CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 INTRODUCTION

Two questionnaires have been distributed during this study as parts of the research methodology. The first questionnaire collected data about the general information about electronic medical record system in the health sector before using the system. On the other hand, the second questionnaire collects data about the system after using it in Khaled Bn Alwalid hospital, Benghazi, Libya. Each questionnaire has 138 respondents and all data are valid without any missing values. In this chapter, all collected data is discussed and analyzed in order to come out with the research results and to conclude if these results meet the research objectives.

5.2 QUESTIONNAIRES RESULTS

5.2.1 Pre-Test Results

The first questionnaire that is pre-test questionnaire was collected from 138 respondents who works in the Khaled Bn Alwalid hospital, Benghazi, Libya. This 138 respondents are the whole population of staff who will be the system users in the hospital. There are two sections in this questionnaire that are Section A and B.

5.2.1.1 Section A: Personal Information

Section A below describe their personal information and general understanding of electronic medical records. There are 7 questions in this section.

A1. What is your gender?

As shown in table 5.1, most of the respondents was male with 71% while the female was only 29%.

Table 5.1: Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	98	71.0	71.0	71.0
	Female	40	29.0	29.0	100.0
	Total	138	100.0	100.0	

A2. What is your age?

Table 5.2 showed 5 categories of age of respondents starting from 20-29 years old category to >50 years old category. The category of 30-39 years old has the majority by 52.2% while the second is 40-49 years old category with 22.5%.

Table 5.2: Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-29	25	18.1	18.1	18.1
	30-39	72	52.2	52.2	70.3
	40-49	31	22.5	22.5	92.8
	> 50	10	7.2	7.2	100.0
	Total	138	100.0	100.0	

A3. What's your nationality?

Only 12 respondents whom were not Libyan nationality, which means 91.3% of respondents have Libyan nationalities as shown in Table 5.3.

Table 5.3: Nationality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Libyan	126	91.3	91.3	91.3
	Others	12	8.7	8.7	100.0
	Total	138	100.0	100.0	

A4. What is your current degree of education?

Bachelor and master degrees have the majority of the respondents with the total of 71.8% which reflect that most of the respondents was well qualified and educated as shown in Table 5.4.

Table 5.4: Current Degree of Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secondary school	1	.7	.7	.7
	High school	10	7.2	7.2	8.0
	Associate degree	8	5.8	5.8	13.8
	Bachelor degree	43	31.2	31.2	44.9
	Master degree	56	40.6	40.6	85.5
	Others	20	14.5	14.5	100.0
	Total	138	100.0	100.0	

A5. What is your current occupation?

Table 5.5 showed the current occupation of respondents where the first choice is Administration staff with 29.7%, the second choice is Doctor with the majority of 41.3% and the third choice is Nurse with 29.0% only.

Table 5.5 : Current Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Administration staff	41	29.7	29.7	29.7
	Doctor	57	41.3	41.3	71.0
	Nurse	40	29.0	29.0	100.0
	Total	138	100.0	100.0	

A6. Do you know about electronic medical record?

This question has Yes or No choice of answers where almost half of respondents chose Yes with the percentage of 47.1% and the rest of 52.9% chose No, which meant that almost half of respondents does not know about the electronic medical record system as shown in Table 5.6.

Table 5.6: Understanding of Electronic Medical Record

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	65	47.1	47.1	47.1
	No	73	52.9	52.9	100.0
	Total	138	100.0	100.0	

A7. Have you used electronic medical record before?

This question also has Yes and No choice of answers and it is noticed that only 20.3% of respondents have used the electronic medical record system which mean only 28 respondents have used the system from 65 whom have known about it, as shown in Table 5.7.

Table 5.7: Usage of Electronic Medical Record

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	28	20.3	20.3	20.3
	No	110	79.7	79.7	100.0
	Total	138	100.0	100.0	

5.2.1.2 Section B: Requirements

Section B below describe respondent's overview of Electronic Medical Record (EMR) and suggestions on information requirements needed to be included in electronic medical records. There are 7 questions in this section.

B1. Electronic medical record is the most important phenomena of modern technology in the present day.

Most of respondents Agree and Strongly agree (total of 76.1%) that EMR system is the most important phenomena of modern technology in the present day as shown in Table 5.8.

Table 5.8: Electronic medical record is the most important phenomena of modern technology in the present day

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	53	38.4	38.4	38.4
	Agree	52	37.7	37.7	76.1
	Neutral	25	18.1	18.1	94.2
	Disagree	7	5.1	5.1	99.3
	Strongly disagree	1	.7	.7	100.0
	Total	138	100.0	100.0	

B2. Patient's data can be stored more efficiently through the electronic medical record.

Results shown in Table 5.9 showed a majority of 47.8 % respondents with Strongly agree, 34.1 % with Agree and 2.2% with Disagree.

Table 5.9: Patient's data can be stored more efficiently through the electronic medical record

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	66	47.8	47.8	47.8
	Agree	47	34.1	34.1	81.9
	Neutral	20	14.5	14.5	96.4
	Disagree	3	2.2	2.2	98.6
	Strongly disagree	2	1.4	1.4	100.0
	Total	138	100.0	100.0	

B3. Electronic medical record reduces the administrative burden for staff in the health sector.

Table 5.10 showed a total of 85.5% of respondents with Strongly agree and Agree that the EMR system will reduce the administrative burden for staff in the health sector, while only a total of 2.8% of respondents Disagree and Strongly disagree. The rest of 11.6% has no clear opinion.

Table 5.10: Electronic medical record reduces the administrative burden for staff in the health sector

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	62	44.9	44.9	44.9
	Agree	56	40.6	40.6	85.5
	Neutral	16	11.6	11.6	97.1
	Disagree	2	1.4	1.4	98.6
	Strongly disagree	2	1.4	1.4	100.0
	Total	138	100.0	100.0	

B4. Electronic medical record security is more than the traditional paper record.

Table 5.11 showed that EMR system will be more secure than traditional paper record because a total of 74.6% respondents Strongly agree and Agree.

Table 5.11: Electronic medical record security is more than the traditional paper record

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	46	33.3	33.3	33.3
	Agree	57	41.3	41.3	74.6
	Neutral	27	19.6	19.6	94.2
	Disagree	6	4.3	4.3	98.6
	Strongly disagree	2	1.4	1.4	100.0
	Total	138	100.0	100.0	

B5. I recommend using the electronic medical record system in the hospital.

Table 5.12 showed 50% respondents Strongly agree to recommend using the EMR system in the hospital while 36.2% respondents also Agree to recommend it. Then, 10.1% respondents has neutral opinion, while the rest 3.6% of respondents Disagree and Strongly disagree to recommend using the system in the hospital.

Table 5.12: I recommend using the electronic medical record system in the hospital

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	69	50.0	50.0	50.0
	Agree	50	36.2	36.2	86.2
	Neutral	14	10.1	10.1	96.4
	Disagree	3	2.2	2.2	98.6
	Strongly disagree	2	1.4	1.4	100.0
	Total	138	100.0	100.0	

B6. All staff in the hospital needs to give their full commitment to the implementation of electronic medical record to ensure its success.

Again most of the respondents have positive responds to this question with a total of 79% Strongly agree and Agrees that all staff in the hospital needs to give their full commitment to the implementation of EMR system to ensure its success. 13.8% respondents has neutral opinion, while the rest of respondents (total of 7.3%) has negative responds of Disagree and Strongly disagree as shown in Table 5.13.

Table 5.13: All staff in the hospital needs to give their full commitment to the implementation of electronic medical record to ensure its success

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	54	39.1	39.1	39.1
	Agree	55	39.9	39.9	79.0
	Neutral	19	13.8	13.8	92.8
	Disagree	7	5.1	5.1	97.8
	Strongly disagree	3	2.2	2.2	100.0
	Total	138	100.0	100.0	

B7. Please choose which information about a patient that is or are useful to be included in electronic medical record that can help to smooth your work in the hospital.

Distributed 14 choices were given for respondents to choose about the information that he or she finds useful to be included in electronic medical records which can help to facilitate their work in the hospital as shown in Table 5.14.

Table 5.14: Distribution of Information Requirement

Information	Frequency	Percent (%)
Name	112	81.15%
National ID	100	72.46%
Hospital ID	86	62.31%
Address	96	69.56%
House phone number	83	60.14%
Hand phone number	95	68.8%
Office phone number	47	34.05%
Fax number	37	26.81%
E.mail	93	67.39%
Disease record	89	64.49%
Treatment record	82	59.42%
Prescription of medicine	81	58.69%
Medicine allergy information	83	60.14%
Payment record	68	49.27%
Others	29	21.01%
Total	138	100%

This section present the results of the pre-test questionnaire for the collection on the general information about electronic medical records system in the health sector and to determine HMS system requirements that was to be developed by the researcher. All correct data was collected without any missing values. The result shows that almost half of the total staff in the hospital were familiar with the term electronic medical records. But majority of the respondents agreed that it is important to adapt electronic medical records in the hospital.

5.2.2 Post-Test Results

The second questionnaire that is post-test questionnaire was collected from 138 respondents who works in the Khaled Bn Alwalid hospital, Benghazi, Libya. There are three sections in this questionnaire that are Section A, B and C.

5.2.2.1 Section A: Personal Information

Section A below describe their personal information and general understanding of electronic medical records. There are 5 questions in this section.

A1. What is your gender?

Female is more than Male respondents as shown in Table 5.15 with 52.2% Female and 47.8% Male respondents.

Table 5.15: Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	72	52.2	52.2	52.2
	Male	66	47.8	47.8	100.0
	Total	138	100.0	100.0	

A2. What is your age?

Table 5.16 showed that the category of 31- 40 years old has the majority by 39.1%, while second shared by 21-30 and 41-50 years old category with 26.1% respectively.

Table 5.16: Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21-30 years	36	26.1	26.1	26.1
	31-40 years	54	39.1	39.1	65.2
	41-50 years	36	26.1	26.1	91.3
	Above 50 years	6	4.3	4.3	95.7
	Below 21 years	6	4.3	4.3	100.0
	Total	138	100.0	100.0	

A3. What is your current degree of education?

Table 5.17 showed that Diploma have the majority of the respondents with 31.9% followed by Bachelor degree with 26.1% and Doctorate degree with 23.9%. This reflect that most of the respondents are well qualified and educated.

Table 5.17: Highest Qualification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor degree	36	26.1	26.1	26.1
	Diploma	44	31.9	31.9	58.0
	Doctorate degree	33	23.9	23.9	81.9
	Master degree	25	18.1	18.1	100.0
	Total	138	100.0	100.0	

A4. What is your current occupation?

This question has three choices; Administration staff, Doctor, and Nurse. Results showed that Nurse have the highest ratio of 42% followed by Doctor with 31.9% and lastly Administration staff with only 26.1% as shown in Table 5.18.

Table 5.18: Current Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Administration Staff	36	26.1	26.1	26.1
	Doctor	44	31.9	31.9	58.0
	Nurse	58	42.0	42.0	100.0
	Total	138	100.0	100.0	

A5. Are you a user of electronic medical records system prototype?

All respondents used and tested the system as of cumulative percent 100% as shown in Table 5.19.

Table 5.19: Electronic Medical Record System Usage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	138	100.0	100.0	100.0

5.2.2.2 Section B: Functionality

Section B below describe respondent's overview on the electronic medical record system functionality. There are 10 questions in this section.

B1. It was easy to learn to use this system.

Table 5.20 showed a total of 62.4% of the respondents found that the system was easy to learn with 16.7% of respondents Strongly agree and 45.7% of respondents Agree that the system is easy to learn. 27.5% of respondents found it Neutral, 7.2% of respondents Disagree and only 2.9% are Strongly disagree.

Table 5.20: It was easy to learn to use this system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	63	45.7	45.7	45.7
	Disagree	10	7.2	7.2	52.9
	Neutral	38	27.5	27.5	80.4
	Strongly Agree	23	16.7	16.7	97.1
	Strongly Disagree	4	2.9	2.9	100.0
	Total	138	100.0	100.0	

B2. The system is easy to be used.

Only one respondent Strongly disagree that the system is easy to use and also 7 respondents of 5.1% Disagree as well. But a total of 60.9% of the respondents Strongly agree (11.6%) and Agree (49.3%) that the system is easy to use while the rest of respondents of 33.3% found it Neutral as shown in Table 5.21.

Table 5.21: The system is easy to be used

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	68	49.3	49.3	49.3
	Disagree	7	5.1	5.1	54.3
	Neutral	46	33.3	33.3	87.7
	Strongly Agree	16	11.6	11.6	99.3
	Strongly Disagree	1	.7	.7	100.0
	Total	138	100.0	100.0	

B3. The information in the records can be created, edited, stored and managed more effectively by using this system.

Table 5.22 showed that more than half of the respondents (55.8%) Agree and Strongly agree that the information in the records can be created, edited, stored and managed more effectively by using the electronic medical record system. 36.2% of respondents have a Neutral opinion as an answer to this question. The rest of respondents with a total of 7.9% Disagree (6.5%) and Strongly disagree (1.4%) in this regards.

Table 5.22: The information in the records can be created, edited, stored and managed more effectively by using this system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	52	37.7	37.7	37.7
	Disagree	9	6.5	6.5	44.2
	Neutral	50	36.2	36.2	80.4
	Strongly Agree	25	18.1	18.1	98.6
	Strongly Disagree	2	1.4	1.4	100.0
	Total	138	100.0	100.0	

B4. I was able to complete my tasks in a short amount of time by using this system.

Most of respondents 65.2% with Agree (50.7%) and Strongly agree (14.5%) that they were able to complete their tasks in a short amount of time by using the EMR system as shown in Table 5.23.

Table 5.23: I was able to complete my tasks in a short amount of time by using this system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	70	50.7	50.7	50.7
	Disagree	9	6.5	6.5	57.2
	Neutral	35	25.4	25.4	82.6
	Strongly Agree	20	14.5	14.5	97.1
	Strongly Disagree	4	2.9	2.9	100.0
	Total	138	100.0	100.0	

B5. I could complete my tasks effectively by using this system.

Table 5.24 showed that most of respondents 63.1% Agree (45.7%) and Strongly agreed (17.4%) that they could complete their tasks effectively by using the system. However, only 10.1% with Disagree (7.2%) and Strongly disagree (2.9%), while the rest of respondents Neutral (26.8%).

Table 5.24: I could complete my tasks effectively by using this system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	63	45.7	45.7	45.7
	Disagree	10	7.2	7.2	52.9
	Neutral	37	26.8	26.8	79.7
	Strongly Agree	24	17.4	17.4	97.1
	Strongly Disagree	4	2.9	2.9	100.0
	Total	138	100.0	100.0	

B6. I believe I could become productive by using this system.

High percent of the respondents (69.6%) believed they could become productive by using the EMR system. 21.0% of respondents have a Neutral opinion about it, while the rest of 9.4% Disagree (5.1%) and Strongly disagree (4.3%) as shown in Table 5.25.

Table 5.25: I believe I could become productive by using this system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	72	52.2	52.2	52.2
	Disagree	7	5.1	5.1	57.2
	Neutral	29	21.0	21.0	78.3
	Strongly Agree	24	17.4	17.4	95.7
	Strongly Disagree	6	4.3	4.3	100.0
	Total	138	100.0	100.0	

B7. The system has a user-friendly design.

Table 5.26 showed that the majority of respondents 71.7% Agree (55.8%) and Strongly agreed (15.9%) that the system has a user-friendly design.

Table 5.26: The system has a user-friendly design

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	77	55.8	55.8	55.8
	Disagree	11	8.0	8.0	63.8
	Neutral	26	18.8	18.8	82.6
	Strongly Agree	22	15.9	15.9	98.6
	Strongly Disagree	2	1.4	1.4	100.0
	Total	138	100.0	100.0	

B8. Whenever I made a mistake using the system, I could recover information easily and quickly.

In term of error recovery, 65.3% of respondents Agree (48.6%) and Strongly agree (16.7%) that whenever they made mistakes using the EMR system, they could recover information easily and quickly as shown in Table 5.27.

Table 5.27: Whenever I made a mistake using the system, I could recover information easily and quickly

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	67	48.6	48.6	48.6
	Disagree	10	7.2	7.2	55.8
	Neutral	34	24.6	24.6	80.4
	Strongly Agree	23	16.7	16.7	97.1
	Strongly Disagree	4	2.9	2.9	100.0
	Total	138	100.0	100.0	

B9. This system has all functions and capabilities as expected.

Table 5.28 showed that the EMR system for sure has all functions and capabilities as expected because 50% of respondents Agree and 15.2% Strongly agree about it. 24.6% of respondents have Neutral choice, and other respondents Disagree (7.2%) and Strongly disagree (2.9%).

Table 5.28: This system has all functions and capabilities as expected

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	69	50.0	50.0	50.0
	Disagree	10	7.2	7.2	57.2
	Neutral	34	24.6	24.6	81.9
	Strongly Agree	21	15.2	15.2	97.1
	Strongly Disagree	4	2.9	2.9	100.0
	Total	138	100.0	100.0	

B10. Overall, I am satisfied with this system.

17.4% of respondents Strongly agree to be satisfied with the system, 48.6% of respondents Agree and 25.4% of respondents have Neutral satisfaction with the system. The rest of respondents of only 8.7% are Disagree (5.8%) and Strongly disagree (2.9%) to be satisfied with the system as shown in Table 5.29.

Table 5.29: Overall, I am satisfied with this system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	67	48.6	48.6	48.6
	Disagree	8	5.8	5.8	54.3
	Neutral	35	25.4	25.4	79.7
	Strongly Agree	24	17.4	17.4	97.1
	Strongly Disagree	4	2.9	2.9	100.0
	Total	138	100.0	100.0	

5.2.2.3 Section C: Security

This section is seeking the user's perception on the security aspects of EMR system. It contains 10 questions to review user's knowledge regarding EMR system security.

C1. I believe that authentication is necessary to ensure the security of records (e.g. using user name, password, etc.).

Authentication is necessary to ensure the security of medical records was the choice of most of the respondents with total of Agree and Strongly agree with frequency of 99 respondents (71.8%), which indicates the importance of using authentication in the EMR system as shown in Table 5.30.

Table 5.30: I believe that authentication is necessary to ensure the security of records (e.g. using user name, password, etc.)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	67	48.6	48.6	48.6
	Disagree	6	4.3	4.3	52.9
	Neutral	28	20.3	20.3	73.2
	Strongly Agree	32	23.2	23.2	96.4
	Strongly Disagree	5	3.6	3.6	100.0
	Total	138	100.0	100.0	

C2. I believe that unique passwords and user names that consist of letters, numbers and symbols help prevent unauthorized access to the system.

Table 5.31 showed that using strong password to access the EMR system was the choice of the majority of the respondents with 102 respondents (52.2% Agree and 21.7% Strongly agree) with the total percent of 73.9%.

Table 5.31: I believe that unique passwords and user names that consist of letters, numbers and symbols help prevent unauthorized access to the system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	72	52.2	52.2	52.2
	Disagree	8	5.8	5.8	58.0
	Neutral	26	18.8	18.8	76.8
	Strongly Agree	30	21.7	21.7	98.6
	Strongly Disagree	2	1.4	1.4	100.0
	Total	138	100.0	100.0	

C3. I believe that same username and password cannot be used for various account.

Respondents with a total of 74.6% (51.4% Agree and 23.2% Strongly agree) believed that same username and password cannot be used for various account as shown in Table 5.32.

Table 5.32: I believe that same username and password cannot be used for various account

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	71	51.4	51.4	51.4
	Disagree	8	5.8	5.8	57.2
	Neutral	25	18.1	18.1	75.4
	Strongly Agree	32	23.2	23.2	98.6
	Strongly Disagree	2	1.4	1.4	100.0
	Total	138	100.0	100.0	

C4. I believe that it is compulsory to clear all browsing history before logging off computer.

Table 5.33 showed that most of respondents with a majority of 76.1% (52.9% Agree and 23.2% Strongly agree) believed that it is compulsory to clear all browsing history before logging off computer.

Table 5.33: I believe that it is compulsory to clear all browsing history before logging off computer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	73	52.9	52.9	52.9
	Disagree	7	5.1	5.1	58.0
	Neutral	21	15.2	15.2	73.2
	Strongly Agree	32	23.2	23.2	96.4
	Strongly Disagree	5	3.6	3.6	100.0
	Total	138	100.0	100.0	

C5. I believe that it is necessary to logged off computer after finish using it.

Logged off computer after finish using it is necessary for most of the respondents with a majority of 79.0% (50% Agree and 29.0% Strongly agree) as shown in Table 5.34.

Table 5.34: I believe that it is necessary to logged off computer after finish using it

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	69	50.0	50.0	50.0
	Disagree	10	7.2	7.2	57.2
	Neutral	15	10.9	10.9	68.1
	Strongly Agree	40	29.0	29.0	97.1
	Strongly Disagree	4	2.9	2.9	100.0
	Total	138	100.0	100.0	

C6. I believe that high speed internet will reduce the service delay (availability) and ensure safe delivery of records.

Table 5.35 showed that 76.8% of respondents (49.3% Agree and 27.5% Strongly agree) believed that high speed internet will provide the availability, reduce the service delay and ensure safe delivery of records.

Table 5.35: I believe that high speed internet will reduce the service delay (availability) and ensure safe delivery of records

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	68	49.3	49.3	49.3
	Disagree	8	5.8	5.8	55.1
	Neutral	21	15.2	15.2	70.3
	Strongly Agree	38	27.5	27.5	97.8
	Strongly Disagree	3	2.2	2.2	100.0
	Total	138	100.0	100.0	

C7. I believe that anti-virus or anti-malware programs and firewall must be installed in all computers and updated regularly

Majority of 81.1% (52.9% Agree and 28.3% Strongly agree) believe that anti-virus or anti-malware programs and firewall must be installed in all computers and updated regularly as shown in Table 5.36.

Table 5.36: I believe that anti-virus or anti-malware programs and firewall must be installed in all computers and updated regularly

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	73	52.9	52.9	52.9
	Disagree	10	7.2	7.2	60.1
	Neutral	13	9.4	9.4	69.6
	Strongly Agree	39	28.3	28.3	97.8
	Strongly Disagree	3	2.2	2.2	100.0
	Total	138	100.0	100.0	

C8. I believe that by conducting system backup can keep records readily available and always safe in the event of incidents such as fire, cyber-attack, natural disaster or others.

Table 5.37 showed that 79.7% of respondents (51.4% Agree and 28.3% Strongly agree) believed that by conducting system backup can keep records readily available and always safe in the event of incidents such as fire, cyber-attack, natural disaster or others.

Table 5.37: I believe that by conducting system backup can keep records readily available and always safe in the event of incidents such as fire, cyber-attack, natural disaster or others

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	71	51.4	51.4	51.4
	Disagree	6	4.3	4.3	55.8
	Neutral	18	13.0	13.0	68.8
	Strongly Agree	39	28.3	28.3	97.1
	Strongly Disagree	4	2.9	2.9	100.0
	Total	138	100.0	100.0	

C9. I believe that the use of encryption technology can protect records from being read by unauthorized people, regardless records that are locally installed or accessed over the Internet.

81.2% of respondents (48.6% Agree and 32.6% Strongly agree) believed that the use of encryption technology can protect records from being read by unauthorized people, regardless records that are locally installed or accessed over the Internet as shown in Table 5.38.

Table 5.38: I believe that the use of encryption technology can protect records from being read by unauthorized people, regardless records that are locally installed or accessed over the Internet

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	67	48.6	48.6	48.6
	Disagree	7	5.1	5.1	53.6
	Neutral	16	11.6	11.6	65.2
	Strongly Agree	45	32.6	32.6	97.8
	Strongly Disagree	3	2.2	2.2	100.0
	Total	138	100.0	100.0	

C10. My hospital should implement effective security measures against various security threats to electronic medical record.

Table 5.39 showed that a majority of 81.1% of respondents (51.4% Agree and 29.7% Strongly agree) have an opinion that their hospital should implement effective security measures against various security threats to electronic medical record system. Other percentage is can be neglected.

Table 5.39: My hospital should implement effective security measures against various security threats to electronic medical record

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	71	51.4	51.4	51.4
	Disagree	7	5.1	5.1	56.5
	Neutral	16	11.6	11.6	68.1
	Strongly Agree	41	29.7	29.7	97.8
	Strongly Disagree	3	2.2	2.2	100.0
	Total	138	100.0	100.0	

5.2.3 Statistical Analysis of Results

A statistical analysis has been made based on Research Objectives (RO) and Research Questions (RQ). All Research Objectives (RO) and Research Questions (RQ) outlined for this research has been achieved and answered as discussed below:

RO1: To determine the features and design requirements to develop Hospital Management System (HMS).

RQ1: How to determine the features and design requirements to develop Hospital Management System (HMS)?

As for the first objective, pre-test questionnaire was chosen as the method to determine features and design requirements needed to be included in the system. The questionnaire findings defined and determined the features and design requirements of EMR system such as it need to be able to manipulate and manage the medical records to reduce the administrative burden and it also need to be able to store the records securely. For example, the users need to finish their task easily and in time, so the best option to provide that is to develop the system as a web-based application where the internet infrastructure will support the availability, simplicity and security of the system.

RO2: To apply the security requirements against unauthorized access of Electronic Medical Records (EMRs).

RQ2: How to apply the security requirements against unauthorized access in Electronic Medical Records (EMRs) for a hospital?

Triple DES is used to encrypt and decrypt the electronic medical records in the proposed system. Even though the data was encrypted in the database, however it arrives decrypted and readable to the user (please refer Section 4.5.1). Other security implemented to secure electronic medical records are system menu, password attempt limitation and login audit (please refer Section 4.5.2). All these security measures for electronic medical records have been successfully implemented in the research.

RO3: To evaluate the effectiveness of Hospital Management System (HMS) implementation.

RQ3: How to evaluate the effectiveness of Hospital Management System (HMS) implementation?

From the statistical analysis results of post-test questionnaire, it can be concluded that the Research Objective 3 have been achieved and Research Question 3 have been answered as following:

As a result, the statistical analysis proves that developing and implementing the HMS is a highly recommend for hospital in order to add many benefits in term of manipulating, managing, and controlling the medical records. The important findings of this questionnaire can be summarized in the table 5.40 and table 5.41.

Referring to Table 5.40, the users' evaluation of the system insured that the system is easy to learn and use with user-friendly interface. In addition, the users can use the system to manipulate and manage the medical report effectively with lesser time and they can effectively complete their tasks with the ability recover any errors and in general most of users were satisfied with the system functionality.

Table 5.40: Functionality of HMS

Section B: Functionality	Strongly agree + Agree (%)
Easy to learn	62.40%
Easy to use	60.90%
Effectively manipulate and manage	55.80%
Effectively working Time	65.20%
Effectively completing tasks	63.10%
Enhancing user productivity	69.60%
User-friendly design	80.70%
Easy errors recovery	65.30%
Expected functions and capabilities	65.20%
Satisfaction	66.00%

In term of security, Table 5.41 shows that the HMS system must implement the important security measures such as using identity authentication, hard password, unique username and password, security software, encryption, data backup and restore, and users must clear the history before logging out from the system or shutdown the computer. It is easily concluded that the need for security is important and highly recommended from the users. All the total of Strongly agree and Agree choices for all

questions in this sector were higher than 70% which indicates that the users believe that the security factors must be used and implemented in the system.

Table 5.41: Security of HMS

Section C: Security	Strongly agree + Agree (%)
Authentication	71.80%
Hard password	73.90%
Don't use same username and password for many accounts	74.60%
Clear all browsing history	76.10%
Necessary to logged off	79.00%
High speed internet	76.80%
Using security software	81.10%
Using system backup	79.70%
Using encryption technology	81.20%
Using implement effective security measures	81.10%

5.3 CONCLUSION

This chapter presented the results of two questionnaires conducted during this study as a one of key parts of the research methodology. Results were presented in general and in detail as defined by tables and graphs to illustrate as well as to explain of the findings of each questionnaire. From analysis conducted based on Research Objectives and Research Questions outline for this research, it can be seen that all Research Objectives and Research Questions have been achieved for this research.