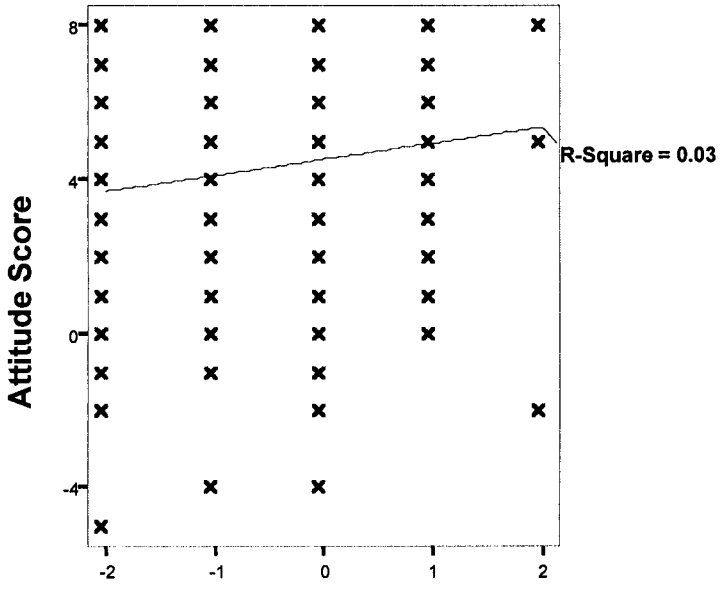

Figure 5.30- Scatter diagram for the users' attitudes towards using IT in the ED against the adequacy of training in the use of information systems

H15- There is no association between the inadequacy of computers in the ED and user attitude towards using IT in the ED.

Tables 5.40.1 to 5.40.3 and Figure 5.31 show the results of simple linear regression for the inadequacy of computers in the ED and users' attitudes towards using IT in the ED. There was no significant (p=0.882) association between these two variables. This suggests that the inadequacy of computers might not be an important issue in the settings of the study.

Table 5.40.1-Model Summary-H15

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.008(a)	.000	-.003	2.625

a Predictors: (Constant), Currently, computers are not adequate in the ED.

Table 5.40.2-ANOVA (b)-H15

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.152	1	.152	.022	.882(a)
	Residual	2438.778	354	6.889		
	Total	2438.930	355			

a Predictors: (Constant), Currently, computers are not adequate in the ED.
b Dependent Variable: Attitude Score

Table 5.40.3-Coefficients (a)-H15

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.519	.144		31.480	.000
	Currently, computers are not adequate in the ED.	.019	.130	.008	.149	.882

a Dependent Variable: Attitude Score

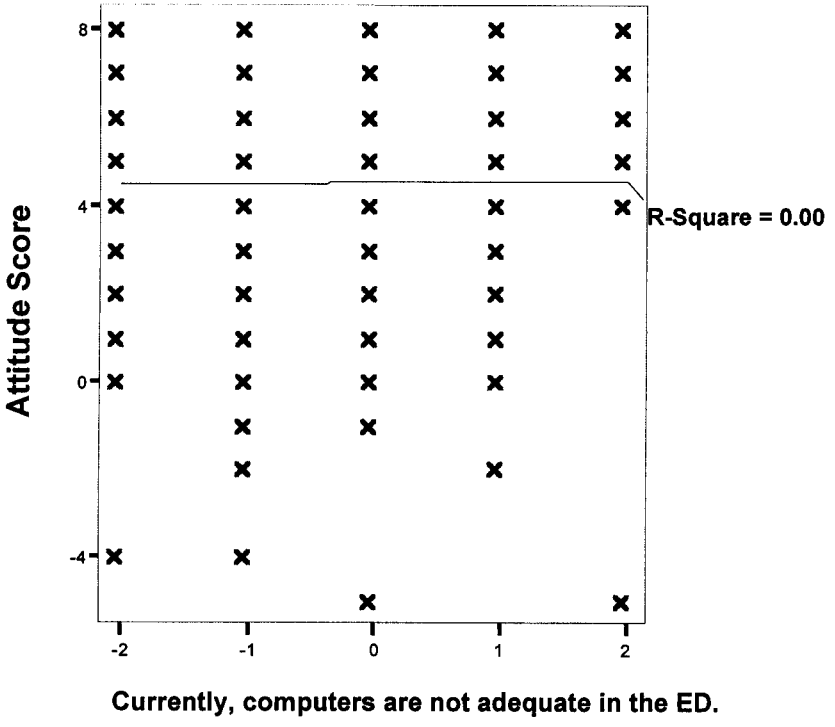

Figure 5.31- Scatter diagram for the users' attitudes towards using a IT in the ED against the inadequacy of computers in the ED

H16- There is no association between the user involvement in the process of developing information systems for the ED and user attitude towards using IT.

Tables 5.41.1 to 5.41.3 and Figure 5.32 show the results of simple linear regression for user involvement in the process of developing information systems for the ED and users' attitudes towards using IT in the ED. There was a significant (p=0.023) positive association between these two variables, and the involvement of users in the process of developing information systems for the ED accounted for 1.5% of the variation in users' attitudes towards using IT in the ED. This suggests that the more the staff were involved in the process of developing information systems for the ED, the more positive they were about using the systems.

Table 5.41.1-Model Summary-H16

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.121(a)	.015	.012	2.603

a Predictors: (Constant), Users should be involved in the process of developing information systems for the ED.

Table 5.41.2-ANOVA (b)-H16

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35.576	1	35.576	5.252	.023(a)
	Residual	2384.582	352	6.774		
	Total	2420.158	353			

a) Predictors: (Constant), Users should be involved in the process of developing information systems for the ED.
b) Dependent Variable: Attitude Score

Table 5.41.3-Coefficients (a)-H16

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	4.029	.259		15.554	.000
	Users should be involved in the process of developing information systems for the ED.	.492	.215	.121	2.292	.023

a Dependent Variable: Attitude Score

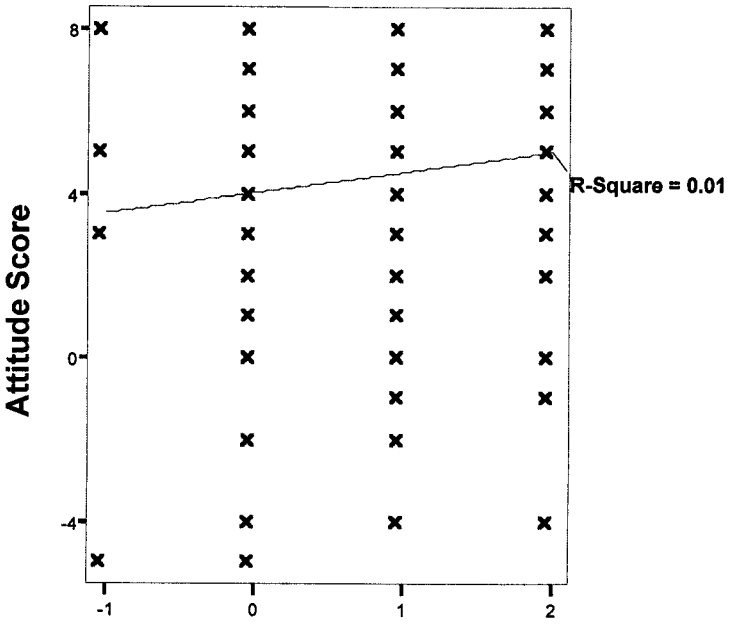

Figure 5.32- Scatter diagram for the users' attitudes towards using IT in the ED against the user involvement in the process of developing information systems for the ED

H17- There is no association between using bedside computer terminals in the ED and user attitude towards using IT in the ED.

Tables 5.42.1 to 5.42.3 and Figure 5.33 show the results of simple linear regression for using bedside computer terminals in the ED and users' attitudes towards using IT in the ED. There was a significant ($p<0.001$) positive association between these two variables, and using bedside computer terminals in the ED accounted for 4.2% of the variation in users' attitudes towards using IT in the ED. This suggests that the staff who were more positive about using bedside computer terminals in the ED, were more positive about using IT in the ED.

Table 5.42.1-Model Summary-H17

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.206(a)	.042	.040	2.569

a Predictors: (Constant), Using bedside computer terminals in the ED is a good idea.

Table 5.42.2-ANOVA (b)-H17

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	103.378	1	103.378	15.669	.000(a)
	Residual	2335.552	354	6.598		
	Total	2438.930	355			

a Predictors: (Constant), Using bedside computer terminals in the ED is a good idea.
b Dependent Variable: Attitude Score

Table 5.42.3-Coefficients (a)-H17

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.404	.139		31.688	.000
	Using bedside computer terminals in the ED is a good idea.	.511	.129	.206	3.958	.000

a Dependent Variable: Attitude Score

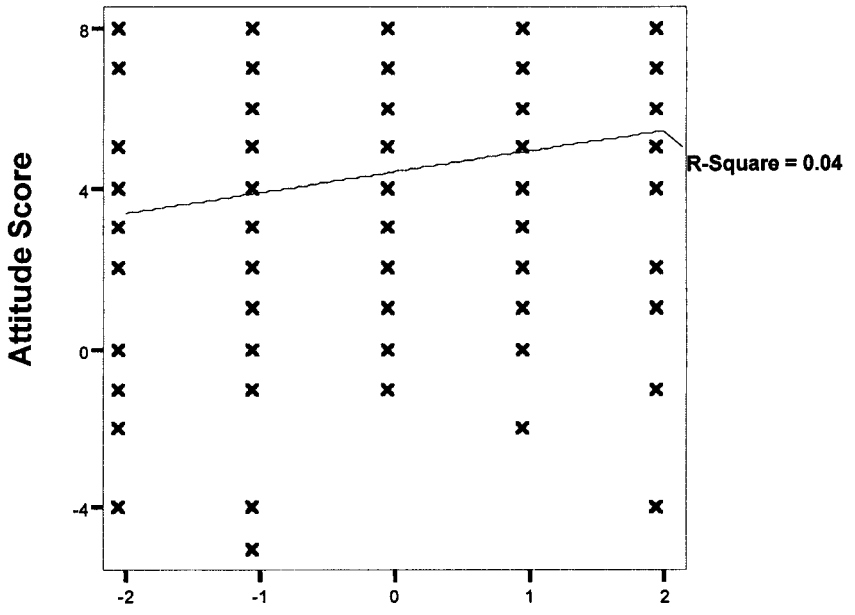

Figure 5.33- Scatter diagram for the users' attitudes towards using IT in the ED against using bedside computer terminals in the ED

H18- There is no association between the inappropriateness of the location of computer terminals and user attitude towards using IT in the ED.

Tables 5.43.1 to 5.43.3 and Figure 5.34 show the results of simple linear regression for the inappropriateness of the location of the computer terminals and users' attitudes towards using IT in the ED. There was a significant (p=0.027) positive association between these two variables, and the inappropriateness of the location of the computer terminals accounted for 1.4% of the variation in users' attitudes towards using IT in the ED. This suggests that the staff who thought that the location of the current computer terminals was not appropriate, were more positive about using IT in the ED. It seemed that the location of the systems was more important for those respondents who were positive about using them.

Table 5.43.1-Model Summary-H18

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.117(a)	.014	.011	2.604

a Predictors: (Constant), The location of the current computer terminals is not appropriate.

Table 5.43.2-ANOVA (b)-H18

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	33.466	1	33.466	4.937	.027(a)
	Residual	2393.081	353	6.779		
	Total	2426.546	354			

a Predictors: (Constant), The location of the current computer terminals is not appropriate.
b Dependent Variable: Attitude Score

Table 5.43.3-Coefficients (a)-H18

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	4.490	.139		32.302	.000
	The location of the current computer terminals is not appropriate.	.305	.137	.117	2.222	.027

a Dependent Variable: Attitude Score

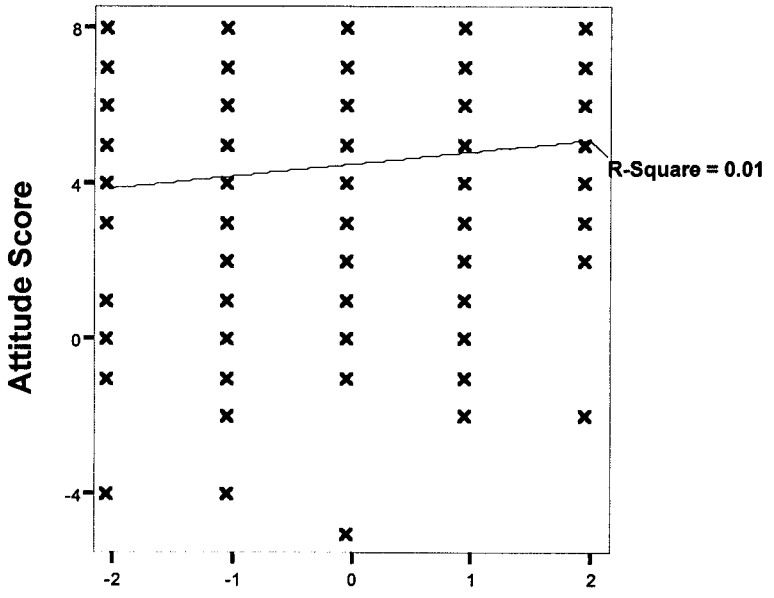

Figure 5.34- Scatter diagram for the users' attitudes towards using IT in the ED against the inappropriateness of the location of the computers terminals

H19- There is no association between using portable computers, such as handheld devices and user attitude towards using IT in the ED.

Tables 5.44.1 to 5.44.3 and Figure 5.35 show the results of simple linear regression for the users' views about using portable computers, such as handheld devices and users' attitudes towards using IT in the ED. There was a significant ($p<0.001$) positive association between these two variables, and users' views about using portable computers, such as handheld devices accounted for 4.9% of the variation in users' attitudes towards using IT in the ED. This suggests that the staff who were more positive about using portable computers, such as handheld devices, were more positive about using IT in the ED.

Table 5.44.1-Model Summary-H19

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.222(a)	.049	.047	2.559

a Predictors: (Constant), Portable computers, such as handheld devices are suitable to be used in the ED.

Table 5.44.2-ANOVA (b)-H19

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	120.412	1	120.412	18.385	.000(a)
	Residual	2318.517	354	6.549		
	Total	2438.930	355			

a Predictors: (Constant), Portable computers, such as handheld devices are suitable to be used in the ED.
b Dependent Variable: Attitude Score

Table 5.44.3-Coefficients (a)-H19

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	4.385	.139		31.562	.000
	Portable computers, such as handheld devices are suitable to be used in the ED.	.522	.122	.222	4.288	.000

a Dependent Variable: Attitude Score

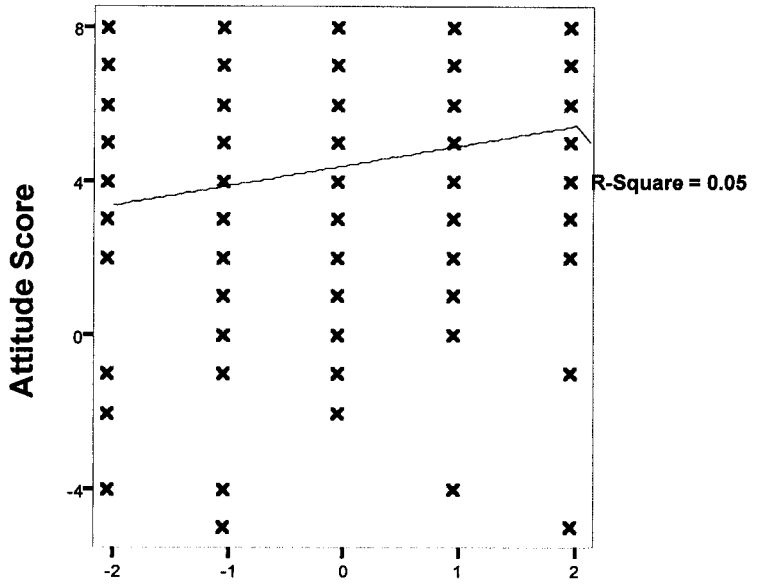

Figure 5.35- Scatter diagram for the users' attitudes towards using IT in the ED against the users' views about using portable computers, such as handheld devices

H20- There is no association between the possibility of damage to the computer terminals in the ED by violent patients or their relatives and user attitude towards using IT in the ED.

Tables 5.45.1 to 5.45.3 and Figure 5.36 show the results of simple linear regression for the users' views about the possibility of damage to the computer terminals by violent patients or their relatives and users' attitudes towards using IT in the ED. The results showed that there was no significant (p=0.308) association between these two variables.

Table 5.45.1-Model Summary-H20

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.054(a)	.003	.000	2.621

a Predictors: (Constant), Computer terminals in the ED can be damaged by violent patients or their relatives.

Table 5.45.2-ANOVA (b)-H20

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.171	1	7.171	1.044	.308(a)
	Residual	2431.758	354	6.869		
	Total	2438.930	355			

a Predictors: (Constant), Computer terminals in the ED can be damaged by violent patients or their relatives.
b Dependent Variable: Attitude Score

Table 5.45.3-Coefficients (a)-H20

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.620	.173		26.653	.000
	Computer terminals in the ED can be damaged by violent patients or their relatives.	-.153	.149	-.054	-1.022	.308

a Dependent Variable: Attitude Score

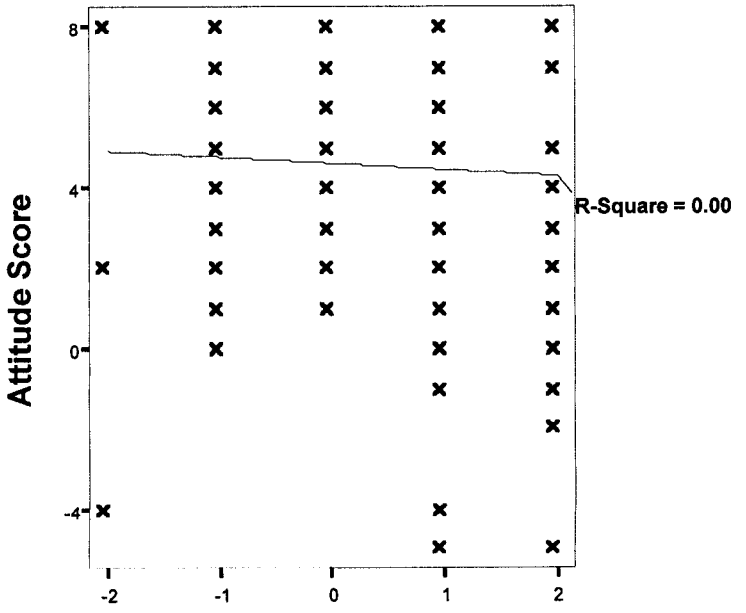

Figure 5.36- Scatter diagram for the users' attitudes towards using IT in the ED against the possibility of damage to the computer terminals in the ED by violent patients or their relatives

The results of the regression tests for the secondary hypotheses are summarised in table 5.46. As table 5.46 shows most of the null hypotheses were rejected and the associations between the environmental variables and users' attitudes were confirmed. However, H15 and H20 were not rejected.

Table 5.46-The result of regression tests for the secondary null hypotheses

Concept	Secondary hypotheses	*P* value	Proportion of variance	Null hypothesis status
Social Environment	H12-There is no association between the subjective norm in a setting and user attitude towards using IT in the ED.	$P<0.001$	6.1%	*Rejected*
	H13-There is no association between the helpfulness of the senior staff in the use of the information systems and user attitude towards using IT in the ED.	$P<0.001$	3.7%	*Rejected*
Organisational Environment	H14-There is no association between the adequacy of training in the use of information systems and user attitude towards using IT in the ED.	$P=0.002$	2.6%	*Rejected*
	H15-There is no association between the inadequacy of computers in the ED and user attitude towards using IT in the ED.	$P=0.882$	0%	*Accepted*
	H16-There is no association between the user involvement in the process of developing information systems for the ED and user attitude towards using IT in the ED.	$P=0.023$	1.5%	*Rejected*
Technological Environment	H17-There is no association between using bedside computer terminals in the ED and user attitude towards using IT in the ED.	$P<0.001$	4.2%	*Rejected*
	H18-There is no association between the appropriateness of the location of computer terminals and user attitude towards using IT in the ED.	$P=0.027$	1.4%	*Rejected*
	H19- There is no association between using portable computers, such as handheld devices and user attitude towards using IT in the ED.	$P<0.001$	4.9%	*Rejected*
	H20- There is no association between the possibility of damage to the computer terminals in the ED by violent patients or their relatives and user attitude towards using IT in the ED.	$P=0.308$	0.03%	*Accepted*

Multiple regression analysis (2)

In order to identify which independent variables among the environmental factors were the most influential ones in predicting users' attitudes towards using IT in the ED, multiple regression analysis was applied using the 'stepwise' method. As Table 5.47.1 shows, five variables remained and others were excluded. The correlation coefficient between the users' attitudes towards using IT in the ED and five selected variables, 'subjective norm, using handheld devices, the location of the computer terminals, using bedside computer terminals, and the adequacy of training in the use of the systems', was 0.393.

Table 5.47.1- Model Summary (f)-MRA (2)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.260(a)	.068	.065	2.546
2	.335(b)	.112	.107	2.488
3	.360(c)	.130	.122	2.467
4	.381(d)	.145	.135	2.448
5	.393(e)	.155	.142	2.438

a Predictors: (Constant), People, who are important to me in my work place, think that I should use information systems in the ED.
b Predictors: (Constant), People, who are important to me in my work place, think that I should use information systems in the ED., Portable computers, such as handheld devices are suitable to be used in the ED.
c Predictors: (Constant), People, who are important to me in my work place, think that I should use information systems in the ED., Portable computers, such as handheld devices are suitable to be used in the ED., The location of the current computers terminals is not appropriate.
d Predictors: (Constant), People, who are important to me in my work place, think that I should use information systems in the ED., Portable computers, such as handheld devices are suitable to be used in the ED., The location of the current computers terminals is not appropriate., Using bedside computer terminals in the ED is a good idea.
e Predictors: (Constant), People, who are important to me in my work place, think that I should use information systems in the ED., Portable computers, such as handheld devices are suitable to be used in the ED., The location of the current computers terminals is not appropriate., Using bedside computer terminals in the ED is a good idea., Adequate training in the use of information systems has been provided for the staff.
f Dependent Variable: Attitude Score

When all five variables included in the model, the proportion of the variance in the dependent variable (users' attitudes), i.e., the R square was 0.155, or 15.5%. This shows that the influence of the remaining environmental variables accounts for about 15.5% of the variation in the users' attitudes towards using IT in the ED. The contribution of each factor was as follows: subjective norm (6.8%), using handheld devices (4.4%), the location of the computer terminals (1.8%), using bedside computer

terminals (1.5%), and the adequacy of training in the use of the systems' (1%). As Table 5.47.2 shows, the regression model with five predictors (model 5) was significantly related to the users' attitudes ($p < 0.001$).

Table 5.47.2-ANOVA (f)-MRA (2)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	162.383	1	162.383	25.057	.000(a)
	Residual	2235.761	345	6.480		
	Total	2398.144	346			
2	Regression	268.720	2	134.360	21.705	.000(b)
	Residual	2129.424	344	6.190		
	Total	2398.144	346			
3	Regression	310.644	3	103.548	17.014	.000(c)
	Residual	2087.500	343	6.086		
	Total	2398.144	346			
4	Regression	347.875	4	86.969	14.507	.000(d)
	Residual	2050.269	342	5.995		
	Total	2398.144	346			
5	Regression	370.987	5	74.197	12.481	.000(e)
	Residual	2027.157	341	5.945		
	Total	2398.144	346			

a Predictors: (Constant), People, who are important to me in my work place, think that I should use information systems in the ED.
b Predictors: (Constant), People, who are important to me in my work place, think that I should use information systems in the ED., Portable computers, such as handheld devices are suitable to be used in the ED.
c Predictors: (Constant), People, who are important to me in my work place, think that I should use information systems in the ED., Portable computers, such as handheld devices are suitable to be used in the ED., The location of the current computers terminals is not appropriate.
d Predictors: (Constant), People, who are important to me in my work place, think that I should use information systems in the ED., Portable computers, such as handheld devices are suitable to be used in the ED., The location of the current computers terminals is not appropriate., Using bedside computer terminals in the ED is a good idea.
e Predictors: (Constant), People, who are important to me in my work place, think that I should use information systems in the ED., Portable computers, such as handheld devices are suitable to be used in the ED., The location of the current computers terminals is not appropriate., Using bedside computer terminals in the ED is a good idea., Adequate training in the use of information systems has been provided for the staff.
f Dependent Variable: Attitude Score

As Table 5.47.3 shows, the regression model predicted that an increase in each of mentioned variables would improve users' attitudes towards using IT in the ED, and the value of change (Beta) for 'subjective norm' was 0.221, for 'using handheld devices' was 0.173, for 'the location of the computer terminals' was 0.134, for 'using bedside computer terminals' was 0.131, and for 'the adequacy of training in the use of the systems' was 0.100. The remaining variables, i.e., the helpfulness of the senior staff in the use of information systems and user involvement in the process of developing information systems for the ED were excluded from the model, as their observed significance level was too large for being included in the model ($p>0.05$).

Summary

So far, the results of the multiple regression analyses has shown that nine variables (four primary and five secondary variables) were the most important factors in predicting the users' attitudes towards using IT in the ED. The primary variables were 'the individual impact of technology', 'perceived usefulness', 'perceived ease of use', and 'users' computer experience'. The proportion of the variance of the dependent variable (users' attitudes) was about 50% when these four variables considered together.

The secondary variables were 'subjective norm, using handheld devices, the location of the computer terminals, using bedside computer terminals, and the adequacy of training in the use of the systems'. The proportion of the variance of the dependent variable (users' attitudes) was about 15.5% when these five variables considered together.

The next step was to identify the most influential factors when the primary and secondary variables considered altogether. Therefore, a final multiple regression analysis was conducted, and its results are reported in the next section.

Table 5.47.3-Coefficients(a)-MRA (2)

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.127	.160		25.813	.000
	People, who are important to me in my work place, think that I should use information systems in the ED.	.901	.180	.260	5.006	.000
2	(Constant)	4.019	.158		25.375	.000
	People, who are important to me in my work place, think that I should use information systems in the ED.	.866	.176	.250	4.923	.000
	Portable computers, such as handheld devices are suitable to be used in the ED.	.491	.119	.211	4.145	.000
3	(Constant)	3.976	.158		25.182	.000
	People, who are important to me in my work place, think that I should use information systems in the ED.	.851	.175	.246	4.875	.000
	Portable computers, such as handheld devices are suitable to be used in the ED.	.534	.119	.229	4.498	.000
	The location of the current computers terminals is not appropriate	.350	.133	.134	2.625	.009
4	(Constant)	3.954	.157		25.192	.000
	People, who are important to me in my work place, think that I should use information systems in the ED.	.811	.174	.234	4.658	.000
	Portable computers, such as handheld devices are suitable to be used in the ED.	.402	.129	.172	3.111	.002
	The location of the current computers terminals is not appropriate	.379	.133	.145	2.854	.005
	Using bedside computer terminals in the ED is a good idea.	.344	.138	.139	2.492	.013
5	(Constant)	3.994	.158		25.340	.000
	People, who are important to me in my work place, think that I should use information systems in the ED.	.765	.175	.221	4.372	.000
	Portable computers, such as handheld devices are suitable to be used in the ED.	.404	.129	.173	3.142	.002
	The location of the current computers terminals is not appropriate.	.352	.133	.134	2.644	.009
	Using bedside computer terminals in the ED is a good idea.	.326	.138	.131	2.364	.019
	Adequate training in the use of information systems has been provided for the staff.	.261	.133	.100	1.972	.049

a Dependent Variable: Attitude Score

Final multiple regression analysis (3)

In order to identify the most important independent variables that might influence users' attitudes towards using IT in the ED, predictor variables derived from multiple regressions (1) and (2) were entered into multiple regression analysis (3) using the 'stepwise' method. As Table 5.48.1 shows, the multiple regression analysis included five main variables, the perceived individual impact of technology, perceived usefulness, perceived ease of use, subjective norm, and users' computer experience which contributed to 49.4% of variation in the users' attitudes. The influence of the perceived individual impact of technology accounted for 38.9% of the variation in the users' attitudes. Perceived usefulness and perceived ease of use contributed to 7.1% and 1.8% of variation in the users' attitudes respectively. Finally, subjective norm and users' computer experience accounted for 0.9% and 0.7% of the variation in the users' attitudes respectively.

Table 5.48.1-Model Summary (f)-MRA (3)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.624(a)	.389	.388	2.069
2	.678(b)	.460	.457	1.948
3	.691(c)	.478	.473	1.919
4	.698(d)	.487	.481	1.905
5	.703(e)	.494	.486	1.895

a Predictors: (Constant), Individual impact score
b Predictors: (Constant), Individual impact score, Usefulness Score
c Predictors: (Constant), Individual impact score, Usefulness Score, Ease of use Score
d Predictors: (Constant), Individual impact score, Usefulness Score, Ease of use Score, People, who are important to me in my work place, think that I should use information systems in the ED.
e Predictors: (Constant), Individual impact score, Usefulness Score, Ease of use Score, People, who are important to me in my work place, think that I should use information systems in the ED., Computer Experience
f Dependent Variable: Attitude Score

As Table 5.48.2 shows the association between the predictors in the final model (model 5) and users' attitudes was significant ($p<0.001$).

Table 5.48.2-ANOVA (f)-MRA (3)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	933.831	1	933.831	218.128	.000(a)
	Residual	1464.143	342	4.281		
	Total	2397.974	343			
2	Regression	1103.781	2	551.890	145.415	.000(b)
	Residual	1294.193	341	3.795		
	Total	2397.974	343			
3	Regression	1145.936	3	381.979	103.729	.000(c)
	Residual	1252.038	340	3.682		
	Total	2397.974	343			
4	Regression	1168.148	4	292.037	80.500	.000(d)
	Residual	1229.826	339	3.628		
	Total	2397.974	343			
5	Regression	1184.387	5	236.877	65.974	.000(e)
	Residual	1213.587	338	3.590		
	Total	2397.974	343			

a Predictors: (Constant), Individual impact score
b Predictors: (Constant), Individual impact score, Usefulness Score
c Predictors: (Constant), Individual impact score, Usefulness Score, Ease of use Score
d Predictors: (Constant), Individual impact score, Usefulness Score, Ease of use Score, People, who are important to me in my work place, think that I should use information systems in the ED.
e Predictors: (Constant), Individual impact score, Usefulness Score, Ease of use Score, People, who are important to me in my work place, think that I should use information systems in the ED., Computer Experience
f Dependent Variable: Attitude Score

As Table 5.48.3 shows, in the final model (model 5), the regression model predicted that an increase in each of the independent variables would improve users' attitudes towards using IT in the ED, and the value of change (Beta) for 'perceived individual impact of technology' was 0.334, for 'perceived usefulness' was 0.294, for 'perceived ease of use' was 0.136, and for 'subjective norm' was 0.100, and for 'users' computer experience' was 0.089.

Table 5.48.3-Coefficients (a)-MRA (3)

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.073	.148		20.770	.000
	Individual impact score	.745	.050	.624	14.769	.000
2	(Constant)	3.076	.139		22.079	.000
	Individual impact score	.513	.059	.430	8.732	.000
	Usefulness Score	.385	.058	.329	6.692	.000
3	(Constant)	2.866	.151		19.021	.000
	Individual impact score	.392	.068	.328	5.748	.000
	Usefulness Score	.398	.057	.341	7.006	.000
	Ease of use Score	.197	.058	.164	3.383	.001
4	(Constant)	2.742	.158		17.394	.000
	Individual impact score	.395	.068	.331	5.842	.000
	Usefulness Score	.365	.058	.312	6.290	.000
	Ease of use Score	.195	.058	.161	3.365	.001
	People, who are important to me in my work place, think that I should use information systems in the ED.	.345	.140	.100	2.474	.014
5	(Constant)	2.192	.303		7.245	.000
	Individual impact score	.398	.067	.334	5.916	.000
	Usefulness Score	.344	.059	.294	5.875	.000
	Ease of use Score	.164	.059	.136	2.775	.006
	People, who are important to me in my work place, think that I should use information systems in the ED.	.346	.139	.100	2.490	.013
	Computer Experience	.182	.086	.089	2.127	.034

a Dependent Variable: Attitude Score

Therefore, according to the stepwise regression analysis, five predictors, the perceived individual impact of technology, perceived usefulness, perceived ease of use, subjective norm and users' computer experience were identified as the most important factors to predict users' attitudes towards using IT in the ED. The remaining variables

(users' views about using handheld devices, users' views about the location of the computer terminals, users' views about using bedside computer terminals, and the adequacy of training in the use of the systems) were excluded from the model, as their observed significance level was too large to be included in the model ($p>0.05$). Figure 5.37 shows the main predictors in the model. As Figure 5.37 shows, the association between the perceived individual impact of technology and user attitude was the strongest association, and the association between user computer experience and user attitude was the weakest association. The association between user attitude and reported IT usage was also rather weak.

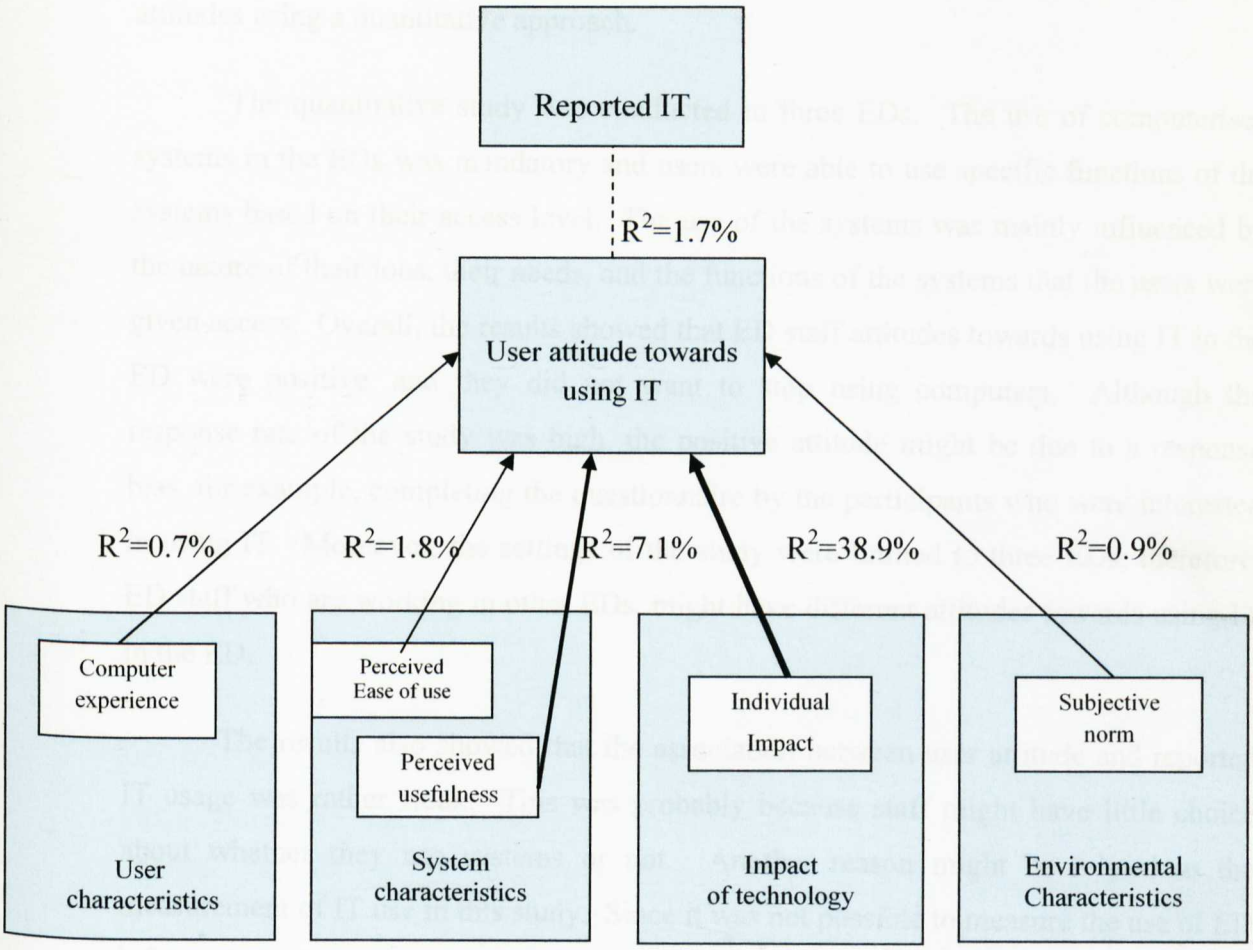

Figure 5.37- A revised model of factors influencing attitudes towards, and use of, IT in the ED

5.11. Discussion

As noted in the previous chapters, given the benefits of using information technology in the ED, for example, improving the accessibility of patient information at the point of care, it is important to know how it is possible to improve users' attitudes towards using these systems. The results of the qualitative study (Chapter 4) suggested that the characteristics of users, their tasks, systems, and the environment as well as the impact of technology could influence users' attitudes and subsequent use of IT in the ED. Each of these factors included several aspects; therefore, a number of hypotheses were set up to investigate the associations between the mentioned variables and users' attitudes using a quantitative approach.

The quantitative study was conducted in three EDs. The use of computerised systems in the EDs was mandatory and users were able to use specific functions of the systems based on their access level. The use of the systems was mainly influenced by the nature of their jobs, their needs, and the functions of the systems that the users were given access. Overall, the results showed that ED staff attitudes towards using IT in the ED were positive, and they did not want to stop using computers. Although the response rate of the study was high, the positive attitude might be due to a response bias, for example, completing the questionnaire by the participants who were interested in using IT. Moreover, the settings of the study were limited to three EDs; therefore, ED staff who are working in other EDs, might have different attitudes towards using IT in the ED.

The results also showed that the association between user attitude and reported IT usage was rather weak. This was probably because staff might have little choice about whether they use systems or not. Another reason might be related to the measurement of IT use in this study. Since it was not possible to measure the use of ED information systems precisely, the respondents were asked to report the amount of time they spent using ED information systems in a week. For example, while most of the receptionists reported that they used computerised systems for 37.5 hours in a week, some clinicians reported that they spent only 1-2 hours on using a computer in the ED weekly. Therefore, the reported IT use might be different from the actual IT use and as a result, the association between users' attitudes and IT use was shown to be weak.

The results of simple linear regression showed that there were associations between most of the variables and users' attitudes. However, the results of the multiple regression analysis excluded a number of these variables, as they were no longer significant in the presence of other variables. For example, when the associations between the primary variables including the characteristics of users, their tasks, systems, the impact of technology, and users' attitudes were investigated, only four variables remained in the model. These variables contributed to 49.6% of the variance in the dependent variable, i.e., users' attitudes towards using IT in the ED, and the perceived individual impact of technology was the most influential factor (40.7%). It seemed that other factors such as users' age, computer knowledge, and task characteristics might be less important compared to the aforementioned factors, or their influence could be explained by the other variables included in the final model.

Similarly, in the second multiple regression analysis, the environmental characteristics including the social, organisational, and technological variables were examined together. The results showed that there were associations between most of these variables and users' attitudes towards using IT in the ED, and the multiple regression analysis showed that these variables contributed to 15.5% of the variance in the dependent variable (users' attitudes). The most influential factor was the subjective norm that explained 6.8% of the variance in users' attitudes towards using IT in the ED.

Finally, the third multiple regression analysis was used to assess the relative importance of both primary and secondary variables that might influence users' attitudes towards using IT in the ED. The results showed that the final model included five main variables. In this model, the highest correlation coefficient was related to 'the individual impact of technology', which contributed to 38.9% of variation in users' attitudes towards using IT in the ED. The influence of 'perceived usefulness' (7.1%) was more than the influence of 'perceived ease of use' (1.8%), 'subjective norm' (0.9%), and 'users' computer experience' (0.7%). The proportion of the variance in the dependent variable (users' attitudes) explained by these variables was about 49.4% when these were considered altogether. It appeared that ED staff had a more positive attitude towards using IT in the ED, if they recognised that the impact of technology at an individual level (e.g., users' tasks) was positive, and if the systems were perceived to

be useful. The perceived ease of use, subjective norm, and users' computer experience seemed to be less important.

In a study conducted by Seckman et al. (2001), the researchers investigated clinicians' perspectives about the use of wireless technology in a hospital, and found that the relationship between the technology adoption and perceived usefulness was the strongest relationship and explained 50% of the variance in the adoption of technology. Perceived ease of use and impact each contributed to 27% and 21% of variance in adoption respectively. Seckman et al. (2001) used the squared value of Spearman rho to explain variations in the dependent variable, namely, adoption of technology. In their study, adoption meant subject's intent to continue using wireless technology. While the main determinants of technology adoption in Seckman et al.'s (2001) study are similar to the findings of the current study, their contributions to the variance in the dependent variable are different. In the current study, the perceived impact and the perceived usefulness of technology were the most influential factors and the perceived ease of use was less important. In contrast to the current study, Seckman et al. (2001) did not use multiple regression to examine the strength of the variables altogether.

While the main aim of implementing information systems in clinical settings is to improve efficiency and effectiveness (Davis, 1993), the possibility of no improvement, or even the negative impacts should not be underestimated. As noted earlier, the perceived individual impact of technology had a significant effect on users' attitudes compared to other variables, and the more positive the perceived individual impact of technology, the more positive the staff were about using IT in the ED. The converse of the current findings is also true. For example, Ammenwerth et al.'s (2003b) found that an increase in the documentation time caused users to show negative attitudes towards using a computer in nursing. This might be due to a lack of fit between the actual practices and the system functions. However, Ammenwerth et al.'s (2003b) study was different from the current research as, in their study, the adoption of a new nursing information and communication system was investigated in four hospital wards (two psychiatric, one paediatric and one dermatologic ward) at three times. The researchers used non-parametric tests and the Spearman correlation coefficient, rather than regression analyses.

Similarly, Moody et al.'s (2004) study showed that users may have different perspectives about the impact of technology. In their study, 64% of respondents perceived that the nursing workload had not decreased by using EHR in the hospital, and 75% of respondents thought that it had improved documentation. In Moody et al.'s (2004) study, all nursing personnel with access to the clinical documentation system from 23 units participated. In order to analyse data, *t* tests and bivariate correlations were used.

In the current study, the perceived usefulness of an information system made a greater contribution to change users' attitudes towards using IT than the perceived ease of use (7.1% vs. 1.8%). The results are consistent with Davis' (1993) findings, which showed that the influence of perceived usefulness on users' attitudes was much stronger than the influence of perceived ease of use. In the study conducted by Chismar and Wiley-Patton (2002), the researchers investigated the adoption of the Internet and Internet-based health applications (IHA) among paediatricians. The results of their study showed that perceived usefulness had a significant influence on the use of the internet by doctors; however, perceived ease of use was not significant. Chismar and Wiley-Patton (2002) suggested that users might be willing to use a beneficial system, even if it was not easy to use. However, the results of the current study showed that system usefulness and ease of use were both important for the ED staff. A possible explanation for the results might be the characteristics of the ED in which the speed of care and decision making is of high importance. Therefore, the systems have to be easy to use to save users' time, and useful to improve users' performance. Although system usefulness and ease of use both are important factors, these can be affected by the technical prerequisites. For example, according to Bastholm Rahmner et al. (2004), the shortage of computers can influence the use of the system, no matter how useful the system is perceived by users.

In terms of perceived ease of use, as the systems were not new to the majority of ED staff and they used the systems on a daily basis, it is assumed that gaining experience with using the systems could influence users' perceptions of the systems' ease of use. The users' computer knowledge and experience of using other computerised systems, or other computer applications, could also influence perceived ease of use of the systems.

The importance of the subjective norm could be related to the context of the use of IT in the ED, which was mandatory, and the views of the senior staff about using a computer in the department could influence other staff attitudes towards using IT. It is worth noting that where the IT use is voluntary subjective norm might have no influence on intention to use the systems (Chismar and Wiley-Patton, 2002).

The other important factor was user computer experience. The results are consistent with the findings of Moody et al. (2004), who examined differences between attitude scores of experienced and non-experienced computer users. In Moody et al.'s (2004) study, the experienced computer users' attitudes were more favourable towards the use of EHR than the non-experienced users. Ammenwerth et al. (2003b) also found that there was a significant positive correlation between computer experience and computer acceptance in general ($r=0.5$, $p<0.05$).

Finally, according to Ward et al. (2008), user attitude is a significant factor influencing the acceptance of an information system. The results here showed that users' attitudes towards using IT in the ED were mainly positive. However, while it was expected to see a strong association between the users' attitudes and reported IT usage, the results showed that this association was relatively weak, and users' attitudes only contributed to 1.7% of variation in the reported IT use. Although the results suggested that the more positive the staff were about using IT in the ED, the more they would use information system; this increase was quite small. This might be due to the amount of IT usage, which was reported by the respondents, rather than being measured precisely. Moreover, it seems that the mandatory use of information systems, the use of a computer on a need-to-use basis, and the users' access level were some of the important mediating factors which might influence the relationship between the users' attitudes and IT use to make it weaker. Therefore, in such a setting, users' attitudes might play a less important role in the use of information systems.

5.12. Limitations

In this study, due to the time and resource constraints for the research, only one questionnaire was designed, and different occupational groups, namely, doctors, nurses, administrative staff, and other clinical staff were invited to complete the same

questionnaire. While this approach helped to draw more general conclusions regarding the factors that might influence users' attitudes and the subsequent use of IT in the ED, designing more specific questionnaires for clinicians and non-clinicians might help to gain more detailed information. However, this approach could not provide the whole picture of the influential factors. Moreover, as the respondents were the ED staff, who might have time constraints to complete the questionnaire, the length of the questionnaire and the format of the questions were specifically taken into account to be as brief as possible, while ensuring it addressed the research questions.

The survey was conducted in three EDs; therefore, a number of issues, such as the period of time that the staff were using the systems, their training, systems' maintenance strategies, the type of information systems and their design, and the organisational issues might have influenced users' perceptions in each setting. While these issues need to be taken into account when reporting the results for each setting, as a whole, these diversities contributed to develop a sample that might be representative of the wider population. This, in turn, helped to ensure that the findings might be generalised to other similar settings. In particular, the high response rate of the survey (67.6%), which was from the all staff across the three EDs, was helpful to ensure the representativeness of the sample, and staff views.

In this study, it was not possible to conduct a precise test to measure users' IT skills and knowledge, due to the time limits and the unavailability of a standardised computer literacy testing instrument. Therefore, self-reported data were used to obtain an overview of users' perceptions of their IT skills and computer knowledge. There is a possibility that the ED staff overestimated, or underestimated, the amount of IT use and their own computer skills and computer knowledge when reported them on a self-report basis.

The construct of environmental characteristics had limited reliability when assessed using Cronbach's alpha. Although each question measured an important aspect of social, organisational, or technological environment, these questions could not be reported as a subscale. Developing a high reliability scale for the environmental characteristics is suggested for future research. Moreover, a bias in this study may have been introduced, if the respondents had recently experienced any difficulty with using the systems, such as system downtime, or they had positive experiences when they

completed the questionnaire; thus, it may have affected how the questions were answered.

The goal of this study was to examine the associations between different factors and users' attitudes towards using IT rather than the interrelationships between the factors themselves. Therefore, the analysis can be continued by investigating these associations, and comparing the results across the settings and the professional groups. Apart from the limitations, this study had good statistical power, as evidenced by factors with modest associations with user attitude (small R square) being highly statistically significant. The response rate was good and completion rates for questions were high.

5.13. Conclusion

In conclusion, this quantitative study highlighted the association between several factors and users' attitudes towards using IT in the ED. These factors were mainly related to the users', system, and environmental characteristics as well as the impact of technology. While most of the null hypotheses were rejected, a few remained accepted. Overall, the results showed that the perceived individual impact of the technology, the perceived usefulness, perceived ease of use, subjective norm, and user computer experience were the main factors that might influence users' attitudes towards using IT in the ED. However, there was a relatively weak association between the users' attitudes and the reported use of IT in the ED. This might be due to the several reasons, such as the context of using IT in the ED being mandatory, self-reported IT usage, and the quality of data that included, for example, full time use of IT in the ED. In the next chapter, between-methods triangulation is used to discuss the results of both qualitative and quantitative studies in relation to each other.

CHAPTER 6: DISCUSSION

6.1. Introduction

In the previous chapters, a justification for the research (Chapters 1 and 2), the methodology (Chapter 3), and the results of the qualitative (Chapter 4) and quantitative studies (Chapter 5) were presented. The aim of this research was to explore factors that might influence users' attitudes towards, and the use of, IT in the ED. To answer the research questions, an exploratory qualitative study followed by an explanatory quantitative study was conducted. According to Jamieson (2004), there are some arguments whether Likert-type categories can be assumed to be an interval scale or an ordinal scale. In the current study, the assumption was that Likert scale measured data at the interval-level. The distribution of data was considered normal, as a range of responses to a given question was distributed across the scale and the sample was large. To analyse the data, parametric tests (simple linear regression and multiple linear regression) were used, as these methods were considered robust enough to analyse this kind of data.

This chapter brings together the findings of these two studies using between-methods triangulation previously described in the methodology chapter. In this research, three types of triangulation; namely, data, theory, and methodological triangulation were applied, and are discussed in the following sections. After presenting the introduction in this section, the results of the qualitative and quantitative studies are discussed in section 6.2. Sections 6.3 and 6.4 are devoted to data triangulation and theory triangulation respectively. The methodological triangulation is discussed in section 6.5. Finally, the limitations of the overall research, and the conclusion of the chapter are presented in sections 6.6 and 6.7.

6.2. Triangulation

As discussed in Chapter 3, the two main purposes of triangulation are confirmation and completeness. This method can help to confirm findings from one

study in another study, and to provide a greater level of detail to obtain complementary perspectives (Begley, 1996). With respect to these purposes, the results of the qualitative and quantitative studies are discussed in this section.

6.2.1. Confirmation of results

Most of the results of the qualitative study were confirmed by the results of the quantitative study which are discussed below.

User characteristics

The results of the qualitative study suggested that factors, such as the users' age, computer knowledge, IT experience, and attitudes could influence the use of information systems in the ED. Among these factors, attitude plays an important role in people's judgments, evaluations, and behaviours (Zhang et al., 2008). As discussed in Chapter 2, attitude towards behaviour is a strong predictor of behaviour, and beliefs are the antecedents of attitude towards behaviour (Zhang et al., 2008). Davis et al. (1989) suggested that variables such as system characteristics, user characteristics, task characteristics, political influences, and organisational environment can influence user attitude, and user attitude, in turn, can influence the use of technology. In the quantitative study (Chapter 5), therefore, the associations between user characteristics (age, computer knowledge, and computer experience) and user attitude were tested.

In the qualitative study, some participants thought that the senior staff or the older staff were less positive about using IT in the ED. The results of a simple linear regression analysis showed that there was a weak negative association between age and user attitude. Similarly, simple linear regression analyses showed that user computer knowledge and computer experience were positively associated with user attitude. However, these associations were weak suggesting that there might be other important factors that might influence user attitude towards using information systems in the ED. These results suggested that the younger the staff, and the more computer experience and computer knowledge they had, the more positive they were about using IT in the ED. However, multiple regression analysis showed that computer experience was the most important factor compared to age and computer knowledge.

Similar findings have been reported by other researches. For example, Lium et al. (2008) reported that in their study the junior doctors were more positive towards using a

newly implemented Electronic Medical Records (EMR) system in their hospital than senior doctors. The researchers suggested that this might be related to more than just age and computer experience, as the EMR system supported the junior doctors in their professional development and helped the senior doctors only in their supervisory roles, rather than in their responsibility for quality assessment and quality improvement. This could be true about the senior ED staff who might delegate routine procedures to the junior doctors and might spend their time on more complicated managerial and clinical tasks which were not supported by the ED systems. Therefore, their attitudes towards using ED information systems may have been affected more by the perceived usefulness of the systems than by their age, computer knowledge, and computer experience. The influence of the perceived usefulness of information systems is discussed later in this chapter.

Moody et al. (2004) examined the correlation between the nurses' age and their attitudes towards using EHR and found that there was a weak, but significant negative relationship between these two variables ($p<0.01$). They also found that the experienced computer users were more positive about using EHR than the less experienced users ($p=0.01$). Ammenwerth et al. (2003b) also found a positive correlation between computer experience and the acceptance of the computer in nursing. As Devitt and Murphy (2004) indicated, junior doctors normally receive formal training in IT during their medical education. However, most of the senior doctors may not have had such training. For these people, self-directed, or on the job, learning might be the most common way to obtain computer skills. Therefore, there might be a cohort effect rather than the influence of age *per se*, and users with less computer knowledge, training, and computer experience might be less positive towards using a computer.

Task characteristics

One of the main aims of implementing information systems in an organisation is to improve staff performance (Davis, 1993). To achieve this, users have to accept and use the systems (Davis, 1993; Venkatesh et al., 2003). The complexity of work in the ED, discussed in Chapter 1, might be a major obstacle to the acceptance of information systems by the ED staff. According to the results of the interview study, the ED staff, particularly the clinicians, acknowledged the complexity of their work in the ED and some of them indicated that when the department was busy, they could not spend time

using computerised systems. This was particularly true about the senior ED staff, and people who used paper-based records.

However, a simple linear regression analysis showed that there was no significant association between the perceived task complexity and the users' attitudes towards using IT in the ED. As the study was conducted in three ED, investigating this association in each setting might give different results. Such a perception in the setting of the qualitative study might stem from the limited use of IT in the ED and the limited functions of the systems. The limited experience of using information systems in the ED could lead to users' concerns about using future systems that might require extra time while they were working under time restrictions. As noted above, the less experienced users might be less positive about using IT in the ED.

As noted in Chapter 4 (theme 2), in the healthcare environment, the context of team working and communication between clinicians and non-clinicians are necessary. Apart from intra-departmental communication, the participants of the qualitative study noted that sometimes they needed to have access to the patient information within and outside the hospital. However, currently the accessibility of information was limited. In this situation, the use of computerised systems, for example, integrated systems could help to improve the availability and accessibility of information at the point of care.

The results of a simple linear regression analysis confirmed that there was a positive, but weak, association between the perceived task interdependency and the users' attitudes towards using IT in the ED. The result was in line with the findings of Lium et al.'s (2008) study in which hospital doctors valued the capabilities of the EMR system to facilitate electronic communication between the professionals, and as a result to facilitate the collaborative work. However, perceived task interdependency was excluded in the multiple regression analysis. This suggested that there might be more important factors that might influence users' attitudes towards using IT in the ED.

System characteristics

The results of the qualitative study showed that although some features, such as interface design, systems integration, system content, and system functions were important for the users, two other factors, perceived ease of use and perceived usefulness appeared to be more important to the ED staff.

In the quantitative study, positive associations between the perceived ease of use and perceived usefulness, and the users' attitudes were confirmed using simple linear regression analyses. These associations were reasonably significant, and the association between the perceived usefulness of the information systems and the users' attitudes was stronger than the association between the perceived ease of use and the users' attitudes. Theses associations were also significant in the final multiple regression analysis.

The results are consistent with the findings of Davis' study (1993), in which the influence of the perceived usefulness of a system on users' attitudes was much stronger than the influence of perceived ease of use. Another example of such an association can be found in the results of the qualitative study, where some users did not use the patient tracking system very often, because they assumed that the system was not useful, although it was easy to use.

In another study, Henderson and Deane (1996) found that the hospital information system was perceived as a system more capable of completing the managerial tasks rather than helping with healthcare services. Therefore, clinicians' views about the usefulness of the system were negative which, in turn, led to the negative attitudes towards using the system.

Lium et al. (2008) found that the EMR system could not support the senior doctors in managerial and clinical tasks. Therefore, the less support they received, the less usefulness they felt they gained from the EMR system, which, in turn, negatively influenced their attitudes towards using the system. It is notable that although perceived ease of use and perceived usefulness are of great importance, other system features should also be taken into account. For example, Lium et al. (2008) found that the instances of downtime negatively influenced the users' attitudes towards using the EMR system.

However, the results could be affected by the characteristics of the systems which were used in the EDs, and can be different, if the associations between these variables are investigated in each setting separately.

Impact of technology

One of the main themes emerged from the qualitative analysis was the impact of technology at three levels: individual users; organisation; and the patient care. In terms of the impact of technology on the individual users, a number of interviewees agreed that using computers had made their jobs easier and quicker. Some clinicians generally agreed with the use of computers in the ED; however, they were concerned about the potential negative impact of the future systems.

The results of simple and multiple linear regression analyses also showed that the association between the perceived individual impact of technology and the users' attitudes towards using IT in the ED was strong, significant, and positive. The results are consistent with the findings of Lium et al.'s (2008) study, in which the researchers found that clinicians accepted using the EMR system when they realised that the system improved the quality of their work and helped with their workload. In contrast, Moody et al. (2004) reported that in their study 64% of respondents perceived that the nursing workload had not decreased using a computer, since they used paper-based records in parallel. The findings of Ammenwerth et al.'s (2003b) study also showed that the impact of the computer-based nursing documentation system on the documentation process influenced users' attitudes towards using this system negatively, since the amount of documentation increased. Similarly, Ash et al. (1999) found that while the clinicians acknowledged the value of a Computerised Physician Order Entry (CPOE) system, they complained about the additional time required to use the system in an already busy working day. It is also worth noting that the perceived individual impact of technology might be different among staff groups.

In the qualitative study, the organisational impact of using the information systems in the ED was more related to improving the accessibility of information and facilitating communication in the ED. The results showed that the organisational impact was more noticeable for the senior staff who were responsible for the supervisory tasks. For example, information about the number of patients in the department and their treatment or discharge status was accessible through the patient tracking system, and this helped the staff to work more efficiently. As some of the interviewees noted, using the systems also helped to improve communications in the department mainly through using electronic messages, such as email.

In the quantitative study, although the association between the perceived organisational impact of technology and the users' attitudes towards using IT in the ED was confirmed using simple linear regression analysis, the results showed that this association was weak. Moreover, this association was not significant in the multiple regression analysis. It is worth noting that the organisational impact is not always positive, and it depends on the systems that are being used. For example, Ash et al. (1999) reported that using a Physician Order Entry system caused an increase rather than a decrease, in paper usage, which might be due to printing information.

In the qualitative study, some interviewees noted that patient care could be improved by using the information systems and also by improving the accessibility of information. However, some interviewees either disagreed with this, or thought that using computerised systems had no impact on patient care. The results of the simple linear regression analysis showed that there was a weak, but significant, positive association between the perceived impact of information systems on patient care and users' attitudes towards using IT in the ED. However, this association was not significant in the multiple regression analysis. The results are consistent with the findings of Ash et al. (1999), who found that the poor usability of a physician order entry system caused problems, such as using the wrong patient record, because the patient's name was not seen easily on the system. As a result, orders might be prescribed for a wrong patient, and this had a negative impact on users' attitudes towards using the system, as patient safety might be at risk.

Environmental characteristics

In the qualitative study, participants talked about some issues that could be classified under the environmental characteristics. These issues were classified under three subheadings that were the social, organisational, and technological environment. In the quantitative study, the association between each question of the environmental characteristics and the users' attitudes towards using IT in the ED was tested separately using simple linear regression analysis (discussed in Chapter 5), and the results showed that there was a weak, but significant positive association between most of the variables and the users' attitudes. However, final multiple regression analysis showed that only one variable, subjective norm, was significant.

In the qualitative study, the influence of the social environment, for example, the importance of subjective norm and the senior staff views about using computers in the ED was noted by the interviewees. Similarly, the results of the simple linear regression analysis showed that there was a positive association between subjective norm, the helpfulness of the senior staff in the use of IT in the ED, and users' attitudes towards using IT in this department. However, multiple regression analysis showed that only subjective norm was significant. The importance of social context and subjective norm has been highlighted in several studies. Venkatesh et al. (2003) reported that social influence was significant in the settings in which the use of IT was mandatory, whereas in the settings in which use was voluntary social influence was not significant. Therefore, the positive association between subjective norm and users' attitudes in the settings of the current study might be due to the mandatory use of information systems in the ED. Moreover, the use of the systems by the senior staff, or their positive attitudes towards using the system can positively influence other staff attitudes towards using the systems. This is in line with Lium et al.'s (2008) study in which some participants noted that they were influenced by how their supervisors and close colleagues used the system. Similarly, Ash et al. (2003) indicated that the involvement of both administrative and clinical leadership is a prerequisite for the success of a system implementation. Tang et al. (1999) suggested that academic senior staff in the ED are required to improve their computer knowledge in some areas, as they are important role models for trainees.

In the qualitative study, issues related to the organisational environment were mainly related to the computer training courses, IT support, and user involvement in the process of system design and implementation. The associations between these issues and users' attitudes towards using IT were examined in the quantitative study. The results of simple linear regression analysis showed that there was a positive association between the adequacy of training courses and users' attitudes towards using IT in the ED. This is consistent with Henderson and Deane (1996) who found that ongoing training had the highest correlation with the users' attitudes towards using the system. These researchers indicated that the user group thought that they had not been given enough ongoing training in relation to operating a Patient Management Information System (PMIS), and this perception negatively influenced their attitudes towards using the system. Ash et al. (1999) also suggested the training strategies included just-in-time

training and support and specialty-specific training can help to implement a system successfully. The association between user involvement and user attitude was also confirmed by simple linear regression analysis. Lium et al. (2008) indicated that involving clinicians during all phases of the project, such as introducing the change can influence system success. Such involvement encourages the users to raise their issues and this, in turn, helps to improve the system and the process of change. Similarly, Ash et al. (1999) reported that listening to the system users and good communication were among the most important factors in the successful implementation of CPOE. However, simple linear regression showed that there was no association between the inadequacy of computers in the ED and users' attitudes. This might be due to the characteristics of the settings of study and the adequacy of computers in the departments.

In terms of technological issues, some of the interviewees were interested in using bedside computer terminals and handheld devices, because using these devices was easier in the ED. Some of the interviewees were also concerned about the location of the current computer terminals, and a number of ED staff suggested that computers could be damaged by patients or their relatives in the ED.

The results of a simple linear regression analysis showed that there was a positive association between users' views about using bedside computers, hand-held devices, and the inappropriateness of the location of computer terminals and users' attitudes towards using IT in the ED. Although the ED staff were positive about using advanced technology, such as hand-held devices, and the small size of these devices makes it convenient to be carried by clinicians, the limitations of using this type of technology including the initial cost and the security issues should not be overlooked (Bird et al., 2001; Baumgart, 2005). Similarly, using bedside computers may not be possible due to not enough space in patients' rooms (Moody et al., 2004). Although some ED staff were concerned about the possibility of damage to the computers by patients or their relatives, a simple linear regression analysis showed that there was no association between this variable and users' attitudes. The reason could be that such incidents were quite rare, and it did not influence staff attitudes towards using IT very much. As noted earlier, the results of multiple linear regression showed that among the environmental characteristics, only subjective norm was significant.

The use of both qualitative and quantitative approaches in this study helped to gain a better understanding of the subject of study. In the next section, between-methods triangulation is used to show how the results of one study could help to complete the findings of another study.

6.2.2. Completeness of results

Another application of triangulation is to provide a greater understanding of data when one part of the study presents the results that have not been found in other parts of the study. This new information increases the completeness of results. In this study, both qualitative and quantitative studies contributed to present complementary results. For example, in the interview study, it was not clear which factors were the most important ones from the users' point of view. However, the quantitative data and final multiple regression analysis showed that the 'individual impact of technology', 'perceived usefulness' and 'perceived ease of use' of the systems, 'subjective norm' and 'users' computer experiences' were the most influential factors from the users' perspectives. Each of these factors is discussed below.

The perceived individual impact of technology was the most influential factor on the users' attitudes, suggesting that a positive impact on the individual staff could significantly influence their attitudes towards using IT in the ED. In contrast, a negative impact might lead to resistance, or rejecting an information system at a later stage. It is often assumed that using a computer will result in positive impact; however, the possibility of negative impact should also be considered. For example, in the study conducted by Travers and Downs (2000), the researchers found that while a newly implemented system was considered useful for one practice and not useful for another practice, the participants in both settings reported that the system had a negative impact on their workflow and they had various problems with the information content of the system, data entry, and computer-generated forms.

The perceived usefulness and perceived ease of use of a system were the second and the third important factors from the users' point of view. According to Davis (1993), perceived ease of use has a direct impact on perceived usefulness. However, the converse is not true. Therefore, in order to improve the usefulness of a system, it

has to be easy to use, and should include useful functions. In Venkatesh et al.'s (2003) study, the perceived usefulness was called 'performance expectancy' construct. The results of their study showed that this construct was the strongest predictor of intention to use information systems and remained significant at all points of measurement in both voluntary and mandatory settings. Similarly, Chismar and Wiley-Patton (2003) found that perceived usefulness had a significant and strong influence on physicians' usage intention of an internet-based health application.

'Subjective norm' was the fourth influential factor on the users' attitudes towards using IT in the ED. Davis (1993) suggested that if users use a system, because they are required to use it, and it is not because of their positive attitudes, the role of subjective norm as a motivational variable will be more important. In the current study, the use of ED information systems was mandatory; therefore, the subjective norm could be an important factor influencing the use of IT in the ED. The results of multiple regression analysis showed that there was a positive association between subjective norm and users' attitudes; however, it was weak. This can be explained with regard to the role of subjective norm over time. As Venkatesh et al. (2003) indicated, by increasing experience of using the system the role of subjective norm becomes less important. This might be the reason for a weak association between the subjective norm and users' attitudes towards using IT in the ED, since the ED information systems had been mainly used in the settings of the study for a while.

According to the results, the final important factor was users' computer experience which was more influential than other users' characteristics, namely, user age and computer knowledge. This is in line with the findings of Lium et al.'s (2008) study in which the researchers noted that a lack of experience of using tools other than the EMR system might negatively influence physicians' attitudes towards using the system.

The quantitative study also showed that while there was a reasonable association between some factors and users' attitudes towards using IT in the ED, the association between the users' attitudes and IT use was quite weak. This might be due to the context of use, which was mandatory, and users had access to certain functions of the systems based on their access levels. Therefore, users' attitudes might not be a strong predictor of IT use. Another reason might be related to the measurement of IT use in

the quantitative study. Since it was not possible to measure the actual use of ED information systems, the respondents were asked to report the amount of time they spent using ED information systems in a week. Therefore, the reported IT use might be different from the actual IT use and as a result, the association between users' attitudes and IT use was shown to be weak.

The quantitative study also revealed that the priority of factors influencing users' attitudes towards using IT in the ED could be different in the EDs. For example, in the qualitative study, the usefulness of information systems appeared to be an important factor for the interviewees; however, in the quantitative study, the perceived individual impact of the technology was the first, and the most influential, factor and the perceived usefulness emerged as the second most important factor. In fact, the quantitative study helped to identify the priority of the factors using statistical tests, rather than using subjective interpretation. Similarly, the rejected hypotheses suggested that users' perceptions in one setting cannot be generalised to the similar settings, as many other factors, such as organisational issues are unique to each setting.

Overall, an important message emerging from this research was that to improve users' attitudes towards using IT in a setting, such as ED, first of all staff need to know what the positive impact of using the systems is at the individual level, e.g., how using a system can help them to complete their job easier and quicker, and how the systems are useful. With regard to the time restrictions in the department, this type of information could be given as part of weekly departmental meetings or teaching sessions. In Hu et al.'s (2002) study, the results showed that after one and half a year gaining experience of using the ED information system, most of the doctors who opposed its usefulness at the begining, favoured and had become dependent on it. The doctors, for example, realised that using a computerised 'order sets' was faster than hand writing. However, such a positive impact could be made clear to the users earlier than this, for example, by training and providing them with adequate information about the usefulness of the system. It is also important to understand what expectations are held by users prior to system implementation to shape realistic expectations when introducing the change (Henderson and Deane, 1996).

6.3. Data triangulation

As noted in Chapter 3, data triangulation refers to the use of multiple data sources to obtain different views about the same subject in order to validate the findings. Three types of data triangulation include person, time, and space triangulation (Begley, 1996). In this research, various sources of data were examined (data triangulation with regard to persons).

In the qualitative study, different members of ED staff including physicians, nurses, and administrative staff were interviewed. Similarities between staff views helped the researcher to identify the most important issues in relation to the use of IT in the ED. Differences between users' perspectives also helped to gain a greater understanding of users' perceptions and different aspects of using IT in this department. Similarly, in the quantitative study, physicians, nurses, administrative staff, and other clinical staff who had access to the ED information systems were invited to complete the questionnaire. This helped to gain a more general picture of users' views about the factors that might influence the use of IT in the ED. Data triangulation with regard to space also applied, as the settings of the research in the qualitative and quantitative studies were different.

6.4. Theory triangulation

According to Denzin (1970), theory triangulation refers to analysing data based on different perspectives, theories, or hypotheses. In this research, a number of theories and models of user acceptance were reviewed in Chapter 2. This section analyses the findings within the context of two models. The first model is Unified Theory of Acceptance and Use of Technology (UTAUT) introduced by Venkatesh et al. (2003), and the second one is 'end-user evaluation of clinical information system' suggested by Despont-Gros et al. (2005). The UTAUT model was chosen as it was developed based on reviewing the previous models and theories of user acceptance of information technology (discussed in Chapter 2). Despont-Gros et al.'s (2005) model was chosen as it appears to be a more complete model for end-user evaluation of information systems in the field of health informatics.

6.4.1. Unified Theory of Acceptance and Use of Technology (UTAUT)

As noted in Chapter 2, the UTAUT model included direct and indirect determinants of IT usage behaviour (Venkatesh et al., 2003). This model is illustrated in Figure 6.1.

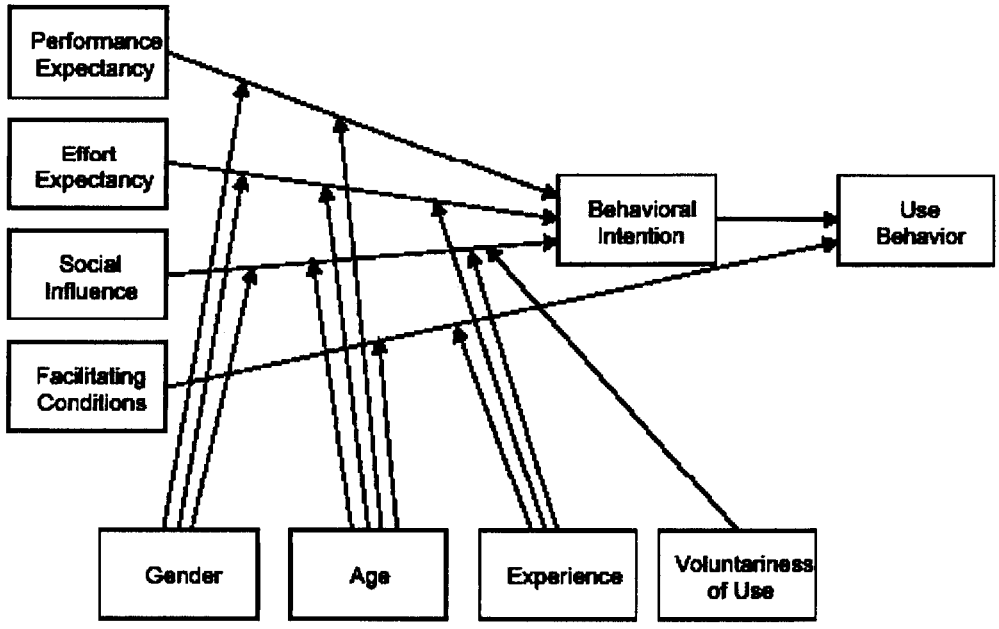

Figure 6.1- Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003:447)

As Figure 6.1 shows, direct determinants of behavioural intention are performance expectancy, effort expectancy and social influence. Facilitating conditions can directly influence IT usage. The moderators or indirect determinants include gender, age, IT experience, and the voluntariness of use. Each of these constructs is discussed below in relation to the results of the current research.

Performance expectancy

As mentioned in Chapter 2, in the UTAUT model, 'performance expectancy' included perceived usefulness, relative advantages, and other similar concepts, and was defined as 'the degree to which an individual believes that using the system will help him or her to attain gains in job performance' (Venkatesh et al., 2003: 447). In the

UTAUT model, performance expectancy was the strongest predictor of intention to use IT.

In the current study, the term 'perceived usefulness' was used instead of 'performance expectancy', as it is more commonly used in the related literature. Similar to the findings of Venkatesh et al. (2003), the results of the qualitative and quantitative studies showed that the perceive usefulness of the ED information systems was an important factor influencing users' attitudes towards using IT in the ED. For example, the results of the multiple regression analysis showed that perceived usefulness contributed to about 7.1% of variance in users' attitudes towards using IT in the ED. In the current study, the perceived individual impact of technology was the first important factor and perceived usefulness was the second important factor.

Effort expectancy

Similar to 'performance expectancy', in the UTAUT model, 'effort expectancy' was used instead of 'perceived ease of use'. However, the definition was the same, 'the degree of ease associated with the use of the system' (Venkatesh et al., 2003: 450).

In this study, the perceived ease of use of ED information systems was investigated in the qualitative and the quantitative studies. The findings of the qualitative study showed that perceived ease of use was an important factor for the ED staff. In particular, with respect to the context of use in which immediate access to information or immediate order entry could be vital for patient care, having an easy to use system was of high importance. The results of multiple regression analysis also showed that perceived ease of use contributed to about 1.8% of the variance in users' attitudes towards using IT in the ED. This is consistent with Venkatesh et al.'s (2003) study, in which the researchers found that effort expectancy or perceived ease of use was a significant predictor of behavioural intention to use IT. The perceived ease of use of an information system is particularly important at the early stages of implementation (Venkatesh et al., 2003), as it can influence users' attitudes towards using the system significantly.

The results of the qualitative study also showed that system ease of use should be coupled with the system usefulness, otherwise an easy to use system will not be used properly, if it is not perceived to be useful.

Social influence

Venkatesh et al. (2003: 451) defined social influence as 'the degree to which an individual perceives that important others believe he or she should use the new system', and used the term 'social influence' instead of 'subjective norm'. The latter term was used in other theories and models, such as the TRA and TAM 2 (Chapter 2). Although the terms are different, the concepts of both terms are the same. As noted earlier, Venkatesh et al. (2003) indicated that social influence is significant when the use of the system is mandated; however, its role left to be less important over time when users gain experience and IT is used over a sustained period.

In the current study, the importance of the subjective norm was identified in the qualitative and quantitative studies. For example, in the qualitative study, some of the junior ED staff complained that the senior staff did not like using the systems in the ED, while it was mandatory. The results of the multiple regression analysis also confirmed that there was a weak, but significant positive association between subjective norm and users' attitudes towards using IT in the ED. Given the characteristic of the teaching hospitals in terms of the attendance of the junior staff or trainees, it seems that the role of subjective norm remains important, as new users of clinical information systems join the staff at regular intervals. These people may need to be encouraged and motivated to use ED information systems. Moreover, subgroup analysis might reveal a stronger association between these factors among different professional groups.

Facilitating conditions

Facilitating conditions refer to 'the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system' (Venkatesh et al., 2003: 453). In the UTAUT model, Venkatesh et al. (2003) suggested that facilitating conditions have a direct influence on IT usage. In the current research, the facilitating conditions were called environmental characteristics and similar to the UTAUT model, they included aspects such as the organisational and technological environment. In terms of the organisational environment, for example, the results of the qualitative study showed that the interviewees were concerned about the inadequacy of training courses and its influence on the use of IT in the ED. This association was investigated using a simple linear regression analysis and the results confirmed that

there was a weak, but significant, association between users' attitudes towards using IT and the adequacy of IT training courses.

In terms of the technological environment, for example, most of the interviewees thought that using hand-held devices was more suitable for the ED due to the nature of work, which involved lots of mobility. The results of simple linear regression analysis also showed that there was a significant positive association between the type of technology and users' attitudes towards using IT in the ED.

Venkatesh et al. (2003: 454) indicated that 'when performance expectancy and effort expectancy constructs are present, facilitating conditions become non-significant in predicting intention'. Similarly, in the current study, the result of the stepwise multiple regression showed that none of the organisational or technological factors was significant in the final model, when perceived usefulness and perceived ease of use were taken into account. In this research, the associations between the environmental characteristics and IT use were not examined directly. This was due to the quality of data collected for IT use. Since this variable was measured using self-reported data, examining the association between the environmental variables and the reported IT use directly would not provide accurate results. Therefore, further research is needed to measure the use of IT more precisely and investigate the direct associations between these variables.

Gender

Venkatesh et al. (2003) indicated that gender has a moderating effect on the relationships between performance expectancy, effort expectancy, social influence, and intention to use IT. They found that the effect of performance expectancy was stronger for men, and the effect of effort expectancy and social influence was stronger for women.

While the role of gender and its moderating effect might be important, the results of the qualitative study did not suggest gender as a variable or moderating factor that might influence users' attitudes towards using IT. Therefore, the effect of this variable was not investigated in the quantitative study. However, investigating the association between these factors among different professional groups might reveal differences.

Age

Similar to the role of gender, the moderating effect of age on the relationships between performance expectancy, effort expectancy, social influence, and intention to use IT was discussed by Venkatesh et al. (2003). The researchers indicated that the effect of performance expectancy is stronger for the younger users, and the effect of effort expectancy and social influence is stronger for the older staff. The relationship between the facilitating condition and IT usage can also be moderated by age, and this effect is stronger for the older workers.

In the current study, the moderating effect of age on the relationships between the aforementioned variables and IT usage was not investigated. However, the results of the qualitative study suggested that there might be an association between age and users' attitudes towards using IT in the ED. The results of the quantitative study suggested that there was a weak, but significant negative association between age and users' attitudes. According to the findings, the younger the staff, the more positive they were about using IT in the ED. However, this result was from the simple linear regression analysis, and in the final model, the association between age and users' attitudes was not significant.

Voluntariness of use

In the UTAUT model, the voluntariness of use has a moderating influence on the relationship between social influence and behavioural intention (Venkatesh et al., 2003). In the current study, the use of the systems was mandatory and, as a result, the construct of voluntariness of use was not taken into account.

Experience

In the UTAUT model, user experience of using an information system was considered a moderating factor that could influence effort expectancy, social influence and facilitating conditions. In fact, effort expectancy, social influence, and facilitating conditions seemed to be more important for the less-experienced users, particularly at the early stages of using the system (Venkatesh et al., 2003).

In the current study, users' experience of using ED information systems were not examined. However, users' experiences of using IT applications in general were investigated, and the results showed that there was a positive association between users' computer experience and users' attitudes towards using IT in the ED. The 'users' computer experience' was also remained a significant construct in the final model and in relation to other factors. However, the association between this factor and users' attitudes was quite weak.

Behavioural intention

Behavioural intention or intention to use technology was another construct in the UTAUT model which had a significant positive influence on technology usage. Three direct determinants of intention to use were performance expectancy, effort expectancy, and social influence. Intention to use was the direct determinant of usage behaviour. (Venkatesh et al., 2003).

As the current study was conducted in the settings, in which the use of IT was mandatory, the behavioural intention could not be used as an appropriate measure. In fact, the ED systems were used when they were needed, and the ED staff used the systems based on their access levels. Hence, investigating various intentions regarding how much and to what extent they would use the system in the future did not make sense. Therefore, the determinant of behavioural intention, which was users' attitudes towards using IT, was investigated. According to Davis et al. (1989), technology usage is determined by behavioural intention; behavioural intention is, in turn, determined by attitude towards using the technology, and attitude towards system use mediates the effect of users' perceptions and beliefs, such as perceived ease of use and perceived usefulness. Furthermore, in the literature, attitude towards behaviour was used as a direct determinant of IT usage where it was appropriate (Davis, 1993).

When the association between users' attitudes towards using IT in the ED and the reported IT usage was tested, the result showed that there was a significant positive association between these two variables; however, it was quite weak. As noted above, such a weak association might be due to either the mandatory context of using IT in the ED, in which users' attitudes could not be a strong predictor of IT usage, the limitation

of the systems' functions and diversity in users' access levels, or the quality of self-reported data for IT usage, which were not precise.

Overall, it appears that the results of the current study could be matched with most of the constructs in the UTAUT model. Although in the current study, the associations between variables were not investigated exactly as shown in the UTAUT model, the results showed that most of the factors influencing behavioural intention in the UTAUT model could influence attitude towards using IT in the ED. Therefore, where appropriate, the association between users' attitudes and behavioural intention, and the association between each of these constructs and the actual IT usage should be investigated to know which of these factors is a stronger predictor of IT usage.

6.4.2. End-user evaluation of clinical information systems, Despont-Gros et al.'s model

Despont-Gros et al. (2005) proposed a model based on the main dimensions of Human-Computer Interaction (HCI) (discussed in Chapter 2) to evaluate the acceptance of clinical information systems from the users' point of view. The constructs were the user characteristics, the clinical information system characteristics, the context of use and the environmental characteristics, the development process characteristics, and the impact or outcome of computerisation.

User characteristics

Despont-Gros et al. (2005) suggested that user characteristics, such as user attitude towards innovation, computer experience, amount of IT use, user expectations and desires, and demographic data in general can influence user evaluation of an information system. In the qualitative study, a number of the above-mentioned factors, such as age, user attitude, computer experience, computer knowledge, and user expectations and desires were identified. For example, in terms of the demographic data, the ED staff thought that the older staff did not like to use the systems. According to Davis et al. (1989), variables such as user characteristics can influence user attitude, and user attitude, in turn, can influence the use of technology. Therefore, in the quantitative study, the association between the users' characteristics (age, computer

knowledge, and computer experience) and users' attitudes towards using IT in the ED were tested. The results of the quantitative study showed that while there were significant associations between users' characteristics and users' attitudes, the association between users' computer experience and users' attitudes was the most significant one which was included in the final model.

Clinical information system characteristics

In terms of system characteristics, Despont-Gros et al. (2005) suggested that several characteristics can be defined for a system, such as system quality (e.g. response time), interface design, and information quality. While these characteristics are important factors, and were addressed by the interviewees in the qualitative study, the researcher focused on two well-known characteristics, that were particularly addressed in the interviews. These factors were perceived usefulness and perceived ease of use of clinical information systems, and have been discussed in several studies (Davis, 1993; Chismar and Wiley-Patton, 2002; Venkatesh et al., 2003; Chang et al., 2003; Ward et al., 2008). As mentioned earlier, the associations between these factors and users' attitudes towards using IT in the ED were significant, and both of them remained significant in the final model. In Despont-Gros et al.'s (2005) model, these factors were classified under context of use and environmental characteristics.

Context of use and environmental characteristics

Despont-Gros et al. (2005) suggested that factors such as system use, the social and organisational context, and the organisational culture belong to the 'context of use and environmental characteristics' category, and can influence user acceptance of technology. These researchers noted that perceived ease of use and perceived usefulness of a system (discussed in the previous section) can be explained in relation to the specific context of the task. Despont-Gros et al. (2005) believed that the organisational context, the environmental characteristics, and user's task are integrated, and when adopting a new system the context of use, workflow, and the constraints of the environment such as space availability and mobility should be taken into account. In the current study, these factors were identified in the qualitative research; however, they were classified under two separate subheadings, task characteristics and environmental characteristics. According to the interview results, perceived task

complexity in the ED and perceived task interdependency seemed to be two important factors influencing users' attitudes towards using IT in the ED. These associations were tested in the quantitative study and the results of simple linear regression showed that while there was a weak, but significant, positive association between perceived task interdependency and users' attitudes towards using IT in the ED, there was no association between the perceived task complexity and users' attitudes. Moreover, none of these factors were significant in the final model.

According to the results of the qualitative study, the environmental characteristics could be divided to the social, organisational and technological environment. Similarly, Despont-Gros et al. (2005) indicated that three environments surround each interaction between a user and an information system. These are the social, organisational, and physical environment. However, in the quantitative study, the association between each of these constructs and users' attitudes towards using IT could not be tested, as the reliability of the constructs was low. Therefore, the association between each question relating to the environmental characteristics and the users' attitudes was tested and reported individually. The associations between the environmental characteristics and the users' attitudes were tested using simple linear regression analyses. While most of these associations were significant in a bivariate analysis, 'subjective norm' was the only factor that remained significant in the final multiple regression analysis. This suggested that, in this study, the social environment was stronger than other environmental factors.

Development process characteristics

Another dimension of the model suggested by Despont-Gros et al. (2005) was the development process characteristics. The researchers suggested that user involvement in the process of design, implementation, and evaluation is an important factor that should be included in this model. The organisational and IT support were other factors categorised under this dimension. In the current study, the importance of user involvement, IT support, and computer training courses were discussed by the interviewees. However, these factors were categorised under the organisational environment characteristics. In the quantitative study, a simple linear regression analysis showed that the association between the adequacy of training courses and users' attitudes, and the association between user involvement in the process of system

design and users' attitudes were significant, but they were quite weak. However, these associations were not significant in the final model.

Impact or outcome of computerisation

The fifth dimension in Despont-Gros et al.'s (2005) model was the real and anticipated impact of technology perceived by users. The researchers indicated that both the real and perceived impact of technology from the users' point of view are important and can influence user acceptance. While the real impact can be seen in communication or workflow, the anticipated impact can be the perceptions of users of completing their jobs in a standardised way. Under this dimension, the researchers included the individual and organisational impact.

According to the results of the qualitative study, the perceived impact of technology was divided into the individual and organisational impact and the impact of technology on patient care. The simple linear regression analysis confirmed that there was a positive association between impact of technology at different levels and users' attitudes towards using IT in the ED. However, in the final model, the perceived individual impact of technology remained significant. This variable was the most important factor influencing users' attitudes towards using IT in the ED.

It is notable that although a number of factors were identified in this research, according to Despont-Gros et al. (2005), the weight of each factor in the acceptance of technology depends on the context of use, the system characteristics, and the users. Having discussed theory triangulation in this section, the value of methods triangulation is discussed in the next section.

6.5. Methods triangulation

Two types of methods triangulation are within-methods and between-methods triangulation (discussed in Chapter 3). While in within-methods triangulation the same or different methods of data collection within the same research approach, for example, qualitative or quantitative are used, in between-methods triangulation, two or more research strategies with the aim of achieving convergent validity are applied in the same study (Begley, 1996). In this research, data were collected using qualitative and

quantitative methods. Although using two methods is more time-consuming than applying a single method (Machan et al., 2005), each approach helped to gain an insight into the factors which might influence users' attitudes towards using IT in the ED and subsequent IT usage. Using both methods in the study enhanced the validity and completeness of the results.

The qualitative study showed that factors, such as user characteristics, task characteristics, system characteristics, the impact of technology, and the environmental characteristics could influence users' attitudes towards using IT in the ED. The associations between these factors and users' attitudes towards using IT was tested in the survey study and 17 out of 20 null hypotheses were rejected. These two methods together also helped to identify the most important factors that might influence users' attitudes towards using IT in the ED (discussed in section 6.2.2).

Both methods covered different professional groups and, as a result represented diverse perspectives on the use of IT in the ED. However, the characteristics of the settings and their ED information systems were different in the qualitative and quantitative study. The qualitative study was conducted in an adult ED, in which three computerised information systems were in place. The quantitative study was completed in three EDs that were responsible for caring for adults and children, and used different types of computerised information systems. In fact, the quantitative study helped to draw a more general and statistical conclusion on the factors that might influence users' attitudes, while the systems and the settings were different. Moreover, as the number of participants in the quantitative study was rather high, the results could be generalised with more confidence.

The content of the survey study did not cover all of the details of the interview study. In the interview study, the researcher talked to the interviewees for a period of time, whereas the survey questionnaire had to be designed to be completed in a short time. Therefore, only the main findings of the interview study were included in the questionnaire. For example, while in the interview study participants talked about the interface design, the speed, and ease of use and usefulness of the systems, the questionnaire only included perceived ease of use and perceived usefulness of information systems as system characteristics. This method helped to ensure that the number of questions was limited to collect useful information.

The survey study was appropriate to test the results of the interview study in a larger sample that was representative of ED staff. Therefore, to conduct the survey in other geographical areas a self-administered questionnaire was used. The findings of the survey study also contributed to draw a better and understandable picture of the associations between different factors based on the statistical analyses. This was not possible through using a single method, such as semi-structured interviews in one setting.

According to Begley (1996), methods triangulation can be simultaneous or sequential. In simultaneous triangulation, qualitative and quantitative methods are used at the same time, and the findings are analysed at the end of the study. In the sequential triangulation, one method is used prior to another method. In this case, the first method can be considered a necessary step for applying the second method. In this study, sequential triangulation was applied. The first phase was undertaking a series of semi-structured interviews that highlighted the areas of importance and helped to gain a wider perspective about the research based on the interviewees' thoughts and examples. These led to generating hypotheses, which were tested in the survey study to find the associations between the variables, and to confirm the results of the qualitative study. The sequential application of qualitative and quantitative studies proved to be a reasonable way to achieve the aims of the current study.

6.6. Limitations

In this research, the associations between different factors and IT use were not examined. This was due to the quality of data collected for IT use. Since this variable was measured using self-reported data, examining the association between the research variables and the reported IT use might not provide accurate results. Therefore, further research is needed to measure the use of IT more precisely and investigate the direct associations between these variables.

Moreover, in the quantitative study, three EDs with different characteristics were selected. While the sample of the quantitative study can be a representative sample of ED staff, these three EDs might not be representative of other EDs. The results might also be different, if a national survey was conducted or more EDs were included.

Moreover, these EDs might have had different response patterns, if their data were analysed separately. Further research could help to know whether similar associations existed in other EDs.

In the current study, the main objectives were to identify factors influencing users' attitudes towards using IT in the ED, and to identify the most important factors that might influence users' attitudes. Therefore, the results were presented with respect to the whole sample. Further analysis is needed to find out the associations between these factors and users' attitudes across the professionals and across the settings of the study.

6.7. Conclusion

In this chapter, the findings of the qualitative and quantitative studies were discussed together using triangulation. In addition, the application of different types of triangulation, such as data, theory, and methods triangulation was presented in relation to the research findings. Triangulation method showed how the qualitative and quantitative studies contributed to improve the confirmation and completeness of the results. Despite the disadvantage of between-methods triangulation in terms of it being a time-consuming approach, it helped to establish one study based on the findings of another study, and improved the understanding of the research area. Therefore, applying qualitative and quantitative methods in one study is suggested where gaining a deeper understanding of an issue and generalising the results both are important.

CHAPTER 7: CONCLUSION

7.1. Introduction

The research presented in this thesis has been exploratory in nature and contributed to the current knowledge in the field of health informatics by identifying factors that might influence users' attitudes towards using IT in the ED and subsequent IT utilisation. As noted in Chapter 2, the ED has special characteristics that make this department different from other clinical settings. Therefore, it is important to know how information technology can facilitate patient care in this department, and what factors may influence the use of computerised information systems. As little research has been conducted in this area, the current study contributed to identify these factors and their relative importance. In this research, both qualitative and quantitative methods were applied, and finally between-methods triangulation was used to enhance the confirmation and completeness of the results. The findings of the current study were also examined in the context of two theoretical models to identify the similarities and differences. The purpose of this chapter is to draw conclusions from the research findings presented in the previous chapters (Chapters 4 and 5). Following this introduction, section 7.2 presents the findings in relation to the research questions and section 7.3 highlights the contribution of the research findings to the body of knowledge in the field. Section 7.4 describes the implications for practice, and section 7.5 discusses the implications for future research. Section 7.6 concludes this chapter and this thesis.

7.2. Research questions

To draw a firm conclusion, the research questions presented in Chapter 2 are answered in this section.

1.What are the user, task, system, and environmental characteristics that might influence users' attitudes towards using IT in the ED?

User characteristics

The results of the qualitative and quantitative studies showed that users' age, computer knowledge, and computer experience might influence users' attitudes towards using IT in the ED. The results of simple linear regression analysis showed that there was a significant negative association between user age and user attitude. In addition, the associations between computer knowledge and user attitude and, computer experience and user attitude, were significant and positive, but weak. However, the results of the multiple regression analysis suggested that only computer experience was significant among user characteristics. This means that age and computer knowledge might not be as important as other factors, or other factors associated with them had a more important effect. For example, the older ED staff, who had less computer knowledge and less IT experience, might be less positive about using IT in the ED, and this might be due to the lack of skills rather than purely the age of the user.

Task characteristics

As noted in Chapter 2, working in the ED seems to be different from working in other clinical settings, mainly due to the specific characteristics of the ED in terms of the speed of work, the variety of patients, and the necessity of immediate decision making for patients with critical conditions. The results of the qualitative study, presented in Chapter 4, also showed that on a daily basis, ED clinicians and non-clinicians needed different types of information, such as medical knowledge, patient information and occupation-specific information. To meet their information needs, they had to use different sources of information, such as verbal communication, paper-based records and computer-based records. These features along with the ED characteristics, especially when the patients are in critical conditions and the needed information is not available, showed the complexity of tasks in the ED.

The qualitative study also showed that ED clinicians' and non-clinicians' tasks were interdependent. For example, while the receptionists could facilitate the process of care by providing the clinicians with the patient's previous ED card, the

inaccessibility of ED cards might cause delays in this process. Moreover, the process of care in the ED was supported by the clinicians who, for example, had to continue care plans provided by their colleagues. In the quantitative study, the perceived task complexity in the ED, in terms of dealing with patients who were difficult to manage and non-routine cases were investigated. However, using simple linear regression, no significant association was found between the perceived task complexity and user attitude towards using IT in the ED. The perceived task interdependency was also investigated in terms of the necessity of communicating with colleagues inside and outside of the department, and a significant positive association was found between the perceived task interdependency and users' attitudes using simple linear regression. Although this association was weak, the results suggested that the benefit of using information systems in terms of facilitating workflow in the ED outweighed the perception of task complexity. However, in the final model, none of these factors were found significant, suggesting that there might be more important factors.

System characteristics

The qualitative study showed that system characteristics, such as the interface design, system reliability, system ease of use and usefulness were important factors from users' perspectives. As the latter two variables were two main determinants of user attitudes towards using technology (discussed in Chapter 2), these were selected for further investigation in the quantitative study. The results of both simple linear regression and multiple regression analysis showed that there were significant positive associations between the perceived usefulness and users' attitudes and, the perceived ease of use and users' attitudes towards using IT in the ED. Moreover, the quantitative data suggested that the influence of the perceived usefulness of information systems on user attitude was stronger than the effect of the perceived ease of use. It seems that the ED staff were more interested in using the systems that they perceived as useful, rather than purely easy to use and not useful. Demonstrating the usefulness of information systems in practice can also help to create positive attitudes towards using IT.

Environmental characteristics

The results of the qualitative study showed that the environmental factors were related to the social, the organisational, and the technological environment. The social

environment influenced user attitude towards using IT mainly through the subjective norm in the ED. As discussed in Chapter 2, subjective norm relates to the degree to which an individual perceives that important others, e.g., senior staff, believe he or she should use the system. This factor is especially important where the use of the system is mandatory. In the quantitative study, subjective norm was found as a significant environmental factor that could influence users' attitudes towards using IT, and remained significant when other variables were considered together. The significance of this factor might be due to the context of using IT in the ED, which was mandatory in the settings of study. This suggested that the role of ED senior staff and ED clinical leaders could be quite important in encouraging the rest of staff to use the system.

The organisational environment included computer training, IT support, and user involvement in the process of system design and implementation. While the qualitative study suggested that the inadequacy of computer terminals might influence users' attitudes and subsequent use of IT, in the quantitative study, simple linear regression analysis showed that there was no association between the inadequacy of computer terminals and users' attitudes. Other organisational factors, such as training and user involvement, could influence users' attitudes towards using IT; however, their influence was not very much.

The technological environment dealt with the type of technology, such as bedside computers and handheld devices, the location of the systems, and the possibility of damage to the systems by violent patients or their relatives. The results of simple linear regression showed that there was a significant positive association between most of these factors and users' attitudes; however, these associations were quite weak, suggesting that more important factors might influence users' attitudes. The possibility of damage to the computers by violent patients or their relatives was not significant suggesting that this sort of problems might be quite rare and do not influence users' attitudes very much. It is notable that none of these factors remained significant in the final model.

2. What is the impact of technology on users' attitudes towards using IT in the ED?

The results of the qualitative study showed that the impact of technology could be perceived at different levels, the individual level, the organisational level, and the impact on patient care. The results of the quantitative study revealed that the perceived individual impact of technology seemed to be more important to the users and, compared to other variables, had the strongest influence on the users' attitudes. It can be concluded that a system that provides end-users with direct benefits is more likely to be accepted and used by the users. Particularly, as clinicians and non-clinicians work under time pressure and patients might be in a life-threatening condition, it is more important to see how systems help them to do their jobs more efficiently and effectively. This, in turn, can help to improve patient care.

3. What are the most important factors that might influence users' attitudes towards using IT in the ED?

In the quantitative study (Chapter 5), the results of multiple regression analysis revealed that among the aforementioned characteristics, five main factors significantly influenced users' attitudes towards using IT. These factors were perceived individual impact of technology, perceived usefulness, perceived ease of use, subjective norm, and users' computer experience. These factors contributed to about 50% of variance in the users' attitudes. The results also showed that the contribution of these factors was not equal and there were large differences between these. For example, while perceived individual impact of technology had the highest contribution (38.9%), users' computer experience had the lowest contribution (0.7%) in changing users' attitudes. These factors were highly significant. This suggested that before designing and implementing information systems for the ED, these factors and their importance need to be addressed properly.

4. What is the association between the users' attitudes and the use of IT in the ED?

The research showed that despite the importance of user attitude towards using IT, the association between users' attitudes and the reported IT use was quite weak. Three main reasons for such a weak association were as follows. Firstly, the use of information systems was mandatory in the EDs; therefore, the role of users' attitudes towards using IT might not be so important compared to the use of IT in a voluntary setting. Secondly, the amount of IT use was dependent on the users' jobs, users' needs, and the functions that they were allowed to use rather than purely depending on their attitudes. Therefore, they did not use the systems more than what they needed. Thirdly, the amount of IT use was reported by users rather than being measured precisely. Therefore, as it could be different from the actual IT use, imprecise data might have influenced the results.

7.3. Contribution to the current knowledge

This research contributes to current knowledge in two important ways. Firstly, although the ED information systems have been studied in previous research, the knowledge of factors that might influence users' attitudes towards using IT in the ED was limited. A number of studies have focused on investigating a limited number of factors, such as perceived usefulness and perceived ease of use of clinical information systems. However, the current study identified different factors that might influence users' attitudes towards using IT in the ED. In this research, not only were these factors identified, but also the results showed that the most influential factors accounted for about 50% of the variance in the users' attitudes. The results were presented as a model which provides an informative representation of the most important factors that should be taken into account in the process of design, implementation, and post-implementation of clinical information systems, such as ED information systems.

Secondly, the use of between-methods triangulation helped to gain a better understanding and to obtain a bigger picture of the factors that might influence users' attitudes towards using IT in the ED. Moreover, past research in this area has typically been undertaken around case studies, with little attempt at theoretical assimilation. This

study used theory triangulation to compare the results with the related theories and models of user acceptance of technology.

7.4. Implications for practice

This research has identified several implications for practice at different stages of system design and implementation for the EDs. For example, before designing a system it is important to investigate users' requirements and understand how using a system can help them to do their jobs. Having clear understanding of what the users' expect of the impact of technology can help to design a better and more acceptable system for them. At the design stage, it is important to involve users and investigate their views to improve the systems, for example, in terms of usefulness and ease of use. Users' computer experience was found an important factor that could influence users' views towards using IT in the ED. Therefore, adequate investment on developing IT skills can help to prepare the users for using information systems. Finally, the implementation stage needs to be supported by people who are enthusiastic about using IT in the ED and have leadership roles in the department. As the results of this research showed, 'subjective norm' is an important factor that can help to create positive attitudes towards using IT among the ED staff and encourage them to use the systems.

7.5. Implications for future research

The factors identified in this study provide a focus area for further research. For example, the proposed model and the results can be regarded as preliminary findings, and future research should be targeted at developing and validating appropriate scales for each of the constructs, and then revalidating, modifying, or extending the model with the new measures.

Although the settings of the study and the systems which were used by the ED staff were typical of the ED, and of the ED information systems, further research is needed to replicate the research in other EDs or departments to establish further external validity of the proposed model and the findings. For example, the research model can

be examined in other EDs to compare the results and the importance of each factor across settings. Similar research can be conducted in other clinical settings to identify similarities and differences between factors that were important to the ED staff and factors that might be important to the staff in other settings. Further analysis of data is also needed to identify similarities and differences of the results across the sites and across the professions.

7.6. Conclusion

This chapter, therefore, concludes this thesis by summarising the main points of the research and answering the research questions presented in Chapter 2. The findings suggested that a number of factors should be considered to improve users' attitudes towards using IT in the ED and the perceived individual impact of technology was the most important factor. A number of implications for practice and future research were also presented in this chapter.

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Appendices

APPENDIX I- NHS Research Ethics Approval

North Sheffield Ethics Office
1st Floor Vickers Corridor

Direct Line: 0114 271 4894 or 271 4011
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Northern General Hospital
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CM/SR

24 January 2007

Mrs Haleh Ayatollahi
Research Student
Department of Information Studies, University of Sheffield
Regent court, 211 Portobello Street
Sheffield
S1 4DP

Dear Mrs Ayatollahi

Full title of study: **Evaluating users' perceptions of, and interactions with, an Emergency Department Information System (EDIS)**
REC reference number: **07/Q2308/2**

Thank you for your letter of 18 January 2007, responding to the Committee's request for further information on the above research [and submitting revised documentation].

The Chair considered the further information on 25 January 2007.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation [as revised].

Ethical review of research sites

The Committee has designated this study as exempt from site-specific assessment (SSA. There is no requirement for [other] Local Research Ethics Committees to be informed or for site-specific assessment to be carried out at each site.

Conditions of approval

The favourable opinion is given provided that you comply with the conditions set out in the attached document. You are advised to study the conditions carefully.

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	*Version*	*Date*
Application		04 December 2006
Investigator CV	Supervisor	
Investigator CV		
Protocol	1	01 November 2006
Covering Letter	2	18 January 2007
Summary/Synopsis	1	01 November 2006
Letter from Sponsor		20 November 2006
Peer Review		27 November 2006
Compensation Arrangements		30 November 2006
Questionnaire: Supplementary questions	2	18 January 2007
Letter of invitation to participant	1	01 November 2006
Participant Information Sheet	2	18 January 2007
Participant Consent Form	2	18 January 2007
Response to Request for Further Information		18 January 2007
Reply Slip	1	01 November 2006

Research governance approval

You should arrange for the R&D department at all relevant NHS care organisations to be notified that the research will be taking place, and provide a copy of the REC application, the protocol and this letter.

All researchers and research collaborators who will be participating in the research must obtain final research governance approval before commencing any research procedures. Where a substantive contract is not held with the care organisation, it may be necessary for an honorary contract to be issued before approval for the research can be given.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

07/Q2308/2	**Please quote this number on all correspondence**

With the Committee's best wishes for the success of this project

Yours sincerely

Dr C A Moore
Chair

Email: sue.rose@sth.nhs.uk

Enclosures: *Standard approval conditions – SL-AC2*

APPENDIX II- Research Governance

Ref: STH14665/GMcV

Sheffield Teaching Hospitals NHS
NHS Foundation Trust

Date: 28 February 2007

Mrs Haleh Ayatollahi
Research Student
Department of Information Studies, University of Sheffield
Regent Court
211 Portobello Street
Sheffield
S1 4DP

Dear Mrs Ayatollahi

Authorisation of project

STH ref: **STH14665**

Study title: **Evaluating users' perceptions of, and users' interactions with, an Emergency Department Information System (EDIS)**

Chief Investigator: **Dr S Goodacre (Clinical Supervisor, University of Sheffield)**

Principal Investigator: **Mrs H Ayatollahi (Research Student, University of Sheffield)**

Sponsor: **University of Sheffield**

Funder: **no funding attached**

The Research Department has received the required documentation for the study as listed below:

1.	**Sponsorship IMP studies (non-commercial)** **Sponsorship responsibilities between institutions** **Responsibilities of investigators** **Monitoring Arrangements**	N/A N/A N/A N/A
2.	**STH registration document: completed and signed**	Mrs H Ayatollahi, 4/12/2006
3.	**Evidence of favourable scientific review**	Dept of Information Studies University of Sheffield
4.	**Protocol – final version**	Version 1, November 2006
5.	**Participant Information sheet – final version**	Version 2, 18/1/2007
6.	**Consent form – final version**	Version 2, 18/1/2007
7.	**Signed letters of indemnity**	Standard University/NHS indemnity applies
8.	**ARSAC / IRMER certificate**	N/A
9.	**Evidence of hosting approval from STH directorate**	Mr F Morris, received 2/2/2007
10.	**Evidence of approval from STH Data Protection Officer**	Mr P Wilson, 29/1/2007

11. Letter of approval from REC	North Sheffield REC, 07/Q2308/2, 24/1/2007
12. Proof of locality approval	SSA exempt
13. Clinical Trial Authorisation from MHRA	N/A
14. Honorary Contract	Mrs H Ayatollahi, issued 20/2/2007 expires 31/1/2009
15. Associated documents	
Letter of invitation to participants	Version 1, November 2006
Supplementary questions	Version 2, 18/1/2007
16. Signed financial agreement/contract	No funding attached. STH Finance Form signed by J Broscomb, 29/1/2007

The project has been reviewed by the Research Department and authorised by the Director of R&D on behalf of STH NHS Foundation Trust to begin.

Yours sincerely

Professor S Heller
Director of R&D, Sheffield Teaching Hospitals NHS Foundation Trust
Telephone +44 (0) 114 2713740
Fax +44 (0) 114 2711790

cc. Greta Pearman, University of Sheffield Research Office

APPENDIX III- Interview Documents- Invitation Letter

The University Of Sheffield.

Department Of Information Studies.

Head of Department
Professor Sheila Corrall
Regent Court
211 Portobello Street
Telephone: +44 (0) 114 222 2630
Fax: +44 (0) 114 278 0300
Email: dis@sheffield.ac.uk

Date

Dear .....

We are writing to invite you to take part in a study being run by the University of Sheffield. You have been identified as a possible participant as you work in the ED and are familiar with information flow and information systems in this department.
The aim of this study is to understand the information flow in the ED, your perceptions of using information in this department and factors which may affect working with the computers and other information systems. Further details about the study can be found on the information sheet enclosed to this letter.
If you decide you would like to take part in the study, please complete the reply slip and send it back to the researcher, in the Freepost envelope provided. If you would like to participate, Haleh Ayatollahi, a research student from the University of Sheffield, will contact you to discuss the study further and to arrange a time for the interview.
Taking part is voluntary and whether or not you decide to take part in this study will in no way affect your work in the ED. If you have any further questions about this study, please contact Haleh Ayatollahi, at the University of Sheffield, on 0114-2226341 or email H.Ayatollahi@sheffield.ac.uk.

Thank you very much for your time,
Yours sincerely,

Haleh Ayatollahi
Research Student

Dr. Steve Goodacre
Supervisor, Senior Lecturer in Emergency Medicine

Dr. Peter Bath
Supervisor, Head of Health Informatics Research Group

APPENDIX III- Interview Documents- Background Information

The University Of Sheffield.

Users' perceptions of ED Information Systems (EDIS)

Please provide the following background information and tick the appropriate box.

1- What is your gender?

Male ☐ Female ☐

2- What is your age group?

25 or less ☐ 26-35 ☐ 36-45 ☐ 46-55 ☐ 56 or above ☐

3- What is your professional status?

Doctor ☐ Nurse ☐ Receptionist ☐ Secretary ☐ Support worker ☐

Other ☐ Please write it: …

4- How long have you been working in Emergency Medicine?

Less than 1 year ☐ 1-3 years ☐ 4-6 years ☐ 7-9 years ☐ 10 years or more ☐

5- How long have you been working in this ED?

Less than 1 year ☐ 1-3 years ☐ 4-6 years ☐ 7-9 years ☐ 10 years or more ☐

6- How much time do you spend working with a computer in a day?

Less than 1 hour ☐ 1-2 hour ☐ 3-4 hour ☐ 5-6 hour ☐ 7 hours and more ☐

7- How much time do you spend working with a computer in the ED during a day?

Less than 1 hour ☐ 1-2 hour ☐ 3-4 hour ☐ 5-6 hour ☐ 7 hours and more ☐

8- Have you ever taken part in computer training courses in your hospital?

Yes ☐ No ☐

APPENDIX III- Interview Documents- Participant Information Sheet

The University Of Sheffield.

Users' perceptions of

ED Information Systems (EDIS)

Study Title: Evaluating users' perceptions of and interactions with an Emergency Department Information System (EDIS)

You are invited to take part in an individual interview for a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Please ask us if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part or not. If you decide not to take part in the study, you do not have to return the reply slip.

What is the purpose of the study?

This study aims to examine factors that may influence working with computerised information systems in the ED. This study is part of a PhD student's research project.

Why have I been chosen?

As you are working in the ED and you have access to the computerised information system in this department, you have been chosen to take part in this study.

Do I have to take part?

It is up to you to decide whether you want to take part or not. If you do, you will be given this information sheet to keep. You will be asked to supply your contact details to the researcher at the University of Sheffield and to sign a consent form. You are free to withdraw at any time, or a decision not to take part, will not affect your job.

What will happen if I take part?

You will be asked to participate in an interview. The interview will involve speaking to a researcher for about 25-30 minutes, and no more than 35 minutes. The interview can take place in the ED, in a convenient room and at a suitable time for you, which may be outside of your work time.

The interview will focus on:

- The information flow and the types of needed information in the Emergency Department;
- The importance of having access to needed information and possible ways to get it;
- The role of using computerised information systems to have access to information;
- The factors which may affect working with computerised systems in the ED to make it difficult or easy.

No sensitive issues will be asked at any time. You are free not to answer any questions that you do not like without having to give a reason. With your permission, the interview records will be kept in a locked drawer at the University of Sheffield.

What do I have to do?

If you are interested in taking part, please complete the enclosed reply slip. Indicate your interest and provide your details so that the researcher from the University can get in touch. There is a Freepost envelope provided for returning the slip. You will be asked to take part in an interview soon after completing the slip. In addition, if it is more convenient for you, you can complete the reply slip and come to the interview straightaway.

Will my taking part in the study be kept confidential?

Yes. All information collected about you during the course of the research will be kept strictly confidential. With your consent, interviews will be recorded and fully transcribed. The interviews will be made anonymous and you will not be identified by name in any reports resulting from this study. Direct quotes may be used, but will be completely anonymous. The data from the interviews will be kept for up to three years and then destroyed.

What will happen to the results of the research study?

You will be sent a summary of the results. The results will also form part of a PhD thesis, which will eventually be available from the University of Sheffield Library. In addition, the results of the study may present in research conferences or publish in peer-reviewed journals.

Who is organising and funding the research?

Haleh Ayatollahi is conducting the study as part of her PhD research. My studentship has been funded by the Ministry of Health and Medical Education of Iran.

Who has reviewed the study?

This study has been reviewed and approved by the Department of Information Studies Research Committee and received ethics approval from the North Sheffield Research Ethics Committee.

Contact Details:

If you would like further information about the study, please contact Haleh Ayatollahi, at the University of Sheffield, on 0114-2226341 or email H.Ayatollahi@sheffield.ac.uk. If you have any concerns during the study please contact Dr. Peter Bath on 0114-2222636 or email p.a.bath@sheffield.ac.uk, or Dr. Steve Goodacre on 0114-2220842 or email s.goodacre@sheffield.ac.uk.

Thank you for considering taking part and taking time to read this sheet.

APPENDIX III- Interview Documents- Consent Form

The University Of Sheffield.

Users' Perceptions of

ED Information Systems (EDIS)

CONSENT FORM

Title of Project: **Evaluating users' perceptions of Emergency Department Information Systems (EDIS)**

Name of the researcher: **Haleh Ayatollahi**

Please initial box

1. I confirm that I have read and understand the information sheet dated 18 January 2007 (Version 2.0) for the above study. I have had the opportunity to consider the information ask questions and have had these answered satisfactorily. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. ☐

3. I give my permission for the interview to be audio taped. ☐

4. I agree to take part in the above study ☐

Name of interviewee	Date	Signature
Name of Person taking consent	Date	Signature

When completed, 1 for interviewee; 1 for researcher site file.

APPENDIX III- Interview Documents- Reply Slip

The University Of Sheffield.

Users' perceptions of ED Information Systems

PARTICIPANT REPLY SLIP

We would like to invite you to take part in a study examining your perceptions of using a computerised Information System in the ED and factors which may affect working with such a system in your department.

If you would like to take part, please write your name and contact details on this reply slip and return in the Freepost envelope provided.

Please indicate your interest and tick the box below

I would like to take part in the study [ ]

Name_____

Address_____

_____

_____

Daytime Tel. No_____

Evening Tel. No_____

Thank you for your time

APPENDIX III- Interview Documents- Interview Guide

User perspective about information needs

What sort of information do you use in your work?

What do you need to know about a patient in the Emergency Department? How do you get this information?

What do you do if you do not have access to this information at the point of care? Could please give me an example?

What other types of information do you use for your work in the ED? How do you get this?

ED information systems

What are the paper-based records that you use in the ED? What sort of computerised systems do you use in the ED?

What are the functions of the systems that you use?

What sort of information can you get from these systems?

How is the quality of information (accuracy, completeness, etc.)?

Do you need patients' medical histories from other wards in the hospital? If so, how does the system help you to have access to them?

How easy or difficult did you find the computerised systems in your department? Why?

How does using a computerised information system help you in the ED?

If you want to compare paper-based records and computer-based records, which one do you prefer? Why?

Are there any other ways that computerised systems could support staff workflow in the ED?

Organisational support

In case of any difficulty with the computerised systems, what do you do?

Are there any computer-training courses in your hospital? If so, what are these courses?

Have you ever attended these courses?

How can these courses help you to have a better use of the systems?

Impact of computerisation

How does having a computerised system help you to care for patients, particularly in emergency situations?

How does the computer system affect the way you carry out your work? And get through your work?

APPENDIX IV- Member Checking- Cover Letter

The University Of Sheffield.

Department Of Information Studies.

Tuesday, 15 July 2008

Dear .....,

In March- April 2007, you allowed me to interview you as part of a study that I am undertaking as a PhD candidate at the Centre for Health Information Management Research, University of Sheffield. The interview was about investigating users' perceptions of, and interactions with, Emergency Department Information Systems (EDIS), and factors that might influence the use of these systems. After completing interviews, these were transcribed, and analysed by the researcher.

As a way to assess the credibility of interview findings is to ask the participants to review a summary of results and comment on the accuracy of the researcher's understanding and interpretation, I am writing to ask you for your assistance in providing me with feedback on the results of this study.

Your feedback is of great importance to me. I would be very grateful, if you could please spend time and read the attached summary of the results of the interviews. An evaluation sheet has been provided for you to express your opinions about the findings of the study. I appreciate you, if you please complete this sheet and send it back to me as soon as you can in a freepost envelope that has been provided for you. Thank you very much for your help.

Sincerely,

Haleh Ayatollahi, PhD Student, Email: H.Ayatollahi@Sheffield.ac.uk
University of Sheffield, Department of Information Studies,
Regent Court
211 Portobello Street
Sheffield, S1 4DP

APPENDIX IV- Member Checking- Summary of results

Evaluation of users' perceptions of Emergency Department Information Systems: a summary of a qualitative study

1. **Users' characteristics**

- Among demographic characteristics, age was found as a factor which could influence system usage indirectly. The diversity of system usage among different age groups could be related to users' computer knowledge and users' experiences of IT at an earlier age.
- In addition to the basic knowledge of how to use a computer, having experiences of using IT could influence the use of information systems.
- A user's attitude towards a change and using new information systems in the ED was found as another influential factor. Generally, people, who had more IT experiences, were more positive about a change and using more advanced information systems than staff who had no experience of using other computerised information systems.

2. **Information needs and related issues**

a) Information needs

- The results showed that for clinicians having access to medical information, patients' demographic, clinical, and social information, and occupation-specific information (e.g. access to the psychiatric database) was of high importance.
- For non-clinicians, having access to the organisational and patients' information, particularly patients' demographic information was important.
- There were times that staff, either clinicians or non-clinicians faced a lack of information about patients. This could happen during registration or treatment.

b) Sources of information

- Three main sources of information used in the ED were communication, paper-based records, and computer-based records. However, there were also other ways to exchange information, for example, using a whiteboard or a tape-recorder.
- Communication was the first and the most important source of information for the ED staff.

- The second most frequently used source of information were paper-based records. However, most of the interviewees complained about a delay in getting medical records, particularly if they were requested from other hospitals in the city.
- Other sources of information in the ED were computer-based records. Different computer applications, such as the Internet and some databases were also used by the authorised ED staff.

3. <u>Emergency Department Information Systems and related issues</u>

a)Patient Focus Information System (PFIS)

- The main hospital information system was PFIS. Generally, the interviewees noted that the PFIS was an easy to use and a useful system.
- The technical issues of PFIS were related to the speed of the system, the system content, systems integration, interface design, navigation, and the system downtime. The main non-technical issues mentioned by the interviewees were related to the quality of information and the confidentiality of information on the system.

b) Patient tracking system

- Most of the interviewees agreed that the patient tracking system was easy to use. Most of the nurses and the administrative staff thought that the system was also useful and could facilitate their jobs. However, some of the doctors perceived the system as an administrative tool.
- In terms of the interface design, some of the clinicians perceived that the system was confusing and the screen was busy. A lack of integration with PFIS, a limited amount of clinical information on the screen, and the system down time were other problems mentioned by the interviewees.
- The main non-technical problem with the patient tracking system was related to the limited use of the system by the clinicians. A reason for not–use or a limited use of the system could be related to a shortage of PCs.

c) E-film

- When the research was conducted, E-film was a new Radiology Information System which had been implemented in the ED for about three weeks. However, a majority of the participants only knew that such a system existed in the ED Radiology Department, and some of them thought it had not gone live yet.

- The interviewees, who had an experience of using E-film, were generally satisfied with the system. Apart from the positive aspects of E-film, the technical issues of the system were related to a limited number of high-resolution screens implemented in the ED, viewing x-ray images on a particular screen rather than on PCs, and the long start-up time of the system.
- The main non-technical issue was related to a limited use of the system. As some of the participants said, the inadequacy of training could be one of the reasons for a limited use of the system.

4. <u>Training and Information Technology support</u>

a) Training

- Most of the interviewees had attended PFIS training courses, as it was mandatory for those staff, who were authorised to use the system. Among the interviewees, there were a few who thought that attendance at training courses was not useful for them.
- Some of the clinicians thought that the computer-training courses were not adequate for the ED staff. Some of the interviewees had difficulties attending training courses, as they would need to leave their workplace and get someone else to do their job. In addition, working afternoons or night shifts would make attendance at these courses more difficult.

b) IT support

- The IT staff would be contacted, if there were any technical problems with the systems, or when a system went down. The ED nurses and administrative staff were the main bodies who contacted the IT staff, and they were generally satisfied with their services.
- In terms of the availability of the IT staff, some of the interviewees indicated that during working hours they were usually available, whereas during out of working hours they were on call and it took time to get their help.
- The main concern of the ED staff was related to the inadequacy of computers and workstations.

5. <u>Impacts of Information Technology</u>

a) Individual impact

- Data analysis showed that if the ED staff were to use a new computerised information system, some of them might experience feelings such as fear, stress, and nervousness.

Such feelings could mostly be experienced when a change happened in their work practice, or they had some problems with the system, such as system downtime.

- The positive impact was mainly associated with having easier and quicker access to the information that the staff needed, and facilitating their work.

b) Organisational impact

- The accessibility of information, in turn, helped to increase efficiency in the department.
- While the use of the computerised information systems in the ED could have a number of positive impacts on the staff workflow, any difficulty with the system (e.g. system downtime) could negatively affect their work.

c) Impact on patient care

- Most of the interviewees agreed that the use of information systems had a positive impact on patient care, mainly in terms of the speed of care and saving time for the staff. A number of interviewees indicated that the more information they had, the better and quicker the clinical decisions were made.
- A few interviewees asserted that using information technology had no effect on patient care. Even, some of the staff thought that system characteristics that might cause spending too much time on a computer rather than on patient care, or having low quality information could affect patient care negatively.

6. <u>Users' preferences, concerns, and expectations</u>

a) Users' preferences

- Some of the clinicians agreed on using computer-based records and some of them agreed on using paper-based records. However, most of the administrative staff agreed on using a computer in their job. The use of a combination of paper and computer was also suggested by some of the interviewees.

b) Concerns

- Implementing a change in the ED would be a major concern for the ED staff. Some of the staff were also concerned about the feasibility of entering data into the computerised information systems by all members of staff. Other concerns of staff were mainly related to using paper-based and computer-based records at the same time with the same information, and disruption in a patient-doctor interaction due to using a computer at the point of care.

- The characteristics of the ED in terms of the speed of work, patients' conditions, and the departmental workload might also influence using computer-based records, and made it difficult.

c) Expectations

- Among non-technical expectations, organisational issues, such as user involvement, change management, and training were of great importance and mentioned by most of the participants.
- The technical issues were mainly related to systems integration, interface design, the adequacy of workstations, ease of use, usefulness, and system functions. Paying attention to the speed of a system, a strong back-up system, the usability of a system, and a system infrastructure was another expectation that most of the interviewees had.

APPENDIX IV- Member Checking- Evaluation Sheet

Evaluation Sheet
Evaluation of Users' Perceptions of Emergency Department Information Systems: a Qualitative Study

Participant's name:

Having reviewed the summary, please tick the response boxes as appropriate.

1. Do you think that the results presented in this summary include different aspects of the discussion that we had in your interview?

☐ Yes ☐ No

If no, please explain it:

---

2. Do you think that the results presented in this summary are accurate representation of the discussion that we had in your interview?

☐ Yes ☐ No

If no, please explain it:

---

3. Other comments about this summary are appreciated. Please use the space below.

Thank you very much

Please return this form using the enclosed freepost envelope.

APPENDIX V- University Research Ethics Approval

Dear Haleh,

Thank you again for submitting your ethics application.

On behalf of the University ethics reviewers who reviewed your
project, I am pleased to inform you that your project was approved on
ethics grounds, on the basis that you will adhere to the documents that you submitted.

If during the course of your project you need to deviate from the documents you submitted please inform me.

Written approval will be required for significant deviations from or significant changes to the approved documents.

You may now commence your research.

Thank you,
Sincerely,

Peter Bath
Ethics Co-ordinator

APPENDIX VI- Survey Study- Cover Letter

The University Of Sheffield.

Department Of Information Studies.

Head of Department
Professor Sheila Corrall
Regent Court
211 Portobello Street
Sheffield
S1 4DP
Telephone: +44 (0) 114 222 2630
Fax: +44 (0) 114 278 0300
Email: dis@sheffield.ac.uk
Website: www.sheffield.ac.uk/is

Dear .....

We are investigating the views of staff about information systems in Emergency Departments, and are writing to invite you again to take part in this study. We realise that you are very busy, but we would be very grateful, if you could spend time completing the enclosed questionnaire. We have invited you to take part in the study because you have access to the information systems in your Emergency Department.

There has been very little research that has evaluated information systems in the ED, and by carrying out this study we hope to build a better picture on how to develop systems in the future. We would like to emphasize that we are not trying to test your computer knowledge, but are interested in finding out about your views on the systems you use. The results of the study could help to improve the use of information and information technology in the ED.

Your participation in this survey is important to us. Although we do have a survey number on each questionnaire to allow us to send reminders when necessary, no name or address will be attached to the information you provide. Your responses will be treated in confidence. We estimate that filling out the questionnaire may take about 10-15 minutes. We would be grateful, if you could please read the enclosed information sheet and fill in the questionnaire, and return it to Dr. ...in the envelope provided for you as soon as it is possible.

If you have any question about this study, please feel free to contact me, Haleh Ayatollahi, at the Department of Information Studies, University of Sheffield, on 0114-2226341, or send me email at H.Ayatollahi@sheffield.ac.uk.Thank you very much for your help.

Yours sincerely,

Haleh Ayatollahi PhD Student	Dr. Peter Bath Supervisor, Senior Lecturer in Health Informatics	Prof. Steve Goodacre Supervisor, Professor of Emergency Medicine

APPENDIX VI- Survey Study- Participant Information Sheet

The University Of Sheffield.	**Study Title: Users' perceptions of Emergency Department Information Systems**

You are invited to take part in a survey study. Before you decide, it is important for you to understand why the study is being conducted and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask us if there is anything that is not clear, or if you would like more information. Take time to decide whether you wish to take part or not. Thank you for reading this.

What is the purpose of the study?

This study aims to examine factors that may influence working with computerised information systems in the Emergency Department. This study is part of a PhD research project.

Why have I been chosen?

As you are working in the Emergency Department and you have access to the computerised information system in this department, you have been chosen to take part in this study.

Do I have to take part?

It is up to you to decide whether you want to take part or not. If you do decide to take part you will be given this information sheet to keep. You are free to withdraw at any time and making a decision to not to take part will not affect your job.

What will happen if I take part?

You will be asked to complete a questionnaire. This will take about 10-15 minutes. The questions will not cover any sensitive issue.

What do I have to do?

If you are interested in taking part, please complete the enclosed questionnaire and return it in the enclosed Freepost envelope.

What are the possible benefits of taking part?

Whilst there is no immediate benefit for those people participating in the survey, it is hoped that this work will help the development of information technology in Emergency Departments in the future.

Will my taking part in this project be kept confidential?

Although we do have a study number on each questionnaire to allow us to send reminders when necessary, no name or address will be attached to the information you provide. Your responses will be analysed anonymously and will be kept confidential. It will not be possible for you to be identified in any reports or publications.

What will happen to the results of the study?

The results will form part of a PhD thesis, which will eventually be available from the University of Sheffield Library. In addition, the results of the study may be presented in scientific conferences or published in peer-reviewed journals.

Who is organizing and funding the research?

Haleh Ayatollahi is conducting the study as part of her PhD research. Her studentship has been funded by the Ministry of Health and Medical Education of Iran.

What happens if something goes wrong?

If you are unhappy with the way in which the study has been conducted, or if in the unlikely event that something goes wrong, please contact either of the supervisors, Dr. Peter Bath (Tel. 0114 2222636; email: p.a.bath@shef.ac.uk) or Professor Steve Goodacre (Tel. 0114- 2220842; email s.goodacre@sheffield.ac.uk). If you are not satisfied with the way this has been dealt with, you can contact the University Registrar and Secretary.

Who has reviewed the study?

This study has been reviewed by the Department of Information Studies Research Ethics Committee.

Contact Details:

If you would like further information about the study, please contact Haleh Ayatollahi, at the University of Sheffield, on 0114-2226341 or email H.Ayatollahi@sheffield.ac.uk.

Thank you for taking the time to read this sheet and considering taking part.

APPENDIX VI- Survey Study- Questionnaire

The University Of Sheffield.

Users' Perceptions of Emergency Department Information Systems: a Survey Study

Study ID:

Individual characteristics (*In answering the following questions, please tick the relevant box).*

1- Gender: Male☐ Female☐

2- What is your job title?

Doctor ☐ Nurse ☐ Secretary ☐ Receptionist ☐ Other ☐ (please state:.....)

3- How old are you?.....

4- How long have you been working in Emergency Medicine?

Less than 1 year ☐ 1-3 years ☐ 4-6 years ☐ 7-9 years ☐ 10 years or more ☐

5- How long have you been working in this department?

Less than 1 year ☐ 1-3 years ☐ 4-6 years ☐ 7-9 years☐ 10 years or more ☐

Computer knowledge and experiences

6- Approximately, how many hours do you spend on using a computer in the ED in a week?

.....

7- Have you ever used any other information systems in other hospitals or departments?

Yes ☐ No☐

8- Which computer applications can you use? Please tick any relevant box.

Microsoft Word ☐ Excel ☐ Access ☐ Internet ☐ PowerPoint ☐ Other ☐ (please state :.....)

9- How do you rate your computer knowledge?

Very poor ☐ Poor ☐ Average☐ Good ☐ Very good ☐

User's attitude

For each statement, please tick the box that most closely describes your feelings.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
10- Using computerised information systems in the ED is a good idea.	☐	☐	☐	☐	☐
11- Using computerised information systems in the ED is better than using manual methods.	☐	☐	☐	☐	☐
12- Using computerised information systems in the ED is more helpful than a hindrance.	☐	☐	☐	☐	☐
13- If I had a choice, I would not use computerised information systems in the ED.	☐	☐	☐	☐	☐

Task characteristics

14- In the ED, I frequently deal with patients who are difficult to manage.	☐	☐	☐	☐	☐
15- In my work, I frequently deal with non-routine circumstances.	☐	☐	☐	☐	☐
16- To do my job, I often need to consult with my colleagues.	☐	☐	☐	☐	☐
17- My work involves communicating with organisations outside of the hospital.	☐	☐	☐	☐	☐

System characteristics

18- The current information systems in the ED are easy to use.	☐	☐	☐	☐	☐
19- Learning to operate the current ED computerised systems is easy for me.	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
20- I have found using computers in the ED quite difficult.	☐	☐	☐	☐	☐
21- There is no clinical benefit in using computerised information systems in the ED.	☐	☐	☐	☐	☐
22- Patient care is more effective when using a computer in the ED.	☐	☐	☐	☐	☐
23- Using a computer in the ED has improved the quality of work that I do.	☐	☐	☐	☐	☐

Impact of technology

24- Using a computer in the ED makes my day-to-day work easier.	☐	☐	☐	☐	☐
25- I feel stressed when I am using a computer in the ED.	☐	☐	☐	☐	☐
26- Using a computer in the ED, my work takes longer than using manual methods.	☐	☐	☐	☐	☐
27- Using computerised information systems in the ED has helped to improve staff communication.	☐	☐	☐	☐	☐
28- Using computerised information systems in the ED has improved work efficiency in the department.	☐	☐	☐	☐	☐
29- Using computerised information systems in the ED has eliminated a lot of paperwork.	☐	☐	☐	☐	☐
30- Using computerised information systems in the ED helps to improve the quality of patient care.	☐	☐	☐	☐	☐
31- Using computerised information systems in the ED helps to decrease medical errors.	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
32- Using computerised information systems in the ED helps to decrease the number of unnecessary medical tests.	☐	☐	☐	☐	☐
Environmental characteristics					
33- People, who are important to me in my work place, think that I should use information systems in the ED.	☐	☐	☐	☐	☐
34- In the ED, the senior staff have been helpful in the use of the information systems.	☐	☐	☐	☐	☐
35- Adequate training in the use of information systems has been provided for the staff.	☐	☐	☐	☐	☐
36- Currently, the computers are not adequate in the ED.	☐	☐	☐	☐	☐
37- Users should be involved in the process of developing information systems for the ED.	☐	☐	☐	☐	☐
38- Using bedside computer terminals in the ED is a good idea.	☐	☐	☐	☐	☐
39- Portable computers, such as handheld devices are suitable to be used in the ED.	☐	☐	☐	☐	☐
40- The location of the current computers terminals is not appropriate.	☐	☐	☐	☐	☐
41- Computer terminals in the ED can be damaged by violent patients or their relatives.	☐	☐	☐	☐	☐

By completing and returning this questionnaire, I agree to take part in this study.

Appendix VII- ED systems' characteristics- Leicester Royal Infirmary Hospital

Name of the system	What is the full name of the system?	What are the functions of the system?	When was the system installed in the ED (or in the hospital)?	Is the system linked to other systems in the hospital, or it is a stand-alone ED system?	Is the system a vendor product or it has been designed for the hospital (ED)?	Who are the users of the system? (Doctors, nurses, administrative staff, other clinical staff)
HISS	Hospital Information Support System	Outpatient scheduling and clinical documentation	Sept 1992 at LGH then rolled out to other sites	Interfaced to all major clinical systems	Vendor Product	Clinical, Admin staff as well as informatics, etc
APEX	APEX Laboratory Information System	Processing and reporting pathology samples and investigations	Live within pathology since 1997	Interfaced to HISS for electronic requesting and reporting.	Vendor Product	Pathology staff and Doctors, Nurses, Admin staff etc., for result enquiry
Agfa	Impax 6.3	To capture, store and display images for Imaging equipment (X-ray's, MRI scans, Ultrasound scans etc). To view clinical reports alongside images.	First introduced at LGH in 1997. Expanded to cover whole of UHL in July 2004. Upgraded to current version in Feb 2008.	All interfaces are passed through Trust's Integration Engine. Demographic updates obtained from HISS. Order updates (requests and clinical reports) from CRIS	Vendor Product	Doctors, Nurses, Radiographers, Sonographers, Medical Physics, Administrative Staff, Ward Clerks across Leicestershire hospitals (UHL + PCT)
e-Pages	e-Pages	Web browser of the radiology CRIS system. View Radiology reports, patients attendances, clinical reports, appointment dates and waiting list information.	Approx 2002 /3	Interfaces to HISS for all patient demographics.	Vendor Product	Doctors, Nurses, Admin staff, clinic coordinators across Leicestershire hospitals
EDIS	Emergency Department Information System	Data collection on patients attending ED and Eye ED, monitoring 4-hour target	2002	Interfaced to HISS	Vendor Product	Doctors, Nurses, Admin staff, duty managers, etc

Appendix VII- ED systems' characteristics- St James's University Hospital

Name of the system	What is the full name of the system?	What are the functions of the system?	When was the system installed in the ED (or in the hospital)?	Is the system linked to other systems in the hospital, or it is a stand-alone ED system?	Is the system a vendor product or it has been specifically designed for the hospital (ED)?	Who are the users of the system? (Doctors, nurses, administrative staff, other clinical staff)
PACS	Picture Archiving Communication System	Storage, Retrieval, & Presentation of Radiology Images	December 2007	Trust-Wide (CRIS system used in parallel for radiology reporting)	Vendor Product	Doctors, ENPs, Radiologists and Radiographers
Symphony	Ascribe Symphony 2.23.3	Patient tracking and clinical process support system	December 2005	Linked to PAS (for demographics, etc)	Vendor Product	Doctors, Nurses, Admin
Results Server v2.5	-	Presentation of laboratory and radiology results	?2004	Linked to labs, radiology, ED, wards, and outpatients dept.	Developed in Leeds NHS Trust	All clinical staff and lab staff
WinDIP	-	Electronic Archiving of clinical notes	-	Within ED only	Vendor product	Admin and senior clinical staff within ED only

Appendix VII- ED systems' characteristics- Barnsley Hospital

Name of the system	What is the full name of the system?	What are the functions of the system?	When was the system installed in the ED (or in the hospital)?	Is the system linked to other systems in the hospital, or it is a stand-alone ED system?	Is the system a vendor product or it has been designed for the hospital (ED)?	Who are the users of the system? (Doctors, nurses, administrative staff, other clinical staff)
PACS	Agfa Impax 5.2	Capture, storage, and distribution of medical images and radiology reports	2002	Linked to PAS via the Radiology Information System	Vendor Product	All Clinical staff
PAS	ED Module	Search index for ED Registration, Diagnosis, Treatment, Follow up reception, Patients' labels, Record Cards, ED clinic booking, Waiting times, A full list of reports	About 20 years ago	Linked to inpatient/outpatient modules	Vendor Product	Mostly Admin staff