The Impact of Computerisation of the Patient Pathway within a National Centre for Prostate Cancer

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Author Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work, and has not been submitted as an exercise for a degree at this or any other university. I further declare that this research has been carried out in full compliance with the ethical research requirements of the School of Computer Science and Statistics.

Signed:

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Jeasonraj Kanagaraj

10th August 2015

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I dedicate this dissertation in memory of my son

JADEN KANAGARAJ

Abstract

Background: Clinical documentation in healthcare records at every stage of the patient's pathway is one of the most essential and challenging tasks for health care professionals. However, computerising the patient pathway may not only prove beneficial in terms of documentation, but also can help access clinical information at anytime and anywhere.

Objective: To identify the impact of computerisation of patient pathway in a national cancer centre for Prostate cancer. The study focussed at the PCPD system used in the cancer centre.

Methods: DeLone and McLean Information System Success Model was used to ascertain the impact of the PCPD system. A Quantitative approach was adapted in this study. Questionnaire was the chosen tool to gather relevant information. There were 43 questions under 6 headings. Questions were based on the five-point Likert scale with parameters being strongly disagree, disagree, neither disagree nor agree, agree and strongly agree.

Results: The total population of N 31 staff in the unit participated in this study and all staff responded to the questionnaire. The majority of the measurable elements (133, 72%) recorded positive impact and small portion (38, 20%) of the measurable elements recorded negative. However, there is also a smaller portion (15, 8%) of the measurable elements recorded as neither positive nor negative. The neutral responses are directly connected to responses where the use of the system has been minimal. The overall mean value is 3.83 which show that the system has a positive impact on the patient care pathway.

Conclusion: This study shows that the PCPD system has a positive impact on the overall patient care pathway. The areas of impact include increased patient satisfaction, reduced waiting time, better reporting, patient privacy and confidentiality. There is also positive impact on the unit staff in the areas of job satisfaction, job efficiency, decision making, learning process, and quality in the care provided. The study also proves that there is a direct link between the

‘system use’ and ‘user satisfaction'. The longer the users had been using the system, the higher the satisfaction was recorded.

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Chapter 1: Introduction

The incidence of cancer is increasing rapidly in Ireland. Everyday more and more patients are registering on to the Cancer Registry (DoHC, 2006a). According to an article published in the Irish Times, a daily journal in Ireland, the occurrence of cancer by 2040 would increase by more than double (Irish Times, 2015).

In concordance with this, there are an increasing number of shortages in staffing levels in the field of cancer treatment (Ryan, 2014). According to Liam Doran (2014) from the Irish Nurses and Midwives Organisation, who has worked for many years in the field of Nursing, the Irish cancer care system is severely suffering due to lack of resources such as adequate staffing. This is a huge challenge in the increasing incidence of cancer. Cancer services are normally skilled-professional intensive, especially in the areas of operating theatre, medical oncology and radiation oncology (DoH, 2003). However, the public hospitals lead the cancer care in Ireland and appropriate staffing levels are required to reduce the risk in patient care (HSE, 2012). On the other hand, primary care centres provide limited services in terms of cancer care. In most cases, the primary care centres only act as a source of referral in relation to cancer care (HSE, 2014).

Clinical documentation in patients' health records is one of the most essential tasks and staff at the cancer centre play a complete and comprehensive role in maintaining the patient record (HSE, 2013a). Maintaining health care record is one of the most common factors that affect the motivation level of the health care staff. This is due to various issues such as time, quality of the health care record, documenting information on the record, storage, etc. (Grossmann *et al.,* 2011). Among all factors, the main factor that contributes to the dissatisfaction of staff is the recording of information in the patient's health care record (Strasberg *et al.,* 1998). This inconvenience is caused due to poor quality of record, legibility of the information on the paper, possibility of losing sheets/documents and other reasons (MPS 2015).

Information Technology has been introduced into the recording of the patient information at the cancer centre. This is expected to provide better patient-centred information for the cancer patients (Sada, 2013). As a result of this initiative, it is anticipated that the cancer patients' information will be recorded, stored and retrieved in a better and more efficient manner, which in turn will have a positive impact on the care of the patients (Orchard, 2009).

A review of the literature suggests that there is sufficient evidence to prove that computerising patient pathway would maximise the productivity of care. Currently, computerisation of health record is not widely spread across all centres of cancer care in Ireland (HSE, 2015). Thus, the impact of electronic health care record is not widely understood. The staff at various levels, such as the consultants, surgeons, doctors, nurses and administration needs to be educated on the benefits of electronic health care records. This would help in filling the knowledge gap between the positive and negative impacts of introducing Information Technology (IT) systems in the care pathway.

1.1 Research Aim

The aim of this study is:

To identify the impact of computerisation of patient pathway in a national cancer centre for Prostate cancer.

In aim of determining the above mentioned aim, the below questions need to be answered:

1. What are the various positive impacts and negative impacts on computerising the patient pathway in prostate cancer in the national centre?

2. What are the actions that can be taken to remove the negative impact of computerising patient pathway?

3. What are the future plans to successfully implement the IT system?

1.2 Research Methods

This section describes how the study was done. In alignment to the nature of the study, the following steps have been adapted to achieve the aim of this study.

1. Choosing a theoretical framework to determine the kind of effects to be measured and compared by the researcher.

2. Recognise the source of the data that will be used to identify the response for the research questions. The data is collected through quantitative methods, which is a questionnaire. The questions on the questionnaire are aimed at finding answers for the research question.

3. Data interpretation and analysis.

4. Organise the outcome of the data interpretation into various dimensions, based on the DeLone and McLean model.

This study has been conducted with quantitative research methodology and the updated DeLone and McLean Information Systems Success Models (D&S IS Success Models) has been chosen as the theoretical framework to ascertain the impact of computerisation of the patient pathway.

The study was conducted at a National Cancer Centre of Excellence for Prostate cancer. The unit has 4 surgeons, 1 Specialist Registrar, 2 Registrars, 1 Senior House Officer, 4 interns, 2 Clinical Nurse Specialists (CNS), 2 Clinical Nurse Managers (CNM), 10 staff nurses, 4

administrative staff and 1 Data Manager. All of the staff participated in the study by completing the questionnaires.

The data was analysed through a systematic approach. The data collected were entered into an excel Spreadsheet for interpretation and various Excel functions such as cell sorting, cell highlighting, filtering, counting, and Pivot table were used.

1.3 Motivation for selecting this topic

The author holds the position of Clinical Data Manager in the Cancer Centre in focus and this role partly was responsible for designing and implementing the Prostate Cancer Patient Database (PCPD).

The recent developments and healthcare reforms in Ireland clearly indicate a process towards significant impact on the Healthcare system (HSE, 2013b). In fact, several hospitals have already started investing in Electronic Healthcare record (EHR). For example, recently the HSE has published a 4-year tender for national integrated services IT project using electronic health records to establish an efficient service delivery (Smith, 2012).

It is therefore important to determine the impact that the smaller systems have on the organisation in advance of introducing a much more sophisticated and established system. These smaller systems will set the direction for the introduction and implementation of the larger integrated systems.

1.4 Organisation of Dissertation

Every effort has been taken by the author to ensure that this thesis is presented in a simple manner, following a ‘top down’ approach. There are 7 chapters in this thesis. The introduction chapter gives an overview and the background of the study. It also gives a quick overview of the

previous paper-based system and introduces the electronic health care system. It defines the aim with a statement of the topic, motivation for the study, and summary of the methods.

The remaining of this thesis is arranged as follows:

Literature Review

The second chapter analyses various national and international literature in relation to the topic of the study. This gives a basis for the work inside the setting of available literature.

Research Methods

The third chapter discusses the methodology and approach of this study.

Results

Chapter 4 and 5 focuses on the results of the quantitative analysis of this study.

Discussion

Chapter 6 consists of detailed discussions on the outcome of the study.

Conclusion

Chapter 7 gives a summarised conclusion of the thesis with implications of the study.

Chapter 2: Literature Review

2.1 Introduction

Healthcare professionals have been delegated with a challenging task in managing their patients' complex information. They are also required to share this in full or partial with other healthcare professionals (Murphy *et al.,* 2007). Basically, the patient's record is the primary document in which information about the patient is stored. This information is stored in either paper-based or electronic method. Although, many healthcare organisations across Europe have pursued or pursuing electronic healthcare record, still paper-based record is widespread. (BEUC, 2013).

Similar to other industries, computer technology has recently played a vital role in the health care industry. The healthcare industry has been increasingly dependent on computers to provide the various services (Ortiz, 2003). Unlike paper records, a computerised health record is intended to record information that can be used interactively (Fischer, 2012). Reminders on when the patient need to have their blood tests is one of the finest examples (Ruffin *et al.,* 2015). Electronic healthcare records stores information about a patient, not only for a particular episode or disease, but a lifetime documentation that can be edited, added, updated and accessed by many users (NIH, 2012). Undisputedly, electronic healthcare records are definitely superior in a number of advantages in comparison to the paper records. However, there advantages can lead to some problems (Boonstra, 2014).

As information technology is increasingly considered as a bridge between the patient and the service provider, computerising of the patient pathway for cancer care has become inevitable (Tang and Lansky, 2005). Since reliable cancer data is needed for effective cancer control measures, storing the data in an electronic format helps achieve the goal (Levit *et al.,* 2013).

2.2 Scope of the literature review

There was a list of studies created based on the availability of full text for free in various databases on the internet such as Google Scholar, Pub Med, Research Gate, TCD Stella search, Google books and Science direct. The primary focus was on the success of various Information Systems (IS). The literature search was covered between a timeframe from 1995 to 2015. The overall search was in relation to the Information Systems in health sector. The literature was read, examined and re-read to produce a proper understanding of their themes. This focus aligns well with the aim and objective of this study. The search materials were confined solely to the English language.

2.3 Cancer in Ireland

The incidence of cancer has been rapidly growing in Ireland. Among all cancers, the most commonly known cancers are skin cancer, Prostate cancer, Breast cancer, Bowel cancer and Lung cancer (DoHC, 2006b). According to Cullen (2015), among all European countries, Ireland is the worst in terms of survival rate in cancer mortality. Even though the main cause of death differs every year, cancer stands at either first or the second leading cause of death in Ireland. According to the statistics published by the NCRI (2015), there are more than 20,000 new cancer cases per year. The number of deaths average around 8,500 a year. These figures show that cancer is a rapidly growing health problem in Ireland.

2.3.1 Prostate Cancer in Ireland

Prostate cancer is a cancer that develops in the prostate gland in men. Normal cells grow extraordinarily quickly and form a mass called a tumour, which is in most cases cancer (ICS, 2015). Prostate cancer is the leading cancer among men aged between 55 and 64 in Ireland. Between the year 1999 and 2009, the number of cases more than doubled from 1492 to 2758. Nearly 31% of all cancers are reported to be prostate cancer. According to the recent trends in

Ireland, prostate cancer rates will double in the next ten years. However, on a positive note, the survival rate will increase simultaneously as well (NCRI, 2015).

2.4 Cancer Care in Ireland

As per international best practice, a multidisciplinary care approach is the best approach for quality cancer care (Silbermann *et al*., 2013). The National Cancer Control Programme (NCCP) is a body setup by the HSE in 2007 to control, coordinate and manage the care of cancer disease in Ireland. In 2008, the NCCP nominated 8 hospitals as the cancer centres of excellence to provide a fast, efficient service for men who need further tests and treatments for prostate cancer (HSE, 2015). Normally, cancer care starts with a visit to the General Practitioner (GP) or community care services if there are any symptoms. In some cases, cancer is diagnosed through incidental findings at routine check-up/follow-up or screening for other diseases. The GPs or community care services or other health care professionals refer the patient to one of the national centres of excellence. The cancer centres will own every stage of the patient pathway from the diagnosis to the final treatment (or palliative care, if required) (NMIC, 2012).

In the case of prostate cancer, if the patient is between the age of 50 and 70 years, then the GP can refer the patient directly to the Rapid Access Prostate Clinic (RAPC). RAPC is a Consultant-led clinic that was established in 2009 where patients get direct access. In this clinic, patients are given first appointment within 20 working days of the referral (Irish Health, 2009).

2.4.1 Challenges for Cancer Care delivery in Ireland

Cancer treatment has advanced and improved over the years in Ireland. But, there are still major challenges that play the role of a hurdle in efficient patient care. One of the major challenges is staffing resources. Wall (2015) argues that the key reason for regional variation in access to prostate rapid access clinics is due to staffing shortages and increased patient volume.

2.4.1.1 The challenge of workforce shortage

The healthcare workforce is large. According to a study by the European Commission (2012), by 2020 there will be a shortage of about one million healthcare workers in Europe. And Ireland will be one of the major affected countries by this shortfall. Ireland has already started to face challenges in the area of recruitment and retention of health care professionals such as doctors and nurses (Mudiwa, 2015).

Gouda (2015) states that nearly 88% of Irish medical students have already decided to emigrate to countries like Australia, New Zealand, United Kingdom, United States and Canada. The main reason for this huge surge in migration is due to excessive workload. Even though the consultants in Irish hospitals are among the best paid in the world, the junior doctors have been always denied this privilege (Hosford, 2014). This is due to the health department's budget cuts during the past few years when Ireland was in recession. This is also one of the reasons for newly graduated health professionals to seek jobs outside of Ireland (Droney, 2013).

2.4.1.2 Infrastructure challenges

According to a study conducted by the Medical Devices Clinical Trial Taskforce in 2006, one of main barriers to an efficient Healthcare service in Ireland is noted to be poor infrastructure (IBEC, 2006). Moreover, the ICT infrastructure is lagging far behind in comparison to other EU countries. Ireland currently only spends 0.85% of the total health budget on ICT compared to the rest of Europe who spend around 2-3%. There is a requirement for an increase in eHealth systems and change management that would support better infrastructure (ICS, 2013). According to a report published by the Department of Public expenditure and reform (2011), there will be expenditure of up to €2 billion in the period 2012-2016 for health care infrastructure.

2.4.1.3 Healthcare Delivery System Challenges

One of the other challenges is the delivery system in healthcare. The major reason for this challenge is the rise in the cost of service delivery. This cost rise is completely interlinked to factors such as ageing population and increase in the number of long-term illness (DoHC, 2006). A study shows that by the year 2020, the problem of ageing population would start to impact the delivery of Irish healthcare. This is due to the decrease in tax payers due to retirement and increase in the number of older people seeking healthcare services. This is also called the Dependency Ratio (ESRI, 2009).

2.5 Application of ICT in Patient Pathway for Prostate Cancer

The application of Information technology in the patient pathway for prostate cancer is not a new concept. ICT is being used in various stages of the prostate cancer patient pathway including areas such as allowing patients to report symptoms during radiotherapy for prostate cancer (Sundberg *et al.*, 2015).

In Ireland, the National Healthlink project provides a suitable platform for various cancer centres, including primary care facilities, to exchange patient clinical information securely. This project was implemented in 1995. Since then, there has been a huge improvement to this project. Healthlink provides extensive benefits to the primary care centres and the hospital such as easy transfer of referral, reduction in waiting times, and minimal administration work (Healthlink, 2015). The E-Referrals play a vital role in cancer care. Advantages of E-Referrals include referrals being sent securely, the referrals reach the cancer teams directly, patient get rapid and direct access to the service, reduction in costs for all care areas (HIQA, 2011a). And finally, the cancer services are streamlined by reducing the communication barrier (eHealth Ireland, 2015). According to a report published by HIQA (2011b), electronic referrals have improved the patients care pathway and the patients receive timely, safe and equitable care.

2.6 The Significance of Healthcare Record and Challenges in Managing Healthcare Record

The Healthcare industry creates a large amount of data and information. As much as there are challenges in processing the data, there are challenges in storing the data too. The simplest and quicker way of storing the data is on a Healthcare record (Lærum and Faxvaag, 2004). According to the Ministry of Health, NSW (2012), "A health care record is the primary repository of information including medical and therapeutic treatment and intervention for the health and wellbeing of the patient / client during an episode of care and informs care in future episodes." It is a complete document of a patient where details in relation to the illness, diagnostic tests, investigations, care plan discussions, treatment information, and on-going education are recorded. Other than this vital information, there is other health and social information such as dietary, social status, habits; it plays a vital role in the care management of the patients in making better decisions (Laerum, 2003).

However, the more importance given to the HCRs, the more challenges they bring. The challenges include non-availability of HCRs at the required time, missing information in the record, legibility of information (See Figure 1) and it is time consuming for recording information. These challenges create frustration in staff and reduce quality in patient care (Pitty and Hanka, 1998).

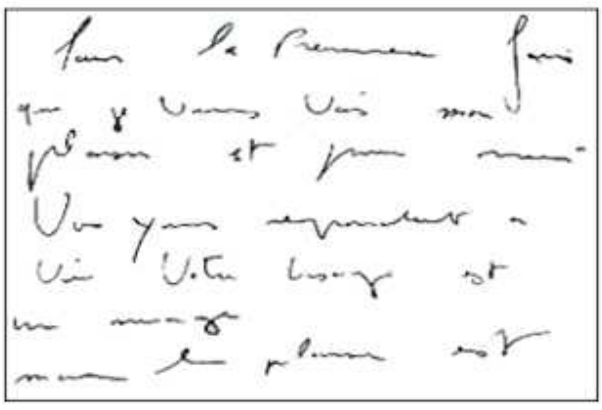

Figure 1: Example of Illegible writing in Patient Healthcare Record

Figure 2: Filing room running out-of-space. Source (Kalra, 2014)

It is universally accepted that paper-based health records do not satisfy the need of the organisation. One of the main reasons is that HCRs required changes and additions on a regular basis and making these amendments on paper-based HCRs could result in more expenditure and time consumption. In most cases, organisations print records and forms in large quantity and making changes may require time and lead to wastage as well (Kipturgo *et al.*, 2014). Storage of paper-based healthcare records poses a serious challenge in terms of shortage of storage space (Stausberg *et al.*, 2003) (See Figure 2).

2.7 Computerisation of Patient Pathway

As paper-based records have significant challenges, computerising the patient information seems to be a better option. Electronic Health Record (EHR) is not a new concept. It dates back to the 1960s and 70s, when academic medical centers' realised that to obtain a comprehensive information for patients, they started developing their own systems. Since the 1980s, there has been a drastic development in EHRs (Tripathi, 2012). EHR has become a hot topic in national parliaments (Bryant, 2015).

In the UK, the National Health Service (NHS) has vowed to go paperless by 2018. This is driven by a new initiative called, “Safer Wards, Safer Hospitals” technology fund. As an initial breakthrough, the NHS has estimated a saving of about £20 billion by the end of 2015 (McKee, 2014).

In Ireland, different hospitals and Healthcare organisations have had systems that capture certain stages of patient pathways or certain sections of the stages. For instance, there are systems like PACS to capture the radiological diagnostics of the patients (DOH, 2014). In December 2013, eHealth strategy for Ireland was launched, which promotes partnership with the EU eHealth Action Plan 2012-2020 (HSE, 2013). This plan would enable greater collaboration with ICT companies to improve technology use in healthcare, where Electronic Healthcare Records (eHCR) would be the core component.

2.7.1 Benefits of Computerisation of Patient Pathway in the Prostate Cancer Centre

The foremost benefit of computerising the patient record is to enable the healthcare staff to quickly access clinical information of the patients at the care point. Invariable of other patient pathways, Prostate cancer care pathway has been integrated with ICT around the world (Atherton, 2013). More specifically for prostate cancer, there have been triggers successfully launched to flag patient records with suspicious symptoms for prostate cancer. This allows doctors to overcome the problem of delayed diagnosis (Murphy *et al.*, 2014). According to a study conducted Thakkar and Davis (2006a) on the benefits of EHRs systems, exchanging patient information electronically with other departments within the organisation and quality of care were the two main benefits. The benefits were identified in the areas of Staff job experience and effectiveness, Interoperability, Patient information confidentiality, efficient reporting, patient care and financial benefits.

In Ireland, other than the existing integrated systems for patient care that helps in maintaining data for prostate cancer, there are individual systems put in place for generating key performance indicators (KPIs).

2.7.2 Challenges of Computerisation of Patient Pathway in the Prostate Cancer Centre

Introducing electronic patient record in the National Cancer Centre has various challenges. Despite the pressing need for computerising the patient record, to enhance the care level of the cancer patients, paper-based records are still commonly used (Stausberg *et al*., 2003). One of the main challenges is the lack of data management staff such as data managers and data administrators. In a study conducted by Ajami and Bagheri-Tadi (2013), inadequate level of support staff was one of the significant barriers in adopting EHRs.

The other challenge would be the level of computer literacy among medical staff. According to a study conducted by Hourser and Johnson (2008) on the perceptions regarding EHR implementation by healthcare professionals, 35% of the professionals cited lack of knowledge, 33% noted lack of support and 28% noted lack of employee training as the barrier for implementation. All these barriers are related to computer literacy of health care staff. Thakkar and Davis (2006b) also argues that factors such as lack of involvement of the medical staff, unsuitable systems, attitude of the healthcare staff, lack of computer knowledge, interoperability and other organisational factors are the main barriers that acts as deciding factors for implementation of EHRs.

2.7.3 Measuring the impacts of Computerisation of Patient Pathway in the Prostate Cancer Centre

DeLone and McLean IS Success Model is the frequently used model around the world to establish the effectiveness of an Information system (IS) (Manchanda and Mukherjee, 2010). DeLone and McLean IS Success Model was published in 1992. When it was published initially, it

was more of an endeavour to compile the outcome of the earlier studies that are analysing the factors determining the success of IS. It was an attempt to give an opportunity to other researchers to perform a comparative analysis between research findings (Livari, 2005). Shannon and Weaver (1949) have noted that there are 3 primary parts for communication; sender, channel, and receiver (See Figure 3). Comprehensively describing these parts, they further argued that the difficulty for communication are of three stages namely; the technical problem, the semantic problem and the effectiveness problem (IACACT, 2012). Furthermore, Mason (1978) renamed effectiveness to influence (See Figure 4). Based on these models, DeLone and McLean defined the six dimensions to determine the success of an IS. The final outcome was that all these dimensions were interconnected which affect the success of IS (See Figure 5).

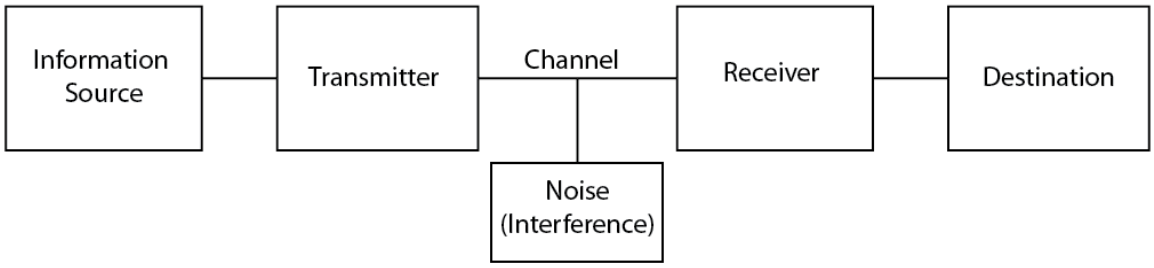

Figure 3: Primary Parts for Communication (Shannon and Weaver, 1949)

Production	Product	Receipt	Influence on Recipient	Influence on System

Figure 4: Updated Parts for Communication (Mason, 1978)

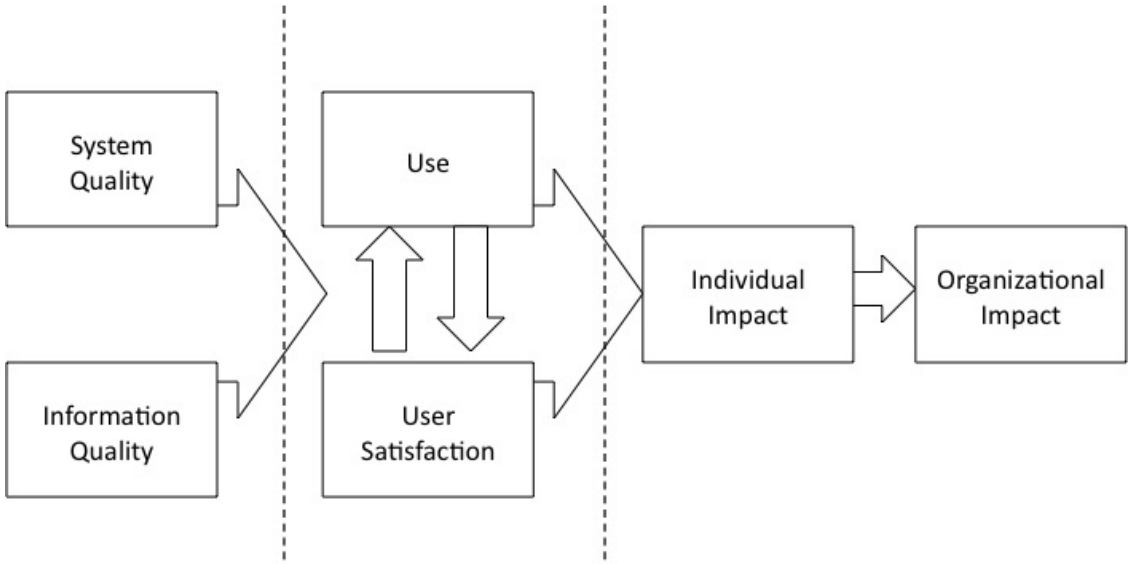

Figure 5: DeLone and McLean IS Success Model (DeLone and McLean, 1992)

Since the release of the model in 1992, DeLone and McLean have been appealing to various researchers to define further developments. Basing this call, many researchers had tried to expand or re-develop the original model. Few researchers claimed that the model was incomplete. Ten years later in 2003, DeLone and McLean released an updated model which reflected the earlier version in 1992 (Zaied, 2012).

The difference between the 2 models is as follows (Wong, 2011):

1. The introduction of Service Quality which reflects the significance of support in the success of an Information system.

2. The introduction of Intention to use, which evaluates the attitude of the user.

3. Individual impact and organisational impact has been combined into net benefits.

The updated model contains three dimensions which affects the use and the user satisfaction. The use and the user satisfactions have direct impact on the net benefits (See Figure 6). Even

though, this model is one of most commonly used models, it still has its own drawbacks. The DeLone and McLean model does not give any explicit measureable elements for each dimension. They claim that all measures should be done on the intention and aim of the individual studies. However, DeLone and McLean have been encouraging other researchers to continue further development to the updated model. On the other hand, one of the main advantages of the DeLone and McLean model is that it can be applied in any context (DeLone and McLean, 2003).

2.7.3.1 Dimensions of the model

The various dimensions of the updated DeLone and McLean model are as follows:

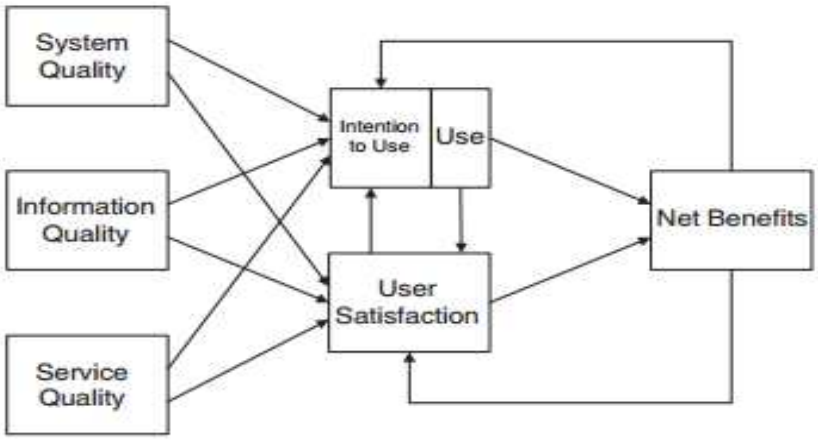

Figure 6: Updated DeLone and McLean IS Success Model (DeLone and McLean, 2003)

2.7.3.1.1 System Quality

The system quality is one of the required features of an information system. It examines the operational and functionality of a system when tested (Gelderman and Kusters, 2012). Several researchers have defined different measurable elements such as, access, convenience, easy to learn, easy to use, system features, flexibility, reliability and response time of the system (Petter *et al.,* 2008).

2.7.3.1.2 Information Quality

This dimension focuses on the IS output. For example, an IS installed in a college can be used to generate various information about a student such as grades scored, on time assignment submission and so on. Thus it focuses on the quality of information produced. Information quality serves as a vital component especially when measuring the user satisfaction (Rai *et al.*, 2002). Due to its significance, information quality has been widely referred by many researchers (Bossen *et al.*, 2013). Some of the measurable elements defined by several researchers are data accuracy, timeliness, availability, completeness, consistency, relevance, format, simplicity and usability (Petter *et al.,* 2008).

2.7.3.1.3 Service Quality

Service quality focuses on the complete and comprehensive support the end-user receives in a timely fashion from the ICT or support department such as technical helpdesk, trouble ticket, orientation and training (Bharati and Berg, 2003). This dimension is an addition in the updated model compared to the previous model (Nguyen *et al.*, 2014). The various measureable elements of this dimension are explained by various researchers as assurance, empathy, flexibility, interpersonal quality, training, reliability and responsiveness (Petter *et al.,* 2008).

2.7.3.1.4 Intent to Use/Use

The dimension intent to use or use measures the level and extent of use by the end-user. It can be looked at in several perspectives. The actual success of the IS depends on the voluntary use by the end-user. The previous version of the D&M Model suggested the objective method of measuring the use. As the method of measuring the actual use was quite difficult, the variable 'Use' was suggested as an alternative. The various measureable elements of this dimension are

intention to use/use, daily use, frequency of use, actual use and nature of use (Urbach and Müller, 2011).

2.7.3.1.5 User Satisfaction

The dimension user satisfaction is the level of satisfaction the end-user has attained upon using the IS (Al-adaileh, 2009). The user satisfaction is the ultimate motive of any IS. The various measureable elements of this dimension are adequacy, effectiveness, efficiency enjoyment, information satisfaction and overall satisfaction (Rai *et al.*, 2002).

2.7.3.1.6 Net Benefits

There are four components that depend on each other: tasks, personnel, organisation and Information technology. Certainly any change in one of the component will have a direct impact on the other. The success of computerising the patient pathway highly depends on the relationship between the four components. The success dimension Net Benefits is a complete extent of outcome to the various stakeholders. This dimension is a collaboration of the two dimensions namely, individual impact and organisational impact from the previous DeLone and McLean model (Elpez and Fink, 2006). The various measureable elements of this dimension are awareness, decision effectiveness, individual productivity, job effectiveness, job performance, job simplification, learning, productivity, task performance and usefulness (Petter *et al.,* 2008).

2.7.4 Research gap, aim and research questions of the study

The aim of this study is:

To identify the impact of computerisation of patient pathway in a national cancer centre for Prostate cancer.

In aim of determining the above mentioned aim, the below questions need to be answered:

1. What are the various positive impacts and negative impacts on computerising the patient pathway in prostate cancer in the national centre?

2. What are the actions that can be taken to remove the negative impact of computerising the patient pathway?

3. What are the future plans to successfully implement the IT system?

The intention of this thesis is to measure the overall impact of the IS elaborately explained in the next chapter. However, there is lack of information in relation to the cost and budget. Therefore the factors relating to cost have been omitted from all success dimensions.

2.8 Summary of the literature review

In this chapter, we have discussed the various academic studies conducted in relation to computerising patient health record. The literature starts with a brief description of cancers in Ireland and how patient information relation to prostate cancers is currently managed. Then the focus turns towards explaining why the current paper-based system is not a feasible option for providing quality patient care. In response to this, the benefits and challenges in introducing electronic patient record in the area of prostate cancer were discussed. Finally, the model that facilitates the aim of this thesis which is to measure the impacts of computerisation of Patient Pathway in the Prostate Cancer Centre was detailed. The aim specifically focuses on the impact on the service, service providers and patients.

Chapter 3: Research Methods

The research gap identified in the previous chapter clearly indicates the need to determine the systems users' opinion of the impacts of the PCPD system. Finding an appropriate answer to the research question and the supplementary questions can help other cancer centres in successfully implementing electronic health record systems. This chapter explains the methods used in finding those answers.

A defined methodology is vital for any research. A research methodology is a defined approach to find a solution to a problem (Sivasubramanian, 2012). It includes theoretical framework, research paradigm and methods by which information is attained. A proper methodology clearly explains why a certain method was adopted to research a problem (Rajasekar *et al.,* 2013).

The following sections will discuss the PCPD system, the study process, theoretical framework, research paradigm, data collection and data analysis.

3.1 Development and Implementation of the PCPD System

3.1.1 Need for electronic system

In March 2012, the NCCP required all of the 8 cancer centres mentioned previously to submit KPIs at intervals such as monthly, quarterly and annually. An electronic database is vital in order to successfully submit these KPIs. The Cancer centre this project is focused on has been generating KPIs through a manual system from the paper-based patient record. This system not only delays the process, but also denies reliability on generating reports. Furthermore, the generated report couldn't be validated, because it was a process of verifying the same records used to generate the report. Due to this, there was a possibility of potential errors on the

reports. In October 2012, the NCCP issued a Prostate cancer Dataset document as a framework for the reporting (Source: Documents within the Cancer Centre).

The Key Performance Indicators:

1. Referrals to the rapid access prostate clinic shall be offered an appointment within 20 working days of the date of receipt of referral in the cancer centre
2. Radical prostatectomy specimens classified a pathological stage pT2
   a. positive margin rate should not exceed 15%
   b. PSA should be undetectable at 3 months post-operatively in 90% of cases
3. All patients with prostate cancer should be discussed at a Multi-disciplinary Meeting (MDM).
4. Radical prostatectomy specimens classified as pathological stage T3
   a. positive margin rate should not exceed 40%
   b. PSA should be undetectable at 3 months post-operatively in 70% of case
5. 80% of all men who undergo a prostate biopsy should receive their results within 10 working days.

3.1.2 Design and development

The intention to develop an electronic system was primarily raised to facilitate the submission of the KPIs. But eventually, the cancer centre management sensed the need to computerise the entire patient pathway due to the benefits that can be attained. In February 2013, a business case was submitted to the management to justify the need of an electronic system, which was later accepted and approved. In April 2013, a project plan was drafted with a technical specification document. The system was labelled as Prostate Cancer Patient Database (PCPD).

The technical specification was designed in consultation with all levels of staff, i.e. from consultants to admin staff. The technical specification consisted of various topics such as forms,

fields, features, reporting tools and interoperability of other systems. There are 16 forms in the PCPD system. The forms are built based on parent-child relationship.

3.1.2.1 The Dashboard

The dashboard is a home page for the PCPD system providing connecting links to the various forms. The forms are arranged in a tree structure. Basically, the system allows data to be entered into the child form, only when the parent form is completed.

3.1.2.2 Referral

The referral form consists of information related to the source of where the patient was referred from. This may include date of referral received, clinic referred to, name of the referring doctor, patient type, triage category, etc. Initially the data had to be entered manually, but later there was an interface placed to connect the Patient Administration System (PAS) and the information auto-synced onto the referral form (See appendix: A.1).

3.1.2.3 Attendance, Symptoms and Clinical Assessment

This form has information related to attendance details, symptoms and clinical assessment. This includes information such as attendance date & time, clinic type, consultant, various symptoms, physical examination, clinical examination and social status, etc. (See appendix: A.2).

3.1.2.4 Investigations Details

This form consists of information related to investigations done to assess the patient. This includes data related investigation name, date and time performed, where the investigation was performed, biopsy and cytology details, etc. (See appendix: A.3).

3.1.2.5 Investigations Summary

Investigation summary is a brief summary of the investigation details. This includes date requested, hospital, morphology, cytology and date completed, etc. This information is automatically pulled-through from the investigation details (See appendix: A.4).

3.1.2.6 Diagnosis Details

The diagnosis details form consists of fields such as cancer type (primary or secondary), date of diagnosis, diagnosis type, diagnosis method, primary operable, laterality, etc. (See appendix: A.5).

3.1.2.7 Staging

Staging is a form that consists of information related to coding of the cancer by various diagnostic specialities like radiology, pathology and clinical. All these specialities would stage the cancer by 3 different categories which are TNM (Tumour, Nodal and Metastasis). This form consists of fields such as Laterality, date of staging and all 3 specialties with the staging codes, etc. (See appendix: A.6).

3.1.2.8 Multidisciplinary Team Meeting

The MDT form consists of vital information relating to the decision made for further course of action in terms of treatment. The further treatments could be either surgery or oncology or both. Blazeby *et al.,* (2006) argue that the MDT decisions are not the final and are not always implemented. However, Wallace (2014) states that MDT discussions are very important for decision-making. This form includes information such as date of MDT, MDT type, MDT procedure, Decision taken, etc. (See appendix: A.7).

3.1.2.9 Treatment Plan Details

The treatment plans are the outcomes from the MDT meetings and discussions with the patients. This form has fields such as source, treatment plan date, treatment type, procedure type, procedure, investigations, onward referral, etc. (See appendix: A.8).

3.1.2.10 Surgery Details

This form is completed at two different times. One is before the surgery and the other is after the surgery. The fields that are filled before the surgery are consultants, date of surgery, date of decision to operate, surgery type, and treatment intent, surgeon, etc. The other part that is filled after the surgery consists of fields such as theatre, additional procedure, intra-operative findings, closure, nerve sparing, etc. (See appendix: A.9).

3.1.2.11 Post-Op complications

This form has information related to any complications that occurred after the surgery. The fields are date, complication type and complications (See appendix: A.10).

3.1.2.12 Pathology Details

The data for this form is currently imported manually from the LABS system. The auto-fill initiative is still work in progress. The fields in this form are date of report, biopsy status, cytology status, etc. (See appendix: A.11).

3.1.2.13 Specialist Nurse Care

The specialist nurses have their own forms where information related to the nursing assessment can be entered. The fields are date, nurse, psycho-social and etc. (See appendix: A.12).

3.1.2.14 In-Hospital Stay

The information related to the patient's stay is stored in this form. The fields are date of admission, source of admission, reason for admission, date of discharge, unplanned return to theatre, no. of PACU days and etc. (See appendix: A.13).

3.1.2.15 Onward Referral Details

This form is completed in cases where the patient is referred to another specialty or facility. The fields are date of referral, referring HCP, HCP referred to, reason for referral, etc. (See appendix: A.14).

3.1.2.16 Follow-up and Discharge

This form has information related to patients follow-up and discharge details. Date of follow-up, treatment, plan, clinical follow-up, recurrence, discharge, etc. (See appendix: A.15).

3.1.2.17 Provision for future additions of other cancers

The PCPD system is not solely designed for Prostate cancer patients. The system has open provisions to add other cancers such as bladder, kidney, etc. in future. To facilitate this most of the fields are as dropdown menu, dictionary or library type.

3.1.3 User acceptance testing

In July 2013, the system was passed through a User acceptance testing (UAT). There were few anomalies and glitches noted which were referred to the developer. It took approximately 3 to 4 months to get the systems functioning properly. A part of this process was entering test patients onto the live system.

3.1.4 Implementation

In January 2014, the system went live. All staff were given comprehensive training on the system. The system was installed in all the workstations in the clinical area, wards and admission area, operating theatre and medical records. The system was piloted in stages to ensure that the transition from the paper-based system to the electronic systems were smooth. For the first three months the data was entered into the PCPD system and then a printout was taken and filed into the patient's HCR. This practice was stopped when all staff were fully competent in the use of the system.

3.2 Project Methodology

This project was developed using the Waterfall methodology. The Waterfall methodology was the first Process Model in its kind. Basically in this model, each stage has to be completed before proceeding to the next stage (See Figure 7). This type of methodology is simply used for projects that are small in size and do not incur any uncertain need (Whitman and Mattord, 2009). So, at completion of every stage, an assessment has to be done on the stage to determine whether to continue or hold the project (Bowes, 2014). This normally helps to avoid incurring huge cost by completing the project and later realise that there will not be any tangible benefit. The final testing only starts after the entire project is completed (Charvat, 2003). So, in summary the stages do not crossover.

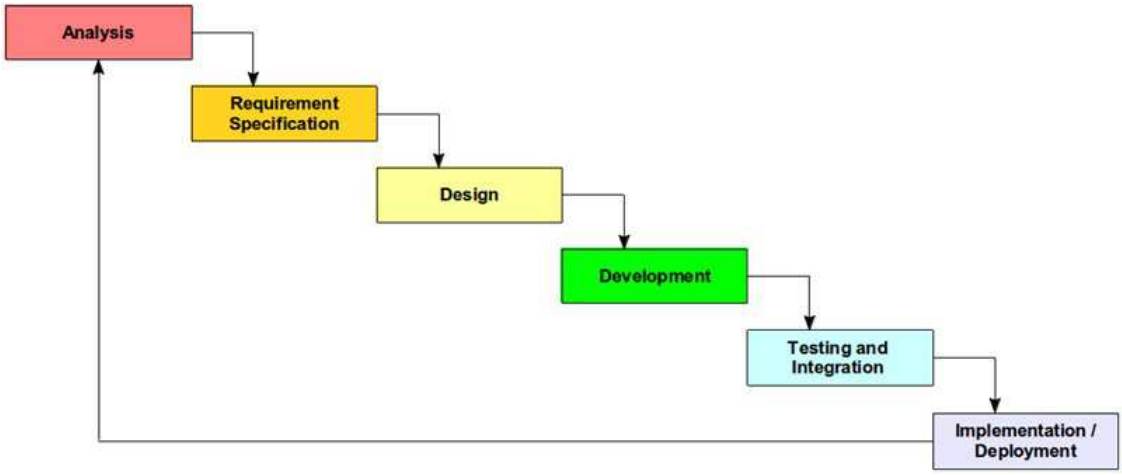

Figure 7: Waterfall Project Methodology (Mitchell, 2012)

The model being simple and easy to understand was one of the major advantages. This project was managed well by using this model. The assessment conducted at the end of each stage, confirmed whether the project had delivered the expected outcome (Munassar and Govardhan, 2010). Invariable of the advantages this model may obtain, Bullingera *et al.,* (2003) argues that this model comes with disadvantages as well. The customers are not fully aware of the final outcome and the final cost during the development stages.

3.2.1 The study process

The primary aim of the study was to identify the impact of computerisation of patient pathway in a national cancer centre for Prostate cancer, which included the positive and the negative impacts. The following procedure was followed to achieve this:

1. Choosing a theoretical framework to determine the kind of effects to be measured and compared by the researcher.

2. Recognise the source of the data that will be used to identify the response for the research questions. The data are collected through quantitative methods, which is a

questionnaire. The questions on the questionnaire are aimed at finding answers for the research question.

3. Data interpretation and analysis.

4. Organise the outcome of the data interpretation into various dimensions, based on the DeLone and McLean model.

3.2.2 The Object Selection

The object that was chosen to study was a small electronic patient record at a National cancer centre of Excellence for Prostate cancer. As discussed earlier, the system was implemented about a year ago. Access to the unit for the purpose of the study was gained through hospital management. The unit is staffed with 4 surgeons, 1 Specialist Registrar, 2 Registrars, 1 Senior House Officer, 4 interns, 2 Clinical Nurse Specialists (CNS), 2 Clinical Nurse Managers (CNM), 10 staff nurses, 4 administrative staff and 1 Data Manager. The unit is a well-established care centre for prostate cancer since 2010.

3.2.3 Total Population Sampling

A research population is a large group of people that are the focus of a similar character or nature. All the individuals in the population have a shared attaching trait (Kyaga *et al.*, 2014). The shared trait or characteristics were that 'The target population of this study included all current since January 2014 and potential users of the PCPD system. So, basically it included all staff in the unit. The population size is 31 PCPD users. Since the population is small, the researcher had decided on sampling the entire population size. This is called total population sampling. This is also called as population studies. Total population sampling is a sampling technique of involving the entire population for study. Total population sampling is usually uncommon for research. It is only adopted in situation where the population is small or the

entire population have uncommon characteristics (Banerjee and Chaudhury, 2010). This study is categorised under this technique because the study is achieved by surveying 100% of the total population.

3.3 Theoretical Framework

A theoretical framework is simply a map that provides direction for the research. It guides the study, defining measureable elements, and the statistical relationships to be compared by the researcher (Trochim, 2006). Research consists of 2 parts, one is the theory and other is the observation. The theory is the part which explains the researcher about the aspect of research, defining the research question and the discussions. The observation, on the other hand is the aspect of the real fact (Keiding, 2010).

A theoretical framework acts as a bridge between the researcher and the existing knowledge. Articulating the theoretical framework in a comprehension manner helps in precisely addressing the research question (Udo-Akang, 2012).

3.4 Research Paradigm

The qualitative research method is a technique for interpretation of data collected through observations and interviews (Kawulich, 2005). This method could be sometimes biased and based on personal relative values. The language of this method is informal and decisions revolve around personal choice of the participants (Jamshed, 2014). On the other hand, the quantitative method is objective and independent. It is also known as statistical research derived by numbers, which can be measured mathematically (Creswell, 2003). This is not the case with qualitative method and therefore cannot be evaluated using statistics. Researchers around the world have conflicting views on both methods; some argue that qualitative researchers are subjectivists (Little, 2013). In the view of many researchers, the quantitative method is a more positive approach (Garbarino and Holland, 2009). However, describing all

quantitative research methods as positivists is a fallacy. The quantitative research method could result as biased if the response rate is low (Driscoll, 2007).

Quantitative research methods are used for 4 types of research questions. 1. When the question is directing to 'how many' (Blais, 2013). For example, how many patients have opted for prostatectomy? Or how many surgeons do we need and how many have we got in our unit? These situations create a platform for a quantitative method. The qualitative does not help in answering these questions. 2. Qualitative method is the only way to precisely study any changes in numerical values (Matveev, 2002). For example: Are the number of patients who get prostate cancer increasing? Or is the number of patients operated on within 20 working days from the date of decision made increasing or decreasing? 3. To analyse a situation where we need to clarify a circumstance (Wisniewski, 2009). For example: what are the factors that affect the attrition rate of nursing staff? Or what are the factors that affect the productivity of nurses over a certain time period? 4. A situation to study a hypothesis (Little, 2013). For example, is there a connection between nurses' efficiency and their social status? The theory could be explained with the hypothesis that nurses with certain social status exhibit lower efficiency, however by applying a quantitative approach, this model could be tested. This study fits in the third type of research question and was the primary reason for the researcher to choose the quantitative approach.

3.4.1 Data Collection

Data collection is a vital process in any research study. Data collection influences the outcome of the research (De Leeuw *et al.,* 1996). There are several factors that affect the collection of data such as the availability of resources, sampling technique, respondent's convenience, response rate, data collection method and intricacy of the study topic (Roberts, 2007).

3.4.1.1 Questionnaire

A questionnaire is a tool that consists of few or several organised questions and other inducing fields with an intention to collect information from the respondents for the purpose of research (Boynton and Greenhalgh, 2004). Questionnaire was the chosen tool to collect data for this study. A questionnaire helps in gathering relevant information. It allows for comparison of the collected data (McColl *et al.*, 2001). It removes the disparity in communicating the question to the respondent and provides a systematic approach to the survey (Boynton, 2004). On the other hand, this is a drawback of quantitative approach in comparison to qualitative approach such as interviews. For example, a question to patients to determine the number of visits to the cancer centre can be asked as, how many times in a year do you visit the hospital? In the case of a questionnaire, this question will be responded in the same verbatim from all respondents. However, in the case of the interview techniques there are chances that the questions could be asked in a different manner to obtain comprehensive responses such as, how often do you visit the cancer centre in a year? The respondent could answer 'very often'. In a situation, where the surveyor who asks the questions might not be the actual researcher, this answer is no good for the purpose of the research. One of the main advantages of the questionnaire is that it can collect enormous quantity of information from a large number of people. At the same time, all the collected information can be processed and analysed scientifically in a timely manner (Taylor-Powell and Renner, 2009). The questionnaire used for this study had 43 questions under 6 sections (See appendix B). The questionnaire had both closed ended questions and open-ended questions. All the closed-ended questions were given multi-choice answers and the open-ended questions were given comment boxes to respond. The questionnaire was designed in the software Sphinx. Sphinx is software that allows the management of all study, data collection and results.

However, there are some drawbacks in using the questionnaire method. One such drawback includes obtaining sufficient responses. Not every respondent who receives the questionnaire have the time and interest to complete the questionnaire and send it back completed. The

other disadvantage is that the respondent could avoid some questions while answering (Hunter, 2012). To overcome these 2 drawbacks, the researcher had contacted all respondents and made appointments to meet with them during which time the questionnaire was answered. By this way the researcher made sure that all respondents answered all questions. This was possible because the population of the study was small.

The questionnaire had a cover letter thanking the respondents and explaining the terms. As discussed earlier the DeLone and McLean Information Systems Success Model have been in this study. The D&M IS Success Model has 6 dimensions and based on various researchers' analysis, the author has selected few measureable elements for each dimension. To precisely obtain answers for these measureable elements; questions were designed in a manner to represent each measureable element. Even though every measure has been taken to ensure that the respondents respond with their experience with the PCPD system, there are possibilities that staff may not be fully aware of every feature and detail of the system. To overcome this challenge, the questionnaire title has included the word 'perception' to enable the staff to give the best possible answer inclusive of assumption.

All these questions were given options as answers to choose numbers between 5 parameters, being strongly disagree, disagree, neither disagree nor agree, agree and strongly agree. All parameters were assigned values where strongly disagree is 1, disagree is 2, neither disagree nor disagree is 3, agree is 4 and strongly agree is 5.

3.4.1.1.1 System Quality

The measurable elements and the questions attached to them are as follows:

1. *Access* - Log in to the system is quick and easy
2. *Convenience* - The system is available on all required workstations
3. *Easy to learn* - The system was easy to learn

4. *Easy to use* - Data Input is easy and fast
5. *System Features* - The system has efficient features
6. *Flexibility* - Updating or adding a new field is easy
7. *Reliability* - The system is reliable for patient care
8. *Response time of the system* - Data Retrieval is quick

3.3.2.1.2 Information Quality

1. Data Accuracy - The information in the system is accurate
2. Timelines - The information in the system is up to date
3. Availability - The system is live and accessible at all times
4. Completeness - The system provides sufficient information
5. Consistency - Data in the system is consistent
6. Relevance - The system provides me with information that I need to do my job
7. Format - The information is provided in a clear way
8. Simplicity - Form Manoeuvring is easy and smooth
9. Usability - Information sharing is easy

3.3.2.1.3 Service Quality

1. Assurance - The ICT support team has adequate knowledge
2. Empathy - The ICT support team understand my needs
3. Interpersonal Quality - The ICT support team are optimistic, calm and confident
4. Training - I have obtained sufficient training to use the system
5. Reliability - The ICT support team completes the tasks within the agreed time
6. Responsiveness - The ICT support team answers calls promptly

3.3.2.1.4 Intend to Use/Use

1. Intention to Use - Have you been working for more than 3 months in the Prostate Cancer Unit?

2. Daily Use - Are you dependent on PCPD system in order to perform your job?

3. Frequency of Use - If answered 'Yes' for Q. 2, how often do you use the PCPD system?

4. Actual Use - If answered 'No' for Q. 2, have you used the PCPD system?

5. Nature of Use - What is the purpose of use?

3.3.2.1.5 User Satisfaction

1. Adequacy - Better system in comparison to the Paper-based records

2. Effectiveness - The system successfully produces intended result

3. Efficiency Enjoyment - Comfortable to use the system

4. Overall Satisfaction - I am happy that this system was introduced

3.3.2.1.6 Net Benefits

1. Improved Decision Making - The PCPD system plays a vital role in the decision making process at the MDTs

2. Learning - The system has provided a good learning process

3. Business Process Change - Reporting KPIs and other metrics are accurate and quick through the system

4. Job Effectiveness & Performance - I perform my job efficiently due to the PCPD system

5. Customer Satisfaction - The PCPD system has improved patient care

Apart from providing a comment box under each section, there is a general comment box at the end of the questionnaire for respondents to give suggestions on how to improve the system. Prior to the administration, the questionnaire was tested through a review by a

colleague who was not a part of the survey respondents. Corrections and rectifications were made to the final version of the questionnaire.

3.4 Data Analysis

The data was collected and since the questionnaire was already categorized into different dimensions, there wasn't a need to categorize afterwards. The first five questions were closed – ended and the remaining questions were based on the five-point Likert scale (See Table 1). The third point was the midpoint and any mean value under value 3 was considered to be negative impact and mean value above value 3 was considered to be positive impact. Since, the requirement to assess the impact in terms of how successful the PCPD system has been after implementation, the researcher was only required to obtain the users' opinion. This served the purpose of answering the research question.

The data was analysed through a systematic approach. The data collected was entered in Excel Spreadsheet for data interpretation. By using various Excel functions such as cell sorting, cell highlighting sorting, filtering, counting, and Pivot table functions.

Table 1: Scoring Criteria for the Measurable Elements

Categories of Dimension	Score	Categories of Impact
Strongly agree	5	Positive Impact
Agree	4	
Neither agree or disagree	3	Neutral

Disagree	2	Negative Impact
Strongly disagree	1	

Table: Criteria for weighing dimensions of Impact

3.5 Ethics Approval

The Cancer Centre in which this study has been conducted had confirmed that there is no need for Ethical Approval and approved the project. Trinity College Dublin subsequently granted Ethical Approval in July 2015 (See Appendix C).

Chapter 4: Empirical Findings

Sphinx and Microsoft Office (MS) Excel 2010 was used for sorting and interpreting the data collected. The comments and suggestions were sorted in MS Excel. This chapter presents the results through graphical representation obtained through the questionnaire.

4.1 Respondents

The unit has 4 surgeons, 1 Specialist Registrar, 2 Registrars, 1 Senior House Officer, 4 interns, 2 Clinical Nurse Specialists (CNS), 2 Clinical Nurse Managers (CNM), 10 staff nurses, 4 administrative staff and 1 Data Manager. All of the 31 staff members participated in the study by completing the questionnaires (100% response rate). Participants were provided with 2 options for completing the survey.

a) Fill-in and submit online option
(http://www.sphinxonline.net/public/questionnaire/questionnaire.htm)

b) Fill-in electronic pdf format then print or email back option.

61% participants responded to the survey through submitting through electronic online option and the remaining 39% chose to submit by printing the PDF file and handed over to the researcher (See Figure 8).

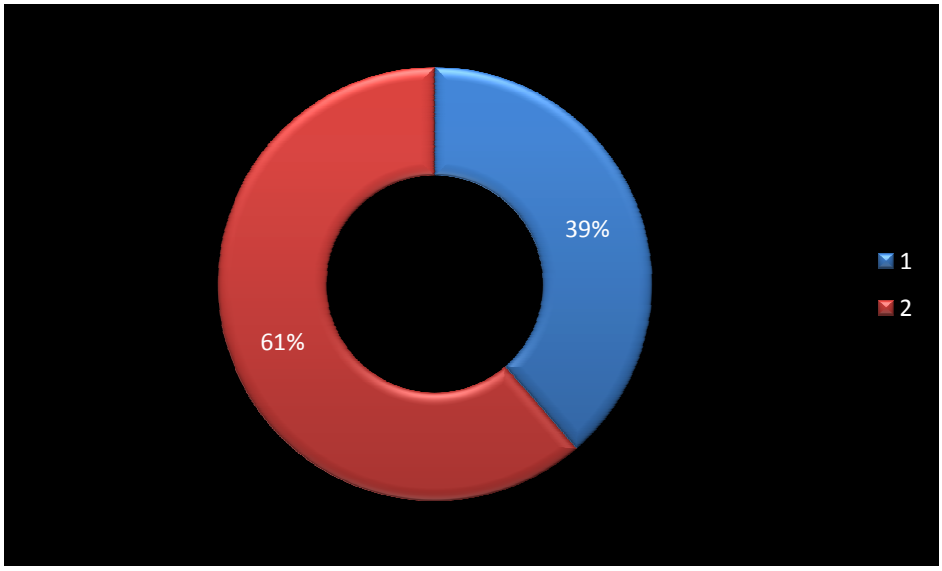

Figure 8: Respondents' response choice

The 61% participants who responded to the survey through submitting through electronic online option were nursing, administration and ICT staff and the remaining 39% who submitted by printing the PDF file and handed over to the researcher were medical staff (See Figure 9).

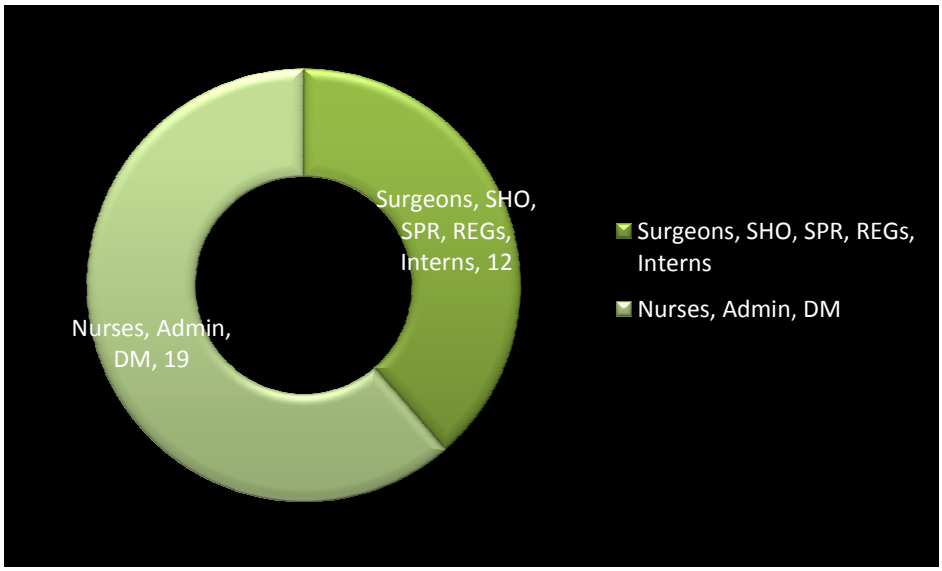

Figure 9: Respondents' response choice category

4.2 System Quality

There are 8 measureable elements in system quality.

4.2.1 Access

12 of the respondents (39%) agree and one of the respondents (3%) strongly agrees that the log in to the system is quick and easy. 16 of the respondents (52%) disagree, while 2 respondents (6%) neither agree nor disagree (See Figure 10).

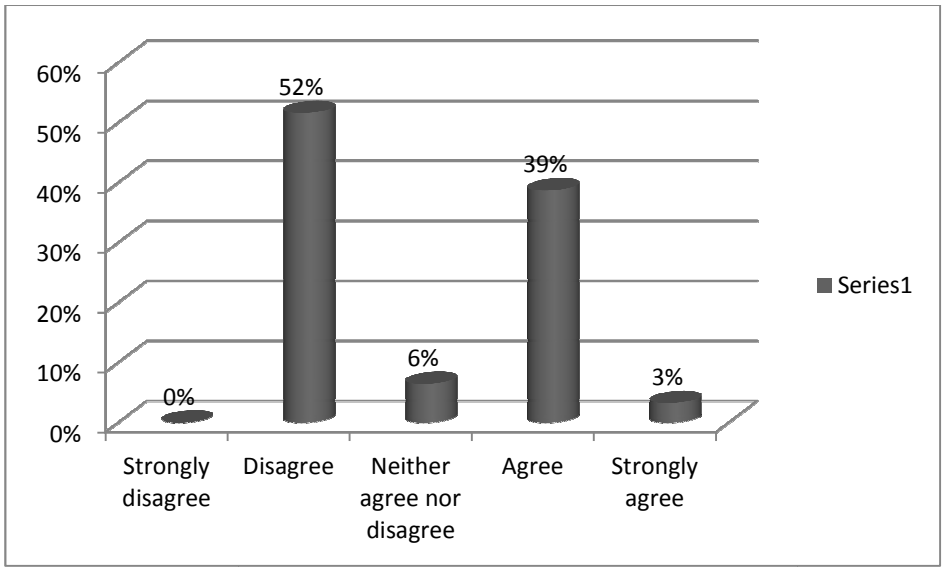

Figure 10: Log in to the system is quick and easy

4.2.2 Convenience

23 and 2 of the respondents (74%) agree and (26%) strongly agree respectively that the PCPD system is available on all required workstations. 2 respondents (6%) strongly disagree, disagree and neither agree not disagree each (See Figure 11).

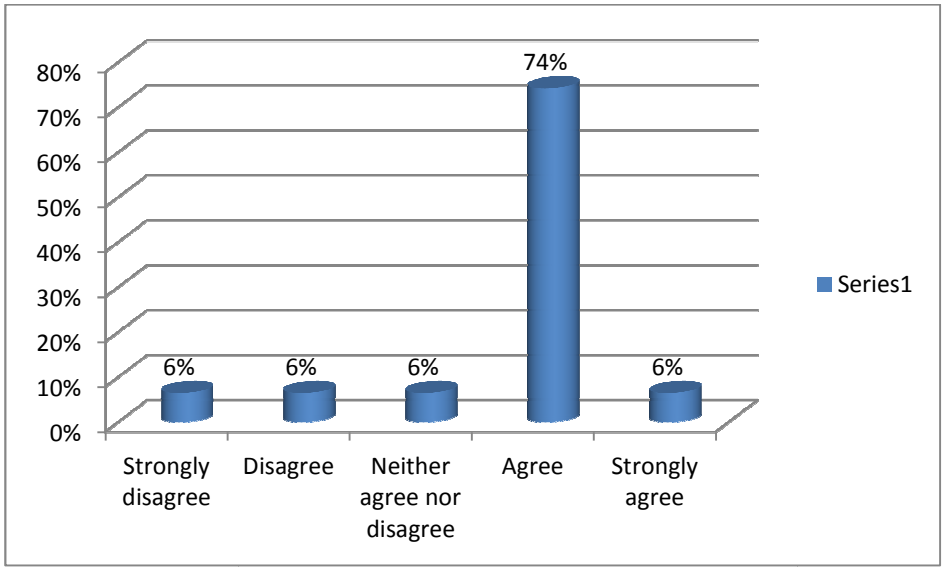

Figure 11: The system is available on all required workstations

4.2.3 Easy to learn

23 of the respondents (74%) agree and 5 of the respondents (16%) strongly agree that the system is easy to learn. While one respondent neither agree nor disagree. However, remaining 2 respondents (19%) either disagreed or strongly disagreed (See Figure 12).

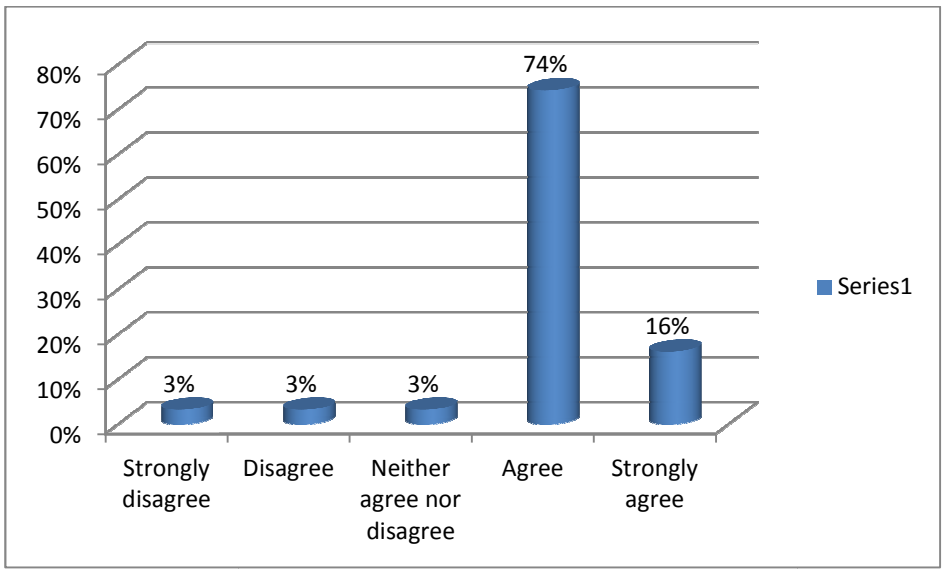

Figure 12: Easy to learn

4.2.4 Easy to use

28 of the respondents (91%) reported that that they either agree or strongly agree that the system is easy to use, while 3 of the respondents (10%) reported neutral and none of the respondents disagreed (See Figure 13).

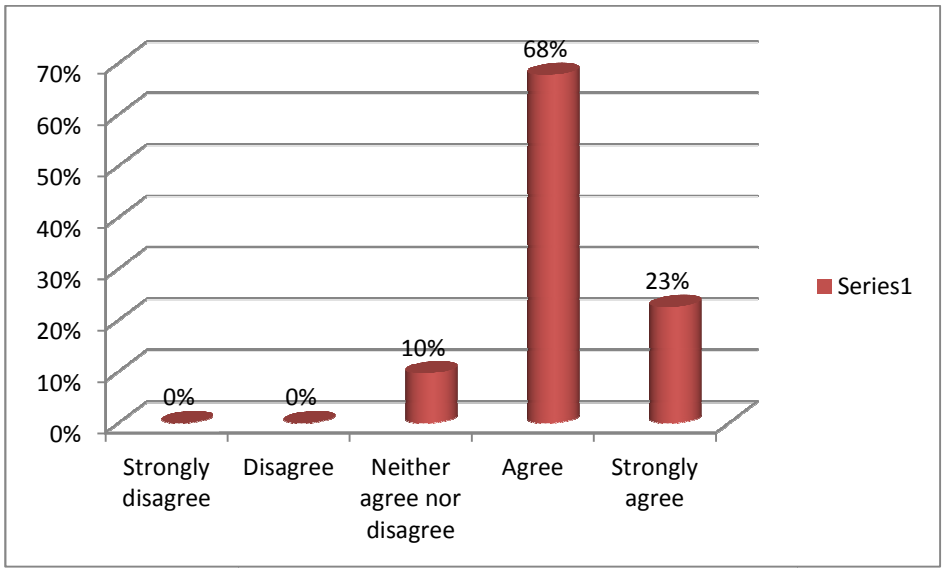

Figure 13: Easy to Use

4.2.5 System Features

16 of the respondents (52%) completely noted positive towards the system features and one of the respondents (3%) noted negative, while 14 of the respondents (45%) were not sure (See Figure 14).

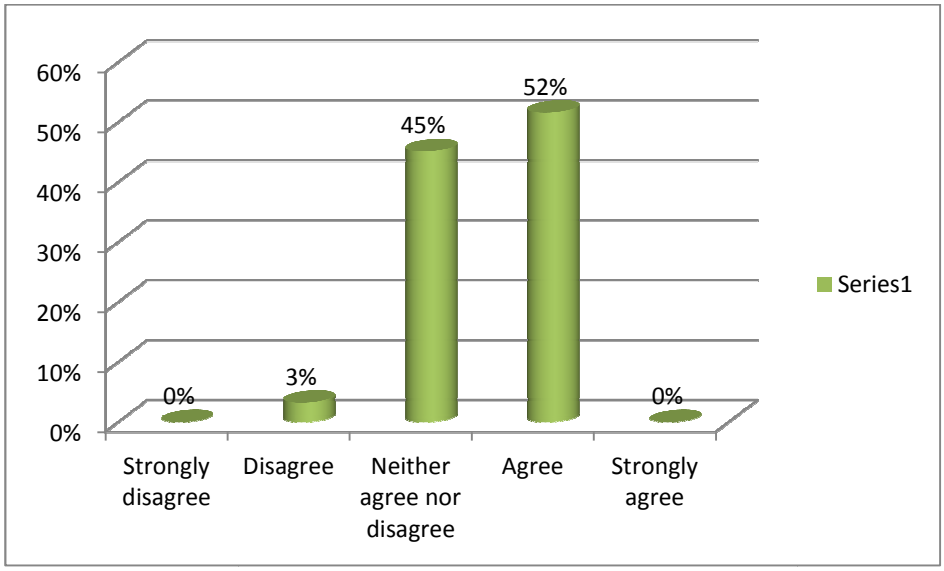

Figure 14: The system has efficient features

4.2.6 Flexibility

10 of the respondents (32%) and 12 of the respondents (39%), saw that it is easy to update of add a field to the system. On the other hand, 5 of the respondents (16%) disagreed with it (See Figure 15).

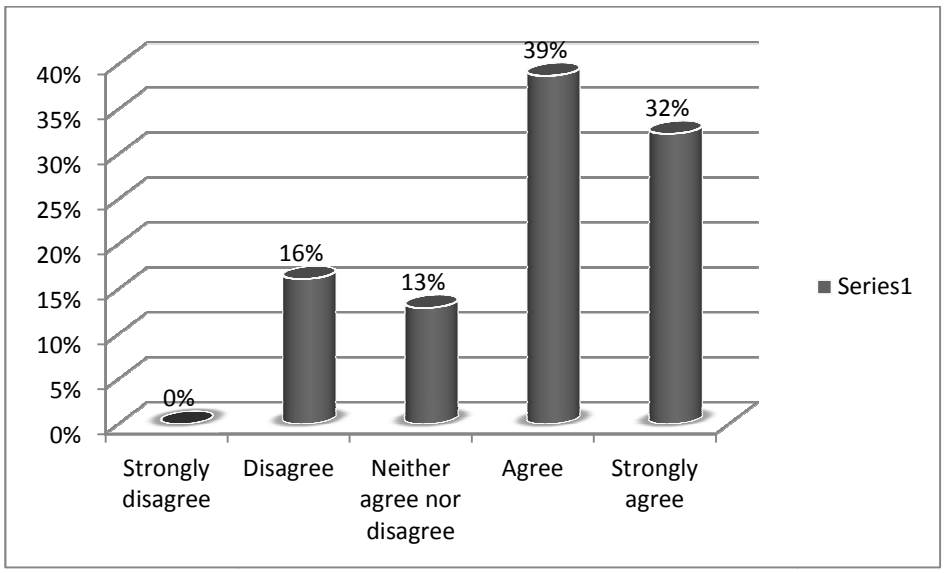

Figure 15: Updating or adding a new field is easy

4.2.7 Reliability

28 of the respondents (90%) felt that the system is reliable for patient care. On the other hand, one of the respondents (3%) disagreed with it. However, 3 of the respondents (6%) had no opinion (See Figure 16).

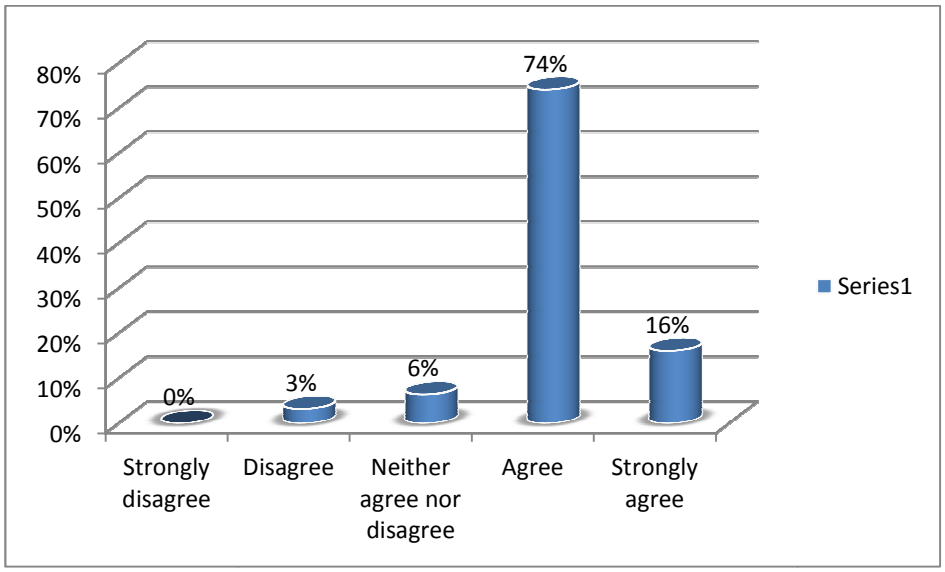

Figure 16: The system is reliable for patient care

4.2.8 Response time of the system

18 of the respondents (58%) experienced slow retrieval of data and 13 of the respondents (42%) felt that they did not experience that it was quick (See Figure 17).

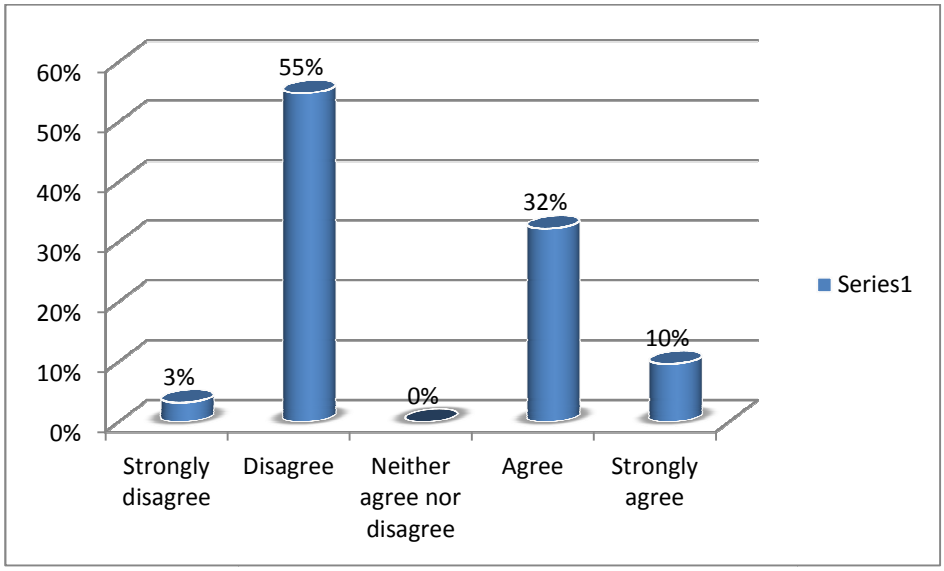

Figure 17: Data retrieval is quick

4.3 Information Quality

There are 9 measurable elements in the information quality dimension.

4.3.1 Data Accuracy

30 of the respondents (97%) reported that the information in the system is accurate, while only one of the respondents (3%) reported that the information in the system could be inaccurate (See Figure 18).

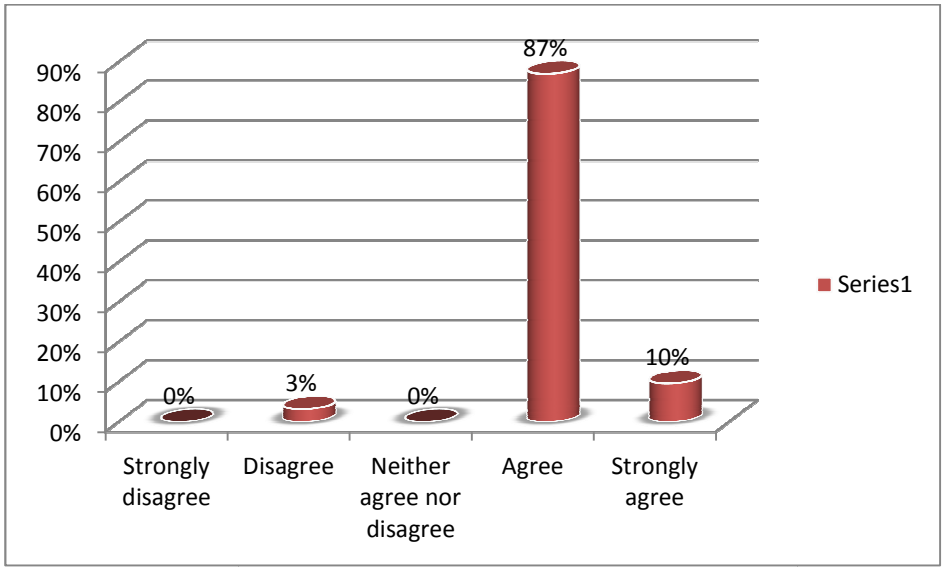

Figure 18: The information in the system is accurate

4.3.2 Timelines

25 of the respondents (81%) agreed that information in the system is up-to-date; however, 4 of the respondents (13%) disagreed. But 2 of the respondents responded neutral (See Figure 19).

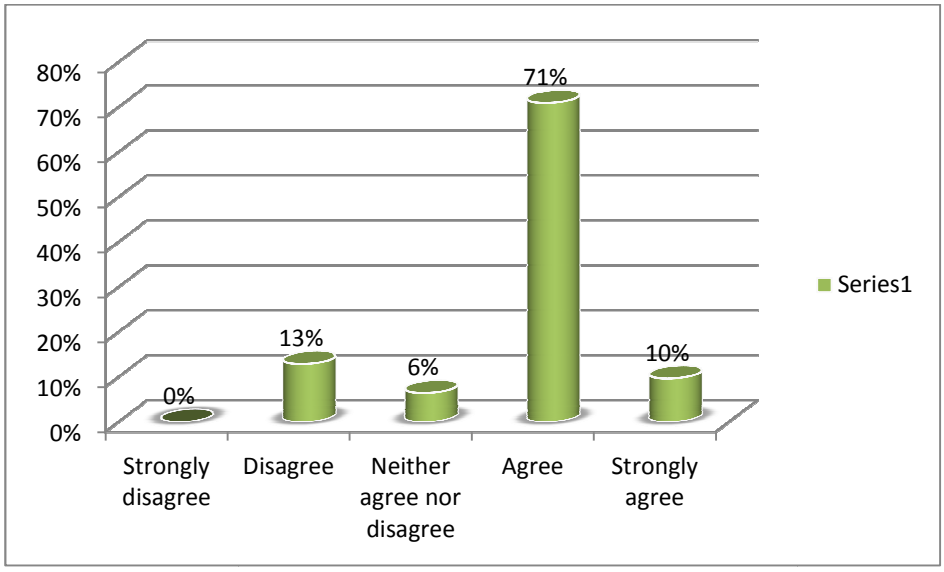

Figure 19: The information in the system is up-to-date

4.3.3 Availability

19 of the respondents (71%) found that the system was live and accessible at all times; while 4 of the respondents (13%) had experience of system being offline. 5 of the respondents (16%) were neutral (See Figure 20).

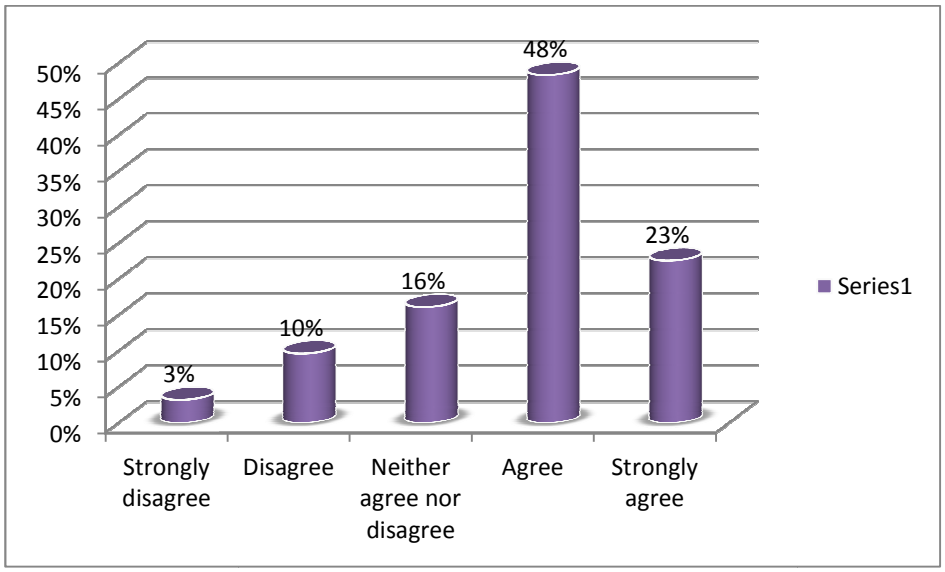

Figure 20: The system is live and accessible at all times

4.3.4 Completeness

Out of the total respondents, 23 thought that the system provides sufficient information required (74%). However, 4 disagreed with it (12%) (See Figure 21).

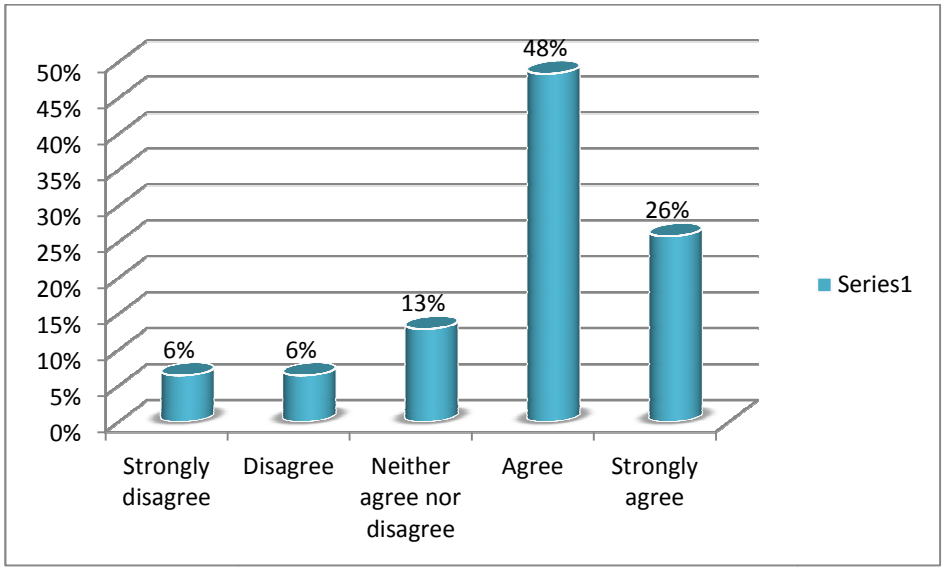

Figure 21: The system provides sufficient information

4.3.5 Consistency

24 of the respondents (77%) were satisfied with the consistency of the data in the system; however, 5 of the respondents felt that the data is a bit inconsistent (See Figure 22).

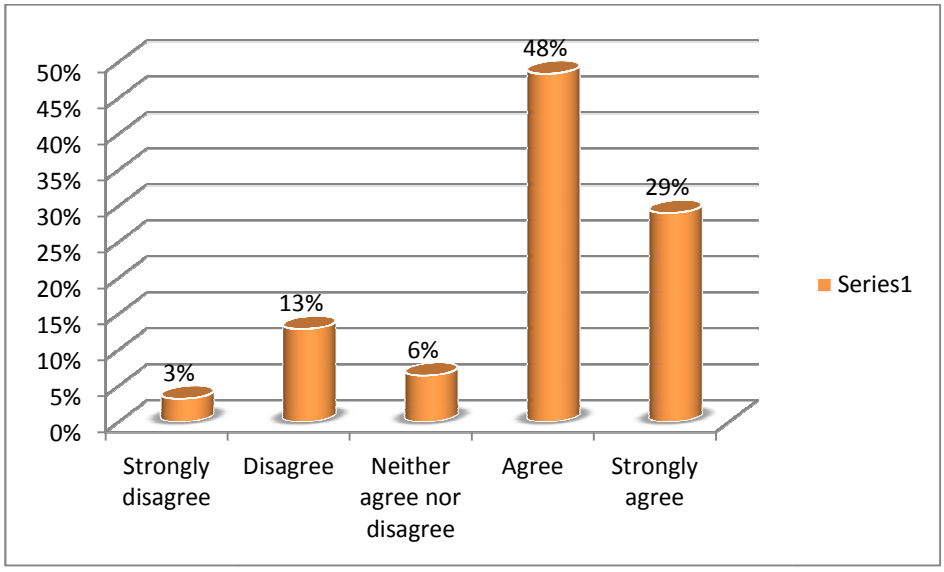

Figure 22: Data in the system is consistent

4.3.6 Relevance

23 of the respondents (74%) reported that the system provides relevant data required to perform their job and 6 of the respondents (19%) disagreed with it (See Figure 23).

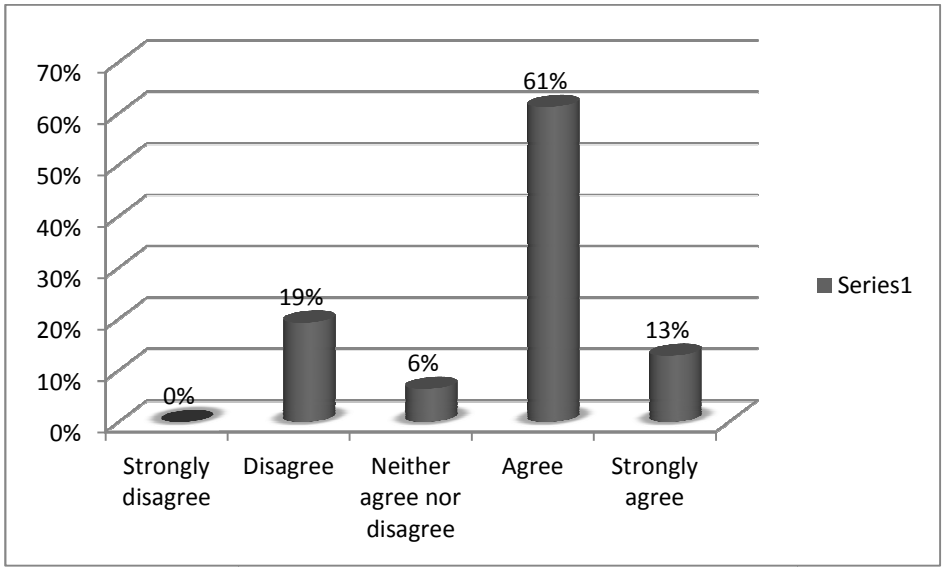

Figure 23: System provides relevant information

4.3.7 Format

22 of the respondents (71%) stated that the information provided in the system is in a clear manner and 6 of the respondents (19%) reported that the location of the fields were not clear enough (See Figure 24).

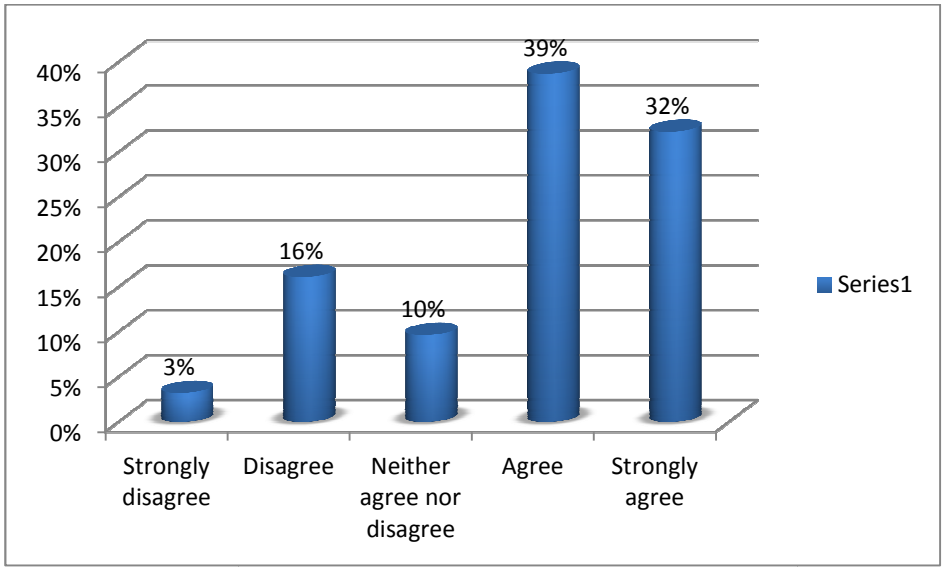

Figure 24: The information is provided in a clear way

4.3.8 Simplicity

20 of the respondents (65%) found it easy to manoeuvre between forms and 2 of the respondents (6%) found manoeuvring difficult. On the other hand, 9 of the respondents (29%) had no opinion (See Figure 25).

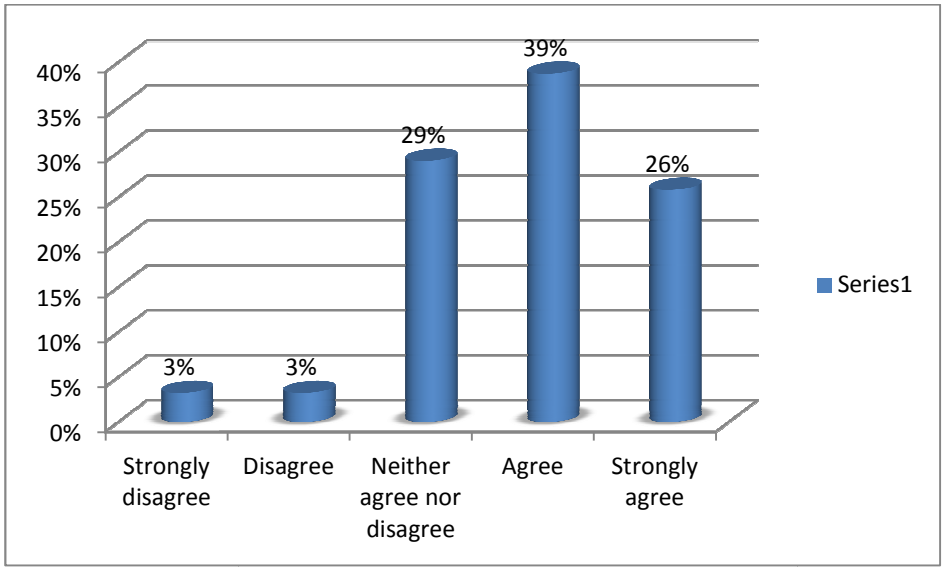

Figure 25: Form Manoeuvring is easy and smooth

4.3.9 Usability

The sharing of the information in the system was found to be easy for 22 of the respondents (71%), however 4 of the respondents (12%) felt it was not wasn't an easy process (See Figure 26).

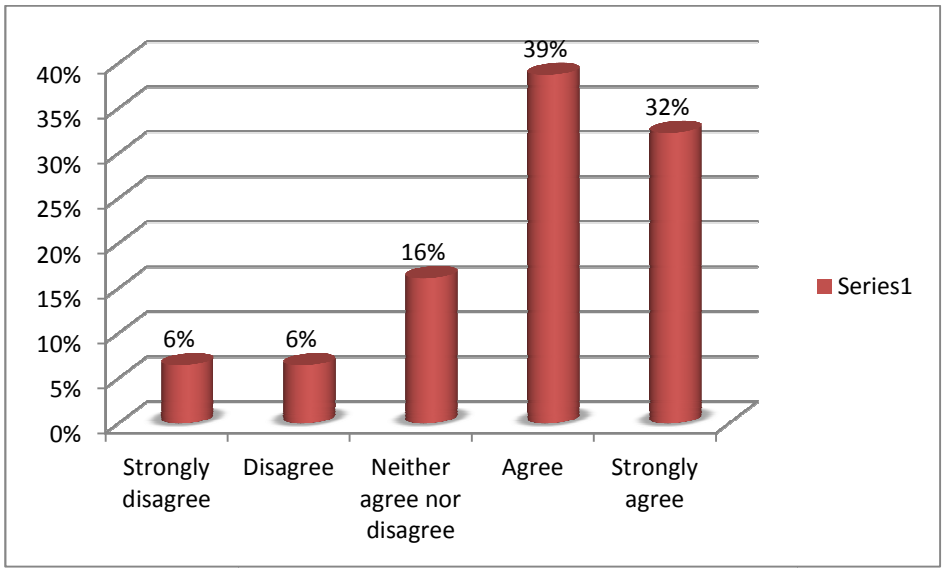

Figure 26: Information sharing is easy

4.4 Service Quality

The service quality dimension has 6 measurable elements.

4.4.1 Assurance

25 of the respondents (81%) think that the ICT support team have adequate knowledge and 5 of the respondents (16%) think the other way (See Figure 27).

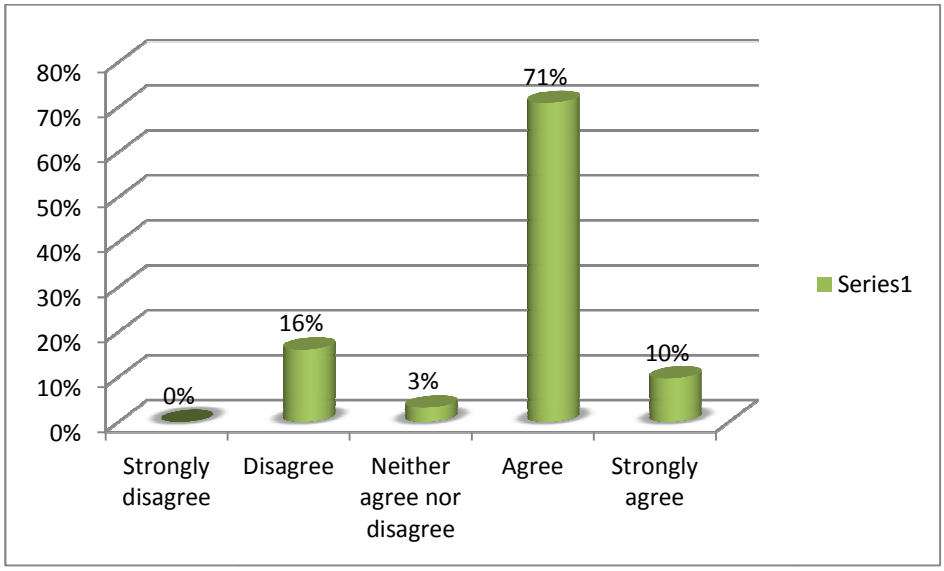

Figure 27: The ICT support team has adequate knowledge

4.4.2 Empathy

25 of the respondents (81%) reported that the ICT support team understand their needs and 5 of the respondent (16%) reported that the ICT support might not have understood their needs (See Figure 28).

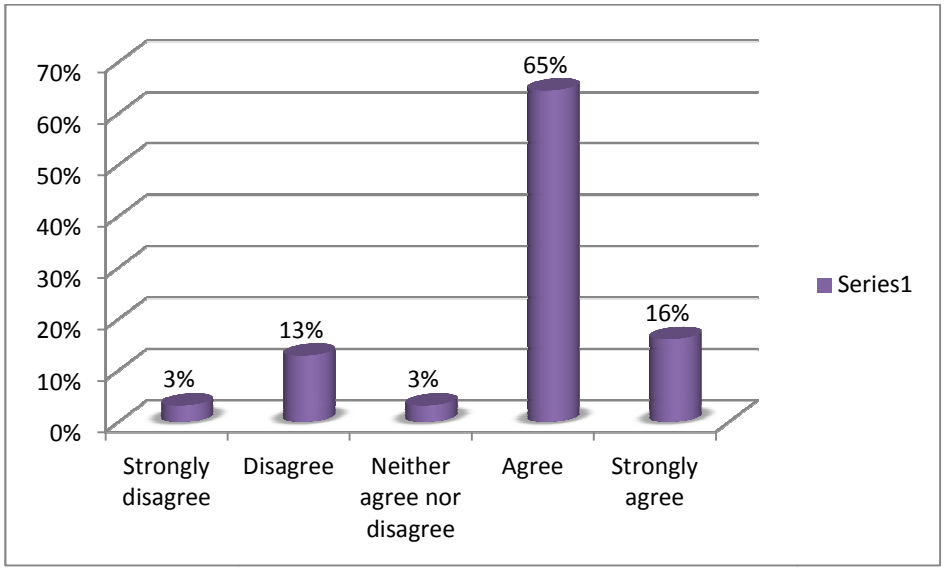

Figure 28: The ICT support team understand my needs

4.4.3 Interpersonal Quality

25 of the respondents (81%) responded that the ICT support team are optimistic, calm and confident. On the other hand, 5 of the respondents (16%) responded that they did not feel that the ICT support were optimistic, calm and confident (See Figure 29).

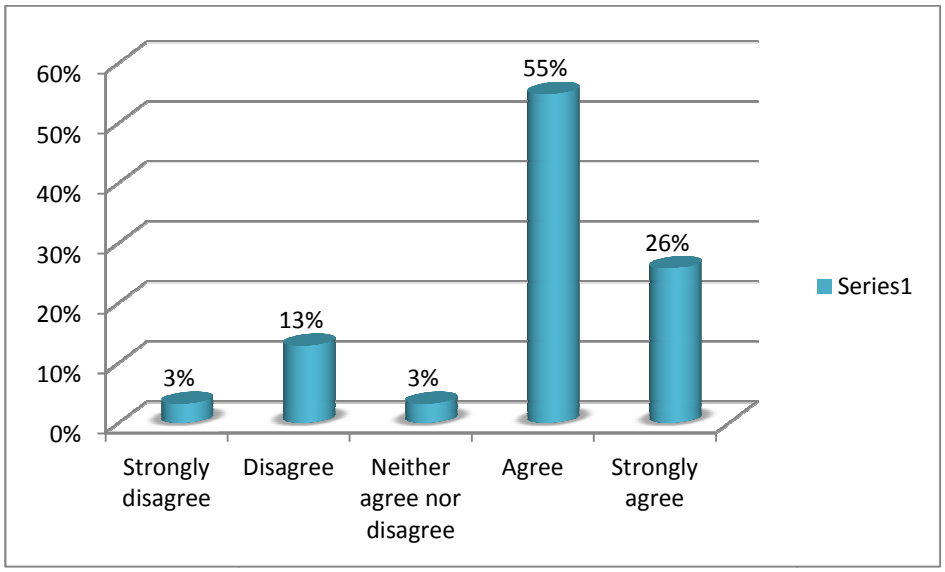

Figure 29: The ICT team are Optimistic, Calm and Confident

4.4.4 Training

21 of the respondents (68%) felt that they have received sufficient training to use the system and 4 of the respondents (13%) did not feel that they received sufficient training. However, 6 of the respondents (19%) had no opinion (See Figure 30).

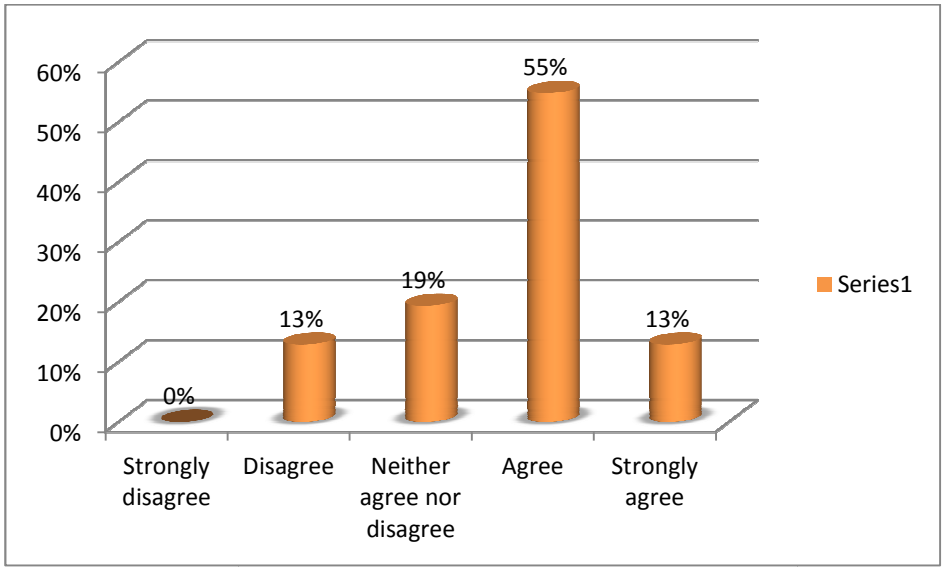

Figure 30: Obtained sufficient training to use the system

4.4.5 Reliability

16 of the respondents (52%) stated that the ICT support team does not complete tasks within the agreed time, while only 12 of the respondents (39%) agreed that the support complete tasks within the agreed time. However, 3 of the respondents (10%) responded neither (See Figure 31).

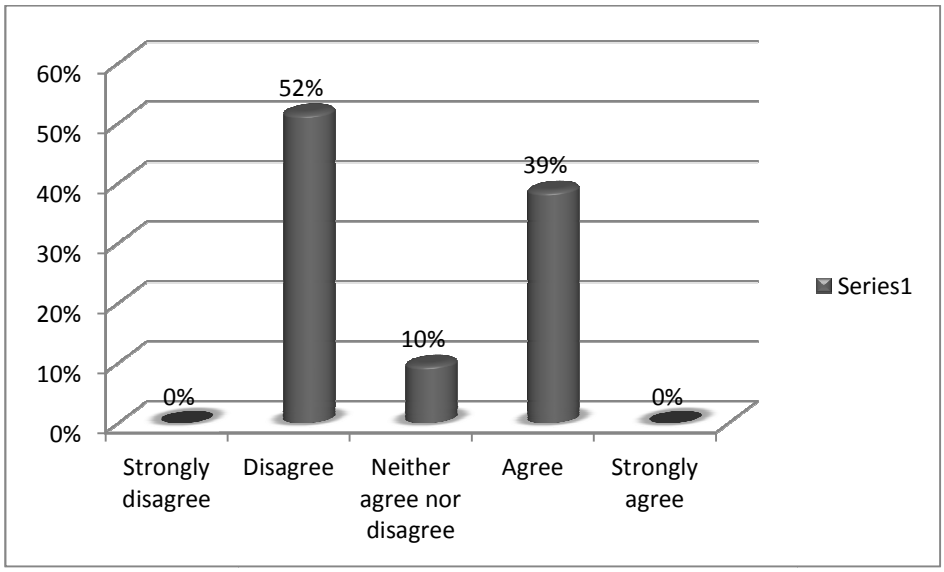

Figure 31: The ICT support team completes tasks within the agreed time

4.4.6 Responsiveness

25 of the respondents (80%) responded that the ICT support team responds to support calls promptly either through phone call or email and 3 of the respondents (9%) disagreed with it (See Figure 32).

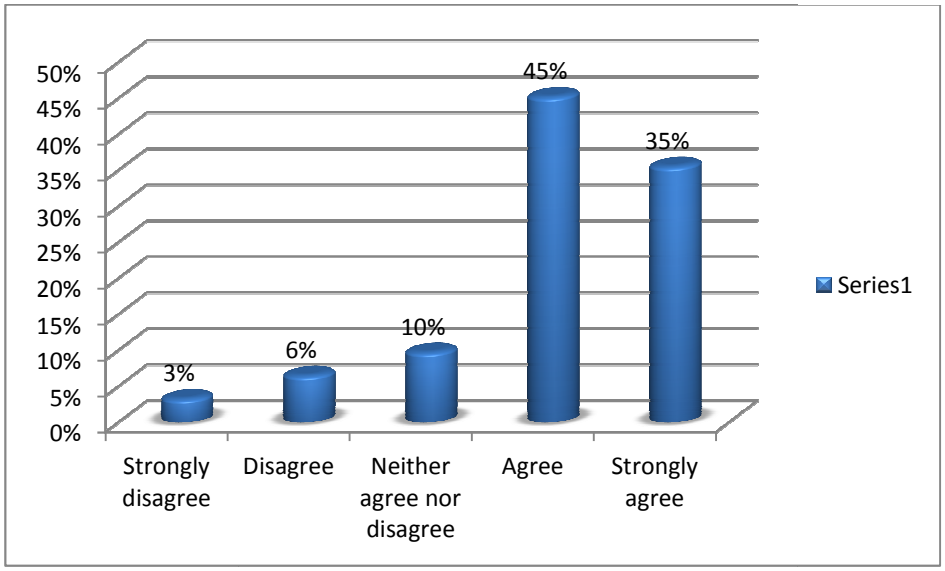

Figure 32: The ICT support team provides prompt service

4.5 Intend to Use/Use

In this dimension, there are 4 measurable elements.

4.5.1 Intention to Use/Use

For the question, have you been working for more than 3 months in the Prostate Cancer Unit? All of the 31 respondents answered 'yes' (See Figure 33).

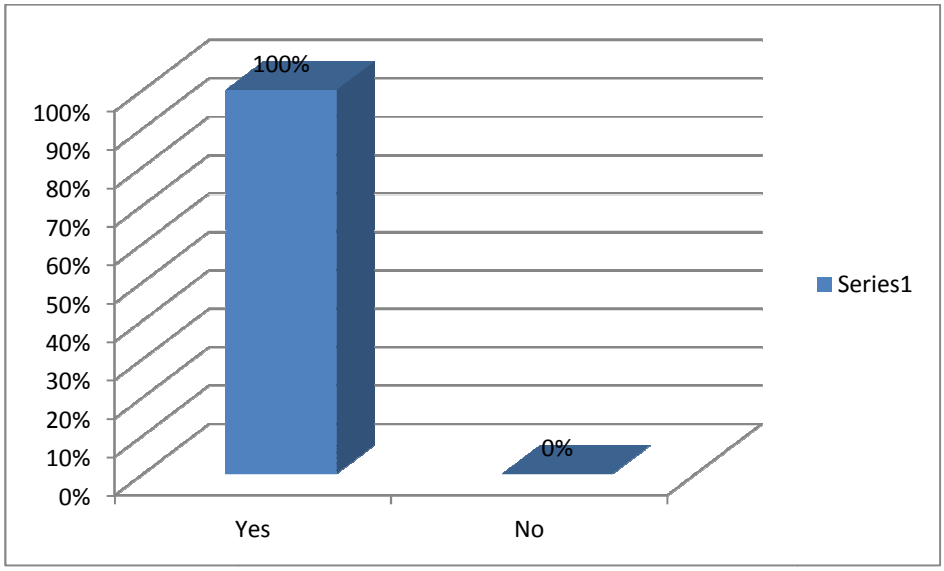

Figure 33: Have you been working for more than 3 months in the Prostate Cancer Unit?

4.5.2 Daily Use

When the responded were asked whether they were dependent on PCPD system in order to perform your job, 21 of the respondents (68%) answered 'yes' and 10 of the respondents (32%) answered 'no' (See Figure 34).

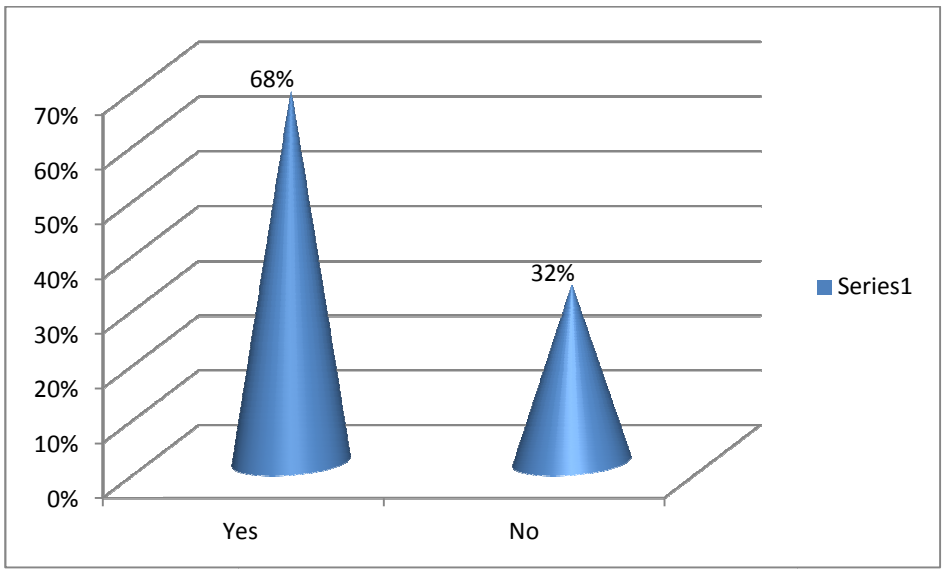

Figure 34: Are you dependent on PCPD system in order to perform your job?

4.5.3 Frequency of Use

For all the respondents who answered 'Yes' for Q. 2, the following question was asked to answer. How often do you use the PCPD system? 2 of the respondents (10%) answered 'rarely', 2 of the respondents (10%) answered 'sometimes', 13 of the respondents (62%) answered 'often' and 4 of the respondents (19%) answered 'sometimes' (See Figure 35).

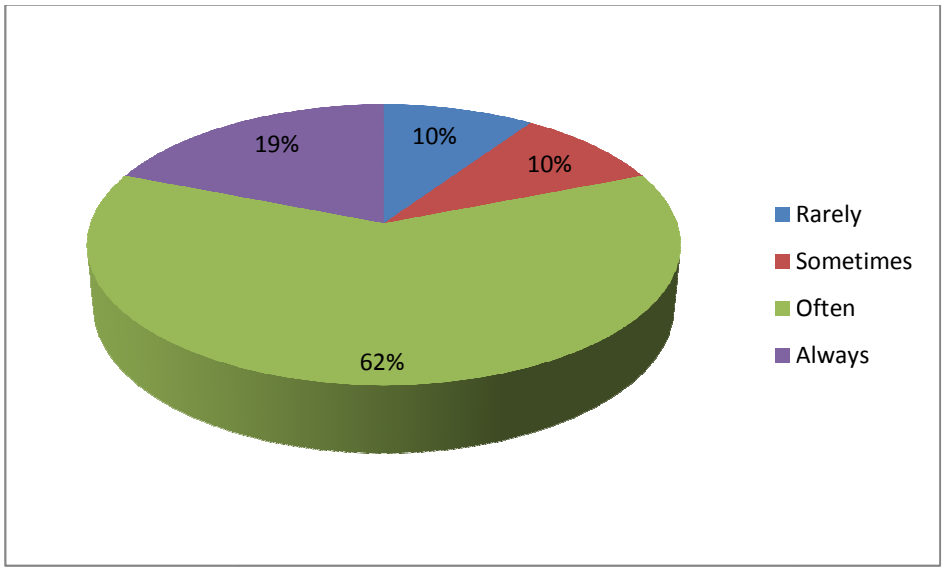

Figure 35: How often do you use the PCPD system?

4.5.4 Actual to Use

For all the respondents who answered 'No' for Q. 2, the following question was asked to answer. Have you used the PCPD system? All the 10 respondents (100%) answered 'Yes' (See Figure 36).

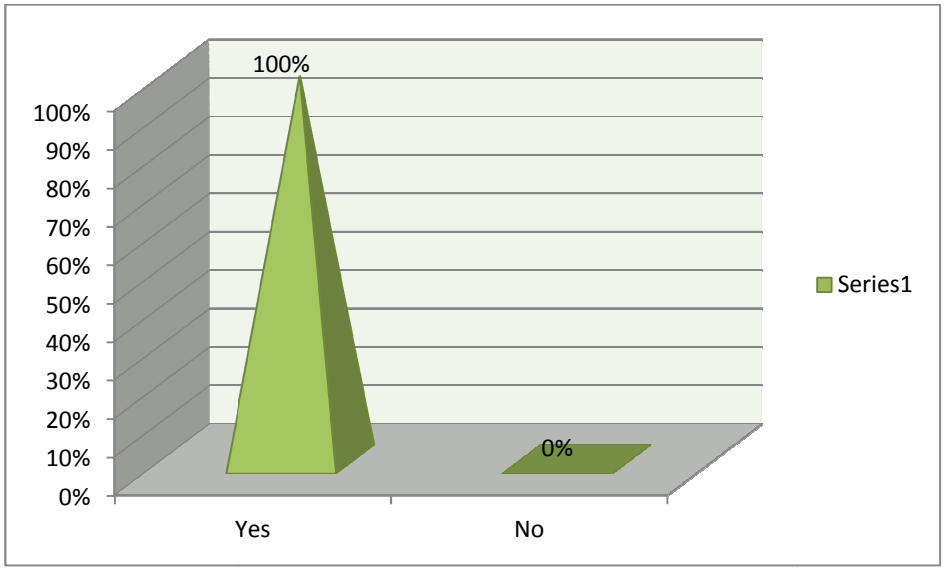

Figure 36: Have you used the PCPD system?

4.5.5 Nature of Use

All respondents who continued the survey were asked what is the purpose of use? 10 of the respondents (32%) answered to view information only and 21 of the respondents (68%) answered both to view information and to input information (See Figure 37).

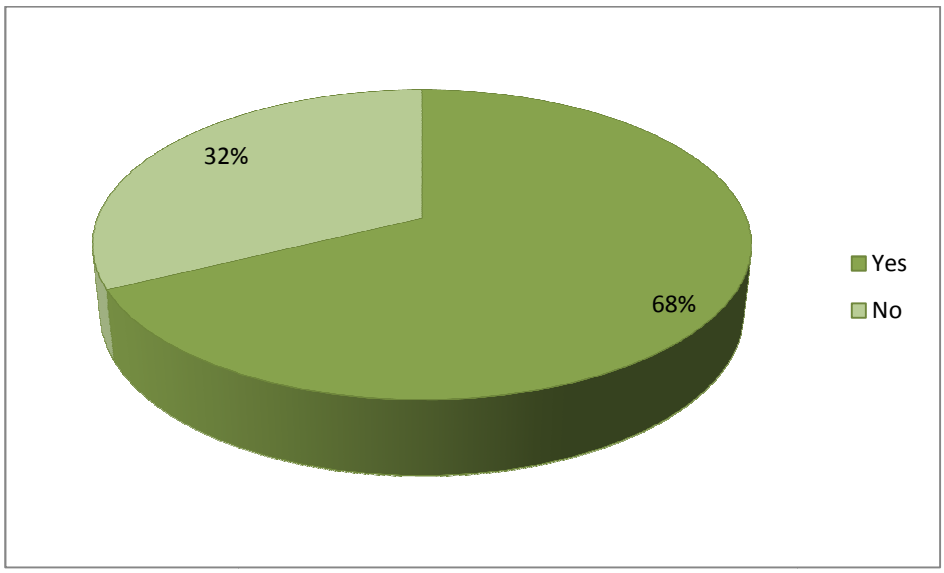

Figure 37: What is the purpose of use?

4.6 User Satisfaction

4.6.1 Adequacy

26 of the respondents (84%) stated that the PCPD system was better in comparison to the Paper-based records and 5 of the respondents (16%) disagreed with it (See Figure 38).

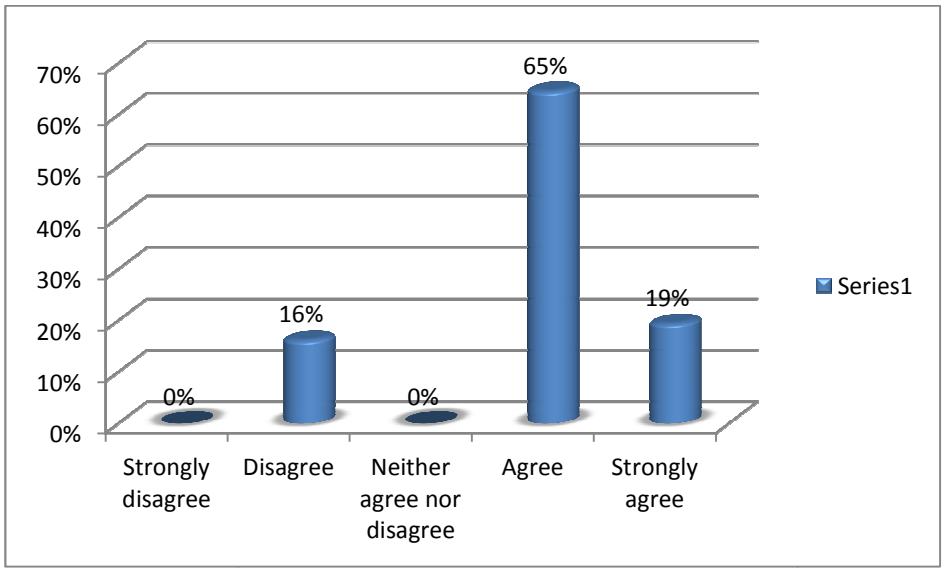

Figure 38: Better system in comparison to the Paper-based records

4.6.2 Effectiveness

22 of the respondents (71%) reported that the system successfully produces intended result, while 5 of the respondents (16%) disagreed that the system does not produce intended results (See Figure 39).

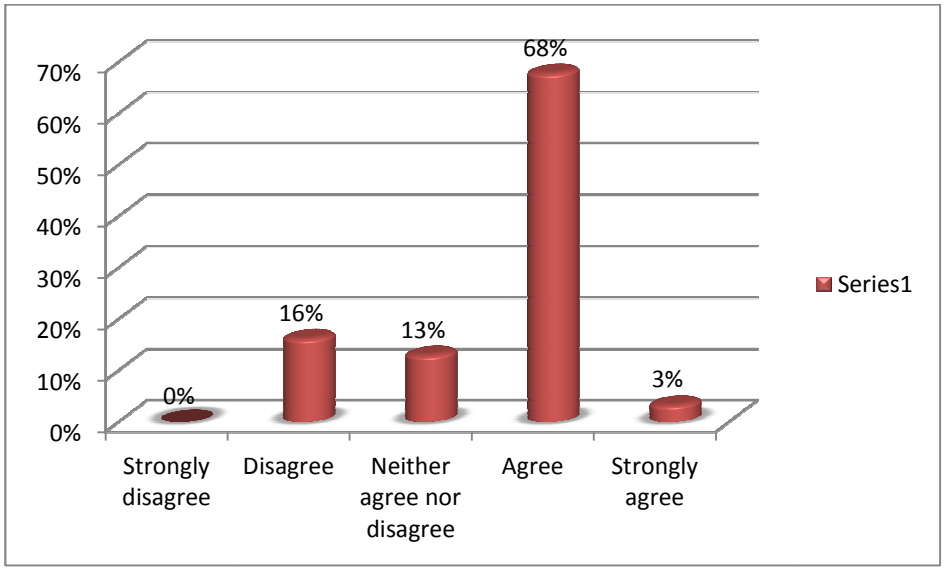

Figure 39: The system successfully produces intended result

4.6.3 Efficiency Enjoyment

22 of the respondents (71%) responded that they are comfortable to use the system and 3 of the respondents (9%) responded that they are not comfortable to use the system, while 6 of the respondents (19%) responded neither (See Figure 40).

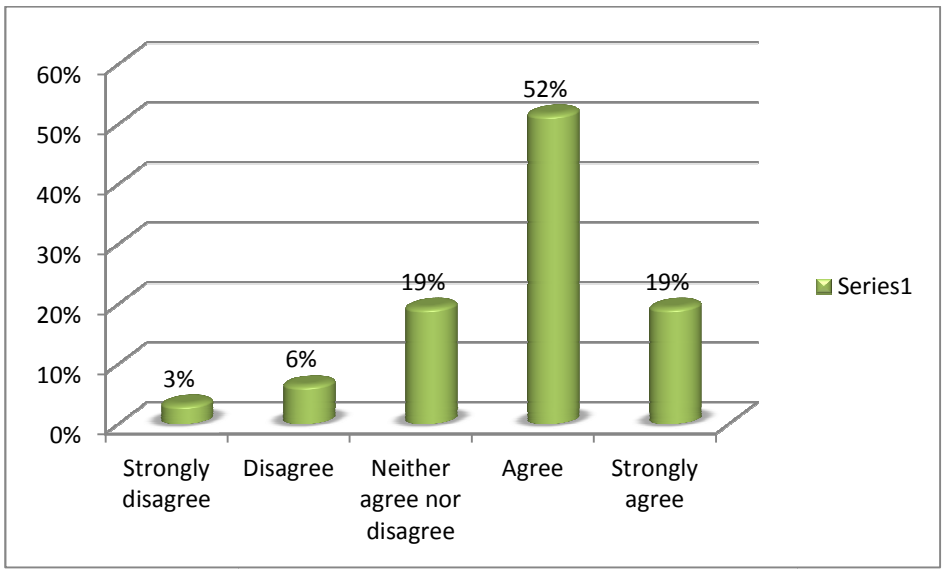

Figure 40: Comfortable to use the system

4.6.4 Overall Satisfaction

23 of the respondents (74%) declared that they are happy that this system was introduced, while 3 of the respondents (10%) disagreed. However, 5 of the respondents (16%) did not give a definite answer (See Figure 41).

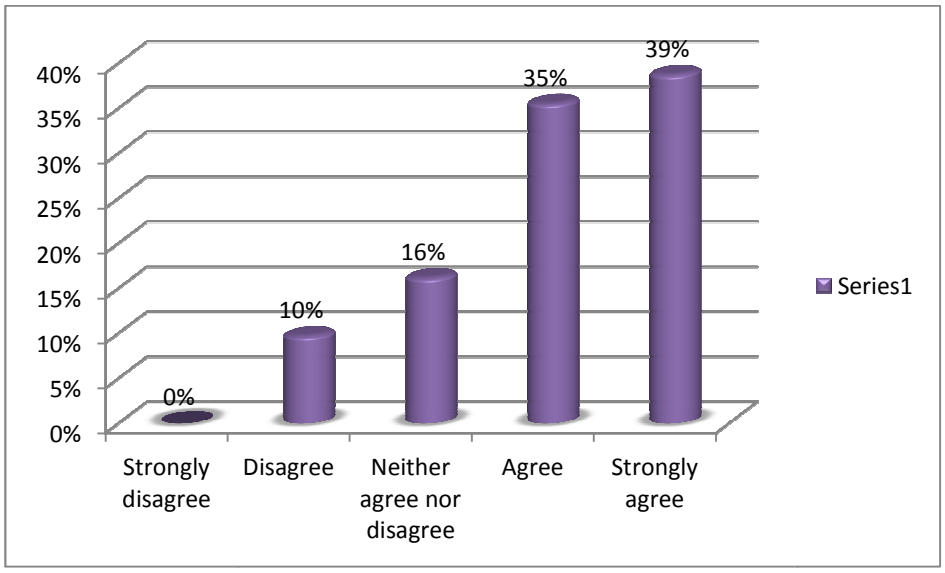

Figure 41: Happy that this system was introduced

4.7 Net Benefits

This dimension has 5 measurable elements.

4.7.1 Improved Decision Making

22 of the respondents (71%) decided that the PCPD system plays a vital role in the decision making process at the MDTs, while 3 of the respondents (9%) disagreed with it (See Figure 42).

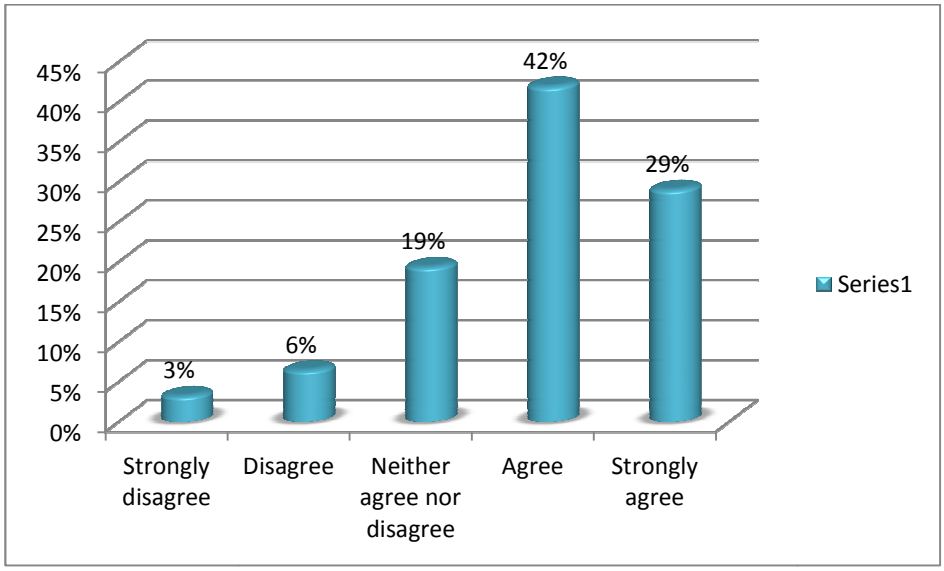

Figure 42: PCPD system plays a vital role in the decision making process at the MDTs

4.7.2 Learning

23 of the respondents (74%) reported that the system has provided a good learning process with only 3 of the respondents (9%) disagreeing to it, while 5 of respondents (16%) staying neutral (See Figure 43).

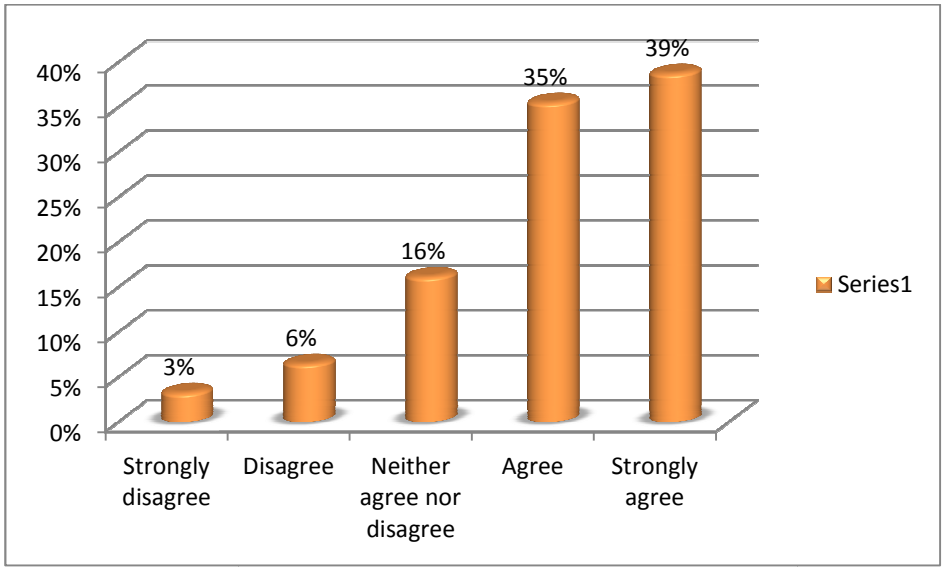

Figure 43: The system has provided a good learning process

4.7.3 Business Process Change

25 of the respondents mentioned that the reporting KPIs and other metrics are accurate and quick through the system, while 2 of the respondent did not find this convincing enough (See Figure 44).

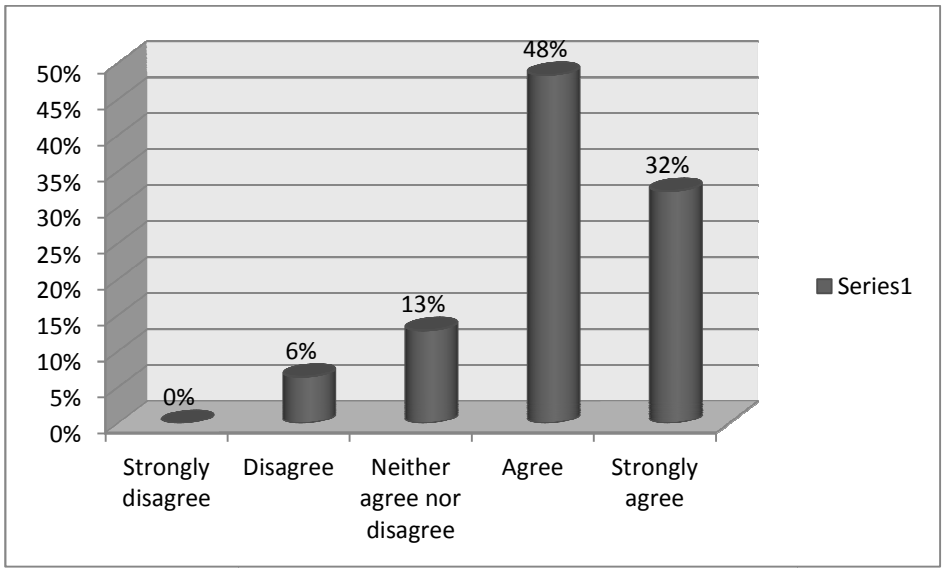

Figure 44: Reporting KPIs and other metrics are accurate and quick

4.7.4 Job Effectiveness & Performance

20 of the respondents (64%) feel that they perform job efficiently due to the PCPD system, while 3 disagreed with that (9%). However, 8 of the respondents (26%) replied neutral (See Figure 45).

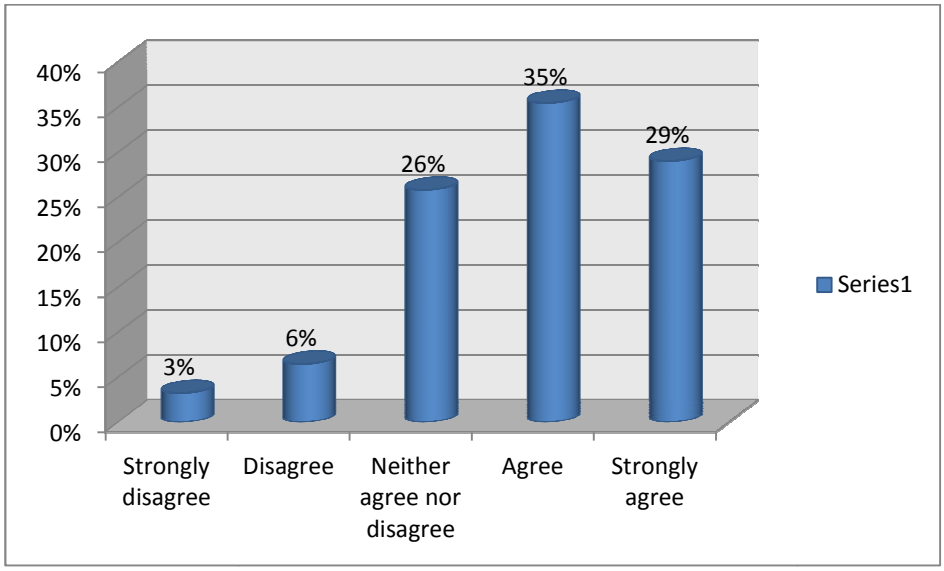

Figure 45: Efficient job performance due to the system

4.7.5 Customer Satisfaction

23 of the respondents (74%) responded that the PCPD system has improved patient care, while 5 of the respondents (16%) disagree with this and 3 of the respondents neither agreed nor disagreed (See Figure 46).

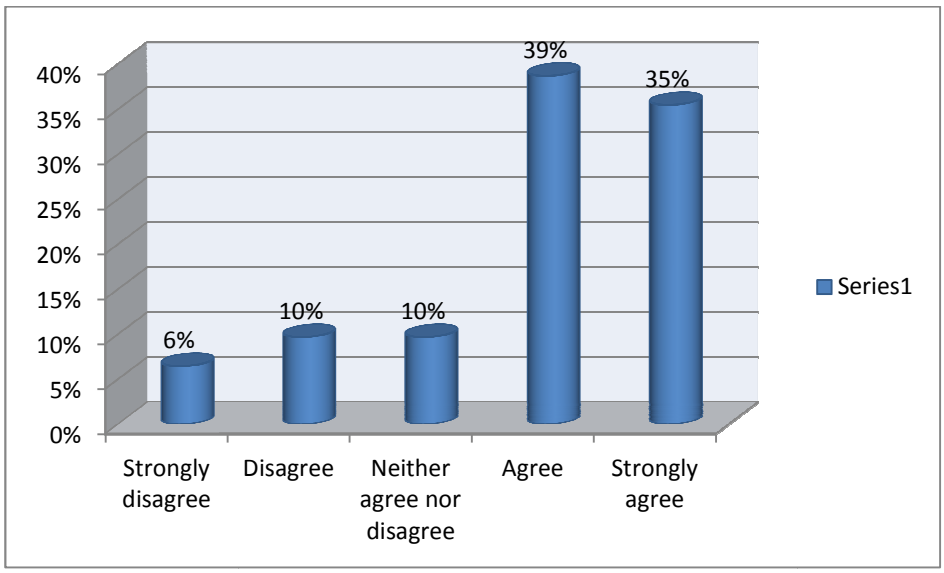

Figure 46: Improved patient care

This chapter gave an overview of the results of the use and perception of the staff at the unit through questionnaires. A total of 38 measurable elements for 6 dimensions have been presented for review.

4.7.6 Summary

This chapter presented the results of the data collection. All measurable elements with graphical representation have been explained.

Chapter 5: Impact of Computerisation of Patient pathway

This chapter will discuss the findings in alignment with the D&M IS Success Model. While responding to the questionnaire, some staff mentioned the negative impact in the comment section which is discussed below in addition to the result analysis. The results of this study suggest that computerising the patient pathway had a both positive and negative impact on staff, patient care and the organisation.

The 5 Likert scale responses were evaluated on the basis that 1 & 2 being negative impact, 3 being undecided and 4 & 5 being positive impact. Thus, any mean value equal to or more than 3.01 is considered as positive impact and any mean value equal to or less than 2.99 is considered as negative impact. The staff comments and suggestions are shown within quotes and italicised. Comments noted by the respondents were not specific to any question, but were specific to each dimension. They were organised under each question upon the author's discretion. The question did not allow respondents to comment for each separate question.

5.1 System Quality

The system quality can affect the IS success if it is able to affect through the various measurable elements namely, Access, Convenience, Easy to learn, Easy to use, System Features, Flexibility, Reliability and Response time of the system. According Manghani (2011), extraordinary level of system quality is required to achieve greater business goals.

5.1.1. Access - Log in to the system is quick and easy

To access a patient's health information, the staff or health care provider need to log into the system using a username and password. Most of the staff complained that the log-in to the system was very slow. One of the medical staff noted as, "*I might be able to finish writing the medical notes by the time I wait for the system to log-in*".

"I think the computers are a bit old and outdated."

"We need computers with good specs."

The mean value for this measurable element is 2.94 which is a negative impact. According to Poissant *et al.,* (2005), one the major challenges of introducing EHR is ensuring the clinicians use the system and factors such as slow login can be a major hurdle. Even though they system only require a two-field credentials for securely logging into the system, the process of the credentials being verified by the server and access authentication requires time. This eventually delays the process of allowing the end-user use the system. However, 42% of the respondents agreed that the logging in time was quick.

5.1.2 Convenience - The system is available on all required workstations

The respondents agreed that the PCPD system was available on all required workstations. Other than clinical areas, where patient care was provided, computers were available in non-clinical areas of the unit such as the nursing stations. This is to facilitate for viewing patient information and for non-urgent data entry. About 80% of the respondents agreed that the system was available on required workstations and 12% disagreed with this. As there were no comments in relation to the system availability, it is difficult to assess the unavailability of the system. The mean value for this measurable element is 3.6 which is a positive impact.

5.1.3 Easy to learn - The system was easy to learn

The findings under this measurable element show that the system was well designed considering the fact that the end-user may not be a computer literate. The learning process was easy for most of the staff. Studies such as Michel-verkerke (2010) reveal that the computer literacy among nursing staff is low. However, the staff in the unit claims that the system was

easy to learn. 28 out of 31 respondents have agreed with this question. The mean value for this measurable element is 3.97 which is a positive impact. Only 2 respondents disagreed with this question.

"I am not that computer savvy, but learning the system was not a tough task for me."

5.1.4 Easy to use - Data Input is easy and fast

The result of this measurable element shows that using the system including data entry and input is easy. About 91% of the respondents agreed with this question and none of the staff disagreed. Most of the fields in the system are dropdown values or multiple select values, which helps the staff to input data quickly and easy. In comparing to the previous paper-based system, the staff will have to handwrite all the information. This reflected in one of the comments.

"*By just clicking the values on the fields, it has saved our hands from becoming tired.*"

"I think data entry in computer is easy because you can use the delete button to erase and retype or you could even use the copy and paste for recurring information."

"It is easy for some of them [Staff Nurse] even though they if they are using only one finger to type."

The mean value for this measurable element is 4.13 which is a positive impact.

5.1.5 System Features - The system has efficient features

The PCPD system has number of features such as reminders for blood test and alerts for high PSI values. These features can play vital role as clinical decision support. But not every staff uses

all the features. Nearly half of the responses neither agree nor disagree. This shows that only half of the respondents use the various features available and only one respondent disagreed. The mean value for this measurable element is 3.48 which is a positive impact.

5.1.6 Flexibility - Updating or adding a new field is easy

The system has 3 level of users namely, User, Super User and administrator. The user has only nominal rights to the system such as viewing information and input data. The super user has the privilege and rights to add and update a field. They also have the rights to amend the information, but do not have the rights to delete any contents. One of the CNMs has been given the super user rights. However, the data manager is the administrator of the system who has additional rights such as deleting the contents. For this question, the super user and the administrator were able to give a direct response, whereas the users were responding in terms of perception on the basis that their requests to the super user or administrator were dealt with quickly and promptly. Nearly 71% of the respondents saw that any changes to the existing forms can be done easily and quickly. And 16% of the respondents felt that it wasn't easy or quick to make any changes. The mean value for this measurable element is 3.87 which is a positive impact. On the other hand, adding or updating data fields are not easy in the previous system as they are printed in papers. Printing of forms is done in large amount. This involves a cost factor as well.

5.1.7 Reliability - The system is reliable for patient care

According to a study conducted by Jamoom *et al.,* (2012) to ascertain the national perception of EHR adoption in the US, reliability for patient care was the main factor for the success of adoption of EHR. The quality of patient care not only depends on accurate information, but also timely information. The PCPD system is has made information available at all times. In comparison to the previous paper-based system, where the medical chart has to be ordered from the medical records department, the new system makes availability of information less

hassle. This helps the system to be more reliable to the staff for provide care. The mean value for this measurable element is 4.03 which is a positive impact. More than 90% of the respondents stated that the system was reliably for patient care. Some of the comments in relation to this:

> *"The system is exceptionally valuable and reliable for access patient information at any time."*

> *"This system has removed the wait time between requesting and receiving the patient health record."*

5.1.8 Response time of the system - Data Retrieval is quick

More than half of the staff expressed that they weren't happy with how the system responds. This is directly linked to technical issue which was shown in 5.1.1 as well. The staff felt that sometimes the screens freezes. Staff were dissatisfied with the search results too. The mean value for this measurable element is 2.90 which is a negative impact. All the respondents responded for this question. However, 42% of the respondents agreed that the data retrieval was quick. Some of the comments in relation to this:

> *"The system takes a long time to open images."*

5.2 Information Quality

The quality of the information is a vital component of an EHR and its information integrity is impacts the success. The information quality can affect the IS success if it is able to affect through the various measurable elements namely, Data Accuracy, Timelines, Availability, Completeness, Consistency, Relevance, Format, Simplicity and Usability. Bowman (2013) argues

that the quality of healthcare provided depends upon the integrity, perfectness and accuracy of the information available at the point of care.

5.2.1 Data Accuracy - The information in the system is accurate

Nearly all staff (97%) except one reported that the information in the system is accurate. There is regular checks and balance to maintain data accuracy. There is also an annual data validation conducted by the data management. The staff in the unit agreed that all information in the system is reliable. The mean value for this measurable element is 4.03 which is a positive impact.

5.2.2 Timelines - The information in the system is up to date

Timelines of information availability is one of the advantages of the system. More than 80% of the staff agreed that the information was up to date on the system. However, few staff expressed that not all information was up to date. There are situations when clinicians cite time constraint and emergency clinical calls for incomplete data entry. The mean value for this measurable element is 3.77 which is a positive impact. There was one comment in relation this:

> *"Sometimes staff leave the data entry for a later time when convenient. This was not possible with the previous medical records. You had to enter the information when you have the charts, or else the chart could be taken by someone. For this reason every ensured they entered information straight away."*

5.2.3 Availability - The system is live and accessible at all times

The system should be live and accessible at all times to provide efficient patient care. Most of the staff concluded that the system was live and accessible at all times. There was about 13% of the staff who disagreed. This could be due to technical problems caused by either the systems

itself or the servers. In some cases it could be third party product failures. Some of the other problems were disconnected network or hardware breakdown. The mean value for this measurable element is 3.77 which is a positive impact.

"I can access patient information at any time/any place."

5.2.4 Completeness - The system provides sufficient information

23 out of 31 respondents answered that the information in the system is complete. This is because a multidisciplinary approach was taken during the development of the system. Moreover, every aspect of the care pathway was carefully scrutinised and possible fields and data elements were included into the system. There were few respondents who disagreed with this statement. This could be due to the factor that healthcare information requirements change every time. Sometimes it might take some time to adopt these changes on to the system. This is completely contrary to the fact fields can be added or update by the local administrator. This requires the approval of the management in terms of cost and manpower. The mean value for this measurable element is 3.80 which is a positive impact.

5.2.5 Consistency - Data in the system is consistent

Most of staff responded that the data captured in the system are consistent with information collected in other units and across the organisation. Nearly 77% of the respondents agreed with this. The system includes consistent data fields that are in place across multiple departments. In fact the system itself processes the data consistently. The mean value for this measurable element is 3.80 which is a positive impact.

"As far as I know, we collect similar information as the other cancer units."

5.2.6 Relevance - The system provides me with information that I need to do my job

About 74% of the staff agreed that they get sufficient information to perform their job. However, there was 6 staff who disagreed. This could be due to the lack of interoperability with all the necessary systems in the organisation. The system is comprehensive and complete that it can provide staff with the information they need to provide patient care or perform their tasks. Information stored within the system includes patient's medical history, referral information, clinical assessment, diagnosis, treatment and discharge information or palliative care. The system is connected through interface, but only acquires specific data fields from other systems. For example, the current registration information for the current episode is pulled-through, where the previous episodes with other specialties are not. The mean value for this measurable element is 3.68 which is a positive impact. There was 2 staff that had no opinion.

> *"I don't think that I had to refer to any other source for information in relation to the patient."*

> *"I have to separately login to RIS system to view the previous images of the patient".*

5.2.7 Format - The information is provided in a clear way

About 71% of the staff was pleased with the format of the system. The format of the system was another well-recognised positive impact. The data fields are arranged in a logical order. The system is also well designed that staff can scroll down a single form and complete necessary data entry for any stage of patient care. For example, the form surgery allows the surgical details, procedure details, surgeons' details, post op complications and pathology to be entered in a single form. Comparison to some EHR, these details will be built into various forms with a parent-child relationship model. This would make it very complicated for the staff as it will require each form to be completed and move to the next one. There was 6 staff that disagreed

as some forms were too long. Rather it would have been better to have multiple screens. The mean value for this measurable element is 3.81 which is a positive impact.

> *"We have been asking on doctors to write legibly, but this system helps us to read the information clear and precise."*

5.2.8 Simplicity - Form Manoeuvring is easy and smooth

The system has 20 forms to enter data. Manoeuvring between screens/form needs to be easy and quick especially when the system is accessed at the point of care. Adequate options are available on the dashboard to enable staff to manoeuvre between screens/forms. 20 out of 31 staff agreed that the manoeuvring is easy and smooth. And 9 staff had no opinion on this statement. This could be due to fact that most of the staff, other than the doctors and data manager, does not use multiple screens as a part of their tasks. However, 2 staff disagreed about the easy manoeuvring. The mean value for this measurable element is 3.81 which is a positive impact.

> *"Moving to other forms is easy."*

5.2.9 Usability - Information sharing is easy

The system allows for sharing of information and as well allows data entry in critical care area, outpatient, and inpatient care settings. The system also helps in assessing the level of quality control and enhancing quality in care through gathering of valuable information. Information can be shared between departments and within the organisation. Even though the sharing is done internally, the ICT department has various security measures that are benchmarked with the standards of other EHRs. The system does not allow data exchanges with external organisations or agencies. The mean value for this measurable element is 3.84 which is a

positive impact. 22 out of 31 staff noted that the information sharing is an easy process. Four staff disagreed and it could be due to slow network speed.

5.3 Service Quality

In terms of service, the organisation's ICT department provides assistance to the unit staff in relation to technical glitches, training and support. The service quality can affect the IS success if it is able to affect through the various measurable elements namely, Assurance, Empathy, Interpersonal Quality, Training, Reliability, Responsiveness. Technical assistance is required during the implementation of the system as well as an on-going support. Lack of technical support and training is one of the core barriers for adopting electronic health records (Ajami and Bagheri-tadi, 2013).

5.3.1 Assurance - The ICT support team has adequate knowledge

25 out of 31 staff reported that the ICT support team has adequate knowledge in terms of the PCPD system. Even though the system being acquired from a third party, the support team received a full and complete training in relation to the technical aspects of the system. All staff in the technical support team as well qualified and trained. However, there was 5 staff that disagreed that the support team has adequate knowledge. This could be due to the staff asking queries unrelated to the PCPD system. The mean value for this measurable element is 3.74 which is a positive impact.

5.3.2 Empathy - The ICT support team understand my needs

25 out of 31 staff agreed that the ICT support team understand my needs of the unit staff in relation to technical requests. The younger staff in the unit is much familiar with computers, but the senior staff are less familiar with computers. Keeping this in mind, the technical support team are more empathetic when dealing with senior staffs' queries. The ICT team are flexible in

providing support for a range of issues. However, there was 5 staff that noted disagreement. This could be due to the lack of basic knowledge in computers on the part of the staff in the unit. The mean value for this measurable element is 3.78 which is a positive impact.

5.3.3 Interpersonal Quality - The ICT support team are optimistic, calm and confident

25 out of 31 staff agreed that the ICT support team possess interpersonal quality. They are positive and confident in their approach towards any technical issues or queries. There were 5 staff that disagreed with this and this could be due to the reason mentioned in 5.3.2. The mean value for this measurable element is 3.87 which is a positive impact.

"The IT guys are cool and calm."

5.3.4 Training - I have obtained sufficient training to use the system

This question is in relation to the staff being trained by the ICT support staff. 21 out of 31 staff agreed that the ICT support team provided sufficient training. There were 6 training sessions arranged for the staff in the unit in a time span over a 2 month period. This was done to facilitate the various shifts staff work. There are also on-going trainings for any changes or updates in the system. The super users received extensive training as well. The mean value for this measurable element is 3.93 which is a positive impact.

5.3.5 Reliability - The ICT support team completes the tasks within the agreed time

The findings under this measurable element show that the ICT support team does not complete the required tasks within the agreed time. 16 out of 31 respondents noted negatively for this question. The unit staff had a lot of technical issues during the implementation stage, which were not resolved promptly. There is also an opinion that the situation exists currently. This could be due to that the staff in the unit seems to contact the support team for each and every

issues. The support team are available to resolve technical issues; however, staff should not view the support team as a panacea. They need to be encouraged to deal with minor issues and not contact ICT team all the time. There were also 12 respondents who agreed that the support completes the tasks on time. The mean value for this measurable element is 2.87 which is a negative impact.

> *"They [ICT support team] get onto the issues straight away, but they [ICT support team] take a long time to solve the issue."*

5.3.6 Responsiveness - The ICT support team answers calls promptly

The support team has a technical support contact number dedicated for all Electronic Patient Record system. The support desk is staffed 8 am to 5 pm Monday to Friday. There is also an out of hours service bleep in case of emergencies. In case of simple queries, the data manager who is technically qualified is able to solve the issues. However, the data manager rarely has contact with the clinical staff regarding technical issues. Mostly, staff in the unit prefers to contact the ICT technical support desk for help. Hence, the data manager is not able to play a major role in service support. The mean value for this measurable element is 4.03 which is a positive impact.

> *"I work in this organisation for more than 20 years and I must agree that I am not that familiar with computers. But I should say that the ICT team are very patient and polite when dealing with my queries."*

5.4 Intend to Use/Use

This dimension is a bridge between prospective adopters and users. 'Intention to use' leads to early use and 'use' is the continuation of the early use. The service quality can affect the IS success if it is able to affect through the various measurable elements namely, Actual Use, Daily Use, Frequency of Use, Intention to Use and Nature of Use. This dimension is not assessed as

the other 5 dimensions that use Likert scale. This dimension assesses the way the PCPD system is used by the end users. Hence, this is a very board perspective. This has to be measured in a subjective manner.

5.4.1 Intention to Use/Use - Have you been working for more than 3 months in the Prostate Cancer Unit?

This question gives the researcher an idea of how long have the staff been working in the unit. In the case that the response is 'Yes', it is presumed that the staff is fully aware of the PCPD system and had an intention to use or have used the system. Staff were asked to stop taking the survey, if 'No' was the response. All staff (100%) responded 'yes'. 4 points on the Likert scale was allocated for all 'Yes' responses. The staff are only presumed to have the intention to use or have used through this measurable element and that is the reason why 5 points were not allocated to. And 2 points were allocated as this is only a presumption of non-use. The mean value for this measurable element is 4.00 which is a positive impact.

5.4.2 Daily Use - Are you dependent on PCPD system in order to perform your job?

This measurable element assesses whether the staff was required to use the system to perform the day-to-day tasks or their job. In the case that the response is 'Yes', it is evident that the staff have used and continuingly using the system. The 5 points on the Likert scale was allocated for all 'Yes' responses. However, the 2 points on the Likert scale was allocated for all 'No' responses as there is a possibility that the staff might be voluntarily using the system. 21 out of 31 staff responded 'Yes' and 10 staff responded 'No'. The mean value for this measurable element is 4.74 which is a positive impact.

5.4.3 Frequency of Use - If answered 'Yes' for Q. 2, how often do you use the PCPD system?

Staff who responded 'Yes' to question No. 2 were asked to continue with this question which assesses how often did they use system. Hence, only 21 staff could take this question. The response options given for this question were Rarely, Sometimes, Often and Always. The Likert points were allocated as the following (See Table 2):

Table 2: Scoring Criteria for Frequency of Use

Always	5
Often	4
Sometimes	3
Rarely	2

4 out of 21 staff responded as 'Always, 13 out of 21 staff responded as 'Often' and 2 staff responded as 'Sometimes' and 'Rarely' each. The mean value for this measurable element is 3.90 which is a positive impact.

5.4.4 Actual to Use - If answered 'No' for Q. 2, have you used the PCPD system?

Staff who responded 'No' to question No. 2 were asked to continue with this question which assesses whether the staff has ever used the system at all. This is a direct response to the assumption in the second question. Staff were asked to stop taking the survey, if 'No' was the response to this question. 5 points on the Likert were allocated for a 'Yes' response. A 'Yes' response indicates a voluntary use of the system. All staff responded 'Yes'. The mean value for this measurable element is 5.00 which is a positive impact.

> *"Even though I can read the patient medication details on the nursing notes, I prefer to read it on the system."*

5.4.5 Nature of Use - What is the purpose of use?

The staff who continued to this question are either using the system as a part of their job or voluntarily. This question enabled to researcher to assess the purpose of use of the system. The purpose were to either 'To view information' or/and 'To input information'. The Likert scale 4 points were allocated if the staff used the system for both purposes and 2 points if it was used for one purpose only. 21 out of 31 staff stated that they use the system for both the purposes and the remaining for only one purpose, which was to view information. The mean value for this measurable element is 3.35 which is a positive impact.

5.5 User Satisfaction

This dimension reproduces the end users' overall satisfaction with the PCPD system. The service quality can affect the IS success if it is able to affect through the various measurable elements namely, Adequacy, Effectiveness, Efficiency Enjoyment and Overall Satisfaction.

5.5.1 Adequacy - Better system in comparison to the Paper-based records

The findings under this measurable element show that the system is superior in comparison to the Paper-based record which was used previously. Nearly 84% of the staff responded that the new system was better than the old. The unit still use the paper healthcare record for some part of the care. However, there were 16% of the staff who felt that the previous system was better. This could be due to the reluctance to use computers and the lack of motivation in the learning curve. The mean value for this measurable element is 3.87 which is a positive impact. Most of the staff expressed that they are feeling good about the system.

> *"The best part of this system is that it can store photos. We take photos and immediately upload them. In fact, they are in high resolution."*

"This system is great."

"I feel that the paper charts were good. I really miss them"

5.5.2 Effectiveness - The system successfully produces intended result

The system has good analytics due to the most discrete data element available in it. Most of the staff (71%) agreed that the system produces intended outcomes. However, there was 5 staff who disagreed. This could be due to the technical knowledge to derive the results from the system. The mean value for this measurable element is 3.58 which is a positive impact.

"I get what I want from it [the system]*."*

5.5.3 Efficiency Enjoyment - Comfortable to use the system

Basically, the PCPD system was developed to support the medical staff in executing their tasks. Given the short time-span the system has been in existence, the level of acceptance on the part of the care givers has been exceptionally incredible. 22 out of 31 staff reported that they are comfortable in using the system. A small number of staff disagreed. This could be due to the various reasons. The mean value for this measurable element is 3.77 which is a positive impact.

5.5.4 Overall Satisfaction - I am happy that this system was introduced

Due to easy accessibility of the system, staff were able to enter data as soon as the task has been completed. In some cases, the data was entered simultaneously along with the task being carried out. 23 staff were happy that the system was implemented. This shows that the overall satisfaction is predominately greater than the staffs that have shown dissatisfaction with the system. The mean value for this measurable element is 4.03 which is a positive impact.

"You get to spend more time with the patients and less time writing notes."

Everyone does the data entry, unlike previously only specific staff were allocated to write certain notes."

"All information in the system is tagged with the author's ID. This helps us to identify who had input that information."

5.6 Net Benefits

The success dimension Net benefits focus on the system's contribution to the various stakeholders. The service quality can affect the IS success if it is able to affect through the various measurable elements namely, Improved Decision Making, Learning, Business Process Change, Job Effectiveness & Performance, Customer Satisfaction.

5.6.1 Improved Decision Making - The PCPD system plays a vital role in the decision making process at the MDTs

19 out of the 31 staff agreed that the system helps in decision making at the MDTs and 2 of the staff disagreed. However, 10 of the staff responded neutrally. This is due to the fact that not all staff has a role in making decision in terms of patient care. But among the staff that responded with opinion, most were positive. The mean value for this measurable element is 3.84 which is a positive impact.

5.6.2 Learning - The system has provided a good learning process

Each time the staff use the system, it is a learning curve. Some of the senior staff in particular that does not have much literacy in computers had gained huge knowledge. Except one, all the other staff agreed that the system provided a good learning process. The mean value for this measurable element is 4.32 which is a positive impact.

"I have definitely learnt something new."

5.6.3 Business Process Change - Reporting KPIs and other metrics are accurate and quick through the system

In the paper based records, the data manager had to make reports by collecting data from each medical chart. This was time consuming and prone to error. The new system not only takes less time, but also removes the possibility of human error. The nurses and doctors are constantly requesting for various reports in relation to the patients. There are requests from external bodies such as HIQA, NCCP and HSE for reports. 26 out of 31 staff agreed that reports were quick and accurate, while 2 other staff disagreed. The disagreement could be due to human error on the report analysis or presentation. The mean value for this measurable element is 4.10 which is a positive impact.

5.6.4 Job Effectiveness & Performance - I perform my job efficiently due to the PCPD system

The system allows spare time and resources that helps the management to adjust work processes. More than half of the doctors and nurses are able to perform their job effectively; this is reflected from the response for this question. 21 out of 31 staff responded positively. The notable area is that 7 staff responded neutral with no opinion and 3 staff responded against. This is a total of 10 staff that did not have an opinion or was negative. This is shows that the overall job performance has less impact than other individual factors. The mean value for this measurable element is 3.84 which is a positive impact.

"Thank you, this system helps me with patient management'."

5.6.5 Customer Satisfaction - The PCPD system has improved patient care

23 out of 31 staff have seen the improvement in patient care as a direct impact of the PCPD system. There are many features that show tangible improvement in the care provided to the patients. On the other hand, there were 5 staff who disagreed. The mean value for this measurable element is 3.87 which is a positive impact.

"Patients are glad to know that we have a computer system in place."

5.7 Summary

This chapter provided an analysis of the results derived from the data collection. It explained the impact of the PCPD system on staff, patient and the organisation based on various measureable elements. Both positives and negatives have been mentioned and the perceived factors that led to the positives and negatives were also explained.

Chapter 6: Discussions

This chapter discusses the various dimensions in an in-depth manner by analysing the positives and negative of each dimension. Overall, the outcome of the study advises that the staff (Medical, Nursing & Administration) had both positive and negative attitude towards the PCPD system.

> *"Some parts of the patient record such as the medication record, food orders and patient hand over information are still on paper because nurses have to fill them for every shift and it is not possible to have nurses input this information onto the computer all the time."*

6.1 Dimensions

The various dimensions have helped in analysing the variables of the system such as structure, task, technology and people that are interdependent.

6.1.1 System Quality

The findings under this dimension shows positive impact that the system is easy to learn and use. Even though the learning factor is greatly influenced by the training quality, the feature of the system on its own is designed in a convenient manner to facilitate people with less computer literacy to learn quickly. The fact that the system was installed in all required workstations, the staff in the unit were also able to access the same information of the single patient simultaneously. More than 69% of the variables in the measurable elements were either agreed or strongly agreed (See Figure 47). The mean value for this dimension is 3.63 which show that it is a positive impact.

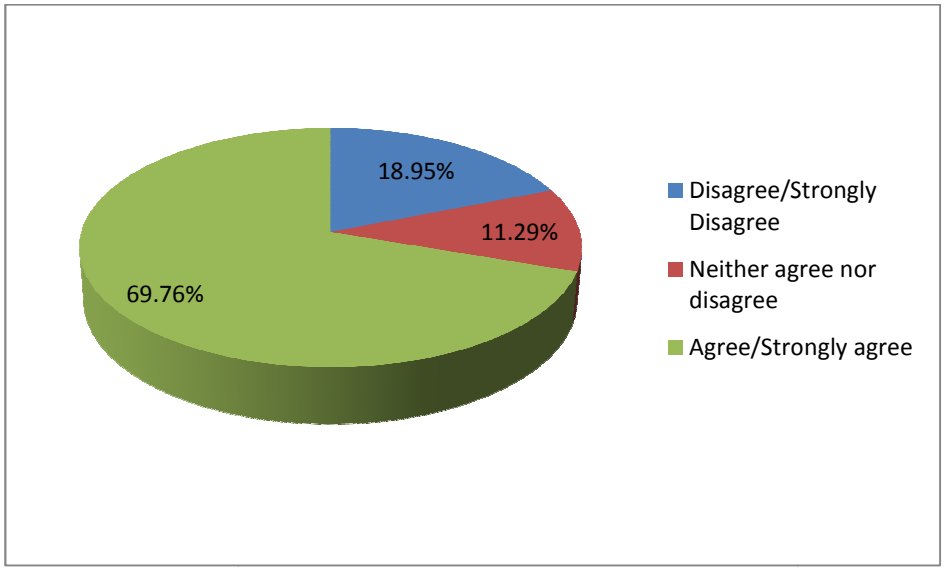

Figure 47: Success Dimension on System Quality

However, there were some negative impact in areas such as logging on to the system and the time consuming for data retrieval. The system is currently based on Internet explorer version 8.0, which could be the reason for the delay in response from the server.

6.1.2 Information Quality

The findings under this dimension shows positive impact that the information in the system was of high quality. The system was running all times during day and night shifts. This allowed continuous access to patient information. The information was accurate and up to date. The format arrangement of various data fields were organised for easy understanding and the manoeuvring between screen and tables were easy as well. More than 75% of the variables in the measurable elements were either agreed or strongly agreed (See Figure 48). The mean value for this dimension is 3.82 which show that it is a positive impact.

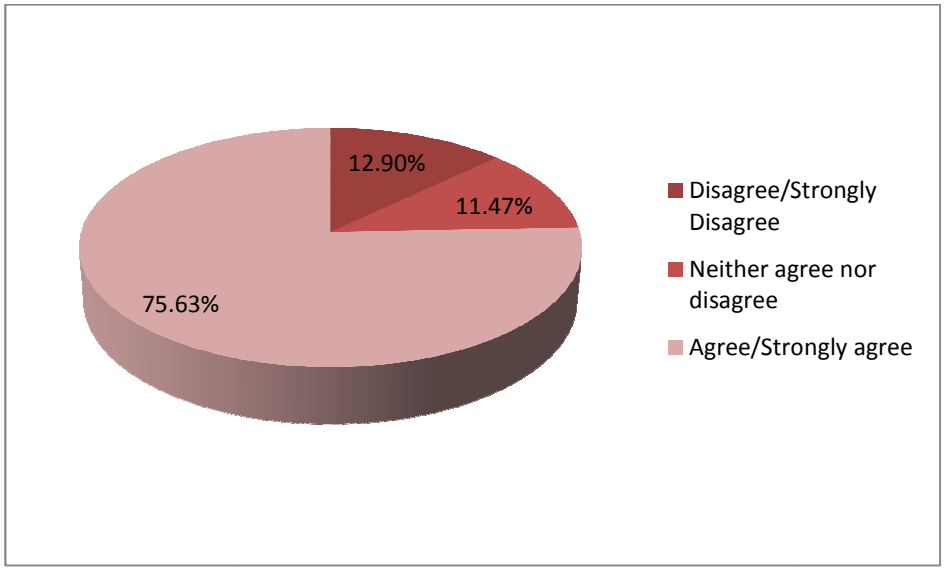

Figure 48: Success Dimension on Information Quality

However, there was some negative impact in areas such as risk of information confidentiality. Anyone had access to any information in relation to the patient. And moreover, the system access is provided to other departments in the hospital and this adds to the problem of inappropriate access of information.

> *"I understand that other departments can access this system, this could compromise patient confidentiality."*

6.1.3 Service Quality

The findings under this dimension shows positive impact that the support provided and the users training was of high quality. The support team acknowledges the user's ability to understand and adapt the system. They are dedicated and committed to solving the problems. The willingness to share knowledge is evident in this case. More than 71% of the variables in the measurable elements were either agreed or strongly agreed (See Figure 49). The mean value for this dimension is 3.66 which show that it is a positive impact.

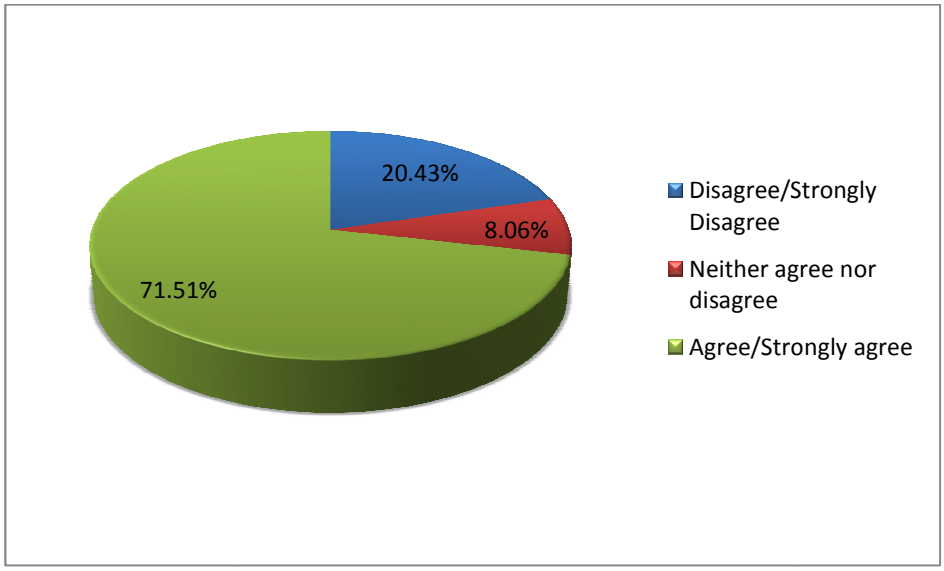

Figure 49: Success Dimension on Service Quality

However, there was some negative impact in areas such as completing tasks with in the required timeframe. Even though, the response in terms of accepting the tasks was quick, there was a lack of prioritisation on part of the support team. This could be due to the reallocation of support staff to other urgent tasks.

6.1.4 Intend to Use/Use

Even though variables under this dimension did not have a direct link to the measurable elements, the outcomes have been accessed based on perceptions. The PCPD system is seen as mandatory for some of the staff to perform their job; hence, the use of the system is not a valuable measure in this case. But, there are some staff that uses the system voluntarily, this is the best valuable measure for actual use. The mean value for this dimension is 4.20 which show that it is a positive impact. However, the negative impact was that the staff who used the system voluntarily, noted the frequency of use as either sometimes or rarely.

6.1.5 User Satisfaction

The findings under this dimension shows positive impact that the users were highly satisfied with the system. There were staff who had limited knowledge in computers or use computers rarely for domestic purposes before this system was introduced who had later expressed their interest in using this system. This system has enhanced their knowledge in computers and computer usage. This has also helped in the betterment of staff career. 75% of the staff felt happy and satisfied with the system (See Figure 50). The mean value for this dimension is 3.81 which show that it is a positive impact. However, the negative impact was that some staff felt that the paper-based records were better in terms of recording information. This could be due to the reluctance to use the system.

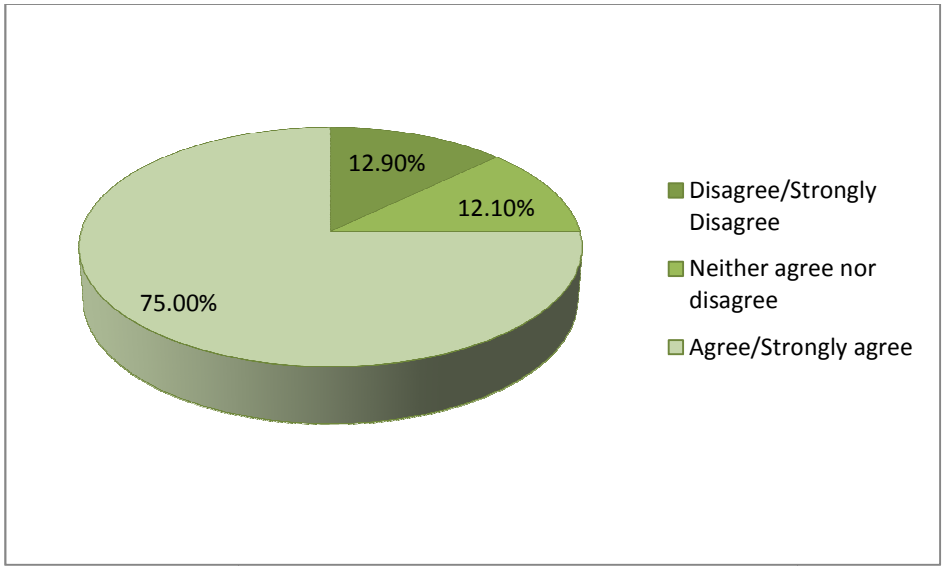

Figure 50: Success Dimension on User Satisfaction

"At home, I always had to take help from my grandkids, but now I work on the laptop on my own."

"This is something I can put on my CV in relation to computer skills."

6.1.6 Net Benefits

The findings under this dimension shows positive impact the specific benefits from the system such as better decision making at the MDT, reporting and better patient care. Providing quality patient care is the ultimate aim of the care providers (AHRQ, 2012) and most of the staff noted that the system assists in achieving this goal, by expediting actions, facilitating quicker and easier decision-making and focusing on patient-centred care. The system provides timely and complete patient information. It allows care staff to spend more time with the patients. More than 76% of the staff felt the system helps them to deliver quality patient care (See Figure 51). The mean value for this dimension is 3.99 which show that it is a positive impact. However, the negative impact was that not every staff felt that the patient care has improved by introducing this system. They noted that even though the documentation process has become much easier, but it does not have any direct impact on the quality of the care delivered.

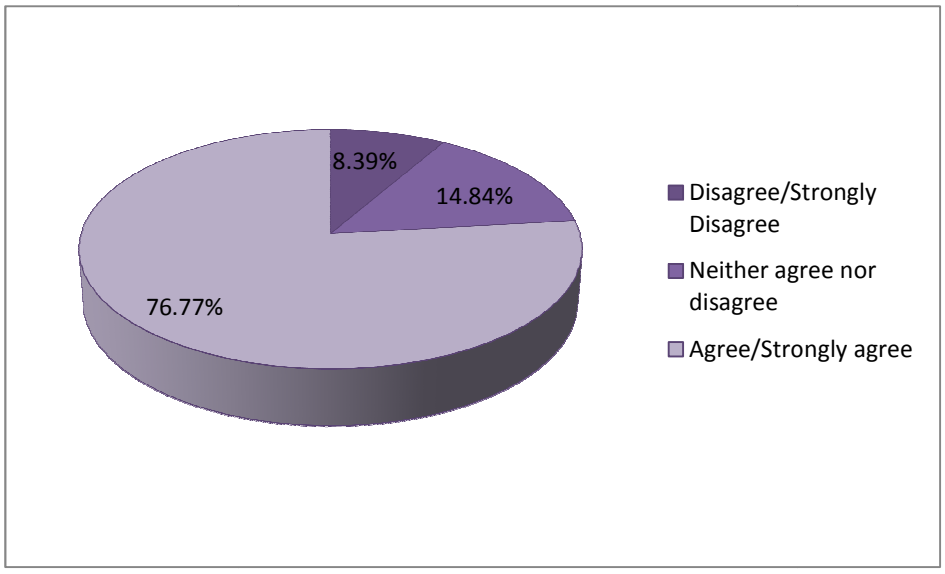

Figure 51: Net Benefits

"I think it drives a patient-focused care."

"The nurse's notes and the doctor's notes are on one single screen. This helps in making decision quicker."

6.2 Positive Impacts vs. Negative Impacts

The findings under all dimensions show positive impact in terms every aspect of the system. The first three dimensions are either dependent or interrelated to the remaining three dimensions. They indirectly act as influencing factors (Petter *et al.,* 2008). The system has allowed provision for direct reporting and accessing all relevant information (lab results, etc.) in a single system. It supports effect and quick evidence-based decision making. One of the major benefits of the system is that it helps in preventing adverse events through the various CDSS functions such as alerts and reminders. Due to the availability of mandatory fields, the clinical staff do not have the options to leave fields recording vital information blank. This is not possible in a paper-based record. It allowed authorised staff to make any amendments or changes to the system, this not help in updating the care process quickly, but also removes unnecessary procedures and protocols. It provides quick, easy access of patients' health information to the right people in the right place at the right time.

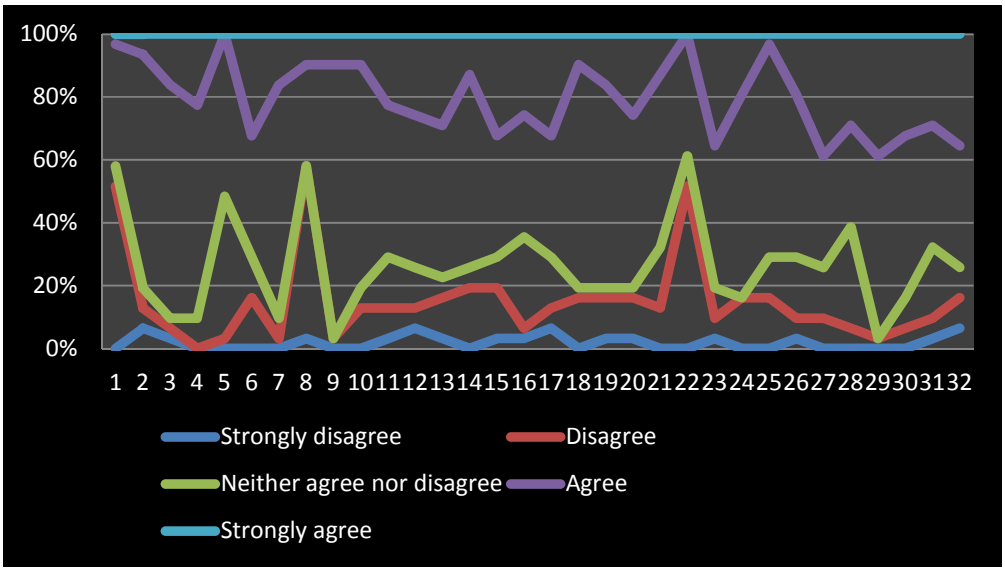

Figure 52: Positive Impacts vs. Negative Impacts

In this study there are positive as well as negative impacts ascertained. Figure 53, shows the trend of the percentage each measurable element contributes. The value 'Agree' is the major contributor in achieving the positive impact. More than 73% of the response was positive towards the system. However, slight above 15% of the response were negative towards the system. Although they expressed mixed feeling about the system, they were generally positive on other variables.

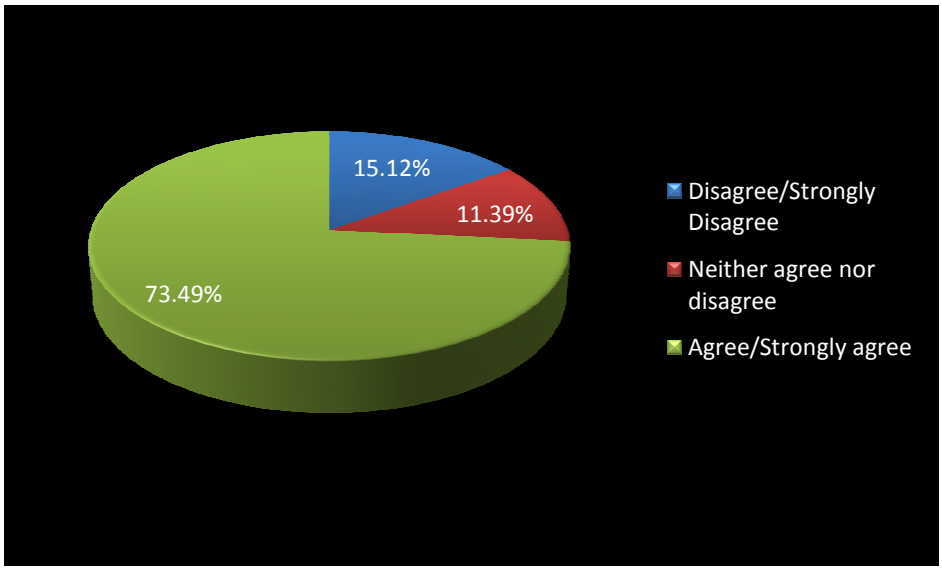

Figure 53: Breakdown of Values for each Dimension

The results also shows few end-users' lack of intention to use the system. Some risk of information was a concern to few staff. Figure 54, shows a breakdown of values for each dimension. The overall mean value is 3.83 which show that the system has a positive impact on the patient care pathway.

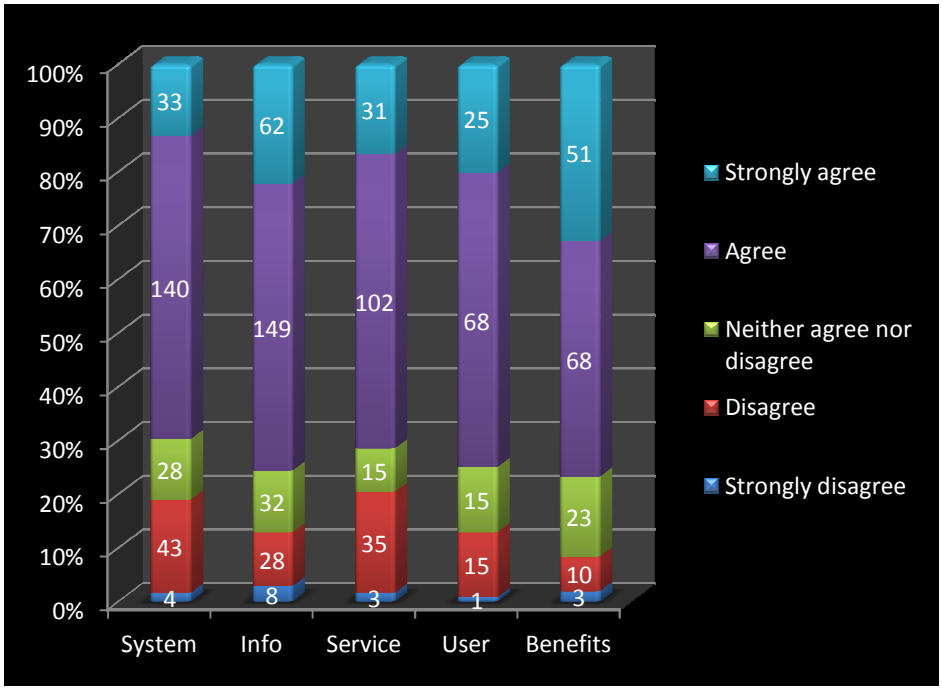

Figure 54: Comparison of Percentage of each Dimension

6.3 Suggestions to overcome negative impacts

About 15% of the various measurable elements were noted as negative impact. There were also suggestions recorded in the final section of the questionnaire. The suggestions have been categorised into three sections: Apportionment of devices, Suggestions on fields update and amendments, and Future Plans.

6.3.1 Apportionment of devices

One of main negatives was in relation to the hardware. These suggestions are divided into three categories: Preference by staff, Number of workstations required and Location of the workstations.

6.3.1.1 Preference by staff

There were suggestions that staff should be given options given in relation to the devices being used for entering and accessing information on to the system. Currently, there are only personal computers installed at all point of care and laptops for doctors. There were suggestions to provide laptops or tablets. The unit should assess the need of the staff and provide devices accordingly.

> *"I wish we were provided with laptops or tablets. It would save a lot of our time from walking around looking for free workstations."*

> *"I prefer to work on a PC rather than a laptop. It's much quicker."*

6.3.1.2 Number of workstations required

Some staff suggested having more computers. This is to facilitate staff document information as they prefer and avoid waiting for other staff to finish. The ICT department should do a needs analysis and provide sufficient workstations for smooth operation of the unit in terms of the system.

> *"Can we have one more system* [Computer] *at the nurses' station please?"*

> *"We have very few computer and so many patients."*

6.3.1.3 Location of the workstations

The computers are normally located at the various administration offices, admin reception and nurses' station. There are no computers in the clinical examination room because the doctors

are provided with laptops. There were suggestions for more computers to be installed at other locations such as nurses' operation room.

"I would be convenient if we had few more computers around the department."

"The Nurses operation room definitely needs a computer."

6.3.2 Suggestions on fields update and amendments

There were suggestions in relation to the screen/forms and data fields. These suggestions are divided into six categories: Additional fields, Easy Manoeuvring, Interoperability, Reporting System, Editing and Logs, and Dictionary.

6.3.2.1 Additional fields

Some staff suggestion to have additional fields to facilitate the capture of all the activities. At the moment there are some information still captured in the paper-based record. The data manager could review the entire care pathway and identify possible additional data items to be captures.

"We should add screens for medication management, falls assessment and pressure ulcer."

6.3.2.2 Easy manoeuvring

Staff expressed that moving between screens should be made simple. The screens should be assessed to find out the frequently used screen and made easy to manoeuvre.

"Moving between screens should be made easy."

6.3.2.3 Interoperability

There were also other useful suggestions to help the care staff to perform their job conveniently by establishing connection between other systems. The ICT team could install interfaces to link the system with other system such as RIS and LABS.

> *"This system should have links with Radiology database."*

6.3.2.4 Reporting system

To get certain information, manager will have to review a lot of data. To avoid this, there were suggestions to creating in-built reporting system which is user friendly.

> *"I wish we could just click buttons and print the reports we need."*

> *"I think we should have a trend prediction which would help us in planning for future clinics."*

6.3.2.5 Editing and logs

To avoid any unwanted activities on the system, staff suggested that there should be proper change logs visible on the dashboard. This should be control by the system administrator.

> *"Once the data has been entered, the information can be changed. The changes are logged, but only the administrator can access the log. The log information should be able to be viewed by everyone."*

6.3.2.6 Dictionary

There are suggestions to have spell-checks to help in auto-correction of the content entered into the system.

"Some features such as a dictionary with spell-check might help when we type fast."

6.3.3 Future Plans

There are few future plans that are interpreted from the negative impacts identified by the researcher. These suggestions are divided into three categories: Additional training, Dedicated Helpdesk and System Upgrade.

6.3.3.1 Additional training

More training is required for staff who feels that the system is difficult to learn or not easy to use. The training program should be planned and executive well in different stages. Assessment of the training sessions should be conducted at the end of each session.

6.3.3.2 Dedicated Helpdesk

The organisation has dedicated support line for patient database system. But it would be convenient for the staff to have a dedicated support line for the PCPD system at least until all staff are confident with the system.

"There should be no wait for solving issues with the system."

6.3.3.3 System Upgrade

There is proposed upgrade for the PCPD system which is named version 2 (v2). V2 is a substantial evolution in the life of the PCPD product. It provides support for a variety of the latest browsers and is much easier to deploy than previous versions of PCPD. V2 provides users with a more user friendly and intuitive user interface that provides up front information to the user on the current status of a particular patient or group patients that are of interest to the user. The application is easier to navigate and is faster and more efficient for the user.

1. PC Requirements

PCPD v2 provides support for HTML v5 browsers, with our recommended browsers being Google Chrome and Internet Explorer 10 or 11. PCPD v2 also has no requirement for ActiveX downloads or for the configuration of browser security settings for Trusted Sites. This makes PCPD much easier to deploy and allows the users the flexibility of accessing it from locations and/or devices that have not been specifically configured for use with PCPD. The PCPD Config Console is still part of v2. The Configuration Console would still be used to Register Clinician & Locations, manage the Access Control Lists and Managed Clinical Networks, Lookup Management, Dictionary Management & System Preferences. There is a new version of Adhoc Reporter Client for v2, but the functionality has remained the same.

2. PCPD Improvements

The focus of the PCPD v2 developments has been to improve the look & feel and the overall ease of use of the PCPD application. As described above PCPD v2 has been developed to operate within a variety of modern browsers and as a consequence does not require ActiveX downloads and security zone configurations. V2 aims to improve the way the user interacts with the patient's record by providing easy navigation between patients and parts of the

patient's record. PCPD v2 can also be configured to provide User, Patient and Enterprise dashboards which allow the users to view pertinent information in a real-time graphical way.

2.1 User Interface

- Improved user interface (UI), with a cleaner look
- Designed to be more users friendly
- Uses Cascading Style Sheets (CSS), so can be configured to required colours, fonts etc.
- Supports HTMLv5

2.2 Patient Label Bar

- Enhanced to comply with the MSCUI (http://www.mscui.net/) guidelines for a health care application.
- Includes a fly out pane that provides the patient's address, contact information, who recently accessed the patient, as well as Allergies, ADRs and Alerts.

2.3 Home Page/Navigation

- Provides a landing page for the user containing a Task Rollup with the items listed below. The items in the Task Rollup can be included or not as required for the client system, and controlled for display to users based on their Security Groups.

  - Notifications:

    System generated messages. These can be configured to be sent to users based on rules set in the system based on data items entered in patient records.

    Messages:

    Sent from other PCPD users (the Internal Message functionality in v4.6, with messages displayed in the Q form)

- ❖ Queued Items:

  Highlights any items that are queued for the user to sign off/approve
- ❖ Care Management Activities
- ❖ Recently Viewed Patients:

  A list of the last 15 patients that have been selected by the user
- ❖ Navigation History:

  A list of the last 15 pages that the user has opened
- ❖ My Appointments:

  A list of the logged in user's appointments for 'today' (based on clinics selected by the user).
- ❖ My Clinics – New Results:

A list of patients (in the users' selected clinics) with lab results returned in the past 'n' period, and a flag to indicate abnormal results.

- ➢ Includes a 'dashboard' section whose content can be configured – see below.

2.4 Dashboards

- ➢ Ability to add and configure new dashboard pages in the system. Dashboards can include multiple panels with different content per panel, including:

  - ❖ drill down reports & graphs
  - ❖ grids displaying data derived from patient record modules
  - ❖ grids configured to support workflows
  - ❖ individual special forms
  - ❖ hyperlinks to patient record modules, based on condition or other factors
  - ❖ hyperlinks to documents or urls

- Dashboard style reports, graphs, pie charts can be configured and are available at the following levels:

  - Home Page – user or system level, showing statistics that the user requires
  - Enterprise – aggregated views across the service/department that PCPD is supporting
  - Specific other dashboard pages configured in the system for a client

The Dashboard reports can be drilled into so individual patients can be identified and selected via the reports.

Note: A service charge will be applied for configuration of the Dashboards.

2.5 Reporting

- Drill down reports are also available in the Report Manager.
- Reports created and available in the Report Manager can also be called up from other areas such as dashboards and the Appointment Scheduler.

2.6 Appointment Scheduler

- The Appointment Scheduler contains the following new features:

  - Improved Clinician Calendar building
  - Overbooking & Double booking functionality to support wave booking
  - Notes for describing the clinic can be entered and are viewable in the end user Appointment Scheduler
  - Patient Alerts are visible on the Appointment Booking Screen

- Reports developed in the Report Manager can be configured to be called from the Appointment Scheduler. This allows multiple clinic reports to be created as required and made available to users based on their privileges.

- Functionality on the roadmap, which will be available by March 2015 includes:

  - A multi-clinic view

2.7 Patient Summary

- The data for the Patient Summary is now taken from the Live database, previously it was taken from the Reporting Database. Being read from the Live database, the data shown is always up to date.
- Can be printed and exported to Excel
- 'Fly out' table of contents

2.8 Document Store (Patient Documents/Letters)

- Simplified summary screen provides the user with a list of Document/Letters created in PCPD in a single click.
- Documents uploaded into the Media Store (Media Items module) can also be displayed in the Document Store, along with patient letters and documents created in PCPD, giving a single view of different types of documents in the patient record.
- New HTML v5 compatible Document Designer and Word Processor

  - Still supports standard Word Processing functionality
  - Functions to export to and paste from Microsoft Word
  - No ActiveX download

- Document Designer is now available from the Web Client

2.9 Media Store (Media Items)

- Summary screen provides the user with a list media items & uploaded documents in a single click.
- Enhanced image and document management for single and multiple items
- Bookmarking of documents
- Management of ‘sealed’ documents

2.10 Care Plan module

A new module for Care Planning has been developed and is now available in PCPD v2. It supports:

- Creation and maintenance of care plan templates, with concerns (needs), goals and interventions, which can be selected from a dictionary or added as text as required.
- The dictionary comes with a set of nursing concerns (needs), goals and interventions, but can be updated to include required concerns (needs), goals and interventions.
- Concerns (needs), goals and interventions can be pre-selected in the template, so they are auto-selected by default when a care plan is added to a patient.
- Care plans can be added to patients as required, manually or automatically based on rules.
- Care plans are added to patients as ‘drafts’, with users confirming, adding or removing concerns (needs), goals and interventions as appropriate to the patient.
- Interventions can generate specific care activities for specific users based on the patient’s care team and rules.
- Care plans can be printed out to give to patients, carers or providers.

Note: A service charge will be applied for configuration of the dictionary and care plan templates.

2.11 Messages

- Includes Received and Sent Messages, with Reply/Reply All options. Forwarding will also be available by March 2015.

2.12 Database Structure

The PCPD database structure for the storage of special form data has been re-architected between your version of PCPD and v2. AxSys have completed this work to provide a database platform that can store extremely large volumes of special form data. The new structure also helps to improve data consistency. The new database structure provides a faster Reporting DB sync process. In a DB with a large volume of data it would take approximately 2 hours to build in v2, currently it takes about 12 hours to sync.

6.3.3.4 Other suggestions

There should be feedbacks and suggestions for PCPD system included in the agenda for all the Unit MDTs. This should be a standing item on the agenda. The feedbacks from these meeting should be communicated to the ICT department and management for further actions.

6.3.4 The standards of the system

There should be standards set for maintaining high quality of information. These standards should be benchmarked with international system.

6.4 Summary

In this chapter, the positive and negative impacts of the various dimensions have been discussed. Both the positive and negative impacts are based on the experience and perception of the staff in the unit. A comparative analysis between the positives and the negatives show that there are more positive impacts than the negative impacts of the system. Although, the negative impacts have a slight impact on the staff in terms of motivation, the overwhelming positives reduce the influence of the negative impacts.

Chapter 7: Conclusion

This research aims to identify the impact of computerisation of patient pathway in a national cancer centre for Prostate cancer. Data collected through questionnaires was analysed using MS Excel 2010 functions such as cell sorting, cell highlighting sorting, filtering, counting, and Pivot table functions. The PCPD system success was measured using the D&M IS Success Model. The various success dimensions; System quality, Information Quality, Service Quality, Intent to Use/Use, User Satisfaction and Net Benefits had various measurable elements to evaluate the system. The questionnaire that was employed to survey the staff has questions directly linked to each measurable element. In nutshell, each measurable element was assessed through a question. Likert 5-point scale was used as a tool to weigh the responses for each question. Responses with value below 3 were considered to be a negative impact and responses above 3 were considered to be a positive impact.

This study show that the impact on staff included increased convenience and satisfaction in performing the job, improved decision making, good learning process, better quality in the care provided. The study also proves that there is a direct link between the ‘system use’ and ‘user satisfaction'. The longer the users had been using the system, the higher the satisfaction was recorded. The majority of the measurable elements (133, 72%) recorded positive impact and small portion (38, 20%) of the measurable elements recorded negative. However, there is also a smaller portion (15, 8%) of the measurable elements recorded as neither positive nor negative. The neutral responses are directly connected to responses where the use of the system has been minimal. This cannot be considered as any value. Considering the fact that the difference between positive and negative impact varies a lot, it is logical to conclude that the positive impacts have overshadowed the negative impacts.

The comparison of the comments noted shows that most of them were positive. There were 33 positive comments and 9 negative comments. There were also 12 suggestions for improvement. Although, the suggestions were not negative comments, but still the contents

are about the features or functions that are unavailable on the system. Therefore they are to be clubbed with the negative comments. However, the number of positive comments outweighs the total number of negative comments and suggestions. In analysing the comments, the overall conclusion can be derived that staff are moderately satisfied with the system. The top 3 measurable elements were, the system provided a good learning process (mean value = 4.32), the system is easy to use (mean value = 4.13) and the reporting of KPIs and other metrics are quick and accurate (mean value = 4.10). All three measurable elements mentioned are directly linked to tasks related to the staff. A careful consideration should be given to the fact that these positives impacts are a direct reflection on the features and functions of the PCPD system in comparison to the previous paper-based record. However, if the quality of the system is moderate; if there is a lack of full fledged training; if there is insufficiency in the level of support provided, the staff in the unit may be negatively impacted by the use of the system.

Currently, the study shows that the negative impacts are on the technical aspect of the system. In order to overcome these negative impacts, a variety of suggestions for improvement in the areas Apportionment of devices, Suggestions on fields update and amendments, and Future Plans. A comprehensive system upgrading plan for both the hardware and software aspects has been listed to be considered by the ICT support team which would help to improve the system and motivate the staff to adapt the PCPD system successfully.

Limitations of this study

The first limitation of the study is that the findings were drafted from the questionnaires completed by some staff who do not use the PCPD system as part of the requirement to complete their job. This may not fully reflect on the experience they had with the system, but may be perception of the staff. This perception could be sometimes influenced by common opinion in the unit or observation on other staff using the system. This could drive the sense of negative impact or positive impact. The second limitation is that this study has been done only at one unit or department. Similar systems have been implemented in other cancer care units

in the organisation. The study could have a complete impact analysis if it was compared with the other system. However, this study would give valuable insight on other studies. The final limitation is that there was no analysis done on the cost analysis due to restrictions by the organisation. The cost analysis could have given a comprehensive view of how successful the system has been since the implementation.

Further Research

This research has identified the positive and negative impacts of the PCPD system on the patient care pathway in the cancer centre through quantitative research method. Future research can be conducted to analyse on how the impact of the PCPD system can lead to other organisational impacts. And other research can be conducted to compare the impact between other patient cancer systems with the PCPD to benchmark the system.

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APPLIED COMMUNICATION", Issue 1 / Edited by I.N. Rozina, Rostov-on-Don: Institute of Management, Business and Law Publishing, 2002. - 168 p. P. 59-67

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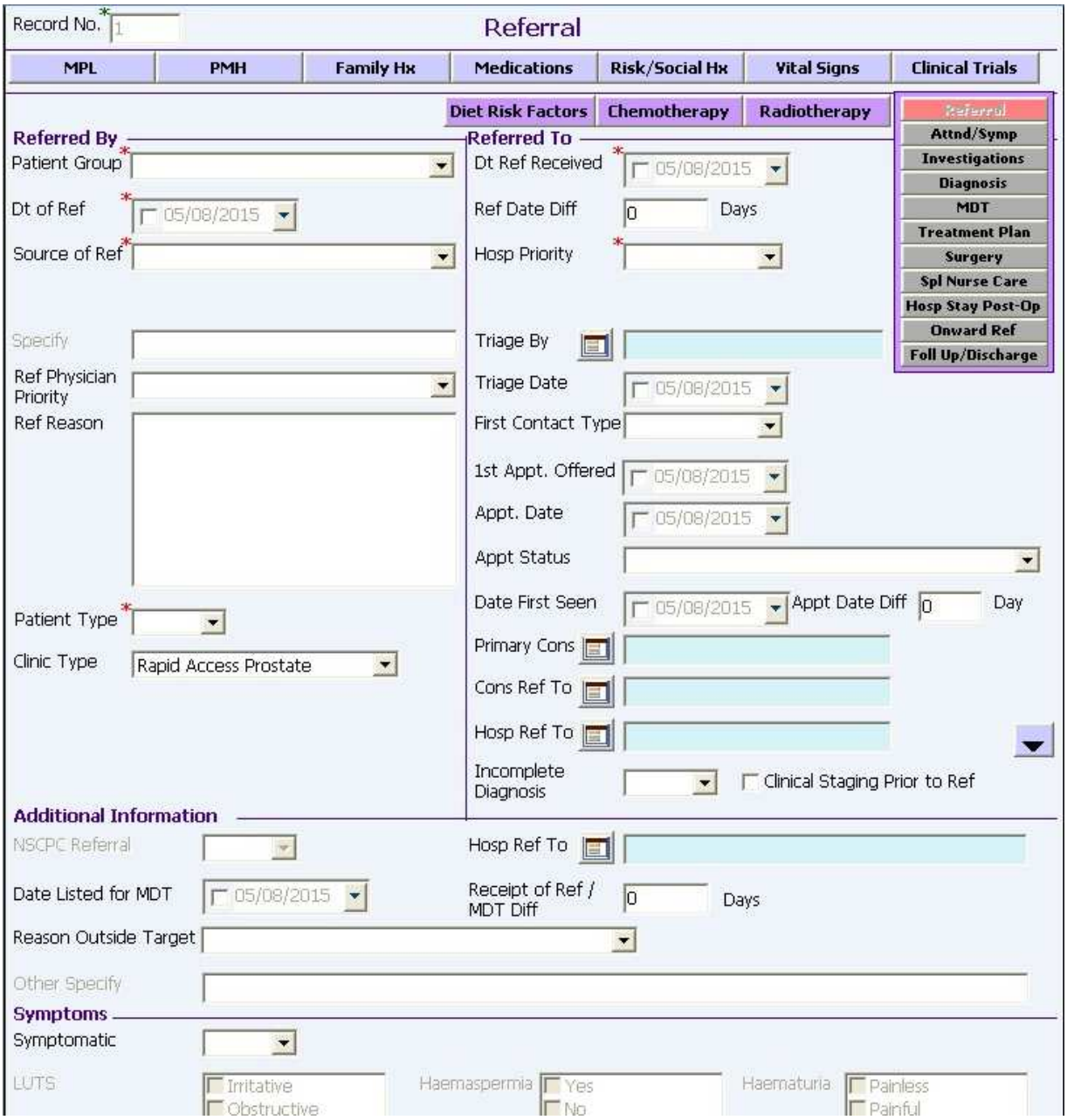
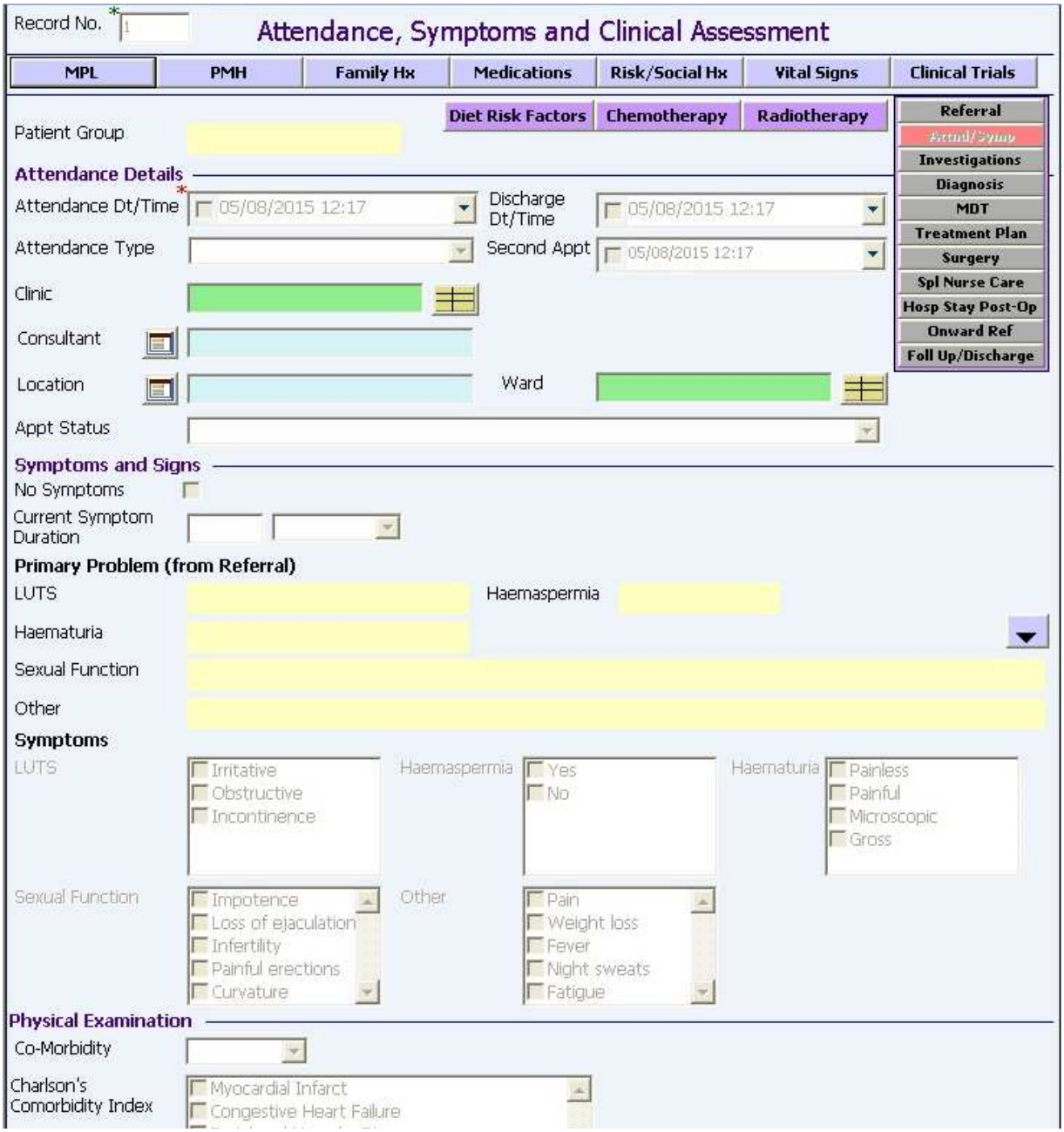
Appendix:

Appendix A: The PCPD System

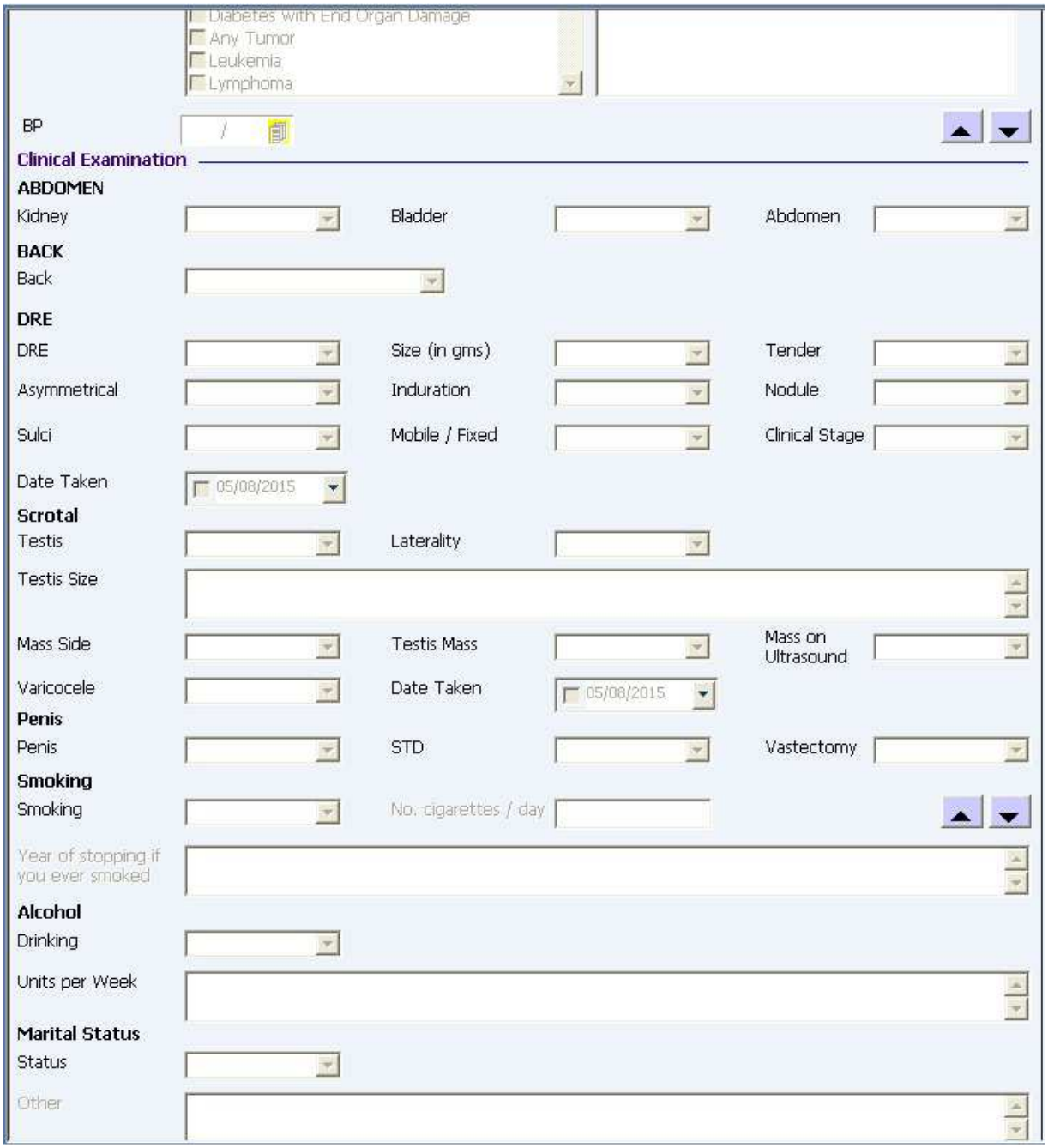
A.1: Referral



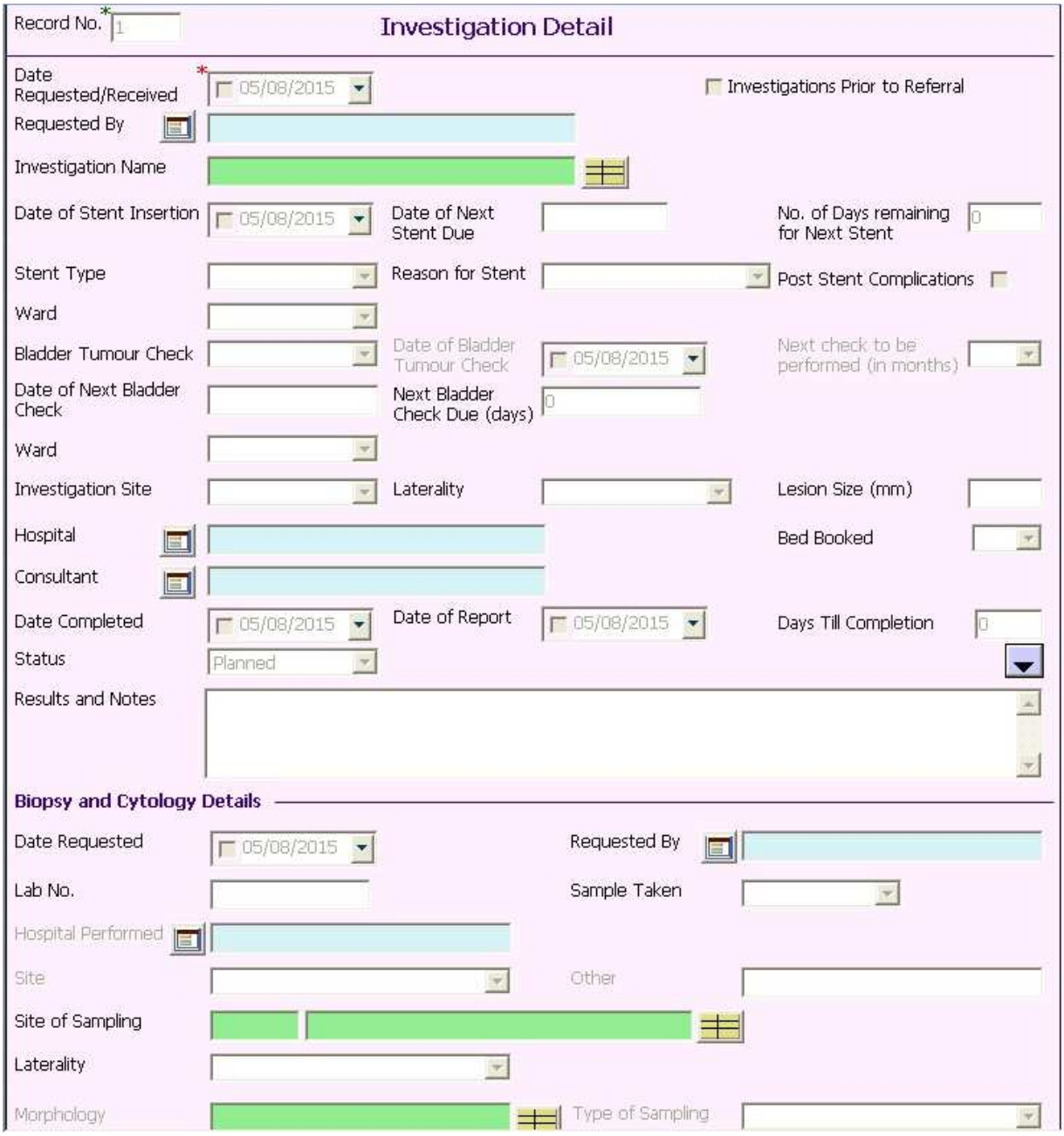
A.2: Attendance, Symptoms and Clinical Assessment (1)



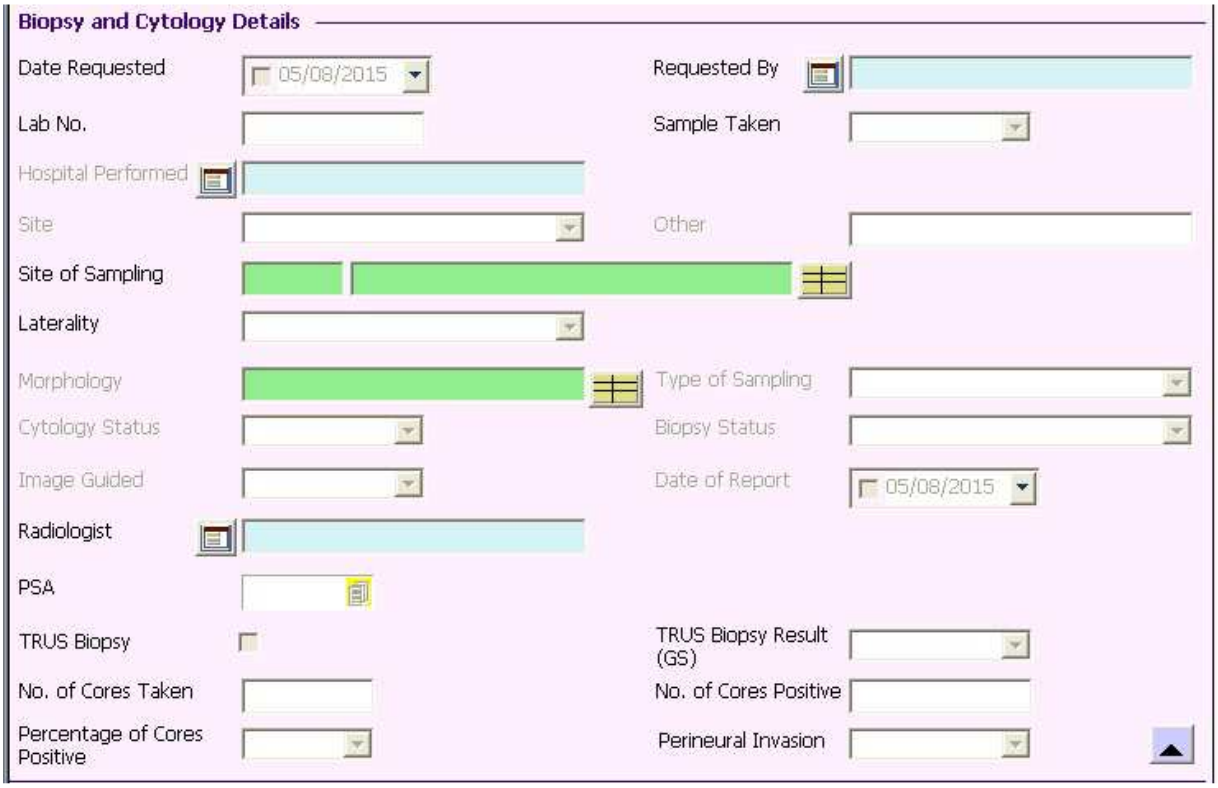
A.2: Attendance, Symptoms and Clinical Assessment (2)



A.3: Investigation Details (1)

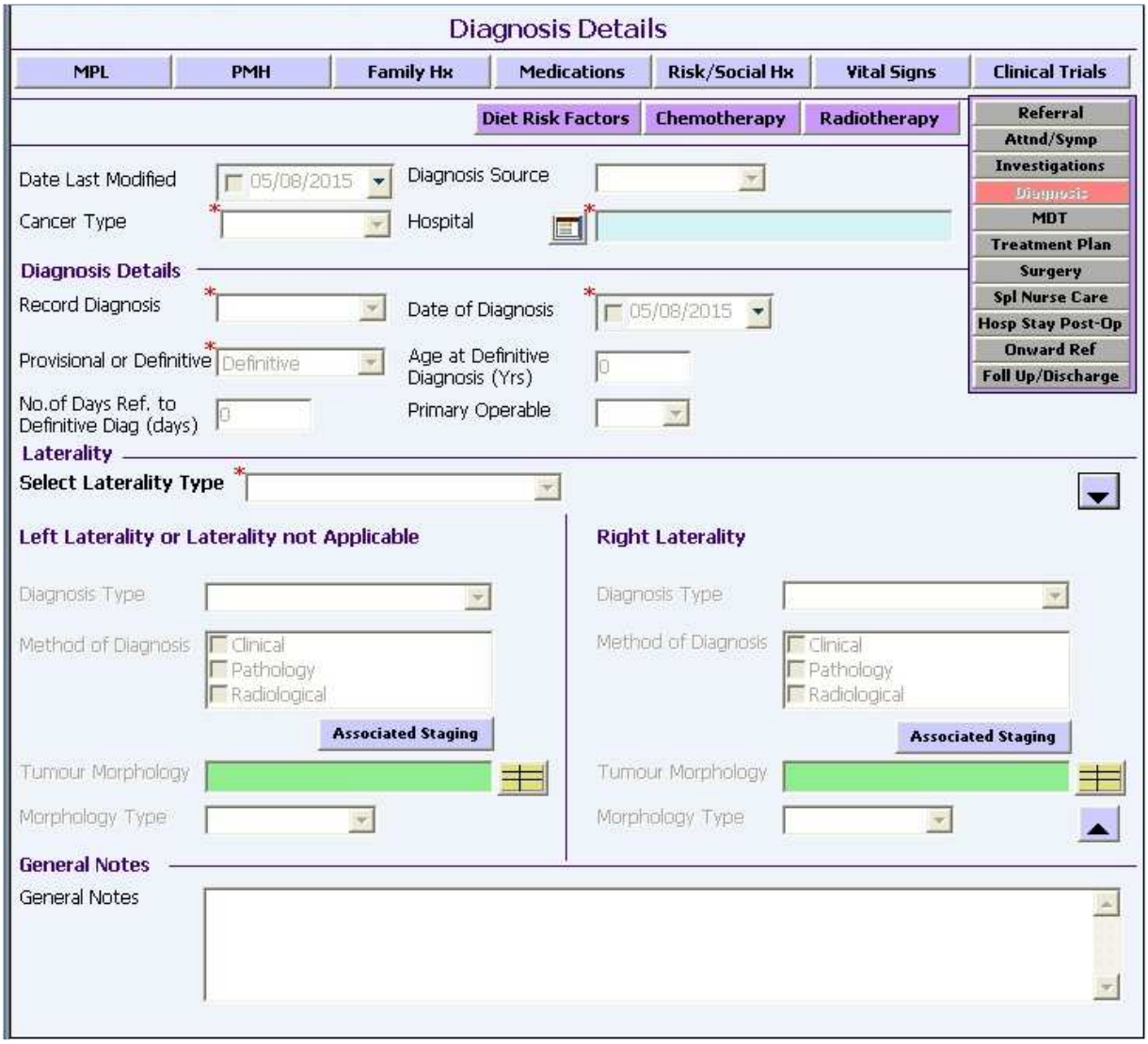


A.3: Investigation Details (2)

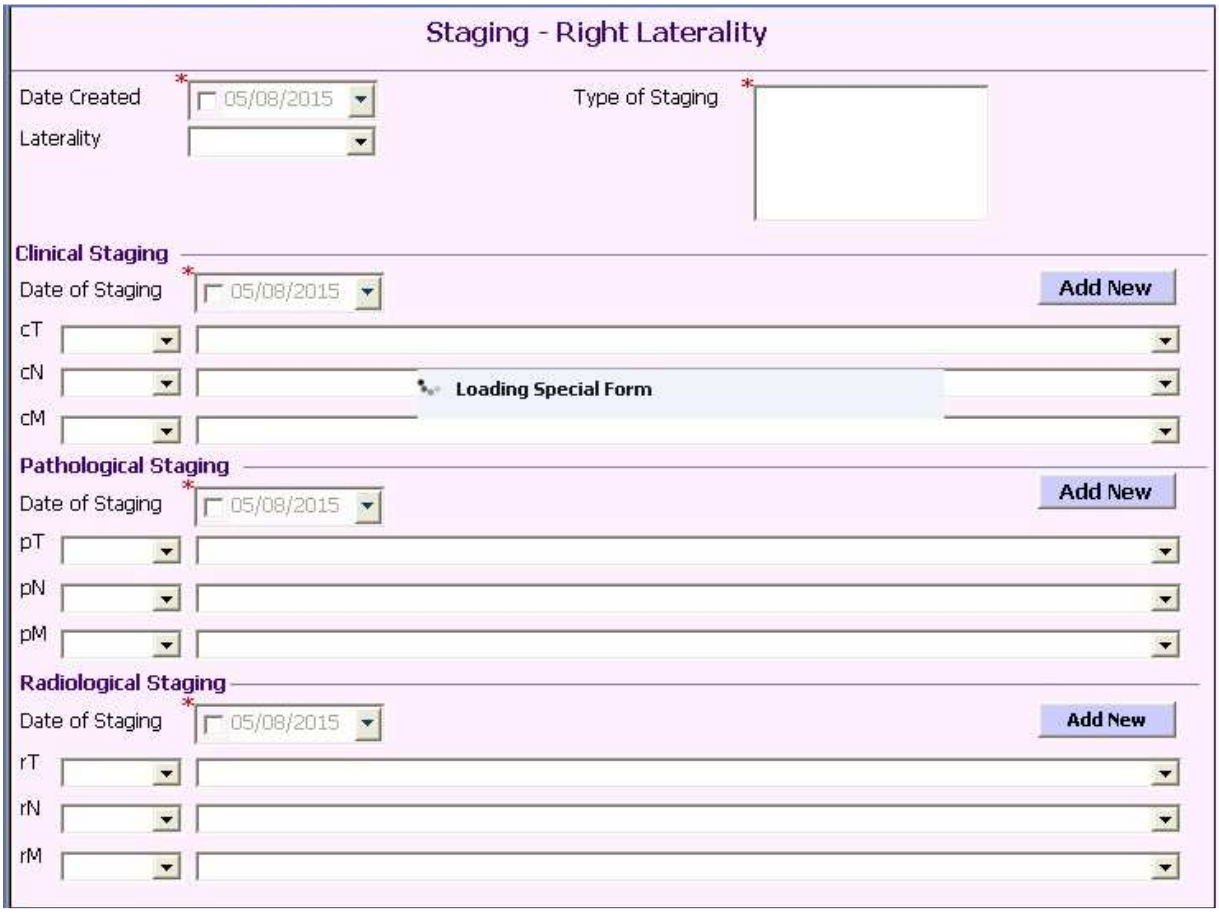


A.4: Investigation Summary

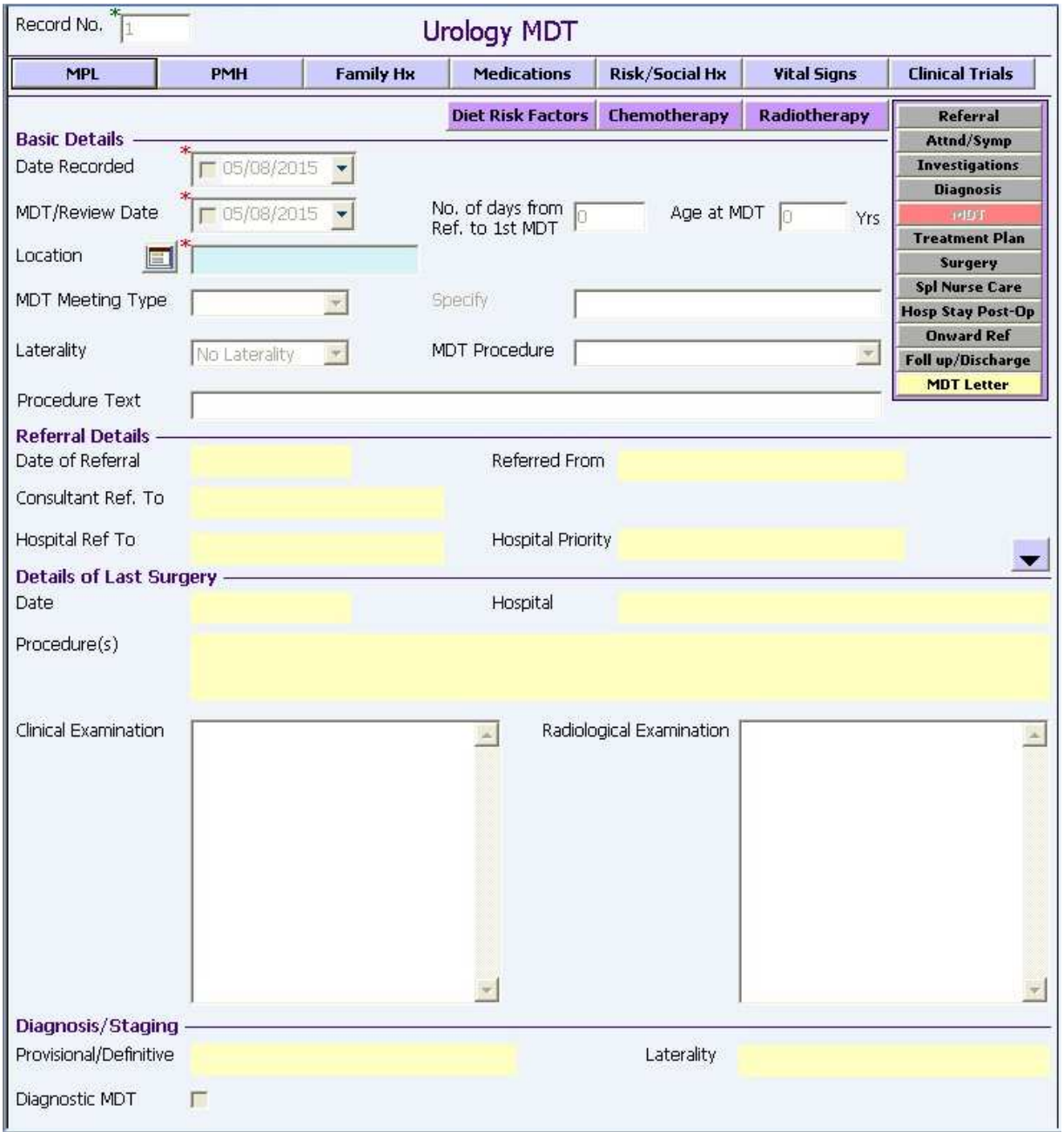
A.5: Diagnosis Details



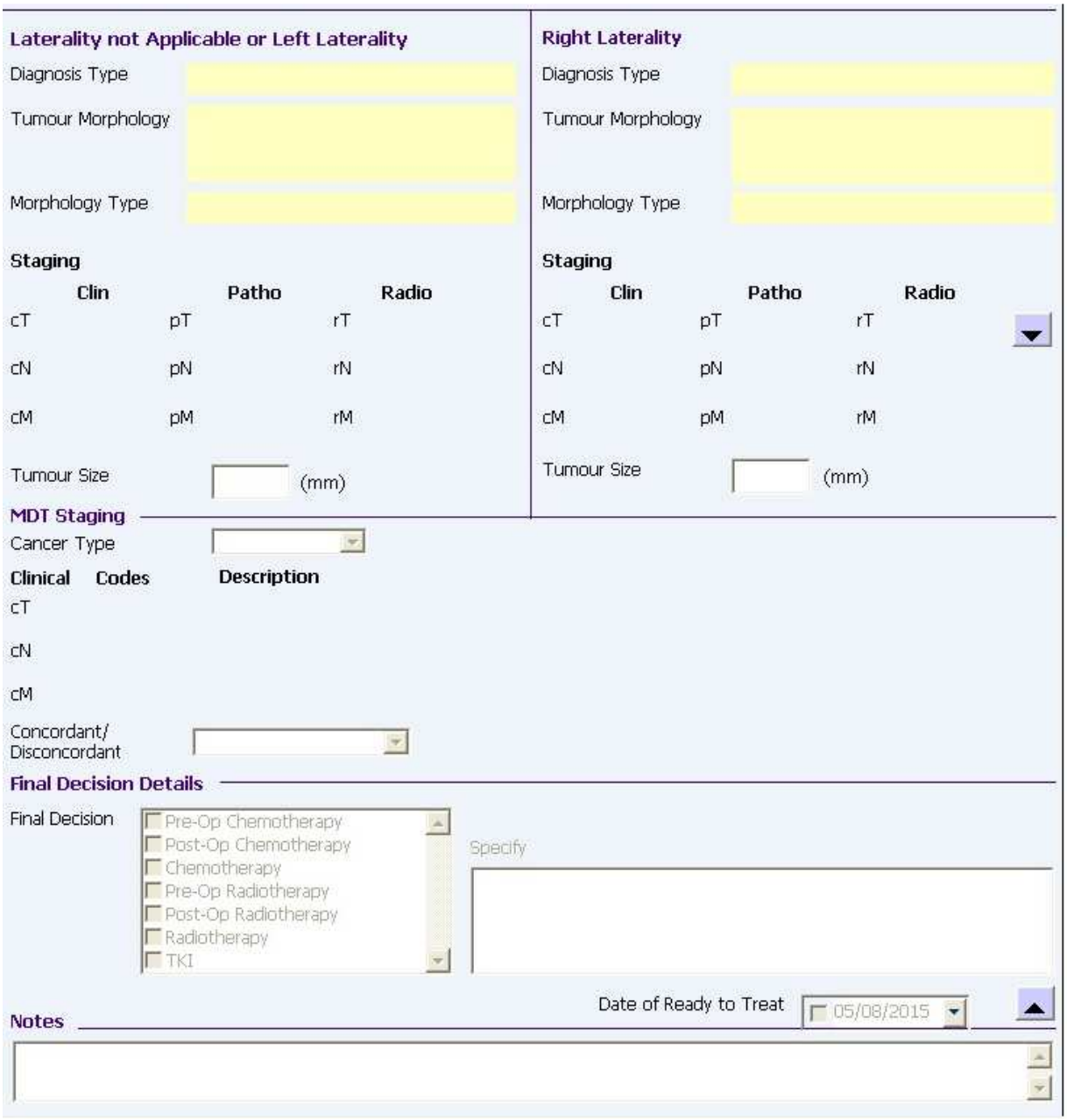
A.6: Staging


Staging - Right Laterality
Date Created
05/08/2015
Laterality
Type of Staging
Clinical Staging
Date of Staging
05/08/2015
Add New
cT
cN
Loading Special Form
cM
Pathological Staging
Date of Staging
05/08/2015
Add New
pT
pN
pM
Radiological Staging
Date of Staging
05/08/2015
Add New
rT
rN
rM

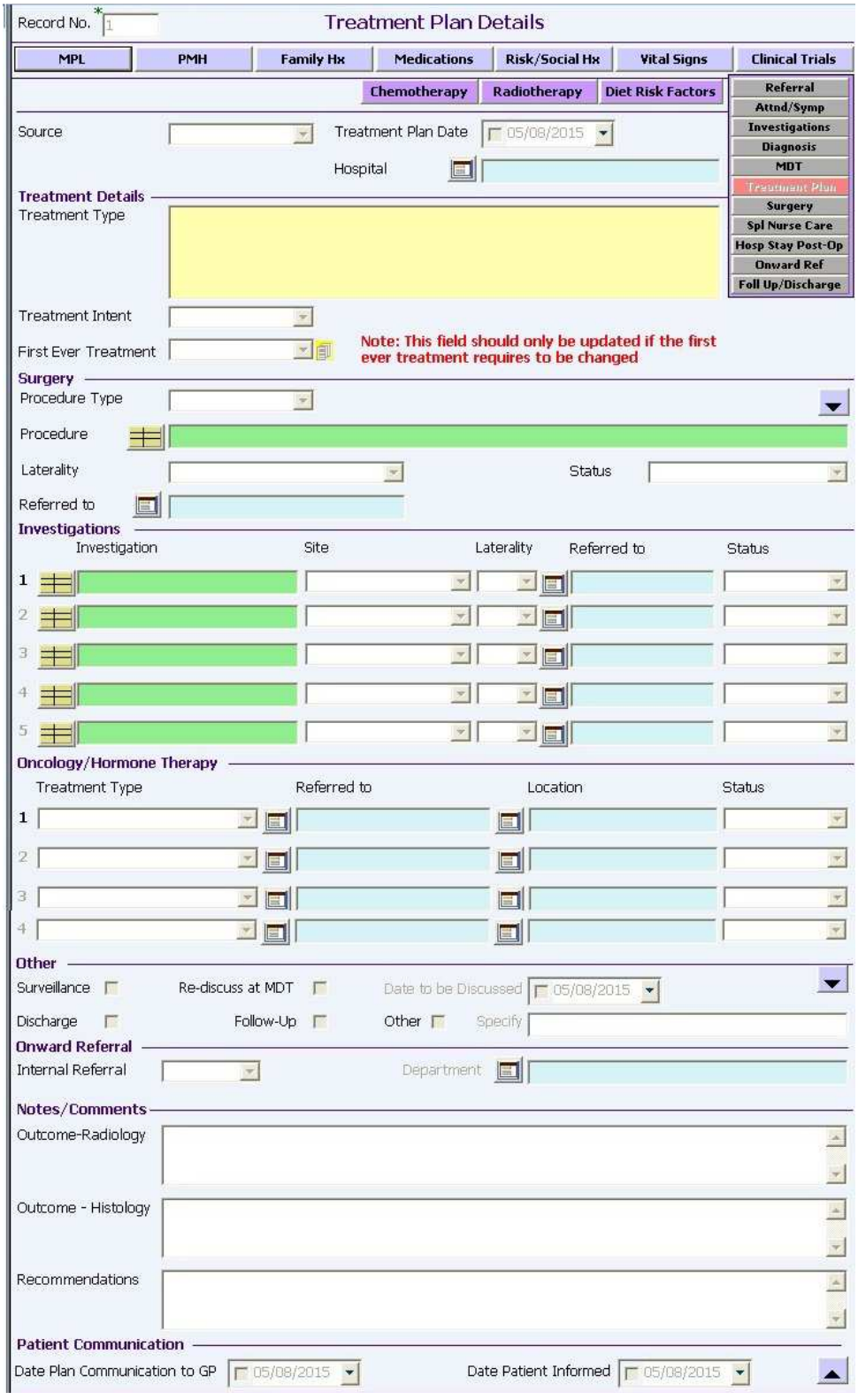
A.7: MDT (1)


Record No. 1
Urology MDT
MPL
PMH
Family Hx
Medications
Risk/Social Hx
Vital Signs
Clinical Trials
Diet Risk Factors
Chemotherapy
Radiotherapy
Referral
Attnd/Symp
Investigations
Diagnosis
MDT
Treatment Plan
Surgery
Spl Nurse Care
Hosp Stay Post-Op
Onward Ref
Foll up/Discharge
MDT Letter
Basic Details
Date Recorded
05/08/2015
MDT/Review Date
05/08/2015
No. of days from Ref. to 1st MDT
Age at MDT
Yrs
Location
MDT Meeting Type
Specify
Laterality
No Laterality
MDT Procedure
Procedure Text
Referral Details
Date of Referral
Referred From
Consultant Ref. To
Hospital Ref To
Hospital Priority
Details of Last Surgery
Date
Hospital
Procedure(s)
Clinical Examination
Radiological Examination
Diagnosis/Staging
Provisional/Definitive
Laterality
Diagnostic MDT

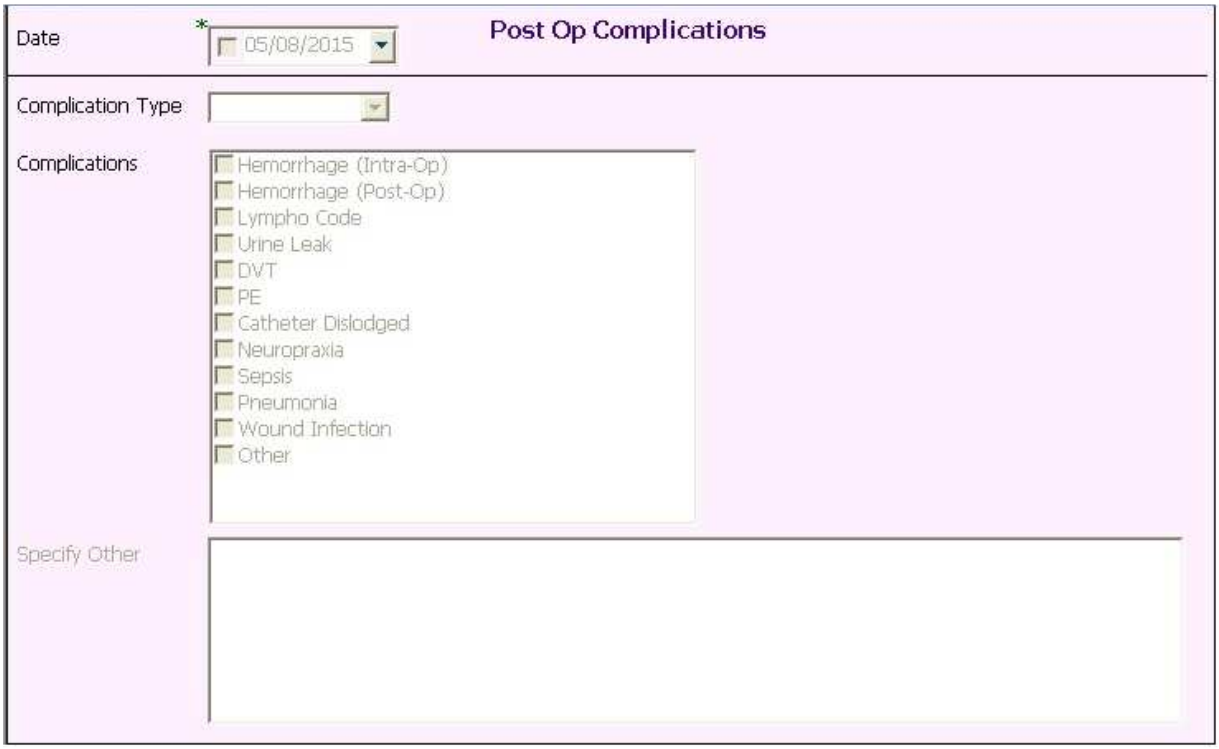
A.7: MDT (2)


Laterality not Applicable or Left Laterality
Diagnosis Type
Tumour Morphology
Morphology Type
Staging
Clin
Patho
Radio
cT
pT
rT
cN
pN
rN
cM
pM
rM
Tumour Size
(mm)
Right Laterality
Diagnosis Type
Tumour Morphology
Morphology Type
Staging
Clin
Patho
Radio
cT
pT
rT
cN
pN
rN
cM
pM
rM
Tumour Size
(mm)
MDT Staging
Cancer Type
Clinical
Codes
Description
cT
cN
cM
Concordant/ Disconcordant
Final Decision Details
Final Decision
Pre-Op Chemotherapy
Post-Op Chemotherapy
Chemotherapy
Pre-Op Radiotherapy
Post-Op Radiotherapy
Radiotherapy
TKI
Specify
Date of Ready to Treat
05/08/2015
Notes

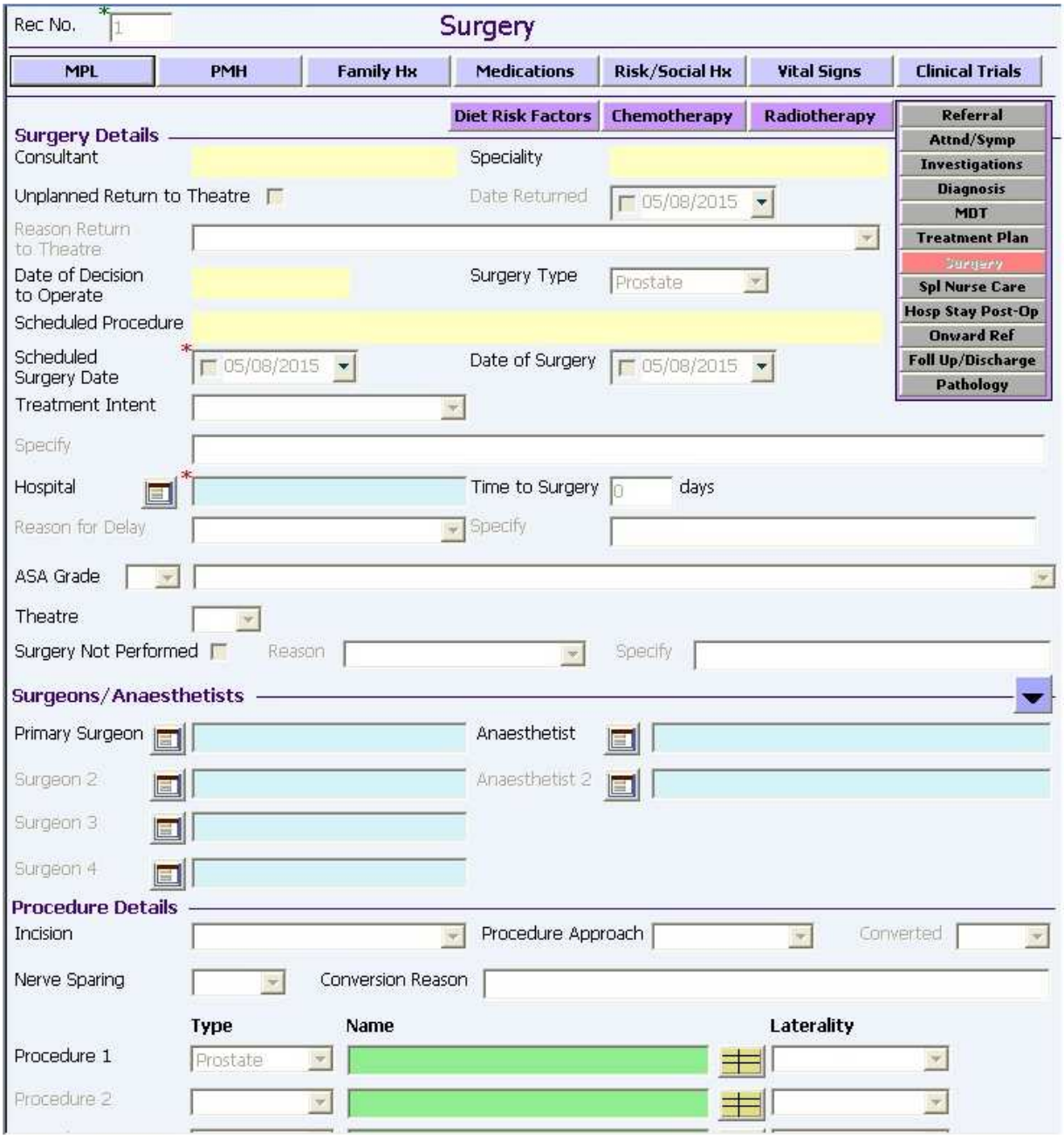
A.8: Treatment Details



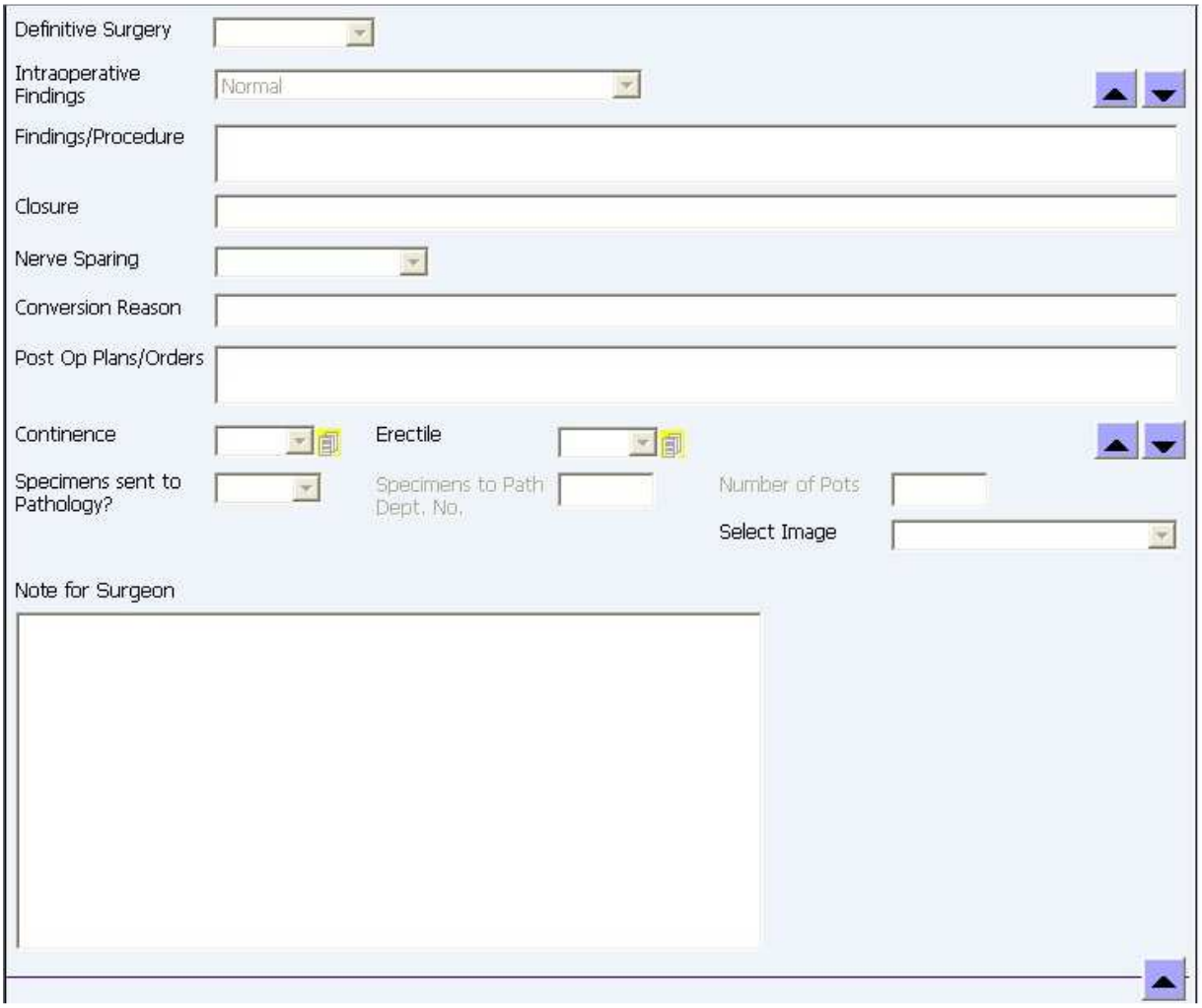
A.9: Post-Op Complications



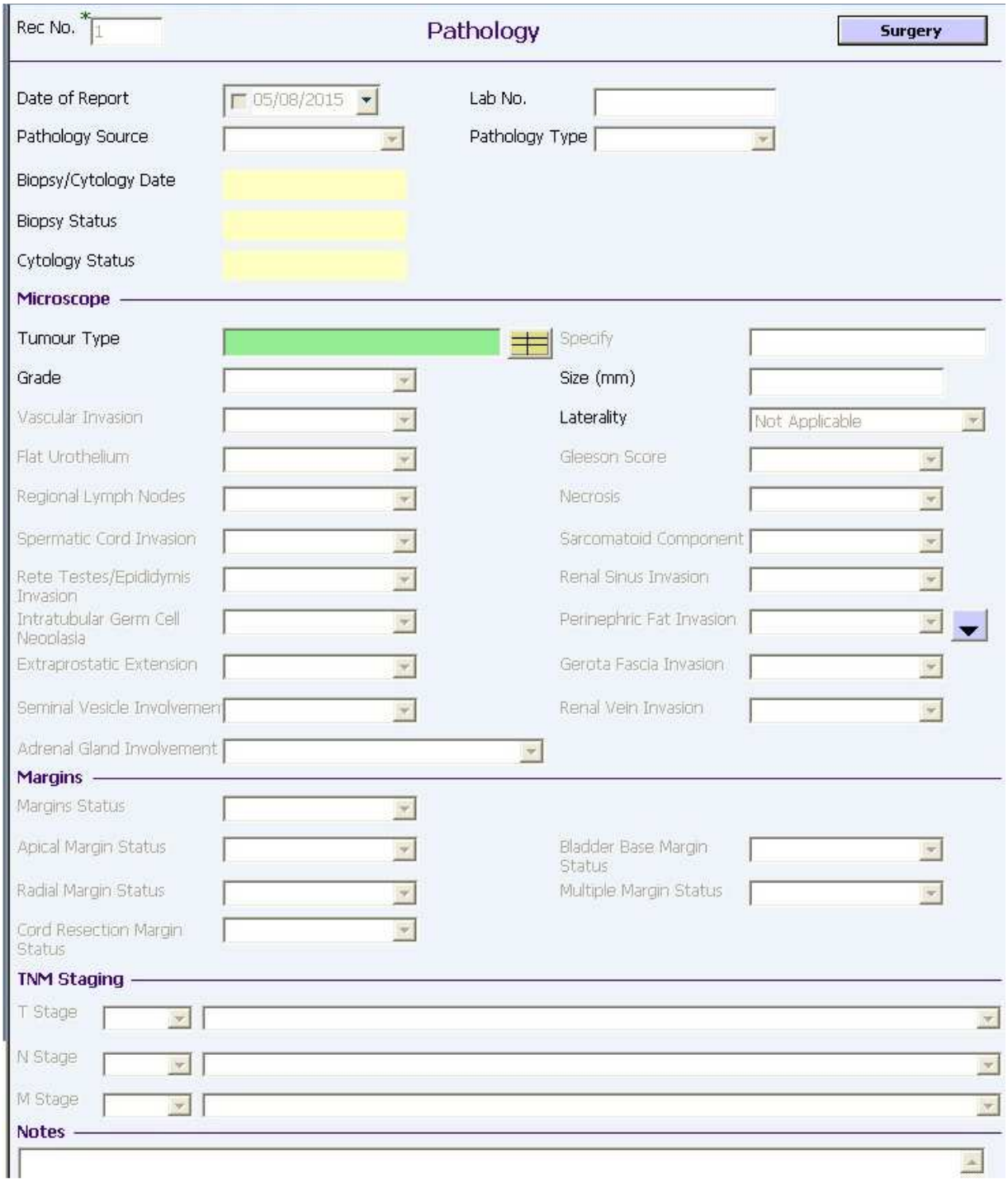
A.10: Surgery Details (1)



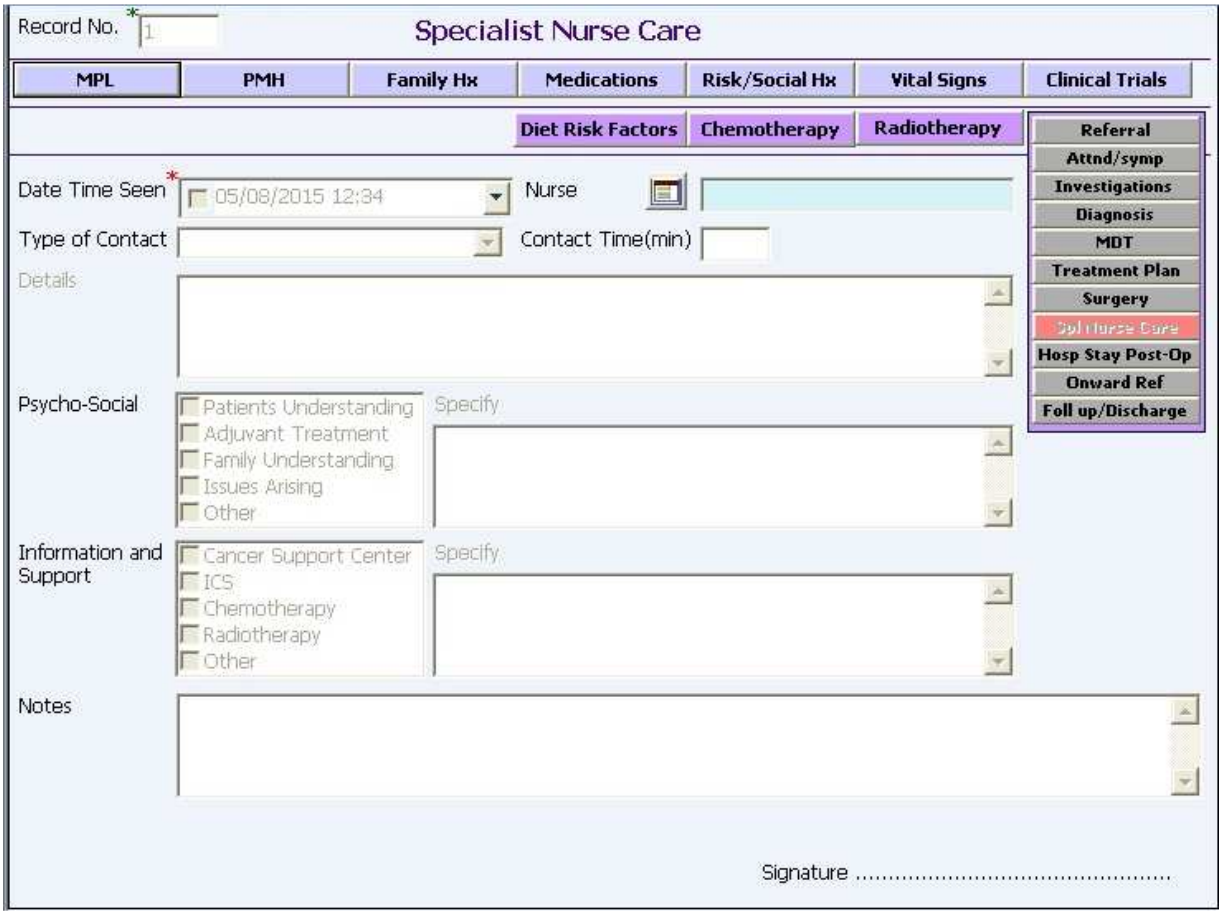
A.10: Surgery Details (2)



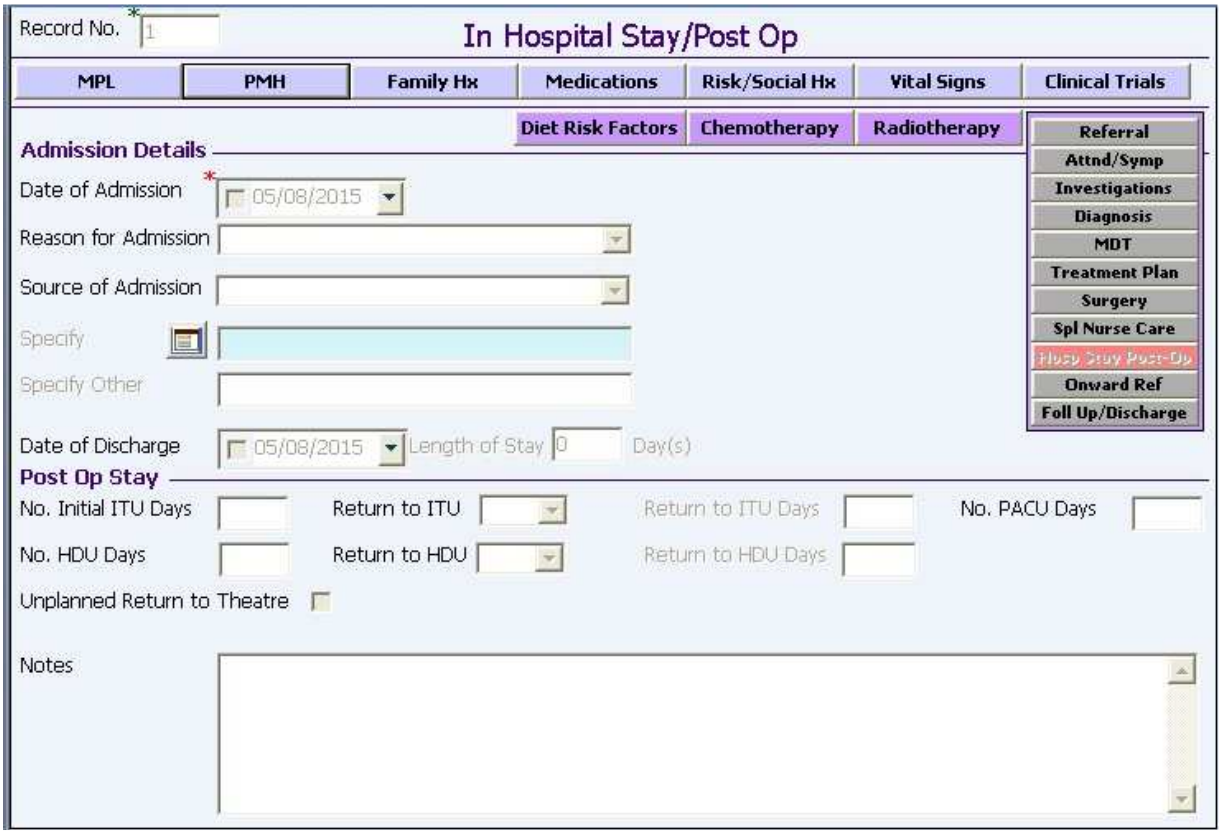
A.11: Pathology Details



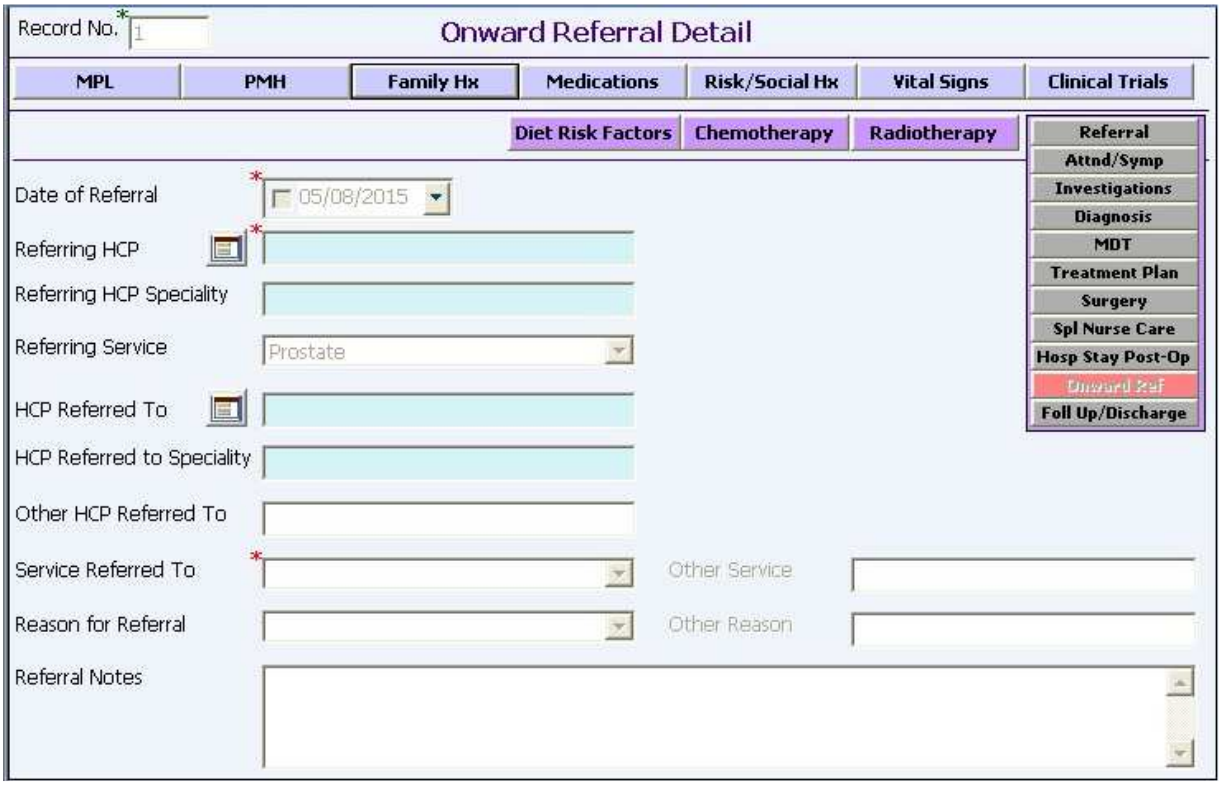
A.12: Specialist Nurse Care



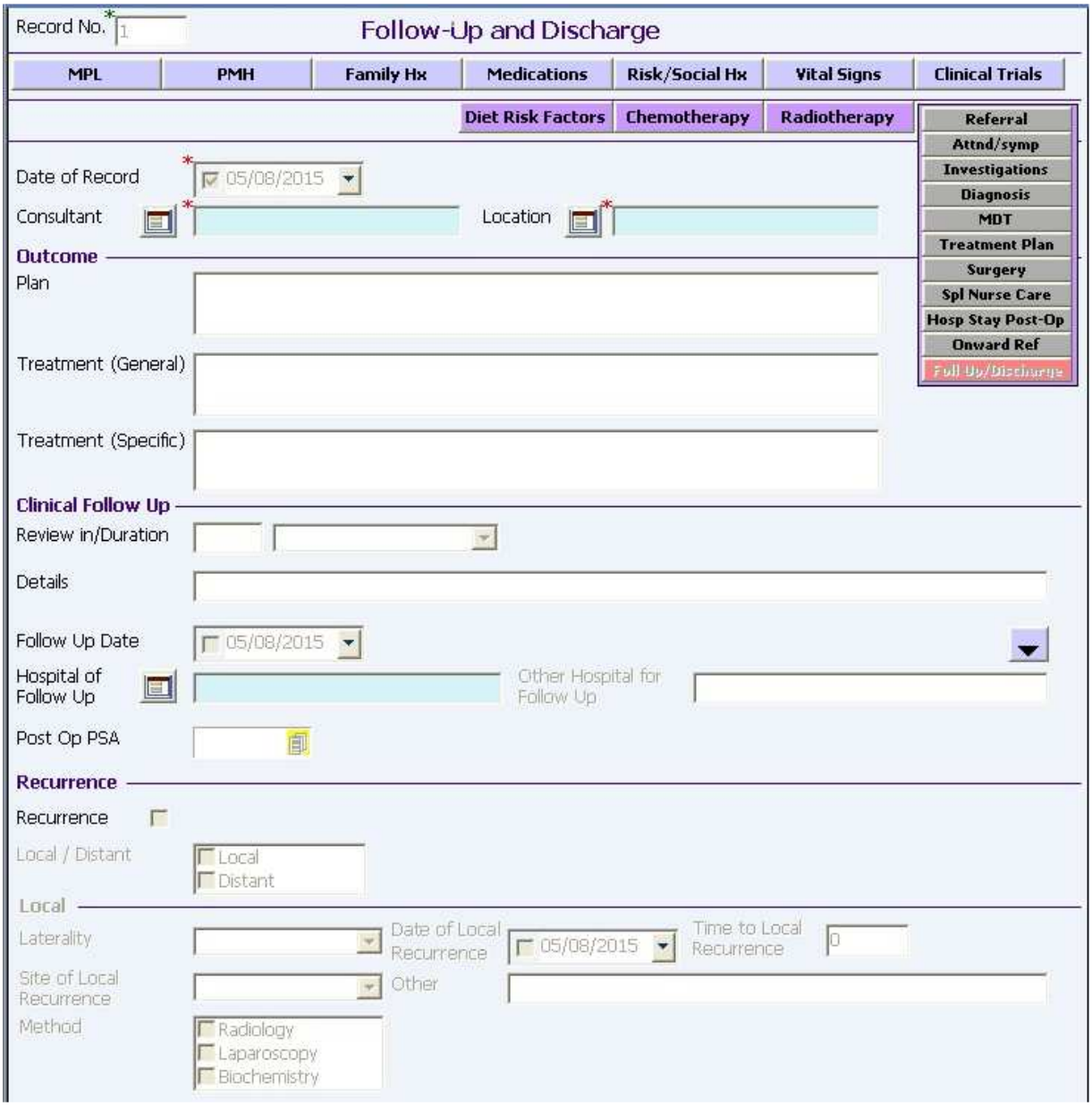
A.13: In-Hospital Stay



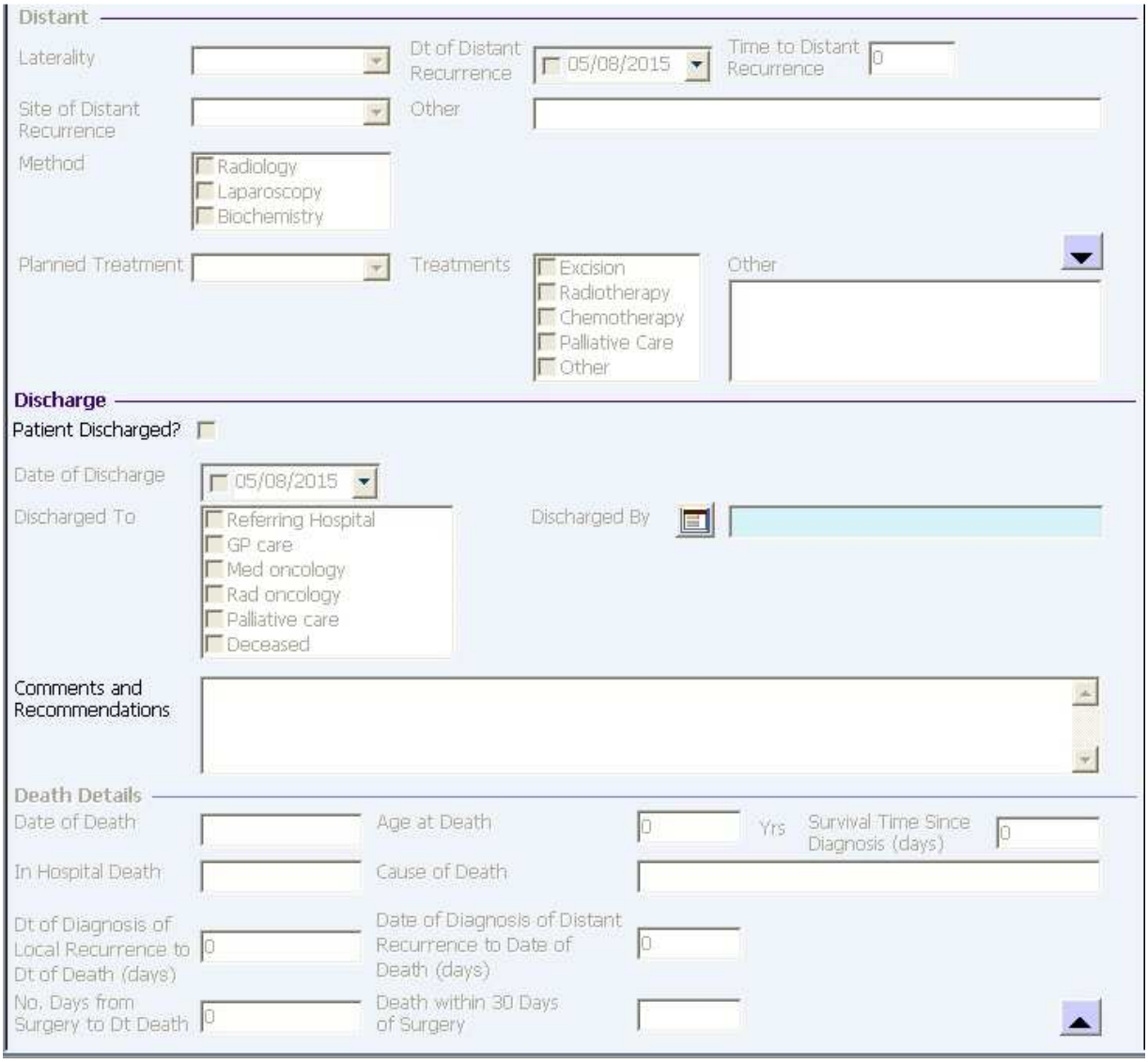
A.14: Onward Referral Details



A.15: Follow-Up and Discharge (1)



A.15: Follow-Up and Discharge (2)



Appendix B: Questionnaire

Use and Perception of the Prostate Cancer Patient Database

Hello:

Thank you for participating in this survey. In this questionnaire, we would like to know about your use of and perception of the Prostate Cancer Patient Database (PCPD) which is built in Excelicare system.

Your participation in this study is completely voluntary. There are no foreseeable risks associated with this project. Each question is optional. However, if you feel uncomfortable answering any questions, you can withdraw from the survey at any point.

Your survey responses will be strictly confidential and data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential. If you have questions at any time about the survey or the procedures, you may contact Jeason Kanagaraj by email at kanagarj@tcd.ie or phone 0877572243.

Thank you very much for your time and support. Please start with the survey now by clicking on the Continue button below.

I. About your position

Please mark 'X' to indicate your response. In case you have responded 'No' to the 3rd question, please DONOT proceed with the survey. For the remaining questions, please circle the number below that indicates how much you agree or disagree with each statement. Circle one number for each statement.

Job Title

◯ Surgeon	◯ SPR	◯ Reg	◯ SHO
◯ Intern	◯ CNM	◯ CNS	◯ Staff Nurse
◯ Admin	◯ DM		

1. Have you been working for more than 3 months in the Prostate Cancer Unit?

◯ Yes ◯ No

2. Are you dependent on PCPD system in order to perform your job?

◯ Yes ◯ No

3. If answered 'Yes' for Q. 2, how often do you use the PCPD system?

◯ Rarely ◯ Sometimes ◯ Often ◯ Always

4. If answered 'No' for Q. 2, have you used the PCPD system?

◯ Yes ◯ No

5. What is the purpose of use?

☐ To input information ☐ To view information

Use and Perception of the Prostate Cancer Patient Database

II. System Quality

System Quality	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
6. Log in to the system is quick and easy	◯	◯	◯	◯	◯
7. The system is available on all required workstations	◯	◯	◯	◯	◯
8. The system was easy to learn	◯	◯	◯	◯	◯
9. Data Input is easy and fast	◯	◯	◯	◯	◯
10. The system has efficient features	◯	◯	◯	◯	◯
11. Updating or adding a new field is easy	◯	◯	◯	◯	◯
12. The system is reliable for patient care	◯	◯	◯	◯	◯
13. Data Retrieval is quick	◯	◯	◯	◯	◯

14. Comments

III. Information Quality

Information Quality	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
15. The information in the system is accurate	◯	◯	◯	◯	◯
16. The information in the system is up to date	◯	◯	◯	◯	◯
17. The system is live and accessible at all times	◯	◯	◯	◯	◯
18. The system provides sufficient information	◯	◯	◯	◯	◯
19. Data in the system is consistent	◯	◯	◯	◯	◯
20. The system provides me with information that I need to do my job	◯	◯	◯	◯	◯
21. The information is provided in a clear way	◯	◯	◯	◯	◯
22. Form Manoeuvring is easy and smooth	◯	◯	◯	◯	◯
23. Information sharing is easy	◯	◯	◯	◯	◯

24. Comments

Use and Perception of the Prostate Cancer Patient Database

IV. Service Quality

Service Quality

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
25. The ICT support team has adequate knowledge	◯	◯	◯	◯	◯
26. The ICT support team understand my needs	◯	◯	◯	◯	◯
27. The ICT support team are optimistic, calm and confident	◯	◯	◯	◯	◯
28. I have obtained sufficient training to use the system	◯	◯	◯	◯	◯
29. The ICT support team completes the tasks within the agreed time	◯	◯	◯	◯	◯
30. The ICT support team answers calls promptly	◯	◯	◯	◯	◯

31. Comments

V. User Satisfaction

User Satisfaction

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
32. Better system in comparison to the Paper-based records	◯	◯	◯	◯	◯
33. The system successfully produces intended result	◯	◯	◯	◯	◯
34. Comfortable to use the system	◯	◯	◯	◯	◯
35. I am happy that this system was introduced	◯	◯	◯	◯	◯

36. Comments

Use and Perception of the Prostate Cancer Patient Database

VI. Net Benefits

Net Benefits

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
37. The PCPD system plays a vital role in the decision making process at the MDTs	◯	◯	◯	◯	◯
38. The system has provided a good learning process	◯	◯	◯	◯	◯
39. Reporting KPIs and other metrics are accurate and quick through the system	◯	◯	◯	◯	◯
40. I perform my job efficiently due to the PCPD system	◯	◯	◯	◯	◯
41. The PCPD system has improved patient care	◯	◯	◯	◯	◯

42. Comments

IV. Suggestions to Improve

43. Please give your suggestions on how to improve the system

Appendix C: Ethics Approval

From: "Sinead Gorham" <gorhams@scss.tcd.ie>
Date: 31 July 2015 09:08:49 IST
To: "'Jeasonraj Kanagaraj'" <kanagarj@tcd.ie>
Cc: <research-ethics@scss.tcd.ie>
Subject: Ethics Approval – Application

Dear Jeason

The Research Ethics Committee have reviewed and approved your application. You may proceed with this study.
We wish you success in your research.

Kind Regards,

Sinéad Gorham
Executive Officer
Research Unit, School of Computer Science and Statistics
Trinity College Dublin, the University of Dublin
Dublin 2, Ireland
Ext.2628
www.tcd.ie

Trinity College Dublin, the University of Dublin is ranked 1st in Ireland and in the top 100 world universities by the QS World University Rankings.