

UNIVERSITY OF KWAZULU-NATAL

THE USER-FRIENDLINESS OF A
HOSPITAL INFORMATION SYSTEM USING TELEMEDICINE IN
A TRADITIONAL PERSONNEL CULTURE AT TERTIARY
INKOSI ALBERT LUTHULI CENTRAL HOSPITAL OF
KWAZULU-NATAL IN SOUTH AFRICA

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THE USER-FRIENDLINESS OF A HOSPITAL INFORMATION SYSTEM
USING TELEMEDICINE IN A TRADITIONAL PERSONNEL CULTURE AT
TERTIARY INKOSI ALBERT LUTHULI CENTRAL HOSPITAL OF
KWAZULU-NATAL IN SOUTH AFRICA

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SUBMITTED: 31 October 2012

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Vuminkosi Lionel Longsdale Magaqa
31 October 2012

As the candidate's Supervisor I have approved this thesis for submission.

.....

Professor Christine Stilwell
31 October 2012

ABSTRACT

The research study assessed the user-friendliness of a hospital information system within a telemedicine context at Tertiary Inkosi Albert Luthuli Central Hospital (IALCH) in order to achieve the broad objective of developing a model for managing the implementation of these systems in the province. The current situation with the Hospital Information System implemented in IALCH is that doctors and nurses have difficulties in accessing the X-Ray images; ordering drugs, making patient notes, and accessing patient records at follow up sessions at a later date in the format they want. There are also problems with patient and staff confidentiality for some types of records. These problems raise the following questions: Have doctors adapted to change from traditional to computerised Hospital Information Systems implemented in IALCH? Have nurses adapted to this change and how user-friendly is the Hospital Information System at IALCH?

The effectiveness and efficiency of the MEDICOM hospital information system and telemedicine system at IALCH for these groups in relation to their participation in the hospital information system and telemedicine system related activities was investigated using Geyser's (1992) framework for a user-friendly information system and frameworks from Coiera, Westbrook and Wyatt (2006), Rigby (2006), and IMIA (2006). The population of the study were seven hundred and eighty six (786) doctors and one thousand eight hundred and sixteen (1816) nurses working at Inkosi Albert Luthuli Central Hospital. Pertinent questions regarding the user-friendliness of the MEDICOM hospital information system and telemedicine system were addressed and answered. Based on surveys by questionnaire survey, focus group interviews and observation the factors that affect the user-friendliness of MEDICOM hospital information system and telemedicine system were identified. The survey data was evaluated and analysed manually.

The study revealed that the nursing, pharmacy and billing modules of MEDICOM hospital information system were not user-friendly, but the system was reliable and always in operation when needed. The users could manipulate the logical operators of the system effectively, generally could control the system and handle errors. They were happy with the output of the hospital information system in terms of layout. However, the system provided technical support only and users wanted more training on the system.

In summary, the study concludes that the Department of Health in KwaZulu-Natal should not roll-out the MEDICOM hospital information system to all hospitals in the province as yet. Since there is no single hospital information system or health information system in South Africa, it is therefore time to develop an eHealth Strategy for South Africa to enable a patient-centric focus to health care delivery across a networked model of care. Therefore, a single integrated and comprehensive hospital information system could be implemented in South Africa provided the issues raised for attention in the study are addressed.

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DEDICATION

**IN THE NAME OF THE LORD
JESUS CHRIST**

This work is dedicated to my wife
Nontuthuzelo Dukada-Magaqa

Children

Libenathi Magaqa

Lifezekile Magaqa

Lonwabo Magaqa

Philisa and Yolisa Magaqa (twins)

And my late parents

Vukaphi and Nomalanga Magaqa

GOD BLESS

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LIST OF ABBREVIATIONS AND ACRONYMS

ADT	Administration, Discharge and Transfer
ATM	Asynchronous Transfer Mode
CAT	Computerised Axial Tomography
CDSS	Computer-based Decision Support Systems
CEO	Chief Executive Officer
CIS	Clinical Information Systems
CME	Continuing Medical Education
CPIS	Computerised Patient Information Systems
CT	Computer Tomography
CU	University of Colorado
DICOM	Digital Imaging and Communications in Medicine
Diss.	Dissertation
DOH	Department of Health
ECG	Electrocardiography
EEG	Electroencephalogram
EHR	Electronic Health Record
EMR	Electronic Medical Record
EMRS	Emergency Medical Rescue Services
ENT	Ear, Nose and Throat
ERP	Enterprise Resource Planning
FAQ	Frequently Asked Questions
GI	Gastro Intestinal
GP	General Practitioner
GSM	Global System for Mobile Communications
HIMSS	Healthcare Information and Management Systems Society
HIS	Hospital Information System
IALCH	Inkosi Albert Luthuli Central Hospital
ICD	International Coding of Diseases
ICT	Information Communication and Technology
ICU	Intensive Care Unit
ID	Identity Document

IEEE	Institute of Electrical and Electronics Engineers
IMIA	International Medical Informatics Association
IR	Information Retrieval
ISDN	Integrated Service Digital Network
ISO	International Standards Organisation
IT	Information Technology
JCT	Joint Committee Team
Kbps	Kilobytes per second
LMS	Leading Management Systems
LTD	Limited
MHz	Megahertz
MLA	Modern Language Association
MR	Magnetic Resonance
MRI	Magnetic Resonance Imaging
NEMA	National Electrical Manufacturers Association
NHC/MIS	National Health Care Management Information System
NM	Nuclear Medicine
PACS	Picture Archiving and Communication Systems
PALS	Patient Administration and Labelling System
PAMS	Professions Allied to Medicine Service
PC	Personal Computer
Ph.D.	Doctor of Philosophy
PIN	Personal Identification Number
POE	Physician Order Entry
PPP	Public Private Partnership
PTY	Property
QUE	Question for Usability Evaluation
R&D	Research and Development
RCT	Randomised Controlled Trials
RIS	Radiology Information System
SA	South Africa
SADEC	Southern African Developing Countries
SMT	Senior Management Team

SPSS	Statistical Package for the Social Sciences
TAM	Technology Acceptance Model
TAMU	Texas A&M University
TB	Tuberculosis
URL	Uniform Resource Locator
USA	United States of America
WHO	World Health Organisation

CHAPTER ONE: SETTING THE SCENE

1.1. INTRODUCTION

Computers in hospitals perform a wide range of activities, such as processing and storing the data necessary to support daily operations, facilitating clinical and financial decision making, and satisfying internal and external documentation requirements. These computer systems are variously referred to as hospital, health and medical information systems. The term hospital information system (HIS) encompasses both patient care and patient management systems, which support healthcare delivery, and the financial and resource management systems, which support the business and strategic operations of the hospital. The core HIS applications perform basic hospital information functions, including patient registration and administration, discharge, and transfer (ADT). Other components of a HIS perform a variety of clinical and operational tasks and these include the pharmacy system, laboratory system, and radiology information system (Ralston, *et al.* 2000:788).

A hospital information system is a comprehensive information system dealing with all aspects of information processing in a hospital. This encompasses human (and paper-based) information processing as well as data processing machines. It is an integrated, computer-assisted system designed to store, manipulate and retrieve information concerned with the administrative and clinical aspects of providing services within the hospital (Centc251 2006).

Telemedicine is the remote communication of information to facilitate clinical care. The exchange of information can be accomplished using voice, image, or data. Telemedicine enables the use of telecommunications technology for medical diagnosis and patient care when the provider and client are separated by distance. Telemedicine includes pathology, radiology, and patient consultation from a distance (Texas A&M University 2006). The mission of the South African Telemedicine System is to facilitate the provision of high quality and cost effective health care to all the citizens of South Africa (South Africa 2002:14).

The role of a hospital information system in telemedicine is dependent on using the power of the computerised database to use the epidemiological and statistical information in the database to improve decision making and ultimately patient care. The computer is also a powerful tool to facilitate the standardising and monitoring of patient care. When applied in continuous quality

improvement methodology a computer can enhance the improvement process well beyond what can be done by hand. It follows that coupling a hospital information system with telemedicine allows sophisticated hospital information systems to be applied in remote areas (Clemmer 1995).

The study investigates the user-friendliness of a computerised hospital information system with an implemented telemedicine system in the Inkosi Albert Luthuli Central Hospital. These computerised information systems in IALCH are in contrast to the traditional systems used in King Edward VIII, Wentworth and Addington Hospitals.

This chapter outlines the rationale of the study, presents the background of the study and defines the research problem. The purpose, together with the objectives of the study, follows the definition of the study problem. The chapter also presents the research questions to be answered by the study, followed by the significance of the study. The operational definitions of terms and the conceptual framework of the study are addressed. The methodology to be used and assumptions of the study are presented. Finally, the chapter presents the anticipated organisation of the study and the study plan.

1.2. BACKGROUND TO STATEMENT OF THE PROBLEM

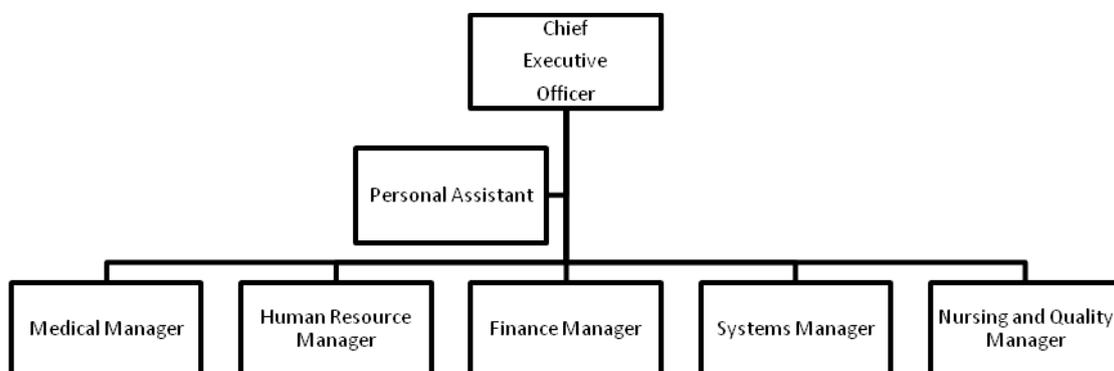
King Edward VIII hospital has been a central hospital for KwaZulu-Natal, and an academic hospital for the Nelson Rolihlahla Mandela School of Medicine. Between 1989 and 1990 after the hospital information system became obsolete, the Informatics Section of the Department of Health developed a Patient, Administration and Labelling System (PALS) that was first implemented in King Edward VIII Hospital. The expansion of this hospital has been impossible due to a lack of space where the hospital is located. Prior to 1994 KwaZulu-Natal was the only region out of four (Transvaal, Cape, Orange Free State and KwaZulu-Natal) without a modern central hospital. Therefore, a decision was taken by the previous Government to identify and buy a site for the development of a new central hospital.

The new democratic government stalled the process and then decided to proceed with the original plan of building a new central hospital for the KwaZulu-Natal province. Thus, the Inkosi Albert Luthuli Central Hospital admitted the first patient on the 28th July 2002 and it was officially opened in the same year as a highly technological hospital in terms of medical equipment, information systems and information technology as well as service delivery. The decision to implement a fully

computerised hospital information system in IALCH was taken by the Provincial Department of Health and supported by the National Department after Ronald Green-Thompson (the Head of the Health Department in KwaZulu-Natal) and his delegation visited Seleyang Paperless Hospital in Malaysia. They were very impressed with what they saw in Selayang Hospital in that the hospital being totally paperless, used a MEDICOM integrated hospital information system. For example, a patient’s appointment is scheduled telephonically. On arrival, the details of the patient are recorded in the system and thereafter the patient is referred to a relevant clinic. By the time the patient gets to a clinic, a doctor already has information about the patient in the hospital information system. Thus, a patient does not have to carry her or his folder around the hospital. This hospital information system was recommended and subsequently implemented in IALCH (Van der Merwe 2002).

The vision of Inkosi Albert Luthuli Central Hospital is to provide world-class tertiary and central hospital services. Its mission is to ensure the highest possible quality of tertiary and central services healthcare, through the provision of first class facilities and services, provided by trained and competent people working together, always putting the needs of the patients first.

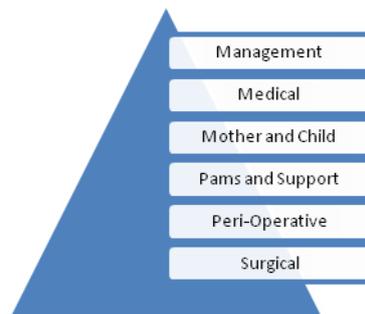
Figure 1: Organogram of IALCH Senior Management (IALCH 2006)



The hospital is managed by a Senior Management Team (see Figure 1 above) and the Impilo Consortium Management Team. The main management meetings are the Senior Management Team Meeting (SMT Meeting) and the Joint Committee Team Meeting (JCT Meeting). There are terms of reference for these meetings. In the near future, part of these meetings may be open-attendance sessions; with the scheduled dates, agendas and minutes provided on the IALCH Web Site. The hospital has a unique management structure to ensure efficiency and effectiveness in the delivery of services.

At the top, is the Senior Management Team for the general management of the hospital, housed in the Management Building. The Senior Management Team consists of the Chief Executive Officer, Medical Manager, Nursing and Quality Manager, Systems Manager, Finance Manager and Human Resource Manager. Closer to services, housed in the hospital building, is the triangular Domain Management Structure.

Figure 2: Domains in IALCH



There are six domains in this hospital (see Figure 2 above), namely, (i) *Management Domain*, (ii) *Medical Domain* (iii) *Mother and Child Domain* (iv) *Professions Allied to Medicine Service (Pams) and Support Domain*, (v) *Peri-Operative Domain*, and (vi) *Surgical Domain*. These domains are each headed by the Domain Manager assisted by the Business Manager and the Nurse Manager. Management domain consists of the Chief Executive Officer; Finance Management; Human Resource Management; Medical Management; Nursing Management and Systems Management. The Medical domain comprises of Cardiology; Dermatology; Gastro Intestinal (GI) Liver and Nutrition; Haematology; Heamodialysis; Medical Emergencies; Metabolic and Endocrine; Oncology; Plasmaphoresis; Renal and Respiratory. The Mother and Child domain includes Obstetrics and Gynaecology; Neonates; Human Reproduction; Paediatric Surgery; Paediatric Medial GI Liver and Nutrition; Paediatrics Infectious Diseases; Paediatrics; Oncology and Haematology; Respiratory and Urology. The Pams and Support Domain comprises of Physiotherapy; Speech and Audiology; Occupational Therapy; Imaging; Pharmacy; Dietetics; Social Work and Clinical Psychology. The Peri-Operative Domain comprises of Operating Theatres; Intensive Care Unit and High Care Unit. The Surgical Domain has nineteen (19) Operating Theatres, supported by seventy-five (75) Intensive Care and ninety-six (96) High Care beds. It provides the following services: Urology; Neurology; Neurosurgery; Plastic and Reconstructive or Cranio Facial; Ear, Nose and Throat (ENT); Maxillo Facial; Cardiothoracic and Oesophageal; Cranio-Facial; Ophthalmology; General Surgery; Advanced Orthopaedic; Burns; Transplant; Vascular Gastro Interology Liver and Total Parental Nutrition.

Inkosi Albert Luthuli Central Hospital provides a tertiary or quaternary service to patients and ensures that the patients arriving at IALCH are attended to. All patients are accepted via an electronic appointment and booking system. The hospital recognises the need to render treatment to patients in an emergency situation, and even if they are not in possession of a referral note, the patient is referred to the Medical Emergency Department where treatment will be rendered. If the patient's condition warrants an admission, the patient will be admitted to IALCH and if the patient's condition warrants stabilisation the patient will receive treatment and then be referred back to a step down hospital.

The hospital provides the following services: Adult intensive care; Anaesthesia; Assisted conception unit; Cardiothoracic surgery; Dietetics; Forensic pathology; Gastro Intestinal; General surgery; Haematology; High care unit; Laboratory; Maxillofacial and Oral Surgery; Medical Physics; Neurology; Nuclear Medicine; Obstetrics; Oncology and Radiotherapy; Orthopaedic Surgery; Paediatric Intensive Care; Paediatric Medicine; Professions Allied to Medical Services; Paediatric Surgery; Parenteral Nutrition; Pathology; Pharmacy; Plastic Surgery; Radiology; Renal; Rheumatology; Stoma Therapy; Theatres and Urology. In addition there is a helistop and residential village. Inkosi Albert Luthuli Central Hospital is striving to be paperless and is the first hospital on the continent of Africa to adopt this concept. Some of the medical specialists and nursing staff in this new hospital were drawn in phases from the traditional King Edward VIII and Wentworth hospitals. The staff who were transferred to IALCH were first acquainted with the state-of-the-art equipment through intensive training until they were able to use it efficiently.

The working environment in King Edward VIII is totally different from that of IALCH. The former has no computerised patient-based hospital information system (HIS) whilst the latter has a system known as MEDICOM. In IALCH, the radiology information system (RIS) is interfaced into the HIS using Picture Archiving and Communication Systems (PACS) for storing and forwarding images to any computer in the hospital, that is, any authorised user may have access to patient radiological images in her or his computer instantly. The system allows users to diagnose or examine images, write and send medical reports electronically.

Scientific studies of provider (both consulting and referring) performance are needed to determine which technologies are useful and workable and how existing ones can be improved. The more mature clinical telemedicine applications have brought to the forefront another area of research that is crucially important, namely the evaluation of how the clinician interacts with the digital display and the impact of this new modality on diagnostic performance. The most critical components of a hospital information system are the end users – the health care providers and the patients (Krupinski, Nypaver, Poropatich, Ellis, Safwat and Sapci 2006). It is the people and not the technology alone that determines the operational success of the system (South Africa 2002:25). Therefore, a primary factor in providing high-quality medical care is the expertise of the care provider. This is particularly true in telemedicine, where the diagnostic skill of the reviewing clinician is of paramount importance. A factor is the quality of training available and expert telemedicine skills do not come cheap (Medenis 1997).

1.2.1. Terms and concepts

The key terms and concepts are explained in this section to provide the context in which they are used as well as ensuring that they are appropriately used for the design and actual collection of data. Choosing a nomenclature and fixing definitions will provide the author and future investigators with means of assessment while at the same time allowing them to operate with the same meanings of terms. Firestone (1987) argued that, defining terms also adds precision to a scientific study. In fact, the power of words like symbols comes from ‘the combination of meaning in a specific setting . . . Scientific language ostensibly strips this multiplicity of meaning from words in the interest of precision (Firestone 1987:17).

1.2.1.1. Acquisition Site

An acquisition site is one which acquires a service from another site. For example, a district or regional hospital acquires a service (radiology consultation) from a tertiary institution which provides that particular service. An acquisition site is the primary (send) site that has a sending station, and digitiser (South Africa 2000:14).

1.2.1.2. Analog

An analog is the representation of a continuous physical variable by another physical variable. It is the representation of an object that resembles the original. An analog computer is a computer in which continuous physical variables represent data (Freedman 2001:23; A Glossary of Computing Terms 2002:125).

1.2.1.3. Bandwidth

Bandwidth is an analog term which provides a measure of a circuit's information capacity. It is a measure of the information carrying capacity of a communications channel; a practical limit to the size, cost, and capability of a telemedicine service. High bandwidth allows fast transmission and high-volume transmission (de Figueiredo *et al.* 1999:7; Freedman 2001:63). Transmission is the transfer of electrical power from one location to another via conductors; the dispatching, for reception elsewhere, of a signal, message, or other form of information; the propagation of a signal, message, or other form of information by any means, such as by telegraph, telephone, radio, television, or facsimile via any medium, such as wire, coaxial cable, microwave, optical fiber, or radio frequency (Answers.com 2006).

1.2.1.4. Computerism

Computerism is defined as 'blind faith in the inherent good of computers' (Clark 2000.). Computerism is the view that humans are a variant of the kinds of computers we have on our desks. Computerism can be defined as:

'You are a computer. Your mother was a computer. And computers, as we all know, are just rigid, rule-following logic machines we use as tools, exactly like the thing on your desk.' (Dietrich 2000).

1.2.1.5. Computerised Tomography or Computerised Axial Tomography scan

Computerised Tomography (CT) or Computerised Axial Tomography (CAT) scan is a computerised X-Ray that differs from an ordinary X-Ray. Instead of having just one X-Ray beam, several beams are used simultaneously from a number of different angles. These pass through the body, and are then detected and their strength measured. Beams that have passed through dense organs such as bone are weaker, those that have passed through less dense tissue, stronger. This

information is used to work out the relative density of the tissues examined and build up a three-dimensional picture of the inside of the body (Walton, Barondess and Lock 1994:161, 837).

1.2.1.6. Conventional Radiology

Conventional radiology is the use of various radiology techniques, mostly non-invasive, to diagnose an array of medical conditions. Diagnostic radiology includes the use of X-Rays, CT scans, MRI scans, and ultrasound (A Glossary of Radiology 2001; Walton *et al.* 1994:837).

1.2.1.7. Customisation

Customisation means the tailoring of an existing system to meet the specific needs of clients, where this does not require the accreditation of the tailored system. A system is customised by the addition or substitution of units of competency or modules on which the system is based, in accordance with the system rules (On-line training 2006).

1.2.1.8. Digital Imaging and Communications in Medicine (DICOM)

DICOM is an application layer network protocol for the transmission of medical images, waveforms, and ancillary information. It was originally developed by the National Electrical Manufacturers Association (NEMA) and the American College of Radiology for CAT and MRI scan images. It is now controlled by the DICOM Standards Committee, and supports a wide range of medical images across the fields of radiology, cardiology, pathology and dentistry (VIDAR 1997).

1.2.1.9. Enterprise Resource Planning (ERP)

A business management system that integrates all facets of a business, including planning, manufacturing, sales, and marketing. As the ERP methodology has become more popular, software applications have emerged to help business managers implement ERP in business activities such as inventory control, order tracking, customer service, finance and human resources. Enterprise Resource Planning. An information system that integrates all manufacturing and related applications for an entire enterprise (Naudé 2006).

1.2.1.10. Full-Field Direct Digital Mammography

Full-Field Direct Digital Mammography is a radiographic visualisation of the breasts, the use of special X-Ray images, scrutinised by radiologists, to detect abnormal growths or changes in breast tissue that may signal the existence of breast cancer (Walton *et al.* 1994:479; VIDAR 1997).

1.2.1.11. Gastroscopy

Gastroscopy is an examination of the inside of the gullet, stomach and duodenum. It is performed by using a thin, flexible fibre-optic instrument that is passed through the mouth and allows the doctor to see whether there is any damage to the lining of the oesophagus (gullet) or stomach, and whether there are any ulcers in the stomach or duodenum (Medical Health Care Information 2005: Ogilvie 2005).

1.2.1.12. Guessability

The measure of the cost to the user involved in using all interface to perform a new task for the first time. The lower the cost, the higher the guessability (cost can be measured either in terms of time, error, or effort) (INTERACT 1997:94).

1.2.1.13. Gynaecology

Gynaecology is a specialty that deals mainly with reproductive disorders of non-pregnant women, but also includes problems in early pregnancy (Walton *et al.* 1994:678).

1.2.1.14. Information Highway

The information highway also known as information superhighway is a proposed high-speed communications system that was promoted by the Clinton and Gore administration for enhancing education in North America in the 21st Century. Its purpose was to help all citizens regardless of their income level. The Internet was originally cited as a model for this superhighway; however, with the explosion of the World Wide Web, the Internet became the information superhighway whether it was ready for it or not (Freedman 2001:464; A Glossary of Computing Terms 2002:50).

1.2.1.15. Integrated Health Information System

Integrated Health Information System is a computer system which extends the concept of integrated software to all end users. Integrated software is a group of programs that perform different tasks but share data. A major advantage results from different applications all updating the one common database, keeping it current (Held 1995:213).

1.2.1.16. Integrated Service Digital Network (ISDN)

According to Field (1996) ISDN is a digital telecommunications technology that allows for the integrated transmission of voice, data, and video; a protocol for high-speed digital transmission. ISDN is a system for transmitting digital data up to 64 kilobytes per second (Kbps). Data is transmitted over special lines and cannot work over normal analog phone lines (de Figueiredo *et al.* 1999:52; Freedman 2001:500).

1.2.1.17. Integrity

In information security, integrity means that data cannot be modified without authorisation. This is not the same thing as referential integrity in databases. Integrity is violated when an employee accidentally or with malicious intent deletes important data files, when a computer virus infects a computer, when an employee is able to modify his own salary in a payroll database, when an unauthorised user vandalises a web site, when someone is able to cast a very large number of votes in an online poll, and so on. There are many ways in which integrity could be violated without malicious intent. In the simplest case, a user on a system could mis-type someone's address. On a larger scale, if an automated process is not written and tested correctly, bulk updates to a database could alter data in an incorrect way, leaving the integrity of the data compromised. Information security professionals are tasked with finding ways to implement controls that prevent errors of integrity (Information Security 2009).

1.2.1.18. Intellectual Property Rights

Intellectual property rights are ownership rights relating to the intellectual content of products such as software packages. Intellectual rights, reflected in copyright laws, are intended authors and publishers of software rights against the risk of being denied due reward for their efforts, first because software distributed on floppy disk is so easy to copy physically, and second where their ideas are stolen for incorporation into competitive products (Gunton 1990:100).

1.2.1.19. Interoperability

Interoperability is the ability of hardware and software on multiple computers manufactured by different vendors to communicate with one another (Held 1995:221; Freedman 2001:487).

1.2.1.20. Learnability

The measure of the cost to the user in reaching some reasonable level of performance on a task, but excluding the special difficulties of completing the task for the first time. A highly learnable interface would be one where a task was instantly memorable once the method had been shown to the user. Conversely, interfaces which cause ‘interference’ with user expectations are likely to be un-learnable (INTERACT 1997: 94).

1.2.1.21. Magnetic Resonance Imaging (MRI) scan

Magnetic Resource Imaging is similar to a CT scan but uses magnetism instead of X-Rays to build up a detailed picture of areas of your body. Radio waves much stronger than the magnetic field of the earth are sent through the body. These disturb the atoms making up the body, causing parts of them, the nuclei, to alter position. As they settle back, they send out radio signals of their own – which are detected and used to build up an image based on their location and strength (Walton *et al.* 1994:837).

1.2.1.22. Multimedia

Multimedia is the dissemination of information in more than one form. It includes the use of text, audio, graphics, animated graphics and full-motion video. It is an integration of various computer and audiovisual devices and methods to produce visual or graphical information and present it in a variety of formats (Freedman 2001:642).

1.2.1.23. Network

A network is a series of points connected by communications channels. It is a set of nodes, points, or locations connected by means of data, voice, and video communications for the purpose of exchange (Field 1996; Held 1995:287). A network is a system that transmits any combination of voice, video and/or data between users (Freedman 2001: 665).

1.2.1.24. Nuclear Medicine

Nuclear medicine is a medical specialty that uses radioactive material diagnosis, prognosis and treatment. Nuclear medicine studies are often presented in the form of pictures, called nuclear images (Walton *et al.* 1994:654).

1.2.1.25. Obstetrics

Obstetrics is a medical specialty that deals with pregnancy and childbirth (Walton *et al.* 1994:678).

1.2.1.26. Otolaryngology

Otolaryngology is a medical specialty that deals with the care of patients with congenital lesions in ears, noses and throats, where specialised facilities and expertise have markedly reduced the risks of treatment (Walton *et al.* 1994:709).

1.2.1.27. Otoscopy

According to Pillinger (2005), Otoscopy is an examination that involves looking into the ear with an instrument called an otoscope (or auriscope). This is performed in order to examine the 'external auditory canal' - the tunnel that leads from the outer ear (pinna) to the eardrum. Inspection of the eardrum can also provide a lot of information about what is happening within the middle ear - the space within the skull where the hearing and balance mechanisms are situated. An otoscope consists of three parts: (Pillinger 2005)

- the handle, which contains the power for the light source,
- the head, which contains the light bulb and magnifying lens, and
- the cone, which is inserted into the ear canal.

1.2.1.28. Picture Archiving and Communications System (PACS)

PACS is a system that acquires, transmits, stores, retrieves, and displays digital images and related patient information from a variety of imaging sources and communicates the information over a network (Field 1996).

1.2.1.29. Radiologist

A radiologist is a doctor who specialises in creating and interpreting pictures of areas inside the body. The pictures are produced with X-Rays, sound waves, or other types of energy (St. Jude Children's Research Hospital 2006).

1.2.1.30. Real-time

Real-time is the capture, processing, and presentation of data at the time the data is originated (de Figueiredo *et al.* 1999:353; Field 1996). Real-time is an immediate response. It refers to process controlled and embedded systems (Freedman 2001:827).

1.2.1.31. Store and Forward

Store and forward is the transmission of static images or audio-video clips to a remote data storage device, from which they can be retrieved by a user, in this case a medical practitioner for review and consultation at any time, obviating the need for the simultaneous availability of the consulting parties and reducing transmission costs due to low bandwidth requirements (Field 1996).

1.2.1.32. Surgery

Surgery is a medical specialty where a doctor literally treats disease with her or his hands (Walton *et al.*, 1994:940).

1.2.1.33. Telecommunication

Telecommunication is the use of wire, radio, optical, or other electromagnetic channels to transmit or receive signals for voice, data, and video communications (Freedman 2001:965; Field 1996).

1.2.1.34. Tele-consultation

Tele-consultation is a geographic separation between two or more providers during a consultation (Field 1996).

1.2.1.35. Telemedicine/Tele-health/eHealth

These terms are often used interchangeably. According to Bashshur, Mandil and Shannon (2002:9) telemedicine is a modality for delivering health when provider and client, or provider and provider, cannot meet face-to-face because of geography, convenience, or practicality. Telemedicine is the use of audio, video, and other telecommunications and electronic information processing technologies to provide health services or assist health care personnel at distant sites (Field 1996; Gagnon *et al.* 2006 (see Section 3.5.9)).

1.2.1.36. Tertiary Institution or Hospital

A tertiary institution or hospital is a hospital which receives patients from, and provides sub-specialist support to, a number of regional hospitals. Most of the care should be level III care that requires the expertise of clinicians working as sub-specialists or in rarer specialties such as, in surgery, for example, urology, neurosurgery, plastic surgery and cardiothoracic surgery. If the tertiary hospital in the province cannot help they refer the patient to a national central hospital (Walton *et al.* 1994:955).

1.2.1.37. Transmission

Transmission is the information sent between computer systems. In medicine, transmission is the passing of a disease from an infected individual or group to a previously uninfected individual or group). In communications, transmission is the act of transmitting electrical messages (and the associated phenomena of radiant energy that pass through media) (Ask 2006).

1.2.1.38. Ultrasound

Ultrasound is a diagnostic technique which uses high-frequency sound waves to create an image of the internal organs (A Glossary of Radiology 2001; Walton *et al.* 1994:979).

1.2.1.39. Usability

The quality of a system, program or device that enables it to be easily understood and conveniently applied by the user (Smith 1997). Usability is the combination of fitness for purpose, ease of use, and ease of learning that makes a product effective. The effectiveness, efficiency and satisfaction with which specified users can achieve specified goals in particular environments (Usability Net 2009; Abran *et al.* 2003).

1.2.1.40. User-friendliness

User-friendliness means easy to use - posing no difficulty and requiring little effort (Farlex 2007). With reference to computing, the system is user-friendly when it is designed to be easy or pleasant to use, or easy to follow or understand (AllWords 2003). User-friendliness means that the interface (the user interface is where users and applications collaborate) will guide the users through different stages towards the accomplishment of the tasks. It lessens the difference between users and the systems, such that users can interact more with the tasks and less with the system. User-friendly interface will ask the user for details that are sufficient to complete the task. The requested details are under a narrow scope and constrained to be meaningful answers. The interface will always ask to confirm users' intentions before performing destructive actions (Ng 2004).

The concept 'user-friendliness' originated more than a decade ago at the Xerox Corporation's Palo Alto Research Centre (Matthews and Williams, 1984:31) where the term was coined as a result of computers being used by ordinary members of the public in homes and offices (Trenner and Buxton, 1985:279). It had become necessary to design systems which were more amenable to these users and marketing principles therefore forcing designers to pay more attention to the inexperienced user. However, the term cannot be dismissed as an advertiser's slogan (Stevens 1983:3) as practitioners, academics and commentators also started using the term freely. On the other hand the fact remains that the term is possibly frequently misused as it continuously appears in articles and advertisements 'but with little or no indication of how or why the system in question can be considered user-friendly' (Wallace 1985:337).

Much confusion still exists regarding the true meaning of the term and consensus as to the exact meaning of the concept, user-friendliness, still has to be reached. One reason for the confusion is that no clearly defined terminology in this area exists as a result of the complexity of man-machine

interaction (Mitev 1986:115). Amidst this confusion certain aspects remain important. In this regard, Wallace (1985:340), referring to information systems, remarks that ‘regardless of whether the term user-friendly has any meaning, the concept of flexibility, adaptable information systems that can be exploited by a wide variety of users with differing backgrounds and needs is of lasting importance.’ As various interpretations tend to be subjective in nature, they are not easy to be described in terms of a computerised system (Geysler 1992:80).

1.2.1.41. Videoconferencing

According to Field (1996) a videoconference is a real-time, usually two-way transmission of digitised video images between two or more locations. Videoconferencing is the process of conducting a conference between two or more people at different locations by using computer networks to transmit audio and video data. Also known as tele-conferencing in which still or moving pictures can be transmitted along with voice and text. The first videoconferencing was done with analogue television and satellites, then digital video systems, using computer networks, evolved (Freedman 2001:1028).

1.2.1.42. X-Ray

An X-Ray refers to any of the electromagnetic radiations of the same nature as visible radiation but having an extremely short wavelength of less than one hundred angstroms produced by bombarding a metallic target with fast electrons in a vacuum or by the transition of atoms to lower energy states. An X-Ray has the properties of ionising a gas upon passage through it, of penetrating various thicknesses of all solids, of producing secondary radiations by impinging on material bodies, of acting on photographic films and plates as light does, and of causing fluorescent screens to emit light (A Glossary of Radiology 2001). The purpose of an X-Ray is the identification of crystalline compound of the specimen and or image. A radiologist reads or interprets an image to pinpoint an injury, determine how serious the injury is or help detect abnormalities such as tumours.

1.3. RESEARCH PROBLEM, PURPOSE, OBJECTIVES OF THE STUDY AND RESEARCH QUESTIONS

Research has been defined as a process through which data is systematically gathered in order to answer a research question or to get a greater understanding of a phenomenon (Leedy 1997:5;

Powell 1999:92). To the extent to which the data can be successfully gathered largely depends on formulation of research questions and objectives. The following subsections are devoted to explaining the research issues that the study addressed.

1.3.1. Problem statement

According to Smith (1997:247) ‘most computer software today is unnecessarily difficult to understand, hard to learn, and complicated to use’. Smith (1997) states that ‘difficult to use software wastes the user’s time, causes worry and frustration and discourages further use of the software’. Smith (1997) asks why ‘the usability of most computer software is so poor’ and responds that ‘in spite of a recent acknowledgement that usability is an important part of software quality, it has remained a fuzzy concept’. The problem with the Hospital Information System (HIS) implemented in IALCH is that doctors have difficulties in accessing the X-Ray images; ordering drugs, making patient notes, and accessing patient records at a later date in the format they want. This raises the following questions.

- have doctors adapted to change from traditional to computerised Hospital Information Systems implemented in IALCH?
- have nurses adapted to HIS change?
- how user-friendly is the HIS at IALCH?
- has the level of training been adequate?

Geyser (1992) states that it is impossible to evaluate an information retrieval (IR) system in terms of user-friendliness unless consensus is reached regarding the meaning of this term. As humans are the most important factor as far as the environment of information systems is concerned, it could be said that systems should be geared towards accommodating the needs of their potential users. The human factor demands systems to be user-friendly. User-friendliness of an information retrieval system is determined by the following categories:

- Physical features – devices of IR systems and their facilities. For example, standardised keyboards with function keys and numeric pad, high-speed communications, large character sets and ergonomic design;
- Reliability of the system – a system which is always in operation when needed;

- Dialogue – a system should allow the user to determine and modify its activities while offering him or her more than one alternative of action;
- Feed back – the system translation of the query should be fed back to the user to enable him or her to establish whether he or she was understood correctly;
- User support – the user should be constantly guided and thus be supported by the system;
- Handling of users errors – the design of the system should eliminate errors whenever possible, tolerate minor errors and offer remedies in case of serious errors;
- User control of the system and transparency – the user should be in control of the system and the system should enable the user to form a clear mental picture (model) of its functioning; and
- Output – should be presented in more than one form and the user should be able to choose a form other than the default.

The International Standards Organisation (ISO 9241) defines usability as the effectiveness, efficiency, and satisfaction with which specified users can achieve specified goals in a particular environment (Abran *et al.* 2003). Effectiveness is the accuracy and completeness with which users achieve specified goals; efficiency is the accuracy and completeness of goals in relation to resources expended; and satisfaction is the comfort and acceptability of the system. Most users of computer systems will easily be able to differentiate between systems that are easy to use and those that are not. What they will find more difficult is being able to quantify how much easier it is to use one system than to use another (Smith 1997:250).

With the MEDICOM integrated hospital information system in IALCH data is captured in Patient Registration, Appointments Scheduling, Out-patients Management, Trauma, In-patients Management, Medical Records and Patient Billing by clerks, secretaries, doctors and nurses. Human factor issues in clinical applications are critical, and they need to be emphasised in any future research agenda. An improved and comprehensive understanding pertaining to technology-based barriers for patients and providers in clinical telemedicine is needed.

In order for an implementation of a hospital information system and telemedicine system to be successful, three aspects should be considered; the hardware, software and humanware. Hardware refers to computers, printers and file servers; software refers to applications, programs and systems installed in computers; and humanware refers to the users of software. The users are the key in the implementation of any system. They need to understand the entire system; therefore they should be trained properly on the system. Therefore, this research study will assess the human-technology interface at IALCH in an effort to reduce technology-based barriers for providers and patients.

Doctors and nurses have been transferred from the traditional culture of hospital information systems (paper) in King Edward VIII and Wentworth hospitals to a computerised and integrated hospital information system (paperless) in IALCH. The information technology (IT) of the two environments are different. The study will be conducted to determine the extent to which the MEDICOM integrated hospital information system is user-friendly, appropriate and productive in improving patient outcomes. Therefore, there is an important need to investigate the effectiveness and efficiency of telemedicine in relation to its participation in health and health care related activities.

1.3.2. Purpose and objectives of the study

The purpose of the study is to assess the user-friendliness of a hospital information system within a telemedicine context at Tertiary Inkosi Albert Luthuli Central Hospital in order to achieve the broad objective of developing a model for managing the implementation of these systems in the province.

The objectives and methods and indicators used to realise the objectives of the study are:

- 1.3.2.1. To assess the user-friendliness of MEDICOM integrated hospital information system.

Method: An electronic questionnaire will be used to ascertain users' comparison of a traditional system to an electronic and/or computerised system.

Indicator: User-friendliness qualities of MEDICOM integrated hospital information system as perceived by doctors and nurses compared to the traditional system.

1.3.2.2. To describe the physical features of the hospital information system and telemedicine system in terms of standardised keyboards with function keys and numeric pad, high-speed communications, large character sets and ergonomic design;

Method: A questionnaire and observation techniques will be used.

Indicator: Physical features that characterise MEDICOM integrated hospital information system and telemedicine system.

1.3.2.3. To describe the reliability of the hospital information system and telemedicine system, that is, are the systems always in operation when needed?

Method: A questionnaire, observation and focus groups will be used.

Indicator: The efficiency features of the hospital information system and telemedicine system as experienced by doctors and nurses.

1.3.2.4. To determine the dialogue flexibility, that is, whether the users' needs and abilities were taken into consideration when developing the hospital information system and telemedicine system;

Method: A questionnaire, observation and focus groups will be used.

Indicator: Users' requirements considered before, during and after the development of MEDICOM integrated hospital information system.

1.3.2.5. To assess time taken by the functionalities of MEDICOM integrated hospital information system and telemedicine system in improving patient service delivery in IALCH;

Method: A questionnaire, observation and focus groups will be used.

Indicator: Time taken by functions performed by MEDICOM integrated hospital information system as well as subsequent actions taken by users.

1.3.2.6. To assess the effectiveness of MEDICOM integrated hospital information system using telemedicine compared to the traditional and/or manual hospital information system in Wentworth and King Edward VIII hospitals.

Method: A questionnaire, focus group interviews and observation will be used.

Indicator: Quality features of MEDICOM integrated hospital information system in improving the health service delivery to patients.

1.3.2.7. To determine whether users have control of the hospital information system and telemedicine system. This means the system should enable the user to form a clear mental picture (model) of its functioning and not confront the user with complicated and unnecessary functions. The users should have a workable understanding of the system;

Method: A questionnaire, observation and focus groups will be used.

Indicator: Layers of information presented to the user.

: Usability of the system,

: Predictability of the behaviour of the system, and

: Consistency of vocabulary for different dialogue modes.

1.3.2.8. To ascertain the output of the hospital information system and telemedicine system in terms of layout;

Method: Questionnaire, observation and focus groups will be used.

Indicator: Number by type of outputs that users can choose in the system.

- 1.3.2.9. To ascertain the training needs relating to the use of MEDICOM hospital information system and telemedicine system;

Method: Questionnaire and focus group interviews will be used.

Indicator: Training programmes attended and/or needed by doctors on the hospital information system and telemedicine system.

- 1.3.2.10. To make recommendations regarding the implementation of the hospital information system and telemedicine system in a hospital and the rollout of the system to other institutions in KwaZulu-Natal.

Method: This will emerge from findings.

Indicator: Considerations when implementing the hospital information system and telemedicine system.

1.3.3. Research questions

- 1.3.3.1. How user-friendly is MEDICOM integrated hospital information system?

- 1.3.3.2. What are the physical features of the hospital information system and telemedicine system in terms of standardised keyboards with function keys and numeric pad, high-speed communications, large character sets and ergonomic design? (Geysler 1992:84).

- 1.3.3.3. Are the hospital information system and telemedicine system always in operation when needed, for example, auto-start, auto-logon, help and data transfer?

- 1.3.3.4. Is the dialogue of the system flexible to a user?

- Were user's needs and abilities taken into consideration when developing a hospital information system and telemedicine system?
- Does the system allow a user to determine and modify its activities while offering him or her more than one alternative of action?

- How would the user describe the commands of the system?
- Is the tone of the system's dialogue easy to understand?
- Does the flexible dialogue structure of the system allow the user to back-track, jump forward or terminate a function at any time he or she wishes?
- What can the user comment about the system's screen design?
- Can the user manipulate the logical operators of the system effectively?
- How long does the system take to feed back the translation of the query to the user?
- Does the system point out clearly certain irreversible consequences of some demands by means of feed back to prevent the user from taking incorrect actions?

1.3.3.5. Does the hospital information system and telemedicine system support the user?

- Does the system provide sufficient assistance that will also not allow the user to enter illegal commands because the user will be prompted efficiently to enter the correct data?
- Is the 'HELP' function available on-line on the system?
- Can the system interpret the user's imprecise and poorly formulated or loosely posed query?
- What motivates the user to use the system?

1.3.3.6. Is the hospital information system and telemedicine system designed to cope with errors made by the user and can it take remedial action when and where necessary?

1.3.3.7. Does the user have control of the hospital information system and telemedicine system and transparency?

- Does the user have a workable understanding of the system?

- Can the user form a clear mental picture (model) of the functioning of the system?
 - Does the system behave in a predictable manner?
- 1.3.3.8. What is the output of the hospital information system and telemedicine system in terms of layout?
- Can output be presented in more than one form?
 - Is there a standard defaulted form?
 - Can the user choose a form other than the default?
- 1.3.3.9. Was the user trained on the use of the hospital information system and telemedicine system before? What are the training needs relating to the use of the hospital information system and telemedicine system?
- 1.3.3.10. What recommendations regarding the implementation of the hospital information system and telemedicine system in a hospital can the user make? Would the rollout of the hospital information system and telemedicine system to other institutions in KwaZulu-Natal be recommended?

1.4. JUSTIFICATION FOR THE RESEARCH

Professionals working in IALCH were concerned about:

- Their involvement in the customisation of the MEDICOM integrated hospital information system,
- User-friendliness of the system, and
- Training on the system before and after its implementation.

The justification and significance of the study were concerned with three major questions identified by Creswell (1994:111) and Ngulube (2003:20):

- How would the study add to the scholarly research and literature in the field of Health Information Systems?
- How would the study improve delivery of health care service using Information Technology?
- Why would the study improve policy of implementing hospital information systems?

This study contributed to the improvement of the range of specific functions that the hospital information system and telemedicine system could provide in the Department of Health of KwaZulu-Natal in South Africa (Bashshur *et al.* 2002:11). Thus, the improved hospital information system and telemedicine system model which emerged from the study could be used by the Department of Health as a new modality of medical care and health care delivery to make major contributions to the universal health care goals and objectives. This study consolidated the knowledge gained to date; framed the issues addressed and the methodologies used; and finally charted the future direction for policy development in this area both provincially and nationally.

1.5. METHODOLOGY

Researchers are faced with many possibilities of designs drawn from the disciplinary fields of anthropology, psychology, social psychology, sociology and education. Tesch (1990), for example, advanced a typology of twenty types organised into those that explored the characteristics of language, discovered regularities, sought a comprehension of the meaning of text or action, and advanced reflection. Smith (1987 in Creswell 1994) categorised qualitative approaches into interpretive, artistic, systematic, and theory-driven approaches. From a broader social science perspective, Jacob (1987 in Creswell 1994) compared and described the ‘traditions’ of qualitative research as ecological psychology, holistic ethnography, cognitive anthropology, ethnography of communication, and symbolic interactionism (Creswell 1994:147).

After defining the research problem, that of establishing the user-friendliness of a hospital information system in South Africa, the next logical step was to make a decision to carry out an empirical investigation. Research methodologies revolve around two major approaches (Creswell 1994:1; Leedy 1997:104; Powell 1999:96), namely quantitative and qualitative, and this study largely adopted the latter in order to explore the human interaction doctors and nurses had with a hospital information system and telemedicine system at IALCH, and therefore achieve the objectives of the research study as mentioned earlier.

The study population consisted of seven hundred and eighty six doctors and one thousand eight hundred and sixteen nurses in IALCH. The multistage cluster sampling method was used to select the doctors and nurses in various departments of the domains with the exception of the Management domain which did not have doctors and nurses using the system for clinical care delivery. The researcher stratified the five domains to ensure proper proportions from each domain, and a systematic sampling was used to select one hundred and fifty seven doctors and three hundred and sixty three nurses from the departments in each domain with the exception of the Management domain which did not have doctors and nurses using the system.

The nature and content of communication in IALCH consisted of both technical and interpersonal aspects. While the technical aspects were concerned with the communication technologies used and the clinical processes enabled by those technologies, the interpersonal aspects were concerned with relationships between system personnel, providers, and the way in which those relationships were organised. A combined positivist and interpretivist evaluation strategy would enable the researcher to make better informed connections between the MEDICOM integrated hospital information system and telemedicine, medical encounter behaviour and health outcomes (Miller 2003).

Firstly, the researcher sent questionnaires to all doctors and nurses in IALCH in order to gather some views about user-friendliness of MEDICOM integrated hospital information system. The researcher used this information to construct the questionnaire he used to collect data. Secondly, the researcher used focus group interviews for doctors and nurses, and thirdly observation techniques (triangulation¹) to carry out a prospective analysis to determine the user-friendliness of the hospital information system and telemedicine (Jithoo *et al.* 2003). The researcher observed the doctors and the nurses as they used the system. Subsequently to that some questions were asked relating to their involvement in the customisation of the system, the user-friendliness of the system, the training needs relating to the use of the system, and recommendations regarding the

¹ This is a multi-method approach where three or more methods are used in combination principally as a check of validity and results compared for convergence (Mays and Pope 1995:44). For example, if you were interested in people's attitudes toward environmental issues, you could look at patterns of voting behaviours for environmental candidates and issues; or you could interview leaders of the Sierra Club, the Nature Conservancy, and similar groups; or you could conduct a survey of a representative sample of the entire population. Or you could do all three and put the results together, in which case you could say that you had used a research strategy of triangulation.

Available at

<http://www.etr.org/recapp/research/researchglossary.html> (Accessed 29 December 2006).

implementation and the rollout of the hospital information system and telemedicine system to other institutions in KwaZulu-Natal (Whitten and Rowe-Adjibogoun 2003).

While interviewing, the researcher kept records so that the report he wrote would be based on accurate renditions of what was said.

The data collection instruments were pre-tested on doctors and nurses in Addington hospital, which also had a computerised hospital information system called Meditech, to determine the accuracy and understandability of items. The instrument pre-testing was important to make necessary improvements by removing ambiguities in the tools before going to the real survey. It was further noted that if the researcher did not pre-test research tools and the instruments were proved to be unproductive in the real study it would be a waste of time for everyone involved in the study (Bright 1991).

According to Tesch (1990 cited in Creswell 1994:153-7) the process of data analysis was eclectic; there was no 'right way'. Data analysis required that the researcher be comfortable with developing categories and making comparisons and contrasts. It also required that the researcher be open to possibilities and see contrary or alternative explanations for the findings. The data was analysed manually using first content analysis and then a coding system, that is, grouping interviewees' responses into categories that bring together similar ideas, concepts, or themes. Following a manual analysis, the data was input into the computer and further analysed. Finally, the findings of the study were used to develop recommendations, refine and improve the IALCH model.

1.6. DELIMITATIONS OF SCOPE AND KEY ASSUMPTIONS

The study was confined to the user-friendliness of the MEDICOM integrated hospital information system in Inkosi Albert Luthuli Central Hospital. It was limited to doctors and nurses. It did not cover staff members in the administrative and technical offices. Inkosi Albert Luthuli Central hospital was chosen because it was the only paperless hospital in the country as far as integrated hospital information systems were concerned. As with all surveys, the generalisability or external validity of these findings beyond South Africa depended on the logic of replication (Campbell and Stanley 1963:30; Kaplan 1964:23). That is, to the extent that additional future studies replicated these findings in other environments, one could have confidence that the results were generalisable. It was important to emphasise that the survey data would form an important baseline

for shaping and formulating further study on the design of a hospital information system for other hospitals. The assumption was that trained and skilled staff was assumed to be key to the effective use of hospital information systems.

1.6.1. Scope and limitations of the study

The study covered the user-friendliness of the hospital information system and telemedicine system at Tertiary Inkosi Albert Luthuli Central Hospital in order to achieve the broad objective of developing a model for managing the implementation of the hospital information system and telemedicine system. The anticipated problem was that since the hospital information systems and telemedicine were new and complex concepts, research studies conducted in this field were very limited in number.

1.6.2. Assumptions of the study

The basic assumption and logic underlying the potential contribution of a computerised hospital information system and telemedicine in Inkosi Albert Luthuli Central Hospital were: accessibility enhancement, cost containment and quality improvement. In theory, access to specialist treatment would be available regardless of the relative location of the patient. Technological advances in testing, diagnosis, and treatment produced significant improvements in health, not however without increased costs. The ready availability of extensive information about electronic forms of information and reliance on efficient information technology might enhance efficiency and coordination of care. A hospital information system and telemedicine could serve as a highly effective tool for clinical decision support for all providers (Bashshur *et al.* 2002:6-7).

The lack of information technology policies was one of the major obstacles to the effective planning of health services in South Africa. The system model that was developed by this study was expected to contribute to the development of information technology policies and legislation regarding the implementation of a hospital information system and telemedicine in South Africa. Thus, this study could inform projects for future developments and help the Department of Health to rollout an integrated hospital information system to other hospitals in KwaZulu-Natal province in South Africa and Southern African Developing Countries (SADEC).

1.7. ETHICAL CONSIDERATIONS

A sound thesis is a product of ethically obtained and scientifically valid data (DeBakey and DeBakey 1975:539). The variables that form the basis of ethics are honesty, integrity, courtesy, and consideration. According to Sapsford (1999:14), all the variables that constituted ethical research are dependent on the researcher. No preconceptions or prior values shape the results and the research strives to be objective. The study complied with the research ethics code of the University of KwaZulu-Natal (see Appendix 1a) and ethical clearance was granted by Inkosi Albert Luthuli Central Hospital on the 31st March 2004 (see Appendix 1b). Further ethical aspects of the study will be discussed in Chapter Four.

1.8. OUTLINE OF THE THESIS

The organisation of the thesis is based on guidelines and suggestions from the literature (Mauch and Birch 1993:228; Miller and Taylor 1987:70; Mouton 2001:122-125; Perry 2000). Chapter One sets the stage by giving a general background, the statement of the problem and objectives of the study. It also includes the justification for the study and relevance to the field, background literature used to build the argument, methodology and limitations.

Chapter Two deals with background to the customisation of a Hospital Information System whereas Chapter Three is concerned with the theoretical framework and literature related to the area of study, that is the user-friendliness of a hospital information system using telemedicine. Building on the experiences of others these chapters reveal what has previously been done on the topic and what is proposed in this study. Chapter Four looks at the procedures and methods used to carry out the study. The aim was to enable another researcher to replicate the study. It typically includes sections on the research methodology, the population and how it was obtained, instrumentation used, step-by-step procedures in gathering and processing data, and statistical treatment of data. The results that pertain to each research question are reported in Chapter Five. Chapter Six is concerned with the interpretation of the results in the light of the research questions. Chapter Seven is the final chapter. It discusses the conclusions, recommendations and implications of the findings for the field. Finally, the chapter speculates on future research that might be stimulated by extending this study. Appendices are at the end of the thesis and they include tables, letters to subjects, questionnaires and observation schedules, checklists and other documents or

samples that are referred to in the text, but are too distracting or voluminous to have been included within the text.

1.8.1. Referencing convention used in the thesis

The author-date system of reference style is followed as outlined in *The Chicago manual of style*, 15th ed. The bibliography (list of references) is arranged alphabetically according to author or according to a title if there is not an author. Works by the same author are arranged chronologically by date and when an author has more than one publication in the same year, a lower case alphabetical suffix is attached after each date. The format used for a website or part of a website is ‘Author. Year of publication. Title of article. Available at URL (Accessed date)’.

1.9. SUMMARY

This chapter introduces the core research problem and then ‘sets the scene’. The stage is set by discussing the background to the statement of the problem, and the research problems and issues. There follows justification of the research, a brief background to the literature review, methodology used in the study, scope and assumptions of the study, ethical issues in research, an outline of the thesis and the referencing convention used in the study.

The main concern of the chapter is to demonstrate that despite the existence of studies concerned with the user-friendliness of a hospital information system, as Cunha and Cunha (1983:3) stated, all the problems with regard to user-friendliness have not been solved, most have been identified and many of those still unsolved are being aggressively investigated. Although this observation was made in 1983, it is still applicable today. Research into various issues is indispensable because the state of human knowledge is incomplete and problems are waiting to be solved. The observation is particularly true in the health information sector and relevant to South Africa experiencing the HIV and AIDS pandemic. We address the void in our knowledge and those unresolved problems by asking relevant questions and seeking answers to them (Leedy 1997:3). Starting with the review of literature the following chapters are going to search for answers to the research questions raised in this chapter in order to expand the knowledge base in the user-friendliness of hospital information systems in general and Inkosi Albert Luthuli Central hospital in particular.

CHAPTER TWO: BACKGROUND ON THE CUSTOMISATION OF A HOSPITAL INFORMATION SYSTEM

2.1. INTRODUCTION

The aim of the hospital information system project was to implement the system successfully in Inkosi Albert Luthuli Central Hospital. The objectives were to:

- Improve patient care by:
 - Making information belonging to patients seen at other departments available at the hospital where the patient is currently being treated;
 - Improving the accessibility of patient related information to health care professionals during the treatment process, through improved medical record handling and shorter turnaround time for the release of diagnostic information such as laboratory and special investigation results; and
 - Improving patient administration procedures resulting in shorter waiting times and better service to patients;
- Form an integral part of a larger quality improvement program in the hospital through the re-engineering and standardisation of patient administration and management procedures across departments;
- Improve the management efficiency of hospitals through:
 - improving revenue collection;
 - improving management decision-making through the availability of integrated management information; and
 - implementing cost-savings measures through the identification of primary cost-drivers at hospital level and the monitoring of mechanisms introduced to lower costs.

The deployment of the Hospital Information System should be seen in the context of the National Health Information System of South Africa. The implementation of the Hospital Information System originated from the initiative of the National Health Information System of South Africa to implement a National Health Care Management Information System and conforms to the specifications originally developed for it. The information discussed below was obtained from IALCH (2006) Web Site on the 29 December 2006.

2.2. MEDICOM INTEGRATED HOSPITAL INFORMATION SYSTEM AT IALCH

MEDICOM integrated hospital information system is a web-enabled, state-of-the-art, one-stop information management solution catering to the various functionalities of healthcare establishments. The implementation partner of MEDICOM integrated hospital information system for the IALCH project is an Austrian company, AME International. Various specialists from different disciplines were consulted by Impilo Consortium in order to ascertain their requirements before the customisation of MEDICOM integrated hospital information system.

South Africa's first-ever paperless and filmless hospital went live at Inkosi Albert Luthuli Central Hospital (IALCH) in Durban with the MEDICOM integrated hospital information system. The hospital was officially inaugurated on 22 November 2002 by the then Deputy President of South Africa, Jacob Zuma. The 800-bed IALCH is under the patronage of the Department of Health, KwaZulu-Natal provincial government, and provides for both National Central Services and Tertiary Care Services.

A paperless and filmless hospital implementation involves documenting and managing all types of information, like character data, graphs, X-Ray images, MRI or CT scan images through the use of electronic media and computers. Information pertaining to a patient, be it administrative or clinical, is captured directly on the computer system at the point of origin of the data. The information was then available across the entire hospital on computers over a network facility. Any authorised user could access the patient information from anywhere in the hospital.

The MEDICOM integrated hospital information system was connected to various types of medical equipment like laboratory analysers, radiology equipment and critical care units at IALCH to create a paperless and filmless environment. This enabled results and outputs from this equipment to be automatically captured into the electronic medical record. It avoided the entry of data, thereby reducing the possibility of data error, and also enabled the technicians to focus on abnormal results and critical patients. Patient information was continuously and accurately stored in a longitudinal health record in the form of text, images, documents and so on, ensuring better quality of care through the completeness and timeliness of available data. The automated hospital information system provided for data discipline and thereby enhanced adherence to best industry practices and enhanced quality of patient care.

The benefits to a hospital that adopts a paperless and filmless environment is that a multimedia-based health record is maintained and the speed of patient information availability is enhanced; the medical record is available to users as soon as it is created. In a conventional paper-based system, such information has to be retrieved from a medical records department, which takes a much longer time. With the bulk of medical records stored electronically and much of the data capture done automatically, the precious time of the healthcare delivery provider - the clinician, nurse or technician - is saved and put to better use. MEDICOM Solutions Executive Vice-President (business development) Ashwini Kumar stated:

‘It is a matter of great honour and pride for the MEDICOM integrated hospital information system to be implemented at the prestigious IALCH. MEDICOM integrated hospital information system at IALCH has delivered the full spectrum of clinical and administrative care functions across the connected Enterprise providing for clinical and operational efficiency, decreased paperwork, reduced clinical errors and improved quality of care.’ (Kumar 2003)

The IALCH is a super-specialty tertiary care hospital and involved in post-graduate teaching. The hospital was equipped with advanced medical equipment from leading vendors in the healthcare industry. A few of the many outstanding facts about the hospital were that it is the first ever paperless and filmless hospital in Africa and the Southern Hemisphere. It has the largest referral laboratory in South Africa, spread over five floors and catering to the entire province. It is equipped to handle a workload of six thousand five hundred samples per day. The then MEDICOM Solutions Chief Operating Officer Sreedharan Govind added: ‘Software development,

quality consciousness and operational excellence is integral to our culture and with IALCH, we have set a paperless and filmless hospital trend for the healthcare sector in South Africa.’ (IALCH 2006)

2.3. PUBLIC PRIVATE PARTNERSHIP (PPP)

Public Private Partnership is a powerful tool in South Africa’s ongoing quest to tackle poverty and grow the economy. It is an instrument in the national policy of enabling previously disadvantaged people to become a part of the economic main-stream in such a way as to enable the entire nation to benefit. The Government’s public service delivery record has been greatly enriched through PPPs in recent years. The National Treasury has set rigorous risk-assessment standards by which the Government makes affordable project choices that best leverage private investment for public services. The national PPP Manual – the world’s first – systematically guides public and private parties through the phases of a regulated PPP project cycle, based on best international practices, unpacking policy and providing procedural clarity.

PPP is a useful service delivery option with a number of advantages such as:

- *Operational gains:* Ensuring that better or more service is delivered for the same price or - by making savings - release finances for investment elsewhere. Operational gains are achieved by focusing on outputs as opposed to processes.
- *Strategic clarity:* Provided by focusing departmental resources on strategic management, ensuring that key services are delivered effectively.

An exodus of professional skills in the medical sector coupled with limited funding to purchase or replace medical equipment has left the public healthcare system in a precarious state – a situation that could be corrected with the implementation of cooperative agreements between government and the private sector. Carlo Blanckaert, Healthcare Project Manager at Siemens Medical Solutions, stated that the Public Private Partnership (PPP) model offers a solution to the current healthcare crisis in the public sector by taking over the non-core functions of healthcare facilities and allowing Health Departments to focus on their core clinical and medical functions. He said that this was based on a number of successful PPPs in provincial hospitals. Citing the example of the highly successful PPP currently in place at the Inkosi Albert Luthuli Central Hospital (IALCH) in KwaZulu-Natal, Blanckaert said the provincial Cabinet’s support for the project saw this unused

teaching hospital brought into service as a state-of-the-art public healthcare facility in just eighteen months: (Siemens 2005)

The IALCH was a shell that had been built but stood empty because the local government did not have enough money to commission the hospital. Through the implementation of a PPP by the Impilo Consortium, of which Siemens is a member, the hospital is now fully functioning and serving the public with the latest in medical equipment at a standard easily comparable to that available in the private sector (Siemens 2005).

The PPP was awarded on the basis of a fifteen year-contract to the Consortium which was charged with the responsibility of delivering a fully functioning hospital, with a set yearly amount paid by the province for hospital facility management, administration, medical equipment and the IT systems. The model offered a totally integrated health facility incorporating the latest in information and management systems such as electronic patient records as well as leading edge medical equipment, including imaging modalities, laboratory equipment and patient monitoring. And to ensure that the Consortium keeps to its side of the contract, a heavy penalty regime was applicable in the event of under performance or a failure to deliver:

The main focus of the penalty regime centres around the availability of critical hospital areas, the response to calls for assistance, the time taken to restore a service, and the quality of service delivery... Given that the nature of the Consortium is to make a profit, the penalty regime places pressure on the private sector company to run the facility efficiently and according to the agreed deliverables in terms of quality healthcare and standards (Siemens 2005).

The KwaZulu-Natal Department of Health, in conjunction with the Provincial Treasury, embarked on a process whereby the hospital equipment, IT systems and most non-core functions were procured in the form of a PPP. Facilities management and outsourcing of all non-medical functions, including catering and laundry services, was included in the PPP. The project's time objective was that the first patient would be admitted in July 2001. The tight programme required the cooperation of all parties and parallel tasking where possible. The advantages of PPP procurement were identified by the KwaZulu-Natal Department of Health as:

- Transferring responsibility for all non-core functions to the private sector.

- Transferring responsibility for the cyclic planned replacement and maintenance of medical equipment and IT systems to the private sector partner.
- Smoothing the public sector cash-flow by funding the equipment refreshment through a sinking fund over the project life cycle.
- Transferring a substantial quantum of risk to the private sector.

2.4. POLICIES, PROCESSES AND PROCEDURES

The Department of Health has policies, processes and procedures that guide the patient referral pattern in South Africa, starting from the primary health care clinic to the community health centre, from the community health centre to the district hospital, from the district hospital to the regional hospital, and from the regional hospital to the tertiary hospital.

2.4.1. Referral

Patients arriving at the hospital are not refused treatment simply on the basis of not being in possession of a referral letter. Patients who present without a referral letter are checked on the MEDICOM booking system to ascertain if they have an appointment. If the booking is confirmed then the normal admitting procedures would apply. If a booking has not been made, the patient is referred to the relevant clinic to be assessed and then given an appointment or referred to a more appropriate level of care.

The referral system is characterised by the district hospital services providing the basis for hospital care and therefore being the most accessible to the surrounding communities whilst the regional, tertiary and the national central hospitals provide the specialist, super-specialist and highly specialised care respectively. The classification of hospitals by the Provincial Restructuring Committee, which has been accepted nationally, is as follows:

2.4.1.1. District Hospitals

These hospitals normally receive referrals from and provide generalist support to community health centres and clinics catering for patients who require admission to hospital for treatment at a general practitioner level.

2.4.1.2. Regional Hospitals

These hospitals normally receive referrals from and provide specialist support to a number of district hospitals. Most care is level two care requiring the expertise of general specialist-led teams.

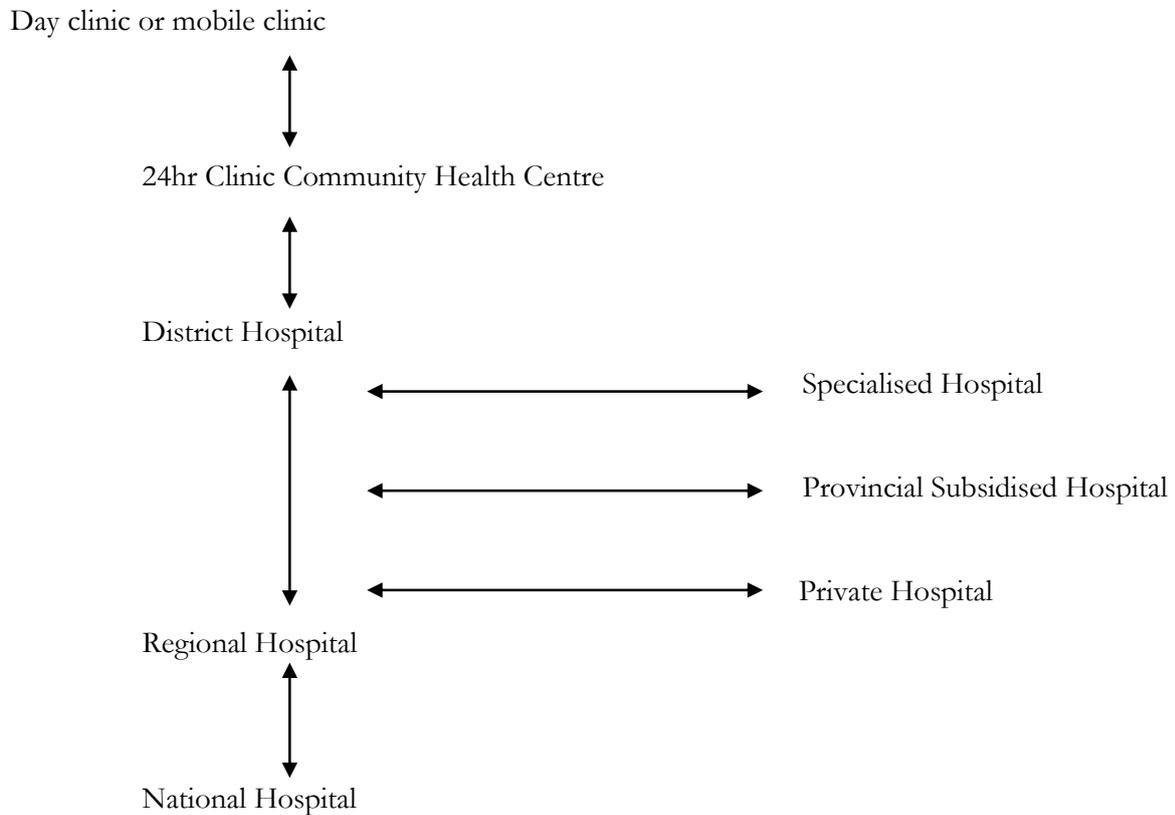
2.4.1.3. Provincial Tertiary Hospitals

Provincial Tertiary Hospitals receive referrals from and provide sub-specialist support to a number of regional hospitals. Most of the care is level three care that requires the expertise of clinicians working as sub-specialists or in rarer specialties, such as in surgery, for example, urology, neuro-surgery, plastic-surgery and cardio-thoracic surgery.

2.4.1.4. Specialised Hospitals

The examples of specialised hospitals are tuberculosis (TB) hospitals and Chronic Psychiatric hospitals. The system implies a hierarchy of services designed to provide medical intervention and treatment at increasingly sophisticated levels. For the system to operate effectively it is essential that all health care providers including the private sector, academic institutions and users, have a common understanding and acceptance of the referral pattern authorising who will be treated at which facility under what circumstances. A generic pattern is reflected below:

Figure 3: Hierarchy of services designed to provide medical intervention and treatment at increasingly sophisticated levels



Source: IALCH (2006)

In terms of the referral hierarchy IALCH has been designated one of the tertiary and central hospitals of the Republic of South Africa providing a sub-specialist consultancy service for patients referred from and to the regional hospitals. Since IALCH is at the pinnacle of the referral system it is imperative that criteria for the admission to its first world facilities be strictly controlled to maintain its tertiary level status (IALCH 2006).

The most important criteria are communication, appointments and the referral letter. Communication between the referring doctor and the doctor of the relevant specialty at IALCH before the patient arrives is mandatory. An anonymous IALCH doctor furthermore emphasised the importance of the referral letter accompanying the patient to the hospital. Lists of IALCH clinics, contact doctors, telephone numbers and clinic times were distributed to all hospital managers in KwaZulu Natal. Entry and exit criteria, Phase One, Phase Two and Phase Three have been drawn up and are available to all IALCH doctors. Information has been disseminated to the community explaining the tertiary function of the hospital.

With regard to appointments, a first visit to a clinic is preceded by prior consultation between the referring doctor and the receiving doctor of the relevant specialty at IALCH. This would normally be by telephone but could also be by Electronic mail (E-mail) or facsimile (fax). An appointment is booked electronically at the clinic on the MEDICOM integrated hospital information system and a referral number is generated. This number is conveyed to the referring doctor to write on the referral letter which the patient must bring on the day of the visit. The appointment procedure detailed in the appointments booking policy, is conscientiously followed. Accommodating patients who arrive without an appointment is not entertained unless the patient is an emergency (IALCH 2006).

The use of the provincially standardised referral letter that serves to channel clinical information both upward and downward in the referral chain is obligatory. Every patient who attends the hospital for the first time should be in possession of a referral letter. This document is shown to the admitting clerk when the patient is being registered. After registration the patient proceeds to the specialist clinic and gives the referral letter to the clinic nurse or doctor. A patient transferred as an emergency should also be in possession of a referral letter. Notwithstanding the above and in the spirit of Batho Pele², no patient is turned away on the basis of not being in possession of a referral letter. A patient who arrives without a referral letter and who does not have an

² Batho Pele (Sotho: 'People First') is a South African political initiative. The initiative was first introduced by the Mandela Administration on October 1, 1997 to stand for the better delivery of goods and services to the public. It is also now used to imply the dissolution of government organisations deemed corrupt or obsolete. The Batho Pele initiative aims to enhance the quality and accessibility of government services by improving efficiency and accountability to the recipients of public goods and services. Batho Pele requires that eight service delivery principles be implemented: regularly consult with customers; set service standards; increase access to services; ensure higher levels of courtesy; provide more and better information about services; increase openness and transparency about services; remedy failures and mistakes; and give the best possible value for money.

appointment is referred to the relevant clinic to be given an appointment or be referred to a more appropriate level of care or otherwise be assessed as an emergency and dealt with accordingly.

Patients arrive at the hospital using public or private transport or by ambulance. A shuttle service based at Clairwood Hospital runs a fleet of vehicles that fetch elective patients from referring hospitals every morning, Monday to Friday, and conveys them back to their hospitals of origin in the afternoon. This is known as planned patient transport. Emergency Medical Rescue Services (EMRS) are responsible for conveying by ambulance, emergency referrals, pregnant mothers and babies under nine months as well as patients requiring special assistance, for example with wheelchairs, stretchers, oxygen, and suction.

Patients are directed to the Admitting counter in the foyer of the main hospital block, Level Three. Enquiry counter clerks issue sequentially numbered discs to the patients and usher them into two separate waiting areas, one for new cases and one for repeat cases. A patient approaches one of the Admitting cubicles when her or his number appears on an electronic screen facing the waiting areas. All patients are checked to determine if they have already been registered on the system.

The names of new cases that are booked for an appointment at a particular clinic should already be on the MEDICOM integrated hospital information system as a result of the appointments booking process. They are required to produce a referral letter and be registered. A unique patient number is automatically generated on the system and barring exceptional circumstances, would be their hospital number for life. Repeat visits already on MEDICOM integrated hospital information system are patients who have booked to re-visit a clinic or be admitted to a ward. Their names should appear in the Master Patient Index. They should have in their possession a small blue appointment card with a white label attached, bearing the name and hospital number of the patient. Emergencies are taken to the Medical Emergency unit where they are seen by the doctor on call for the relevant specialty. A 'flying registration clerk' processes the registration either in the Emergency unit or in the ward to which the patient has been admitted (IALCH 2006).

Most patients arriving at IALCH are referral patients who have been booked in advance to see a consultant at a specific clinic. Their names should therefore appear on the system. Patients are interviewed by admitting clerks in separate cubicles. Patients are required to furnish details such as name, birth date, address, and identity document (ID). A fee, which should be paid in advance, is levied in accordance with the KwaZulu-Natal Department of Health Hospital Fees Manual. Medical Aid membership is confirmed before registration, otherwise patients are required to pay cash. All information and transactions are recorded electronically on a MEDICOM integrated hospital information system. A unique number which is automatically generated by the system is printed on a sticker and attached to a blue appointment card which is given to the patient. The patient should produce this card at every subsequent visit to the hospital. Once patients have been registered and paid the assessed fee they are directed to the relevant clinic. The clinic doctor might require further investigations, necessitating referral to other departments, for example, MRI scan, blood tests, or Electrocardiographies (ECG). At the conclusion of the visit the patient is referred back to the receiving doctor at the hospital of origin with a letter detailing treatment given and further management.

A patient is admitted under the following circumstances:

- As a planned admission from a clinic either on the same day or at a future date;
- As an emergency transferred from another hospital. The doctor on call for the relevant department assesses the patient and admits him or her, if the patient meets the entry criteria for tertiary care;
- The patient, relative or escort is directed to the Admitting Department to record the admission. Otherwise a 'flying registration clerk' follows the patient to the ward to effect the registration and admission.

It should be noted that the receiving institution is responsible for finding accommodation for patients referred from lower levels of care. It was therefore the responsibility of the admitting doctor to ensure that there is a bed available in her or his discipline before admitting the patient.

All investigations are available on admission to the ward where a plan of action is devised, conducted by a group of consultants, that is, the Professor in charge, senior and junior consultants and doctors. If the plan is accepted, then tertiary care proceeds. Patients for elective surgery are referred to the Pre-Anaesthetic clinic before admission to the ward, or directly from the ward if they have already been admitted and are mobile. Theatre policies on preparation, pre-operative care, transportation and transfer of patients are followed if the patient is scheduled for theatre.

When the exit criteria have been reached the patient is discharged back to the hospital of origin with a referral letter from the ward doctor informing the referring doctor of the diagnosis and plan for continued care if necessary. Alternatively the patient might be booked for a follow-up visit to a clinic or for admission as an in-patient.

2.4.2. Recording and storage of medical records

Inkosi Albert Luthuli Central Hospital is a paperless hospital and all documentation relating to patient registration should be stored electronically to ensure that all documents relating to patient registration are electronically captured and stored in the MEDICOM integrated hospital information system. Patients are required to produce original information documents when presenting themselves for registration, for example, identity book, pension card, medical aid card, salary advice slip, bank statement and affidavits. The Admissions' clerk makes photocopies of the documents and returns the originals to the patient (except in the case of an affidavit where the original copy is retained). The Admissions clerk attaches a patient label to the bottom left of the photocopied document. If the patient is a repeat case the label is reprinted. Thereafter documents are sent to Medical Records for indexing on MEDICOM integrated hospital information system. The Medical Records clerk sticks a barcode on the top right of the photocopied document. Once indexed the documents are scanned.

All documentation relating to patient care are filed electronically to ensure that all patient records are available electronically. Patients who are referred from other hospitals to IALCH have a summary of their previous medical records scanned into their electronic records at IALCH.

All new patients have an electronic record. The comprehensive medical records that belong to referring hospitals are returned as soon as possible to those hospitals. Departmental records brought from other hospitals are retained in the Medical Records Department at IALCH. All medical practitioners working at IALCH should be aware of this policy. The filing and movement of records in the Admissions Medical Records Section is strictly controlled to ensure that all manual records are easily traceable.

Inkosi Albert Luthuli Central Hospital is committed to the preservation of patient confidentiality and the safe storage of all patient related documentation. No patient related information is released other than with approved consent. Patient data may be divulged to authorised persons only. The supply of data to anyone else might only occur with the patient's written consent.

All requests for access of medical records have to be made to the Chief Executive Officer (CEO) in writing and should be accompanied by the written consent of the patient, parent or legal guardian and *curator ad litem* in the case of minors and other patients. The request should state clearly the reason as to why copies of such records are required. Medical reports might be furnished provided that the CEO is satisfied that the reason was not litigation against the Department, the Province or the State. Where litigation is indicated such requests should be forwarded to Department of Health (DOH) for consultation with the State Attorney. The following documents may be supplied free of charge to authorised persons or institutions:

- Application for Employment in the Public Service.
- For medico-legal services in respect of :
 - Assault;
 - Rape;
 - Driving a motor vehicle while under the influence of alcohol and/or drugs having a narcotic effect;
 - Mentally ill persons for the purposes of observation in terms of the Mental Health Act, 1973 (Act 18 of 1973);
 - Certification or confirmation of death;
 - Post mortem examination;
 - Corporal punishment;
 - Court cases.

- Original sick leave certificates;
- Medical reports for private practitioners in respect of private in- and out-patients treated by medical personnel in the employ of the hospital; and
- Medical reports for private practitioners in respect of the Compensation for Occupational Injuries and Diseases Amendment Act cases treated by medical personnel in the employ of the hospital.

All other reports and certificates should be supplied on request and with the written permission of the patient to any authorised person or authority, upon receipt of the appropriate fee as laid down in Part Ten of the current Fees Manual.

Inkosi Albert Luthuli Central Hospital adheres to the guidelines set out by the National Archives in respect of the retention period for both In-Patient and Out-Patient records to ensure that all patient records are dealt with thereby creating more storage space for the medical records section. Due to an increase in patient visits and shortage of storage space, National Archives have reduced the retention period of records as follows:

- In-patient and Out-patient records to five years.
- Non - archival records are at the discretion of the Institution.
- A system was implemented by the Medical Records Manager to ensure controlled disposal of records at the periods stipulated.
- All manual records are filed in the designated medical records storage department that should be kept locked with no unauthorised persons allowed entry.

Electronically filed records at IALCH are stored permanently on the database. All manual records that come up for disposal after the retention period are noted in a destruction register and shredded under the supervision of the Medical Records Manager. All electronically stored records are retained permanently due to the storage database being so large.

The filing and movement of records in the Admissions Medical Records Section is strictly controlled to ensure that all manual records are easily traceable. Deceased patients' record folders are removed from the main filing cabinets and filed in separate filing cabinets designated for deceased patient files. When these folders are removed from the main filing cabinet red tracer

cards are inserted in their place. A patient file label is printed and attached to the top right hand corner of the tracer card.

2.4.3. Training

Siemed Services (Pty) Ltd mandated that a program exists to ensure that all IALCH employees are thoroughly trained in the operation of appropriate equipment, associated risks, and appropriate procedures to follow when medical equipment fails. Siemed Services (Pty) Ltd provides and manages a training program for the initial and ongoing training of operators of all medical equipment as supplied by Siemed Services (Pty) Ltd, for the period of the contract. The program incorporates mechanisms to ensure that employees remain competent with respect to the operation of equipment that they were using on a daily basis. All employees of IALCH complete appropriate training during orientation on the medical equipment that they are expected to operate as employees. The frequency of re-training is determined by the frequency the employee uses the medical equipment or by episodes of improper operation of equipment. The training procedure is as follows:

- New employees should demonstrate operational proficiency in the use of all medical equipment that they should be required to operate in the performance of her or his duties;
- The training process follows the implementation training schedule as supplied by Siemed Services (Pty) Ltd;
- Siemed Services (Pty) Ltd requests from IALCH a candidate list for the scheduled training;
- Inkosi Albert Luthuli Central Hospital provides the list of candidates with due notification period (suggested three weeks before the scheduled period);
- Siemed Services (Pty) Ltd confirms the list with due notification to IALCH (suggested period one week) before the scheduled training;
- Training takes place at the scheduled period;
- Training detail varies depending on the nature of equipment and training requirement;
- A test is conducted at the end of the training period. Students who display competence in the operation of the equipment according to test results (theory and/or practical) receive a certificate of competence;

- Unsuccessful students have to attend an additional training period and complete an additional test;
- The training department and suppliers at their discretion include additional information and comments as to their observations as to class attendance and students performance and ability;
- At all times the agreed contractual documents are adhered to concerning training and related training issues.

2.5. SUMMARY

This chapter introduces MEDICOM integrated hospital information system and then ‘set the scene’. The stage is set by highlighting the objectives of implementing MEDICOM integrated hospital information system in IALCH, discussing Public Private Partnership as a useful service delivery option, and then policies, processes and procedures as a guide in using MEDICOM integrated hospital information system. The chapter demonstrates the benefits of a paperless and filmless hospital information system in IALCH. It shows a hierarchy of services designed to provide medical intervention and treatment at increasingly sophisticated levels. Finally, it discusses a referral pattern, storage of medical records and training of users on MEDICOM integrated hospital information system.

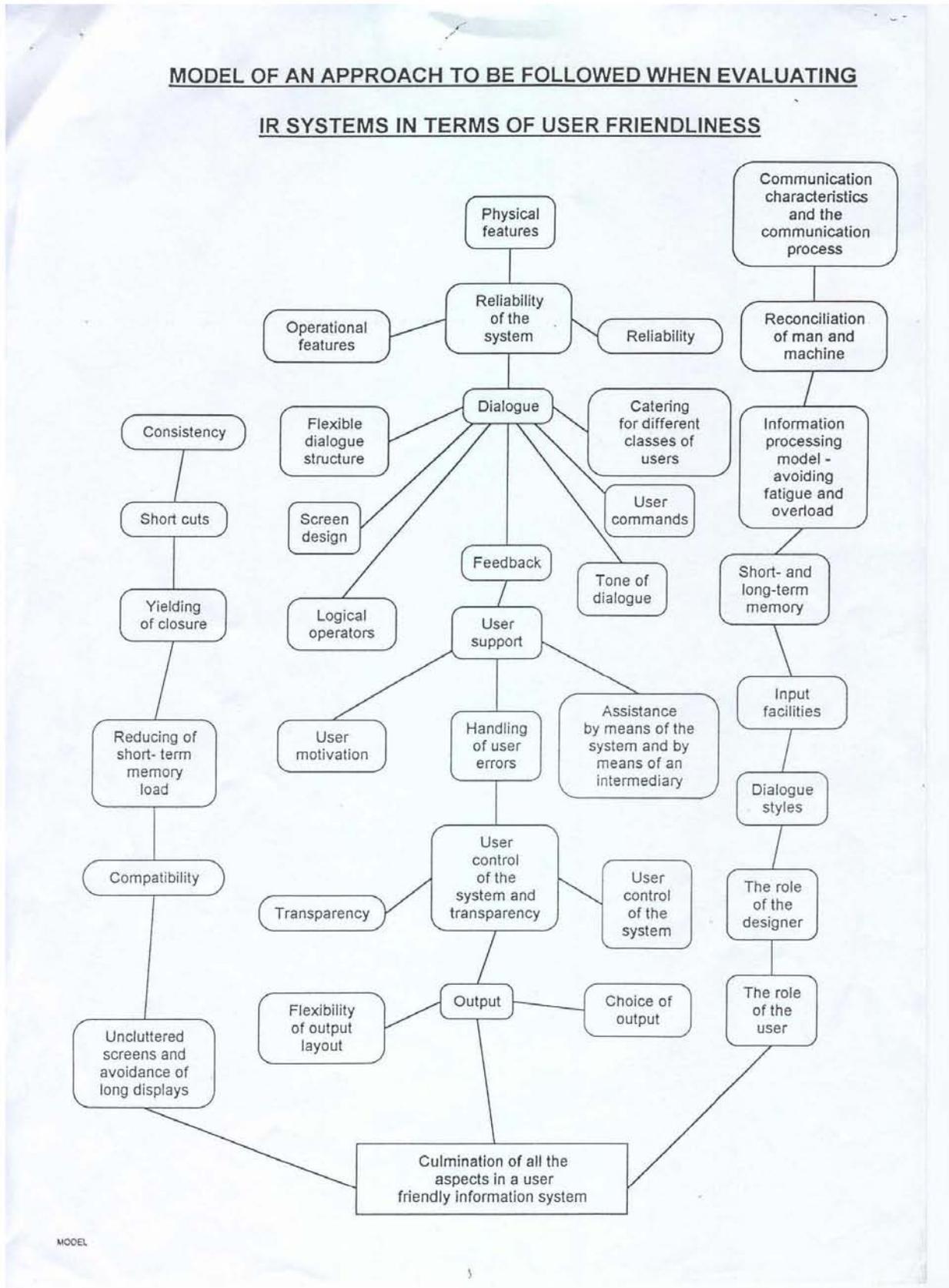
CHAPTER THREE: CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

3.1. INTRODUCTION

This chapter presents the conceptual framework of the study, looking at the need for a hospital information system and the framework around the user-friendliness of a hospital information system; and it also discusses the literature on the user-friendliness of a hospital information system using telemedicine in general. Geysers' model (see Figure 4) is used as the basis for the conceptual framework to determine the user-friendliness of a hospital information system in addition to Coiera *et al.*'s work on computer-based decision support systems (2006), Rigby's work (see Table 1) on the user's view (2006), and IMIA's work on usability testing and evaluation (2006). At the time of commencing, Geysers' model was one of the few on user-friendliness and it had the advantage of being a South African model which had been evaluated in the South African context.

Scientific studies of provider (both consulting and referring) performance are needed to determine which technologies are useful and workable and how existing ones can be improved. The more mature clinical telemedicine applications have brought to the forefront another area of research that is crucially important, namely the evaluation of how the clinician interacts with the digital display and the impact of this new modality on diagnostic performance. The most critical components of a hospital information system are the end users – the health care providers and the patients (Bashshur *et al.* 2002:26-7).

Figure 4: Model for a user-friendly Information Retrieval System (Geysler 1992)



3.2. THE NEED FOR THE DELIVERY OF A HOSPITAL INFORMATION SYSTEM

This section outlines the technologies that are useful and workable in healthcare organisations, the importance of information technology in an organisation, and the consequences of installing health informatics systems. It also defines different clinical telemedicine applications, for example, tele-diagnostics, tele-radiology, tele-dermatology, tele-consultations, remote guidance and training, laboratory information, tele-cardiology, tele-psychiatry, tele-endoscopies, tele-neurophysiology, and tele-pathology. These definitions were obtained from the National Department of Health document titled *Establishment of a Telemedicine System for South Africa: Strategic Outline* compiled by Telemedicine Task Team (South Africa 1998).

3.2.1. Technologies are useful and workable

The entry of information technology in health care has been slow, due in part to the conservatism that has always been part of health care, and in part to the immense complexity of health care, both in working routines and organisation. Until now it has not been feasible to create overall and effective computer support for multi-faceted and varying activities such as health care. To understand why this has been the case and why this will now change radically, it is necessary to understand what information technology means, including what it is, how it is developed, and where it is headed. Without this basic understanding of the new concepts and the new patterns of thought that govern and distinguish information technology today, discussions about it inevitably end in confusion (Peterson 2006:180).

Information technology assessment is invariably a challenge. In health care, the complex, hard to control interactions between rapidly changing technologies and how they are used by medical practitioners raise unique issues in measuring and judging the impact of IT. Nevertheless, if we are to improve the quality of health care for increased, distributed and heterogeneous populations, the assessment of the health effects of our information systems on them is critical. With the development of so many specialised technologies, assessing how and whether they are truly improving diagnostic and therapeutic techniques, as well as the organisation and management of care, becomes a major undertaking, with many obstacles along the way. Safety and quality of care, how care is integrated, and affected by new technologies must be addressed (Kulikowski and Haux 2006:2).

Nowadays, it is hard to imagine health care without information technology. The introduction of IT can radically affect health care organisation, health care delivery and outcome. It seems evident that the use of modern IT offers great opportunities and appropriateness of care. However, there can also be hazards associated with information technology in health care: IT can be inappropriately specified, have functional errors, be unreliable, user-unfriendly, ill-functioning or the environment may not be properly prepared to accommodate the IT in the working processes, leading to sub-optimal support or even to negative effects on patient care. It is therefore deemed good practice to identify both benefits as well as potential side effects of IT on quality of health care by conducting systematic evaluation studies. Evaluation can be understood as ‘the act of measuring or exploring properties of health information system (in planning, development, implementation, or operation), the result of which informs a decision to be made concerning that system in a specific context (Ammenwerth 2006:16).

Rigby’s study shows the importance of evaluation in that it gives some expected results such as technical functioning of the information system like MEDICOM, user’s views and organisational views about the system (see Table 1 below). According to Rigby (2006:116), once an organisation has invested – usually heavily - in a health informatics application, the prime drive is to ensure that it is seen to work satisfactorily. If the technicians or users report serious problems they naturally have to be fixed. However, any evaluation study which shows that the organisation appears to have acquired a less than optimal solution is unwelcome and seen as an apparent questioning of organisational competence at policy and procurement levels. This unfortunate interpretation may be applied even if the lessons learned from the evaluation are as a result of potential new opportunities for improvement following user or corporate learning from an initial period of successful implementation. Thus there is strong corporate drive to undertake internal checks to ensure that there are no problems causing technical or user friction but to deal with these privately and discreetly, whilst at the same time seeking to avoid more formal evaluations with the perceived corporate risk of possibly finding uncomplimentary results.

At the same time as addressing the principle stakeholder’s views it is possible to identify three different depths (broadly matched to time-scales) to which the evaluative study may be undertaken.

These are technical functioning, resultant effects and deeper outcomes. First of all, it is comparatively easy to undertake the first level of evaluation, namely whether the technical functions are achieved. However, the word ‘comparatively’ is the key one. As health informatics applications become increasingly complex, it is now increasingly difficult, tending to be impossible, to check systematically every combination of circumstances and data values. Thus the evaluation of function cannot any longer be considered as absolute except with the simplest of systems (Rigby 2006:116).

Secondly, every health informatics application has a deeper functional purpose than merely collecting the specified data and undertaking the related computational processes. The system is there to support a business process, and there is an iterative pattern of change caused by the relationship between the structuring of processes to enable computerisation, the standardisation of operations to ensure that the data flows to and from the system appropriately, and the execution of the core business objectives by the health care staff, whether this is a clinical support system, financial, or other business management. Thus evaluation should look for the results in terms of increased quality, efficiency, or reliability of the supporting business process. These results may be conflicting, requiring an overall balancing judgement. For instance, quality of prescribing and speed of dispensing may increase with a prescribing support system, yet the system itself may have operating costs greater than the previous paper systems, thus compromising the operational budget. Telemedicine may save neither health system costs nor professional time, yet deliver a better quality and more convenient form of care (Rigby 2006:116).

Thirdly, once a health informatics system is installed and in regular use, it may have deeper consequences, both anticipated and unanticipated. Only a matching evaluation study will show whether these are beneficial effects, such as improving efficiency, quality, or practitioners satisfaction on the one hand, or are perverse effects such as increasing staff ‘technophobia’ leading to staff loss, or restricting appropriate special circumstance ‘off protocol’ prescribing or procedures. Rigid diagnostic coding systems may either make standardised clinical data about a patient more readily available in more accurate form, or may have adverse effects such as diagnosis delay because uncertainty cannot be accommodated, or diagnosis creep to ensure workloads are not under-represented. These two dimensions of evaluation can be seen to interlink. Table 1 below shows their inter-relationship, and the different evaluative subjects possible in each of the dimensional intersecting cells (Rigby 2006:116).

Table 1: The inter-relationship of the two axes of evaluation

	Does it work?	With what results?	With what outcomes?
Technical	<ul style="list-style-type: none"> • Technical performance, speed, etc. satisfactory. • Reliability or Availability 	<ul style="list-style-type: none"> • Technology proven in use. • Process specifications proven in use. 	<ul style="list-style-type: none"> • Further uptake or rollout. • Positive (negative) image.
User	<ul style="list-style-type: none"> • Ease of use of compliance. • Trust. • Reliability of function. 	<ul style="list-style-type: none"> • Time saved (lost). • Better (worse) working context. • Better (worse) quality delivered. 	<ul style="list-style-type: none"> • Job satisfaction (dissatisfaction). • Professional gain (loss).
Organisation	<ul style="list-style-type: none"> • Specification met. • Service delivered. 	<ul style="list-style-type: none"> • Efficiency gains (losses). • Throughput changes. 	<ul style="list-style-type: none"> • Competitive positioning. • Recruitment effects. • Referral effects.

Source: Rigby (2006)

3.2.2. Clinical telemedicine applications

There are several definitions of telemedicine used in the world literature today. The International Consultation Group was convened by the World Health Organisation (WHO) in Geneva in December 1997 to draft a health telematics policy. WHO subsequently adopted the following definition:

‘Telemedicine is the delivery of health care services, where distance is a critical factor, by health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of diseases and injuries, and for the continuing education of health care providers as well as research and evaluation, all in the interests of advancing the health of individuals and their communities.’

The essence of telemedicine is the use of electronic communication networks for the transmission of information related to the diagnosis and treatment of medical conditions at a distance. Telemedicine is no longer a ‘technology awaiting application’. Rather this powerful clinical tool, which has been successfully utilised in actual patient care for many phases, is now ready for widespread implementation as the equipment has advanced to the point where its applications are practical and potentially cost-effective. The most critical components of telemedicine are the end

users - the health care providers and the patients. It is the people and not the technology that determines the operational success of the system (South Africa 1998).

The mission of the South African telemedicine system is to facilitate the provision of high quality and cost-effective health care to all the citizens of South Africa, particularly to women and children in the rural areas. The telemedicine system is used to establish an amalgamation of South African Medical Schools for the purpose of providing cost-effective medical education of health care providers in South Africa. The system also facilitates recruitment and retention of health care providers in rural communities. In order to deliver the clinical services, the South African telemedicine system conducts regularly scheduled electronic clinics. Clinics are an effective way to apply telemedicine. At regularly scheduled times, doctors in designated centres are available to provide consultations. Although telemedicine is often conceived in terms of dynamic inter-active real-time video consultations, non-real time applications are also effective (South Africa 1998).

The benefits that can be achieved by using telemedicine are numerous. The general level, as well as, the accessibility of health care services improve significantly using telemedicine; and, the equality between rural areas and urban centres increases. An immediate benefit is the decrease of patient transfers through an efficient use of modern telecommunications solutions. The role of basic health care becomes much more significant when specialised health care resources can be used optimally. Quicker diagnoses and health care enhancements bring savings to many parties and improve patient safety and care. Telemedicine also provides new and interesting business opportunities to the private sector without geographical limitations. Besides tele-diagnostic applications, telemedicine has open care, remote monitoring and administrative applications as well. The efficient use of medical databases and information resources, for example, through the Internet is also one of the major aims of telemedicine (South Africa 1998). There are different types of telemedicine services that are implemented in health facilities, for example:

3.2.2.1. Tele-diagnostics

Imaging and image information is essential in diagnostics. Tele-diagnostics focuses on developmental work related to radiology, pathology and histology as well as dermatology. For example, sound can be easily transmitted as a normal computer file to request the statement of a cardiologist about abnormal heartbeats or heart murmurs (South Africa 1998).

3.2.2.2. Tele-radiology

Tele-radiology is currently the most important application field in telemedicine internationally. The situation in Finland is particularly unusual. There is X-Ray equipment in almost every health care centre, but the radiologists are only located in large hospitals. In South Africa the X-Ray equipment is not available in clinics and community health centres, but in all hospitals and the radiologists are also located in large hospitals. This emphasises the importance of tele-radiology. Specialised nurses in the radiology department of a health care centre can make X-Rays, digitalise X-Ray films with a special scanner and transfer them to an appropriate service provider, which can be either a university or a private hospital. Nurses and general practitioners can also perform ultra-sound examinations with the remote guidance of a radiologist. Tele-radiology also provides excellent diagnostic capabilities between hospitals, for example, for CT and MRI, especially in the field of neurophysiology (South Africa 1998).

3.2.2.3. Tele-dermatology

There are very few dermatologists in Finland and they are usually concentrated in urban centres. This is also the case in South Africa. The present technology provides excellent conditions to make the most of their expertise. Videoconferencing systems and high resolution cameras provide the means to transmit close-up, still-pictures during real-time consultations. This has turned out to be an ideal solution for general practitioners of health care centres who need dermatological consultations. Digital cameras are another good alternative to be considered, but the size of the still image file is quite large and requires fast connections (South Africa 1998).

3.2.2.4. Tele-consultations

A videoconferencing system has many functions. Unnecessary traveling of the patient can be avoided when doctors use videoconferencing to consult specialists. The visual aspect is important when one physician is consulting another. It is possible to perform at the various remotely-guided medical acts and examinations using one videoconferencing system, with additional features. The system also enables an exchange of information including texts, diagrams or pictures (South Africa 1998).

3.2.2.5. Remote guidance and training

Multi-point videoconference seminars can be organised to respond to the educational needs of the general practitioners working in remote health care centres. District-wide training seminars can be held without losing too much of the physicians' working time because traveling can be reduced or eliminated. For example, a physician working in Northern Lapland would have to travel three days to participate in a training seminar held in Rovaniemi. In South Africa the physician travels less than a day to participate in a training seminar. Also Internet-based training options are under investigation and they will be used in the near future (South Africa 1998).

3.2.2.6. Laboratory information

Laboratory results are much more easily available and transferable when they are computer files. Several systems have been developed and can be used with data transmission networks so that results can be conveniently transmitted between health care sites, which can lead to faster treatment decisions (South Africa 1998).

3.2.2.7. Tele-cardiology

Electrocardiographies (ECGs) are transferred to cardiologists or emergency centres using network connections like Global System for Mobile Communications (GSM). Also, heart murmurs can be transmitted to cardiologists who can then evaluate the condition of the patient (South Africa 1998).

3.2.2.8. Tele-psychiatry

Real-time videoconferencing consultations between physicians of health care centres and psychiatric experts make their work more efficient and enhance the use of available resources. The results of a domestic project in Northern Finland using tele-psychiatry has been very positive so far. Also, the experiences in other countries in this field, for example, in infantile psychiatry, have reinforced the usability of tele-psychiatry in health care. Tele-psychiatry is also practiced in South Africa. (South Africa 1998).

3.2.2.9. Tele-endoscopies

Quite often in Finland, gastroscopies and otoscopies have been performed locally and diagnoses have been made hundreds of kilometers away. Videoconferencing systems with additional features are quite well suited for these procedures. Local physicians' skills and expertise improve under specialists' guidance. This service has not been practiced in South Africa (South Africa 1998).

3.2.2.10. Tele-neurophysiology

The real-time transfer of electroencephalograms (EEGs) through telecommunications networks has been problematic thus far due to the large amount of data it involves. The new high-speed Asynchronous Transfer Mode (ATM)³ networks are an adequate solution thereby making more efficient use of the neurophysiological resources of the large medical units nationwide. For example, CT and MRI brain image files can be transferred almost instantaneously between two hospitals, again, making treatment faster (South Africa 1998).

3.2.2.11. Tele-pathology

Tele-pathology is mainly aimed at hospitals. Tele-pathologic applications are in use in many places in Finland. During surgery, it is possible to take a frozen section and transmit the image through a videoconferencing connection to the pathologist of a central hospital. The pathologist can get still-images from the live picture when necessary and give a diagnosis and advice regarding the continuation of the surgery. Also, high resolution still-pictures taken with digital cameras can be transmitted as ordinary files to pathologists for statements in less urgent cases. This service has not been practiced in South Africa yet (South Africa 1998).

³ This is a communication technology that uses high-bandwidth, low-delay transport technology, and multiplexing techniques. Through dedicated media connections it provides simultaneous transport of voice, video, and data signals more than fifty times faster than current technology. May be used in phone and computer networks of the future (Texas A&M University 2006).

3.3. THE FRAMEWORK AROUND THE USER-FRIENDLINESS OF A HOSPITAL INFORMATION SYSTEM

This section discusses the clinician interaction with a hospital information system, and the end users' view of the system (human factors engineering) in terms of the physical features of the system, reliability of the system which includes operational features, dialogue between the user and the system, feed back of the system to the user, user support, handling of user errors, user control of the system and transparency, and choice of output and flexibility of output layout.

3.3.1. Clinician interacts

There is now clear consensus as Coiera *et al.* (2006) demonstrate that computer-based decision support systems (CDSS) can be a potent intervention to improve the quality, safety and effectiveness of clinical decision-making, can result in improved patient outcomes and in more effective clinical services. Nonetheless, the uptake of CDSS remains low in many settings, possibly because it is often believed that the introduction of CDSS requires the prior implementation of electronic health records (EHR) – a substantial organisational challenge in itself. In settings such as primary care, where the task of introducing such records is less complex, the rates of CDSS use, such as electronic prescribing, have now reached significant levels in many countries. Consequently, it seems that the message that CDSSs are an important component of clinical services, and indeed, are probably essential to much of modern practice, has finally started to break through (Coiera *et al.* 2006:20).

However, while we know that CDSS can improve clinical outcomes, we still know relatively little about the specific impact of CDSS on clinicians. How do we know when a CDSS provides its advice safely and in a format which will encourage use? Even the simplest paper-based decision tools frequently lead to the wrong answer being generated, with serious consequences for patient care. Does the same happen with the CDSS? Do all clinicians get the same benefit from using a CDSS? Do some clinicians use CDSS more effectively than others or do some face challenges and require specific training prior to using a CDSS? Are there specific work settings in which certain CDSS designs are problematic? Currently, most research comes from single institutions that have pioneered their own decision support systems, and as a consequence they have strong local ownership and clinical acceptance of the system. Where there have been cross-studies, it seems

there is indeed wide variation in CDSS use, often because of organisational and cultural factors (Coiera *et al.* 2006:20).

This variation should be unsurprising, since clinical software is just one component of clinical service. It is the totality of interaction between users, clinical settings, and technology that shapes the final outcome. Clinical services are socio-technical systems, meaning that we recognise the social and social variables as likely to affect service performance as are the individual cognitive variables, or specific aspects of the design of a technology. Such socio-technical systems are complex, and a feature of all complex systems is unexpected emergent behaviour (Coiera *et al.* 2006:20).

There are various different forms of decision support available to clinical users. In many situations a clinician is interested in accessing text-based resource like clinical guidelines, research papers and systematic reviews to help form an opinion about a clinical problem. On-line evidence retrieval systems that allow clinicians to search for and access such resources are sometimes characterised as passive CDSS, to contrast their performance with decision support systems that try and formulate a specific recommendation or alert (Coiera *et al.* 2006:23).

3.3.2. End users

In terms of success or failure of a system, in the spectrum between efficiency on the one hand and costliness on the other, the user's view is also the one aspect which is most frequently overlooked. Too often users are taken for granted, and system experts forget that the prime focus of expertise of the end users of health systems is elsewhere - for instance, in nursing or medicine. Users are permanently featured in Rigby's matrix (1999) in section 3.1. Secondly, accommodating the individualised needs of users in the specification process, education and training of users in the implementation process, are both expensive activities (Rigby 2006:114).

Human factors can be the difference between systems that function well in the clinical environment and systems that function poorly. The physician-patient relationship has now become the physician-computer-patient relationship. Human factors engineering is the field of study which deals with the cognitive aspects of the human computer interaction (IMIA 2006:249). At the IMIA General Assembly meeting held in Washington on the 10th November 2006 at which the

researcher was also present, Peter Elkin⁴ proposed the creation of an IMIA working group on Human Factors Engineering, to include Usability Testing and Evaluation.

‘This is an important field of Health Informatics which is under-utilised and not generally understood by the health informatics community. There are many outstanding research questions which exist in using these techniques in healthcare. The creation of the working group would provide the health informatics community with a place to bring these discussions to the improvement of our field and our work.’ (IMIA 2006:251).

The number of studies in medical informatics focusing on such topics as: usability, human factors, user-centred design, user acceptance, or ergonomics have constantly increased (Zhang 2005). Not only do usability studies prove to have a great impact on user acceptance of new technologies (Zhang *et al.* 2002), they also prove very effective in preventing new categories of medical errors generated by badly designed applications (Horsky *et al.* 2005; Beuscart-Z’ephir *et al.* 2005). The human factor engineering principles adhered to in the usability study methodology can assist institutions in employing user-centred design principles when designing and developing their hospital (clinical) information system or crafting their academic web environment. Evaluation studies based on cognitive and usability engineering methods also prove very effective in improving the healthcare applications’ quality (Kushniruk *et al.* 2004; Beuscart-Z’ephir *et al.* 2002). An emphasis on user-centred design can help to ensure that an organisation’s or institution’s electronic environment will serve its intended purpose. User-centred design can be incorporated in a complete usability engineering lifecycle, intertwined with the project and engineering lifecycle (Mayhew 1999). Unfortunately, most systems are built without using the rigorous scientific user-centred design principles. Usability studies show the value of performing a formal evaluation of software which in order to be effective must function with a high degree of efficiency and flexibility (Shackel 2000).

The following categories and sub-categories of user-friendliness were determined taking into consideration the different authors’ interpretation of the term ‘user-friendly’. These categories do not necessarily exclude each other. Some aspects could indeed have been classed into two or even more of the categories; they could be named differently and in some cases may be explained differently. The terms and explanations of the specific authors led to the categorisation as it is

⁴ The chair of the International Medical Informatics Association (IMIA).

presented here (Geyser 1992:83-7). The sources drawn on, are Geyser's model (1992), Rigby (2006), Coiera *et al.* (2006) and IMIA (2006).

3.3.2.1. Physical features

The physical class of features refers to the devices of information retrieval systems and their facilities. Aspects such as standardised keyboards with function keys and numeric pad, high speed communications, large character sets and ergonomic design are of importance (Geyser 1992:84).

3.3.2.2. Reliability of the system

3.3.2.2.1. Reliability

A reliable system can be described as a system which is always in operation when needed. Furthermore the response time of a reliable system has to be low, the user's data has to be protected and no side or hidden effects should be allowed. A reliable system therefore also implies the hardware is readily available and reliable (Geyser 1992:84).

3.3.2.2.2. Operational features

Operational features refer to auto-start, auto-logon, help and integration and data transfer. Without auto-logon the user has to logon manually in which case 'making a connection to an on-line information system should be easy' (Geyser 1992:84).

3.3.2.3. Dialogue

3.3.2.3.1. Catering for different classes of users

The user should be able to choose a specific entry mode from the selection of various modes and it should be possible for him or her to enter data by means of only one stroke. In this regard Geyser (1992) discusses dialogue flexibility which means that the users' needs and abilities should be taken into consideration. A system should allow the user to determine and modify its activities while

offering him or her more than one alternative of action. Depending on the needs and sophistication level of the user, the system should allow him or her an acceptable mode of communication, be it a menu mode, command mode or form filling mode. In addition, the maintenance of an acceptable response time is essential. Geysler (1992) states that the needs of different groups of users should be borne in mind and that the system should be able to accommodate these needs by means of different dialogue modes, search strategies and 'help' instructions and messages (Geysler 1992:84).

3.3.2.3.2. User commands

What is of importance here is that not only one should command be considered as the correct, but more than one command, if correctly keyed in, should be interpreted by the computer as a correct command. This, of course, will relieve the user from having to memorise strictly prescribed unique words. 'INQUIRY' and 'Q' could, for instance, be interpreted by the system as being synonymous. The novice would most probable type in 'INQUIRY' while the more sophisticated user would key in the letter 'Q'. Less strict demands on the part of the computer as far as spelling and punctuation are concerned, should also offer relief to the user. As regards user commands, the following points are of importance in the list of characteristics of a user-friendly on-line system: (Geysler 1992:84-5)

- 'The command language must be simple, logical and mnemonic: the syntax and structure of commands should be based on the same principles;
- Generic commands triggering a set of instructions may be advantageous; and
- The user should have a chance to create her or his own generic commands and save them for later or repetitive use'.

3.3.2.3.3. Tone of dialogue

'Computer output should be factual, positive and polite' and the messages should never be hostile to the user. Dialogue should be natural and without computerisms which implies that it should be easy to understand. Geysler (1992) listed the following aspects which are relevant to the tone of dialogue: (Geysler 1992:85)

- ‘Avoid library jargon and especially avoid computer jargon;
- Avoid cuteness; and
- Do not tell users they have done something wrong. Rather, let the results speak for themselves and provide positive suggestions. Assume that users are in control’.

3.3.2.3.4. Flexibility dialogue structure

Flexibility dialogue structure allows users to back-track, jump forward or terminate a function at any time they wish. The issuing of demands should not be set in a specific order. In this regard Geyser (1992:85) says:

- ‘The user should have the chance to return or to go on to some distinct points in the procedure (a ‘forced jump’);
- Closing of operations must be possible at (nearly) any moment , and it must be easy; and
- At the moment of closing the session, the user should be informed about the time and cost of the session’.

3.3.2.3.5. Screen design

In Geyser’s (1992:85) discussion of principles relating to screen design, the following salient aspects are listed:

- ‘Keep screens uncluttered;
- Provide a cursor at the spot where user typing will appear, and make that spot consistent from screen to screen;
- Do not use blinking fields or reverse video;
- Systems have style, keep it consistent; and
- Pay attention to layout as well as content’.

3.3.2.3.6. Logical operators

Logical operators (also referred to as Boolean operators AND, OR and NOT) are often handled poorly. The problem can be sidestepped by ‘making some of the logic specification implicit so that in many cases users are unaware that they are effectively manipulating logical entities’ (Geysler 1992:85).

3.3.2.4. Feed back

Feed back could be considered as a sub-category of dialogue, but because a diversity of aspects is of relevance here, it is best considered an independent category. Feed back can mean that the system’s translation of the query should be fed back to the user to enable him or her to establish whether he or she was understood correctly. The input should be set in context and should be a mere repetition of the input of the user (Geysler 1992:85)

Users tend to feel abandoned when they receive no response. An interim response should therefore be used to put them at ease when lengthy processing is taking place. Response time is also of importance and should normally not exceed more than two seconds (Geysler 1992:85).

Data and systems integrity should be protected by feed back in the sense that certain irreversible consequences of some demands should be pointed out clearly by means of feed back to prevent incorrect action taken by the user. Only after confirmation from the user should specific action be taken by the machine. This aspect of feed back will be experienced as a safety device, protecting the user from unpleasant consequences. Many of the characteristics of the system listed by Geysler (1992:85) refer to feed back:

- ‘The system should always give information that is needed, only the information that is needed, and at the moment when it is needed;
- More detailed information must be given on request or if the user has apparently misunderstood a message;
- The system should acknowledge the receipt of a command if it is not executed immediately;

- It should inform that a command, if given in advance, has been saved for later execution;
- The user should always be kept informed about the stage of processing;
- The system should never let the user wait longer than a few seconds;
- If the waiting time is longer, the user should be informed about the expected to time of operations; and
- During long wait times the user should be regularly informed about the progress of operations’.

3.3.2.5. User support

The user should never be ignored by the system but should be constantly guided and thus be supported by it. The user should never feel deserted.

3.3.2.5.1. Assistance by means of the system and a intermediary

Fayen (1987:54-55 in Geysler 1992) regards user support as one of four requirements which she calls main features of a user-friendly system. According to her a user-friendly system should not allow the user to get ‘lost’. By this requirement, it is meant that the user should be made aware of the functions which are being performed by the system as well as subsequent action which is to be taken by himself or herself. A system which provides sufficient assistance will also not allow the user to enter illegal commands because the user will be prompted efficiently to enter the correct data (Geysler 1992:85).

Geysler (1992) considers user support as a criterion for user-friendliness. He therefore believes that ‘Help’ should always be available on-line. The user should be prompted concerning the kind of input that is expected of him. He should also be able to determine at what stage the man-machine dialogue finds itself at any specific moment. The following characteristics of a user-friendly on-line system, as listed by Geysler (1992:85) can be categorised as user support:

- ‘It should inform him or her about the options available, and a suitable option technique should be used (command, menu, YES or NO reply, and so on.);

- There should always be a default action in case the user does not want or is not able to give a specific command;
- The system must yield help when the user asks for it, but ...
- It must help spontaneously if the user apparently needs help; and
- Dangerous operations should be protected (for example, a command to delete a large file should not be executed without confirmation)'.

All Geyser's criteria for a user-friendly system pertains to user support (1992:86):

- 'An information system should be conversational but instructional at the same time;
- Use consistent format and technology;
- Use mnemonic devices whenever possible;
- Use formats which facilitate understanding of information presented on screen;
- Eliminate as many steps as possible;
- Be positive in response statements;
- Be forgiving of errors in entry;
- Accommodate many user punctuation and spacing inputs; and
- Provide computer response time averaging three seconds or less'.

Cuff (1980 in Geyser 1992) discusses user support under the heading 'Guiding the forgetful user' and considers it a required quality of user-friendliness. What is stressed in this discussion of guidance which should be available to forgetful users is that the user should be supported because of the difficulties that arise as a result of her or his erroneous model of the system. The use of properly designed dialogue modes (menu and prompt based) and a natural-language interfaces are discussed. The user should be assisted continuously by means of information which clearly informs him or her where her or his particular action fits in. He or she could be allowed to make inquiries by feeding a question mark into the machine (Geyser 1992:86).

With regard to user support Geysler (1992) is of the opinion that the needs of users should be seriously taken into account when systems are designed. It should not be expected from the user to think like the computer but the system should be designed in accordance with the human mode of thinking. In Stevens' analysis of 'a new approach to the design of the software-interface', he allocates user support to the role of the intermediary in system usage. Two intermediaries are discussed (Stevens 1983:11-13): the technical intermediary and the management intermediary (Geysler 1992:86).

Technical intermediary refers to the ability of the machine to translate the user's request into the systems inputs. This intermediary plays an important role when an IR system is used. Management intermediary, on the other hand, refers to the person who helps the user to formulate her or his request for system use. It is expected that the intermediary will actually carry out the request for the user. As the user is not expected to understand the intricate structure, content and semantics of the database, it remains the responsibility of the system to guide him through the available choices to retrieve wanted information. The system has to be able to interpret the user's imprecise and poorly formulated or loosely posed query which often ignores the semantics of the database (Geysler 1992:86).

3.3.2.5.2. User motivation

Support can be provided by means of motivation. The increase of user motivation can be viewed as an inspiration of user-friendliness. The following three aspects of motivation discussed by Geysler (1992:86) are:

- Motivation use;
- Maintaining motivation over time; and
- Assisting motivated users.

The man-machine interface can be directed towards one, two or three of these aspects.

3.3.2.6. Handling of user errors

One of the qualities for user-friendliness is the elimination of errors by the design of the system whenever possible. Where errors cannot possibly be eradicated, the system should be designed to cope with them and to take remedial action when and where necessary. Some errors can only be detected by the user which necessitates the system to feed back to the user its 'understanding' of a query before actually carrying it out. Errors must be dealt with intelligently. In case of faulty input of just part of a query the user should, for example, not be forced to re-enter the query in its entirety. Error messages should be simple and should not only clearly state that an error has been made, but should also provide subsequent action which should be taken. The system should be able to tolerate minor errors or clarify the user's intentions by means of constructive and intelligent dialogue. Remedies should be offered by the system in the case of more serious errors. The following two statements come from the list of twenty-five characteristics of a user-friendly on-line system (Geysers 1992:86):

- In case of error or potential error, the system should advise the user and inform him or her about the options available;
- Messages, warning and error signals should be clearly distinguished; they must not be vague (for example, 'ERROR DETECTED' or 'ERROR CODE D901').

3.3.2.7. User control of the system and transparency

3.3.2.7.1. User control of the system

The user should be in control of the system. This means that the user should have a mental model of the system as a result of sufficient information being at her or his disposal. The user will thus have a workable understanding of the system (Geysers 1992:84). The user should also be able to determine the time and cost of an expensive operation before the execution thereafter. The following relevant point of relevance is once again taken from Geysers's (1992:86) list:

'Before executing an expensive operation (voluminous print-out, large sorting run) the user should be informed about the time and cost'.

3.3.2.7.2. Transparency

A system can be considered as a transparent system if it enables the user to form a clear mental picture (model) of its functioning and if it behaves in a predictable manner. The user can form a consistent model of a system (Geysers 1992:86):

- The user is not burdened with unnecessary layers of information;
- The user is not confronted with complicated and unnecessary functions;
- The behaviour of the system is predictable; and
- The vocabulary for different dialogue modes is consistent.

3.3.2.8. Output

3.3.2.8.1. Choice of output

Input, output and stored data need no longer be identical, as it has been in the case of manual or mechanised systems. As stated, output data can vary in a similar fashion to input data. Output can be presented in more than one form. The standard form is default while other variants of the form can be explicitly or indirectly chosen by the user (Geysers 1992:87).

3.3.2.8.2. Flexibility of output layout

The form of output layout need no longer be rigid as was the case before the advent of computers. Although many of the basic rules should still prevail (for example, related data should be grouped together, important data should be placed prominently, and layout should enforce orientation) the user should be able to choose a form other than default. Short, standard and full variants have become possibilities (Geysers 1992:87).

3.4. PURPOSE OF THE LITERATURE REVIEW

Building upon previous studies this section begins by addressing the purposes for which the literature was used in the current study and then shows the paradigm shift that has occurred in hospital information systems. The purpose of building upon earlier research as Ngulube (2003:29)

has argued is to clarify which research had previously been carried out that could provide answers to the research questions, to establish if this research is needed and to choose an appropriate methodology for the research.

The literature was used for the purpose of review and for underpinning the study with authoritative referencing. The researcher explained the terms and explored themes and issues in the literature review that were of relevance to the study and he also reviewed various research studies. Literature review in this particular context has been defined as:

A systematic, explicit, and reproducible method for identifying, evaluating, and interpreting the existing hospital information systems work produced by researchers, scholars, and practitioners (Fink 1998:3).

Thus, the literature review established information sources and evaluated their methodological characteristics and content in relation to the research problem. Methodological features refer to study methods which include research design, data collection and data analysis, whereas the content consists of the objectives, findings and conclusions (Fink 1998:63). Referencing refers to the text or quotation being referenced, the reference itself and the corresponding bibliographic entry (Ngulube 2003:29).

This section outlines the studies that the researcher draws on for this chapter, for example, Robert (2003 in Scott 2005) investigated the post implementation usability of the Enterprise Resource Planning (ERP) manuals. Regarding users' attitudes towards ERP manuals, users were asked what they like and dislike about the training manuals. Wimelius (2004) studied the user's perception and interaction with Web pages, investigating preference of different environmental settings, for example, *legibility, simple, nice looking, good structure, messy, and confusing*, while Werth (1998) studied the feasibility and effectiveness of embedded evaluation tools into clinician workstations. Lærum, Ellingsen and Faxavaag (2001) investigated doctor's use of electronic medical records systems in hospitals, investigating the usefulness of different systems by comparing their functions in general clinical tasks.

3.5. THE USER-FRIENDLINESS OF A HOSPITAL INFORMATION SYSTEM USING TELEMEDICINE SYSTEM

Information Technology is inherently a service department, charged with providing hardware, software, and support to the organisation. As such, the rating of Information Technology by end users, particularly those in finance and clinical areas, is paramount in ascertaining how well a job Information Technology is doing. Methods to determine user satisfaction vary. Some organisations send out survey forms via E-mail to hundreds of users, others mail multiple-page questionnaires to managers only. Regardless of the method, organisations should conduct these Information Technology user satisfaction surveys regularly. The first indicator of a top-performing Information Technology department is merely the existence of any such survey, and the second is how well the department is rated by its customers (Williams 2005).

Physicians play a lead role in supporting the organisation's patient base through referrals. Also, as clinical quality becomes increasingly important in this age, focusing on improved safety and pay for performance and attracting the best physicians to the organisation gains in significance. Therefore, it is key for the organisation's Health Information System and Information Technology infrastructure to appropriately serve the medical staff. Features physicians typically look for in an Information System include:

- Patient 'rounding' census reports;
- Graphs of patient test results;
- Highlighting of abnormalities;
- Computerised physician order entry and alerts;
- Personal order sets;
- Knowledge searches, such as an on-line physicians' desk reference; (vii) Intranet service for physician policies and memos;
- Face sheet retrieval for physician billing; and
- Support from a dedicated physician informaticist in Information Technology.

The recent move by many organisations toward clinical systems, such as computerised physician order entry, will probably improve the physician-friendliness of Information Systems in the future. As stated, the physician-patient relationship has now become the physician-computer-patient relationship. The researcher believes that the more physicians use computerised information systems, the more they will get used to these systems. For example, if the physician places orders for laboratory results, X-Ray images and so on, on the information system instead of writing a request note for the results or images, her or his relationship with the information system will gradually improve until he or she perfects the information system. However, the effectiveness of the functioning of a hospital system is critical for maintaining physician referrals, given today's highly competitive healthcare market (Williams 2005).

Scott's study on usability is important in this research study because of the key basic issues that need to be taken into account before the information system like MEDICOM is implemented. Early pioneers in the usability field pointed out the fundamental principles of good design, such as having a good conceptual model before designing a product. Usability in simple terms is making sure that something works well, and that a person of average ability can use it for its intended purpose without frustration (Krug 2000 in Scott 2005). Usability was later applied not only to the design of everyday products, but also to computer interfaces and training manuals. For example, Wimelius (2004) identified attributes that seemed to have an impact on how people perceive information systems' applications, and subsequently tried to relate these attributes to more general attributes that have been found influencing perception of real world environments. The positive attributes are 'legibility' which is connected to the attribute 'simple', 'nice looking', and 'good structure'; and the negative attributes are 'messy' and 'confusing'. The International Standards Organisation (ISO 9241) defines usability as 'the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use' (Usability Net 2009; Abran *et al.* 2003).

Effectiveness measures the 'goodness' of the output by the user or whether users can perform their tasks, whereas efficiency has more to do with the quantity of work output in relation to the time, effort, and resources involved (Dillon and Morris 2001 in Scott 2005). The satisfaction of a user is a measure of the user's attitudes and perceptions about the usability of an item. Products with good usability allow users to complete their tasks well in a timely manner and with minimum frustration.

Prior research has used a practitioner instrument to assess usability (Agarwal and Venkatesh 2002 in Scott 2005). Similarly, in the study conducted by Scott in 2005, the items assessing usability of the training manuals were adapted from the Questionnaire for Usability Evaluation (QUE), designed by United States West Information Technologies (1996) to assess the usability of interfaces. The dimensions of usability assessed using QUE are navigation, presentation, learnability, and task support.

Navigation refers to the methods by which users move around a system or documentation. Usability research recognises the importance of navigability (Gillan and Bias 2001; Nielsen 2000; Palmer 2002 in Scott 2005). Documentation should be easy to search (Nielsen 1994), so efficiently finding information in the training manuals is not a problem. The manual should facilitate finding - what is needed quickly without too many steps. Effective presentation uses good graphic design principles for fonts, colours, layout, graphics clarity, and white space, while making sure not to distract users from their primary task (Gillan and Bias 2001; Keirnan *et al.* 2002; Nielsen 2000; Palmer 2002; Shneiderman 1998 in Scott 2005). Presentation organised with tabs, a table of contents, and an index help with navigation. Structure and organisation facilitate ease of use (Agarwal and Venkatesh 2002 in Scott 2005).

Learning is an important issue for usability (Gillan and Bias 2001 in Scott 2005). Unnecessary technical jargon and confusing acronyms deter learning. Terminology should use the language of its users (Keirnan *et al.* 2002 in Scott 2005). In QUE, learnability is defined as how easy a system is to learn so that users can begin to get their work done quickly.

In this study, learnability is applied to how helpful the manuals were to users in learning the ERP system. Documentation should not be too large (Nielsen 1994 in Scott 2005), as a large manual with too many details is likely to cause information overload and hinder learning. Reactions to information overload include frustration and stress. As a result, users might avoid using the manuals. The use of hyperlinks in on-line documentation is a potential solution to information overload. Task support refers to the capability to help users perform their tasks quickly, effectively, and economically (Keirnan *et al.* 2002 in Scott 2005).

Documentation should focus on the user's task, and list concrete steps to be carried out (Nielsen 1994 in Scott 2005). The content should be relevant, have the appropriate depth and breadth, and have current and timely information (Agarwal and Venkatesh 2002 in Scott 2005). Tailoring content would be effective for increasing relevance. Navigation, presentation, learnability, and task support dimensions contribute to users' effectiveness, efficiency, and satisfaction. While the terminology sometimes varies, QUE dimensions are analogous to those proposed by usability experts and researchers (Agarwal and Venkatesh 2002; Gillan and Bias 2001; Krug 2000; Nielsen 1993, 1994, 2000; Palmer 2002; Shneiderman 1998 in Scott 2005).

3.5.1. Investigating post implementation usability: Robert's study (2003)

A web-based survey was designed to investigate the post-implementation usability of the Enterprise Resource Planning (ERP) manuals. The Director of the Office of Change Management Services at University of Colorado (CU) collaborated on the survey, which had two parts. Part one of the survey asked users for information on their hardware and operating system in preparation for an ERP system upgrade to PeopleSoft 8.3. Part two of the survey included several usability questions, followed by two open-ended questions on what users 'liked' and 'disliked' about the manuals. The focus is on the responses to the two open-ended questions and reports on this part of the larger study. Of the four hundred and eighty (480) respondents to the survey, two hundred and eighty nine (289) of these responded to one or both open-ended questions.

Regarding users' attitudes toward ERP manuals, users were asked in the survey (1) what they liked and (2) what they disliked about the training manuals. For most users, their responses were collected more than two years after they had attended the ERP training class just prior to implementation. Content analysis of user comments revealed many usability issues, which are discussed below.

A total of one hundred and thirty five (135) usable positive comments were provided about the ERP training manuals. These positive comments were coded for the four dimensions of usability introduced above: navigation, presentation, learnability, and task support. Analysis of the positive comments showed that users commented on task support much more than on navigation, presentation, or learnability.

Only five percent (5%) of the positive comments mentioned navigation, thirteen percent (13%) presentation, and ten percent (10%) learnability, while task support was mentioned in eighty eight percent (88%) of the comments. Additionally, one hundred and fifty seven (157) usable negative comments on the ERP manuals were received. The negative comments were also coded for the four dimensions of usability. Analysis of the negative comments showed that users again mentioned task support much more than navigation, presentation, or learnability.

Although five percent (5%) of responses to the 'like' question expressed satisfaction with navigation in the manuals, twenty five percent (25%) of responses to the 'dislike' question complained they could not find information easily in the manuals. They found it 'challenging to locate which step-by-step guide is needed' when, for example, one is new to the CU system and does not understand what terms such as 'Payroll Expense Transfer' mean. Other comments included:

It is not always easy to find what one needs to do because it may involve multiple entries. Everything ran together and it was difficult to find a particular subject. End users often did not want to read extensively to find what was relevant. It is confusing to find correct information because of the many 'alerts'. The user gets tired of having to leaf through everything (which is quite thick) to find the one thing he or she is looking for.

Navigation would also be easier if the presentation of the manuals was improved. Two point thirteen percent (2.13%) of the responses to the 'like' question and twenty percent (20%) of the responses to the 'dislike' question mentioned the presentation of the manuals. Users suggested that the structure and organisation of the manuals could have been improved with tabs and cross-reference indexing, as well as a better table of contents and index. Some of these comments follow:

Users think there should be tabs for each process to help them easily find instructions. Maybe a cross-reference index in case they do not know the exact name of the procedure they are looking for.

The following users suggested a frequently asked questions (FAQ) section for advanced problem solving:

Maybe it could use an index or FAQ section. The users wish they could have a FAQ section for a little advanced level, including the problems which would not make it saved.

A FAQ section might also improve ERP learnability using the manuals, as discussed below. Ten percent (10%) of user responses to the 'like' question reported that the manuals helped them learn the system. However, forty seven percent (47%) complained about aspects of learnability such as unclear explanation (25%) and information overload (26%). A few users reported that they learned the system through trial and error rather than from the manuals. Some respondents complained about the learnability of the system, regardless of the manual:

The PeopleSoft system is not easy to learn, even for users who have no trouble learning other programs. There are too many ways that users can leave out information that is needed, creating problems later. The (PeopleSoft) system is hard to learn and the layout of the manual is indicative of that. It is easy to forget steps.

Some users preferred learning with a person, rather than a manual:

Users tend to learn more quickly when they have had hands-on training while looking over someone's shoulder or working with someone else rather than using a manual. It is easier to ask than look in a book. Sometimes the book is just too cumbersome and what one needs is an abbreviated outline to recall how an entry is made.

One user pointed to the value in multiple methods of learning: 'The on-line training, step by step guides, manuals, and the call centres are all necessary to learn the PeopleSoft system.' Criticisms of technical jargon and acronyms were mentioned by three of the respondents. The following is an example:

It is frequently apocryphal, sometimes wildly inaccurate, and does not actually offer insight into processes on campus but rather clouds them by informing us of unexplained (and inexplicable) jargon.

Many users (25% of responses) complained about information overload and were overwhelmed by the size of the manuals. Comments included:

- Too big and bulky.
- Users feel as if it is too much information.
- One section that users found a little confusing and overwhelming was the report reading section.

- Also would like to see the manuals less ‘dense,’ more concise directions.
- Too cumbersome. Too much is assumed as far as understanding, probably due to the fact the people who put them together have forgotten how much they had to learn when they first came to the University.
- Users would prefer simplification for tasks that they are required to do rather than having to sort through and learn tons of things they will never do.

Some of the comments suggested that more tailoring of the documentation would help users learn the system and improve task support. Task support was mentioned in eighty eight percent (88%) of the ‘like’ comments. The aspects of task support that the responding users liked were:

- having a manual for reference;
- the step-by-step guides; and
- the screen-shot illustrations.

Users liked having the manuals as a reference; forty five percent (45%) of the ‘like’ comments mentioned appreciation for having a hard copy to access, especially for procedures that were used infrequently. When users did not perform a procedure on a regular basis, they tended to forget the details and the manual helped refresh their memories. A few users commented that the manuals were designed more for training rather than as an ongoing reference tool and therefore the content was in the order used in training. One of the users considered the step-by-step guides as reference tools.

The step-by-step guides were mentioned by thirty nine percent (39%) of the users who submitted ‘like’ comments. They found the guides easier to follow than descriptions of the process and were glad to have help without bothering anyone. Many users commented that the on-line step-by-step guides were more current than the printed manual that they received at the training session. The screen prints were mentioned by thirteen percent (13%) of the users who responded to the question on what they liked about the manuals. The screen prints showed users where they were supposed to be in the software and clarified the instruction step. Screen prints are categorised as task support rather than presentation because their content is much more important to users than their appearance. Task support was mentioned in seventy one percent (71%) of the ‘dislike’ comments. Users disliked aspects of the manuals relating to:

- difficulty understanding processes (explanations);
- incomplete information; and
- problems keeping the documentation updated, and described in more detail below.

Mention was made of problems in understanding processes in forty six percent (46%) of the responses. They complained that the manuals did not ‘explain why something is done a certain way’; did not give the implications of selecting various answers; did not help with troubleshooting; did not explain the reason for errors in the system; did not explain who does what; did not explain CU-specific processes; and assumed that users are already familiar with the CU processes. Some examples of user comments follow:

The process on each campus outside of PeopleSoft is important and was not given enough attention in the desk manual. Most of the training seemed to be ‘click your mouse here’ and not WHY this needs to be done and this is what you do if it does not work.

Incomplete information and documentation of processes was mentioned by thirty three percent (33%) of the responses. Many complained that the off-line processes were left out and that the manuals did not indicate ‘what other processes need to occur in conjunction - with the PeopleSoft processes.’ Others complained that the manuals leave out special circumstances; leave out quirks in the system; leave out little details that make ‘all the difference’; have no flowcharts or descriptions of paper flow; and do not provide data dictionary information so users are ‘constantly guessing at field content and interpretation.’ For example, one user commented: ‘If you find it and follow the instructions, there is invariably a step that is left out or assumed in the instructions, and so on.’

Problems keeping the manuals current were mentioned by twenty two percent (22%) of the respondents. They complained that they are not always notified when there are updates; they are unsure if the manuals are current; the manuals were obsolete ‘the day we went live’; too many ‘alerts’ were published after training; information in the manuals is different from that on-line (‘mine is so out of date that nothing is relevant to today’s work’); and because the manuals were not updated, they had ‘incorrect information related to panels and data.’

The four perceived usability characteristics discussed above are likely to affect the perceived usefulness, use, and user acceptance of the training manuals. However, sixty five percent (65%) of

respondents who provided 'like' comments and fifty seven percent (57%) of those - who provided 'dislike' comments answered better than neutral (on the seven-point Likert scale) to the following survey questions:

The manual provides useful information. Users would recommend that other people in my group use the manual as a resource.

As suggested in some of the responses above, however, forty two percent (42%) of respondents to the 'dislike' question indicated the usefulness of the manuals could be improved. The manuals would be more useful to users if the off-line processes were documented in an integrated way with the on-line procedures in the software. Furthermore, troubleshooting content needed to be provided. The following examples suggested other problems that affected the usefulness of the manuals:

Users also would find it more useful if it indicated what other processes need to occur in conjunction with processes. They often find they have done something only halfway because they followed only the manual. Sometimes, steps seem to be missing; and when users have problems, the manual is rarely useful.

About ten percent (10%) of the 'dislike' respondents reported that they did not use the manuals, either because they were obsolete or not helpful for troubleshooting.

In summary the relatively small ERP training budget for the implementation hampered efforts to prepare more than two thousand ERP users at the University of Colorado for their new roles.

With more resources, CU users may have had more role-based training like at Motorola, which had learned from a prior ERP implementation failure (Roberts *et al.* 2003 in Scott 2005), and training materials would have been more customised to user roles. Under this scenario, users would not have been intimidated by the bulk of manuals containing irrelevant material, but would have been able to find the information they needed quickly. Two years after training, usability problems with the manuals still plagued staff that used the ERP irregularly and relied on the documentation.

On the other hand, many users appreciated having a printed manual to help them do their jobs. The complexity of the software, the radical change in tasks, and the large numbers of users affected meant that having no documentation was not an option. The positive comments showed that users considered task support much more important than presentation, navigation, and learnability. Among the aspects of task support, the most significant were availability of a reference, step-by-step guides to carrying out the task, and, to a lesser extent, illustrations of screens from the ERP software. However, problems with presentation, navigation, and learnability were also obstacles to task support. The negative comments also emphasised task support - specifically, not enough explanation, and incomplete and out-of-date information. Learnability and navigation received the next most complaints and presentation the least. The overwhelming size of the manual and information overload was a common complaint that implied obstacles to learnability.

The findings have implications for improving the design of ERP documentation, which would decrease the pain and cost of ERP implementations. Although most ERP training documentation has moved on-line at CU and elsewhere, there are lessons to be learned from this study:

- Documentation should focus on organisation-specific business processes. Providing a hyperlink from on-line documentation to process flow diagrams would help users understand who does what and the rationale behind the ERP transaction. This would also address the complaints about incompleteness of information in the manuals.
- Role-based training would provide knowledge integration and better mapping to users' needs. More tailoring of documentation would increase perceived usability, especially learnability and task support.
- FAQs (frequently asked questions) available on-line would explain advanced tasks and provide troubleshooting advice.
- Out-of-date information should be avoided by printing only the more static content in manuals and posting the dynamic content on-line where it is more easily updated. A learning management system would help organise training-related content.
- The most recent version of the manuals could be available for download. The download could be by chapter or the entire manual.
- The on-line version of the manuals should include advanced search capabilities so users can easily find the help they need.

- Popular on-line step-by-step guides could be made more usable with a search engine.
- An obvious and relatively easy change would be to restrict the size of the manuals. Much like desktop software documentation, there could be a 'getting started' manual, a reference manual, and an advanced manual. This solution would give users more control over information overload.
- Using hyperlinks in on-line documentation is another potential solution to information overload.
- Providing a data dictionary on-line would help users who want an explanation of field content and interpretation.
- Use of colour-coding, tabs, more section breaks, and a good layout for the table of contents and index would improve the presentation of the printed documentation.
- Soliciting feed back on the manuals - in the design phase, at the end of classroom training sessions, and at regular intervals - would provide a means of monitoring user attitudes (Roberts *et al.* 2003 in Scott 2005).

In conclusion, this research study identified users' perceived usability of ERP training documentation for the University of Colorado's PeopleSoft implementation. Because user-training issues are common in ERP implementations, it is likely that the results of this study are generalisable to other organisations and other industries. The results are also applicable to training in other categories of complex software that have large numbers of enterprise-wide users whose jobs have changed radically. The survey responses confirm a need for process-centric documentation, as mentioned in the literature. This is the most important finding for both research and practice.

While it may seem obvious that users are most concerned with task support, the fact that many users were not satisfied with the manuals' facilitation of their work activities more than two years after training suggests major shortcomings. Analysing the users' likes and dislikes yielded some clear guidelines on ways to enhance the usability of printed training manuals and on-line documentation. Documentation is a relatively small part of a typical ERP project budget, yet the impact on learning and troubleshooting the ERP system is potentially high. If the usability of the documentation is poor, users waste more time trying to correct errors, and also are more likely to call the help desk or ask colleagues for help. These forms of support may not be immediately available, especially at go-live.

However, this study clearly shows that organisations should not neglect the usability of their documentation after go-live, because it impacts the future returns on their investment in the ERP system.

3.5.2. User perceptions and interaction with Web pages

Information Technology is developed every day. The healthcare environment is also changing, and this evolution is impacting healthcare providers, physicians, and the information technology that must support them. The hospital information system in Inkosi Albert Luthuli Central Hospital is currently not web-based (using the Web pages), but this option will be explored in future when MEDICOM Hospital Information System is upgraded (Van Niekerk 2006). According to the study conducted by Wimelius (2004):

Information technology is today connected to almost every single activity that humans in the modern world engage in. The efficiency but also the complexity of information systems and applications has increased dramatically during the last decades. Further, a widely spread usage of information technology by people in general has also lead to a situation where many different types of user groups should be able to use the same application or system (Wimelius 2004).

Bonnes and Marino (2002) argue that:

the environment constitutes an important factor in the lives of humans. Some places are found inviting and appealing while others are dull and boring. Questions focusing why people prefer certain types of environments to others are thus interesting to investigate. Environmental psychology as a field deals with questions of this type, among many others. The field ranges from trying to understand the basic relationship between human behaviour and physical environment in terms of the spatial-physical dimension of the environment as constituting part of human actions and behaviour, to looking at social-psychological factors and a broader, more general theme of interplay between people and their contexts.

Bell *et al.* (2001) add that:

environmental psychology can be seen as the study of the relationships between behaviour and experience and the built and natural environments.

For Synek (2002):

theories within the area of environmental psychology suggest that there might be both cultural as well as evolutionary factors affecting how people perceive different types of environments'. 'Both environments that people have previous experiences from and a possible existing heritage from the shared history of humankind seem to affect perception. Research has been done trying to identify the type of attributes in environments that appeal to people, that is, why a specific environment such as the savanna, is preferred before another. One set of suggestions builds on the concept of exploration and information gathering.

3.5.3. Wimelius's study (2004)

According to Wimelius (2004) studies investigating preference of different environmental settings have showed that an attribute named mystery often is positively related to preference. Mystery means that a specific environment has something more to offer than what is immediately perceived. An example of mystery could be a small hill in an open space, promising a better and more overarching view of the environment behind it than the current view offers. To study perception of and interaction with an information system or application, also includes creating a basic understanding of the relationship between aesthetics and functionality.

As a starting point for exploring the use of theories from environmental psychology in generating an overarching understanding on the subject of perception of- and interaction with web pages, a pilot experiment was conducted by Wimelius (2004). The main objective of this pilot experiment was set at trying to identify attributes that seem to have an impact on how people perceive web pages, and subsequently try to relate these attributes to more general attributes that have been found influencing perceptions of real world environments. A second purpose was to attempt to relate the respondents' interaction with the web pages to the three different stages included in the spatial frame of reference. Thus, this implies making use of the terms (1) *initial encounter with environment*, (2) *information gathering* and (3) *decision-making-process*. At each stage in the spatial frame of reference, certain main attributes in the environment are important, and are thus interesting to look at in relation to web pages as well.

Being a pilot experiment, the research methodology was explorative. Eight individuals were involved in the experiment. Respondents represented two different types of users. The two different user-types were defined as experienced and non-experienced users. This was achieved through preliminary interviews with the respondents. The experienced users were all familiar with browsing websites, whereas the non-experienced users only had sparse knowledge and experience of using computers and browsing websites. Each respondent subjectively described their own view on their knowledge and experience of browsing websites and using computers. Four respondents representing each group were selected.

The experiment was a pilot experiment where the main objective was focused more towards exploring the idea of environmental psychology applied to web pages, than finding statistically valid relations. Thus, the experiment was considered as a first possible step towards a more comprehensive set of studies.

Four web sites were used in the experiment. An attempt to include web pages that in some way differed regarding for example, spatial configuration and the degree of complexity was made. Each individual was asked to browse through the four different web sites. There was no explicit time limit for this activity, however the user had to spend at least five minutes on each particular site. The browsing session took place in a room containing a desktop computer on which the respondent browsed the websites. Two people were present in the room at each session, the respondent and the researcher. After browsing through each site, an interview was carried out with the respondent. The interview was conducted as a semi-open interview in which the respondent was asked general questions as a form of support in order to be able to express her or his opinions, feelings and thoughts concerning the specific website. The interview was recorded and transcribed to simplify analysis of the material. The researcher also took notes during each session.

The procedure for extracting relevant attributes from the empirical material was to analyse the material in order to uncover concepts that were expressed (by the respondents) to have an influence on perception. Concepts that were closely connected were then condensed into single concepts by the researcher. For example, the use of the attribute 'exciting' was a generalisation that covers closely related concepts such as 'thrilling' and 'stimulating' as expressed by the respondents. Consequently, it was important to emphasise that the key attributes used below represent generalisations.

The findings were divided into two main parts. The first part focused on perception of web pages, specifically looking at attributes that seem to be central for perception. Wimelius (2004) asked whether the same kind of attributes that are important in perception of natural environments also central in perception of web pages. The second part of the purpose is focusing on investigating if and how interaction with web pages can be described using a model inspired by the conceptual framework depicting habitats selection described by Orians and Heerwagen (Orians and Heerwagen 1995). In other words, does interaction with web pages go through the three stages as presented in the spatial frame of reference?

The *generalised* attributes derived from the expressions the participants gave voice to concerning the web sites they were confronted with are described. The list presents a somewhat simplified view of the attributes. Attributes seldom exist in isolation, but are rather connected to each other in a complex web of relations. What is being considered as positive in one context can be perceived as negative in some other context. However, the list gives a basic view of the central attributes expressed by the participants as influencing their perception of the web pages, such as; legible, simple, boring, nice looking, good structure, exciting, messy, confusing, and lack of structure.

In general, *legibility* was considered a positive attribute. Often this concept was associated with both the structure of the web page and the actual text being presented. A web page containing a fairly small number of objects was often considered having a high amount of legibility. When specifically related to the text that was presented on the web page, legibility was often related to (i) the amount of text being presented, (ii) the size of the text and (iii) the contrast between the text and the background. Some respondents argued that a bad combination of colours regarding text and background made the entire web site hard to grasp and appreciate. A bad combination was often referred to as a lack of contrast. For example, one respondent said the following about this relationship:

The colours used on this web page makes understanding it hard. It is almost impossible to see the text on that background.

However, *legibility* was also connected to the attribute '*simple*'. A web page having a simple design was often considered having a high amount of legibility. Although this was often perceived as something good, the combination of these two attributes was not something solely positive. In

some contexts, several of the respondents found the combination to be negative. One respondent said the following about the site spelbutiken.se:

The design is very simple [...] which in this case fits the purpose of the site, but it is boring, not enticing at all.

What is interesting about this statement is that the respondent in some way thought the design of the web page to be good in relation to the content of the site, still the respondent also argued that the design was too boring. In other words, the design of a web page might be considered as fitting the purpose of the site, but still not appealing. The purpose of the respondents visit to the site might thus in this context play a very important role.

An interesting attribute was '*nice looking*'. Although this was a fairly frequently used concept for describing positive feelings toward the design of a web site, many of the respondents had problems explaining specifically what in the page constituted the 'nice looking' part. However, one of the respondents had the following explanation to this concept regarding the site k10k.net:

It (the web site) was, to speak in aesthetical terms, nice looking. That is to say, the use of colours, the constellation and the proportions between text and images.

For this particular respondent, the most important feature of the web page considered nice looking, was the proportion between the different objects on the page. Referring back to the concept of information gathering and exploration, this might be looked upon as corresponding to the moderate degree of complexity and the semi-open spatial configuration found to be positive factors in perception of natural environments.

Good structure was considered something positive by all respondents included in the study. However, this concept seemed to be even more important for the non-experienced respondents than for the respondents familiar with computers and information technology. Good structure was often related to a design that the non-experienced user previously had been in contact with. One of the non-experienced respondents said the following about what he or she thought to be good in the site vnunet.com:

... What is good about this web page is that I recognise the design from other sites I have been visiting. The menu – I like to feel ‘at home’.

Thus, recognition of familiar patterns was central in this context. However, it is important to understand that the recognition of patterns does not have to do solely with patterns from computer-based environments, but can as well be connected to patterns found in other types of environments or media. As an example, one of the included web pages (vnunet.com) uses a common newspaper-metaphor in their design, which some respondents expressed helped them understanding the structure of the page.

Though recognition of familiar patterns was considered as something positive, lack of recognition could also influence perception of a specific web page in a positive way. This phenomenon is illustrated by the attribute exciting. A good example of how this attribute was considered to be something positive regarding perception is illustrated by the following quote made about the site theremediproject.com:

There were some sounds and funny colours (on the web page) which made me feel curious – what will come out of this? But then again, I had some difficulties in understanding what the web page was all about.

The attribute exciting was in general connected to some kind of explorative feeling experienced by the respondents. This attribute can be seen to correspond well to the concept of mystery as described in the theoretical framework. One web page in particular (theremediproject.com) seemed to generate stronger feelings of exploration than the other web pages included in the study. This web page differs from the other three pages by actively using sounds in the design. As an example, sounds were being used both as effects when the user clicks on a link, and as a background component which means that the sound contribute to the overall impression and perception of the web page. However, theremediproject.com also differed by containing a movable navigation. The user can interact with the web page by moving pictures and blocks of text around. At some points different objects on the page partially covered other objects, which led the user to a situation where he or she had to interact in some way to be able to access the information located behind what was currently being presented.

Many respondents thought the concept of actively interacting with the web page to be appealing, though in some cases the explorative features were also considered negative when related to the purpose of the visit to the site. As one respondent put it:

[...] I like the fact that it was interactive, I can move things around [...] But if you access the site for the first time and just want some quick information, that will be hard to find. You have to understand the site in some way to be able to use it.

The specific purpose of the visit to a web page could be important in how an individual experiences a particular site.

The attribute *messy* was primarily considered something negative. Judging by the answers given by the respondents, the attribute was used to describe both lack of structure on a general level and too vast amount of objects being presented on the screen. Of the four web pages used in the study, one (1) in particular (k10k.net) seemed to generate many similar reactions like the one outlined above. The main reason for this was according to several of the respondents the very high complexity of objects on the page.

However, this was not the only factor that appeared important in the perception of computer-based environments containing a high complexity. Vnunet.com also had a high number of objects, but many of the respondents did not consider this page messy. The main difference between the two web pages is that vnunet.com used a common way of presenting information on the web, the newspaper metaphor, whereas k10k.net presented information in a more experimental fashion. The fact that the respondents recognised the pattern of a newspaper, or at least were familiar with the navigation concepts of vnunet.com seemed to help many of them finding their way through the web site and understanding the structure. The attribute *messy* could also be seen as corresponding to the general attribute 'complexity' deriving from environmental psychology.

Closely connected to 'messy' was the attribute *confusing*. If a web page is perceived as confusing, it seems like the purpose of the visit to the site is highly important regarding whether this is perceived as positive or negative. One respondent argued:

'The purpose with my browsing serves as the starting point. The design of the web page gets more important the more I want to get entertained.'

Many respondents expressed that a web page could be enticingly confusing if he or she was not searching for a specific piece of information nor had some other specific goal with the visit to the site. On the contrary, if there was a specific purpose with the visit, such as obtaining information, the confusing attribute solely was perceived as a highly negative factor. The concept confusing was also in some contexts perceived as lack of structure in the web page. For some respondents this expressed itself in a lack of recognition of familiar patterns and structures in the web page.

3.5.4. Shaikh *et al.*'s study (2006)

In another study Shaikh *et al.* (2006) determined whether or not participants consistently attribute personality traits to a variety of fonts presented onscreen. The study also attempted to determine if participants associate fonts with particular onscreen uses.

Participants completed the survey in two (2) parts (personality and uses). A total of five hundred and sixty-one (561) participants completed Part A (Personality) of the survey, and five hundred and thirty-three (533) completed Part B (Uses). For both parts of the survey, seventy-two percent (72%) of participants were females and twenty-eight percent (28%) were males. Approximately sixty percent (60%) of participants were full-time students; forty-five percent (45%) of participants were in the twenty to twenty-nine (20-29) year old age group, and twenty percent (20%) were in the 30-39 year old group. Eighty-one percent (81%) of the participants reported visiting websites daily. Approximately forty-six percent (46%) of respondents indicated they spend two (2) to six (6) hours per week reading on the Internet.

An on-line survey was used to collect the data (Shaikh *et al.* 2006). Database tools such as PHP and MySQL were used to construct the survey to allow for randomisation of stimuli. These are the applications that are used to develop systems. Participants were provided with a consent form on-line. The survey took approximately forty minutes to complete and consisted of a demographic questionnaire followed by two parts. Part A asked participants to rate twenty (20) font samples using fifteen (15) personality adjective pairs based on a four (4) point Likert scale. In Part B participants viewed twenty (20) font samples and indicated whether they would use the font for twenty-five (25) different digital uses.

The twenty (20) fonts used throughout the on-line survey are shown in Figure 5. The fonts chosen included samples of serif fonts (Cambria, Constantia, Times New Roman, and Georgia), sans serif (Calibri, Corbel, Candara, Arial, Verdana, and Century Gothic), scripted or fun fonts (Rage Italic, Gigi, Comic Sans, Kristen ITC and Monotype Corsiva), monospaced fonts (Consolas and Courier New), and display or modern fonts (Impact, Rockwell Extra Bold, and Agency FB). Cambria, Constantia, Corbel, Candara, Calibri, and Consolas are new ClearType fonts developed by Microsoft.

Figure 5: Twenty font samples used in the on-line survey

Cambria	Times New Roman	<i>Gigi</i>
Constantia	Arial	Kristen
Corbel	Verdana	Rockwell Extra Bold
Candara	Comic Sans	<i>Rage Italic</i>
Calibri	Century Gothic	Agency FB
Consolas	Courier New	Georgia
	Impact	<i>Monotype Corsiva</i>

Source: Shaikh et al. (2006)

In Part A, the participants saw a randomised sample of text (provided as an image) that included the alphabet, numerals, and common symbols rendered in fourteen (14) point as shown in Figure 6. The fifteen (15) personality adjective pairs used in Part A are shown in Figure 7. Personality research, adjective lists, and pilot testing were used to determine the final fifteen (15) adjective pairs used in the survey.

Figure 6: Sample of the text seen in Part A to assess personality traits associated with the fonts

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	0	.	:	,	;	(#	!	?	")	@	#	\$	%		

Source: Shaikh et al. (2006)

This sample shows the font Consolas.

Figure 7: Fifteen adjective pairs used to assess perceived personality of font

Stable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Unstable	Polite	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Rude	Formal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Casual
Flexible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Rigid	Exciting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Dull	Assertive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Passive
Conformist	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Rebel	Attractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Unattractive	Cuddly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Coarse
Creative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Unimaginative	Elegant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Plain	Masculine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Feminine
Sad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Happy	Youthful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Mature	Practical	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Impractical

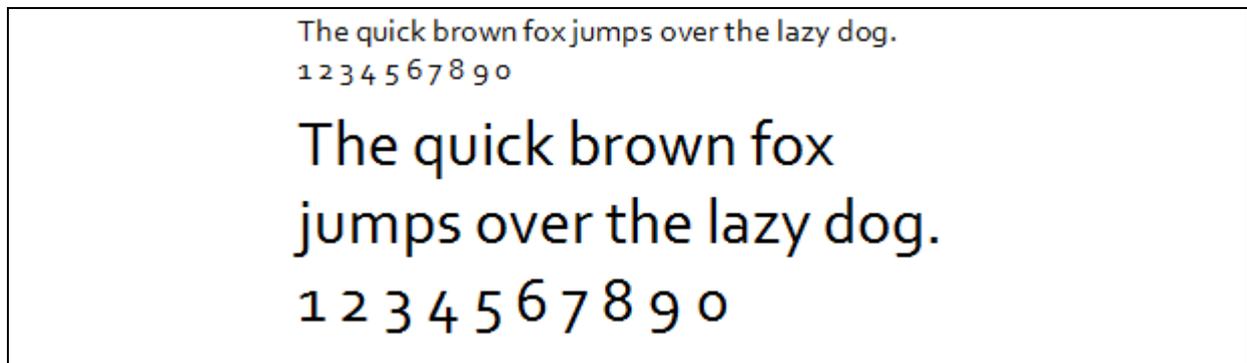
Source: Shaikh et al. (2006)

The scores were based on a four (4) point Likert scale as shown.

Images showing one of three pangrams and the digits 0-9 were used in Part B to assess perceived uses of the fonts. The following pangrams were used (i) The quick brown fox jumped over the lazy dog. (ii) Amazingly few discotheques provide jukeboxes. (iii) Whenever the black fox jumped the squirrel gazed suspiciously. Display of the pangrams was randomised. The pangrams and digits were shown in both 12-point and 24-point for each font as shown in Figure 8. In Part B, the participants were asked to indicate whether they would use a font or not by clicking a checkbox (yes) or leaving it unchecked (no). Table 2 provides the twenty five (25) uses assessed in Part Three (3). Participants were allowed to choose as many or as few uses as they felt were appropriate; participants could also choose the option:

‘I would not use this font for any purpose.’

Figure 8: Sample of pangrams and digits used in Part B to assess perceived uses of font



Source: Shaikh et al. (2006)

This sample shows the font Corbel.

Table 2: Twenty-five (25) users evaluated for each font

Websites	Documents	Reading Material	Correspondences	School-Related	Other
Graphics or Logos	Business	eBooks	Email	On-line Textbooks	Scrap booking
Textual Content	Technical	On-line Magazines	Instant Messaging	Assignments	Brochures
Advertisements	Children's	On-line Scientific or Research Journals	Letter or Memo	On-line Tests	Computer Programming
Headlines	Math	On-line News Articles	Electronic Greeting Card		Spreadsheets
		Short Stories			PowerPoint Presentation
I would not use this font for any purpose.					

Source: Shaikh et al. (2006)

The fifteen (15) personality traits were collapsed into a mean personality score for each font. Principal Component Factor Analysis with Varimax rotation was used to form factors with eigen values exceeding 1.0. Analyses of scree plots and eigen values resulted in five (5) factors as shown in Table 3. Fonts that shared typographic features (serif, etc) grouped together; but further means analyses of personality traits indicated the font groups also shared common personality traits. The Sans Serif fonts did not score extremely high or low on any personality traits. The Serif fonts scored highest on traits such as Stable, Practical, Mature, and Formal. Fonts in the Script or Funny factor had the highest means for Youthful, Happy, Creative, Rebellious, Feminine, Casual, and Cuddly. Masculine, Assertive, Rude, Sad, and Coarse were most associated with the Modern Display fonts. The final group, Monospaced, had the highest means for Dull, Plain, Unimaginative, and Conforming.

Table 3: Five font factors

<i>All Purpose</i>	<i>Traditional</i>	<i>Happy Creative</i>	<i>Assertive Bold</i>	<i>Plain</i>
Sans Serif	Serif	Script/Funny	Modern Display	Monospaced
Calibri	Constantia	<i>Gigi</i>	Impact	Courier New
Century Gothic	Georgia	<i>Kristen</i>	Rockwell Xbold	Consolas
Arial	Times New Roman	<i>Rage Italic</i>	Agency FB	
Verdana	Cambria	<i>Monotype Corsiva</i>		
Corbel		<i>Comic Sans</i>		
Candara				

Source: Shaikh et al. (2006)

Fonts are listed in order of factor loadings.

The study shows the fonts rated the highest for each personality trait evaluated in the survey (see Appendix 9).

Data for the uses were analysed using frequency analyses due to the dichotomous nature of the data. All uses except for computer programming had at least one font chosen as appropriate by fifty percent (50%) of the participants; forty-six percent (46%) of participants chose TNR for computer programming. Approximately twenty-eight (28%) of participants said they would not use Agency FB for any purpose listed. Over twenty percent (20%) of participants said they would not use any of the Modern Display fonts (Agency FB, Rockwell Extra Bold, and Impact).

**Table 4: Uses with the highest consistency among participants.
Percent saying ‘Yes, I would use this font.’**

Use	Font	%
Website Text	TNR	72%
	Calibri	70%
	Cambria	70%
Business Documents	TNR	78%
	Cambria	76%
Children's Documents	Kristen	78%
	Comic Sans	77%
E-Greeting	Monotype Corsiva	74%

Source: Shaikh et al. (2006)

The top three (3) fonts for each use and the lowest scoring font is present in appendix 10.

In summary;

Sans Serif Fonts. Users preferred Sans Serif fonts for Website Text (62%), Email (60%), and On-line Magazines (56%). Sans Serif fonts were least preferred for Digital Scrapbooking (32%), Computer Programming (34%), and Math Documents (36%). Uses for Serif Fonts. Users preferred Serif fonts for Business Documents (71%), Website Text (67%), and On-line Magazines (63%). The three uses that were least associated with Serif fonts were Scrapbooking (28%), Children’s Documents (34%), and E-Greetings (38%).

Script or Funny Fonts. Digital Scrapbooking (61%), E-Greeting (60%), and Website Graphics (53%) were rated as the highest uses for this group of fonts. The Script or Funny fonts were not preferred for Computer Programming (2%), Scientific Documents (3%), Spreadsheets (3%), and Math Documents (3%).

Modern Display Fonts. The three uses rated the highest by users for Modern Display fonts were Website Graphics (47%), Website Headlines (44%) and Website Advertisements (44%). The uses least often chosen for this group were On-line Tests (9%), E-Books (9%), Spreadsheets (10%), and On-line Assignments (10%).

Monospaced Fonts. Users chose Technical Documents (45%), Computer Programming (40%), and Math Documents (40%) as the highest uses for Monospaced fonts. The uses receiving the fewest votes were Digital Scrapbooking (18%), E-Greeting (21%), and PowerPoint (22%).

The results from the on-line survey resemble previous research based on print samples. Users consistently attributed personalities to fonts displayed onscreen. The twenty (20) fonts chosen for this survey resulted in five factors based on prevalent personality traits. The factors each contained fonts that were related by typographic features. The factors provide designers with some guidance in terms of which type of font is best suited to differing personality expressions. Such knowledge can be used to set the tone of on-line documents.

The factors found using the personality data were used to analyse the uses from Part B of the survey. Uses were summarised across the factors in order to provide designers with overall guidelines concerning the use of fonts. Sans Serif and Serif fonts were most likely to be appropriate for items that are typically read onscreen. Artistic elements and children's documents were seen as appropriate uses for the Script or Funny fonts. Modern Display and Monospaced fonts were not particularly high on any use. The choices of fonts for uses can be seen as related to the personality of the fonts. The Script or Funny fonts scored high on Youthful, Casual, Attractive, and Elegant traits which are all related to Children's Documents and artistic elements. The Serif and Sans Serif fonts were seen as more stable, practical, mature, and formal; the uses they are appropriate for fit these characteristics.

Waern *et al.* (2006) studied people's perceptions of human and computer advice with the aim of studying users' perception of computers and human beings as advice givers in problem-solving situations. They asked if people's self-confidence and their perception of the advice vary depending on the origin of advice. Their two studies showed somewhat different results. In the first study, people were given advice either by a (putative) computer or by a human being. Their self-confidence did not vary with the origin of the advice, but with the correctness of their own answer as well as of the advice. The perception of this advice did not differ for the two situations. Their general trust in computers was, however, much less than their trust in human beings.

In the second study, the subjects had to attribute advice to a computer or a human being, without being told from whom the advice emanated. For Swedish subjects, the ratings showed consistently higher attributions to human beings regarding knowledge and explanation value of advice and higher attributions to computers regarding trust and understanding. For Indian subjects, humans always received the higher attributions. It was concluded that people's perception of computers seems to be related both to existing attitudes and to their experience of the advice given. Knowledge in the domain seems to be an important factor influencing the perception of the computer as trustworthy.

3.5.5. Embedding evaluation tools: Werth's study (1998)

According to Werth (1998 in Scott 2005) clinicians use medical informatics systems to make their work easier and more effective. Yet such systems remain rare, in part because of difficulty communicating different professional paradigms between clinicians and software developers. Evaluation tools in other fields have enhanced such communication among system stakeholders. The objective of Werth's study (1998) was to study the feasibility and effectiveness of embedding evaluation tools into clinician workstations. A case study hypothesis-generating experiment using grounded theory qualitative analysis was used. Clinician workstations at University of Minnesota hospitals and clinics blood bank and four in-patient units were sampled. Participants were physicians and nurses using the system and developers of the system. The following techniques were used to collect data:

- Embedded evaluation tools for observation of stakeholder and system behaviour and stakeholder surveys;

- Electronic mail for observation collection and automated reporting;
- Pre-addressed E-mail feed back for direct communication from clinicians to developers;
- Multi-layered security supporting personal E-mail for two-way communication among stakeholders; and
- E-mail surveys allowing stakeholders to distribute questionnaires and collect responses.

Main outcome measures were: Deployability of embedded evaluation tools; Tool use by stakeholders: quantity and content of feed back and E-mail messages from clinicians; observations selected and used by developers; survey questionnaires created by stakeholders, response rates, and result use.

The findings were unexpected resistance to clinician E-mail from nursing administration, centred on perceived lack of resources for training, although the system itself was deployed without training. Therefore, clinician E-mail and survey tools were not deployed. Most common clinician feed back messages were requests for features and display formats. Initial feed back averaged twenty five messages per month, tapering irregularly by half over one year, with increases early each month. Developers perceived themselves understaffed for the system⁵, with few resources for feed back follow-up. User authentication was added to feed back access after several clinicians denied messages sent in their name. Developers used observation to track clinician usage, software behaviour, and database response times.

In conclusion, it was found that embedded evaluation-tools could be successfully deployed in clinician workstations, helping to expose divergent concerns between stakeholder groups, and generate hypotheses.

3.5.6. Doctors' use of electronic medical records systems in hospitals: Lærum, Ellingsen and Faxvaag's (2001) study.

Electronic medical records systems have been used in hospitals throughout Europe for some time. However, there seem to have been few formal evaluations of them, possibly because of a lack of established evaluation methods. Lærum *et al.* (2001) therefore investigated the usefulness of

⁵ This means that there were few developers to cope with the development of a complex system.

different systems by comparing their use in general clinical tasks. Frequency of use is a possible indicator of how well such systems are adapted to clinical work in general because a successful system ought to be used by most doctors for important tasks. They developed a questionnaire to investigate and compare the use of electronic medical records systems among doctors in Norwegian hospitals.

Lærum *et al.* (2001) conducted a cross sectional survey on doctors' use of electronic medical records systems in hospitals. The objective of the study was to compare the use of three electronic medical records systems by doctors in Norwegian hospitals for general clinical tasks. Of the seventy-two (72) hospitals in Norway, fifty-three (53) had purchased a license for an electronic medical records system by January 2001, covering seventy-seven percent (77%) of hospital beds. In practice, there were three main electronic medical records systems - DIPS, Infomedix, and DocuLive (see Table 5 below). The DocuLive system was installed in the five university hospitals and hence was associated with the largest hospitals in the country. None of the largest hospitals had completed implementing the electronic medical records system in all of their departments at the time of our survey.

Table 5: Distribution of electronic medical record systems in Norwegian hospitals by January 2001 and respondents in survey. Values are numbers (percentages)

Records system (vendor)	Nationwide			In survey		
	Hospitals (n=72)	Hospital beds (n=13 751)	Doctors (n=6700)	Respondents (n=227)	Hospitals (n=19)	Hospital units (n=32)
DIPS (DIPS)	23 (32)	2336 (17)	912 (14)	69 (31)	6	11
DocuLive EPR (Siemens AG)	9 (13)	4375 (32)	2829 (42)	77 (33)*	6*	9*
Infomedix (EMS)	20 (28)	3844 (28)	1550 (23)	81 (36)	7	12
Other	1 (1)	12 (0.1)	2 (0.03)	0	0	0
None	19 (26)	3184 (23)	1407 (21)	0	0	0

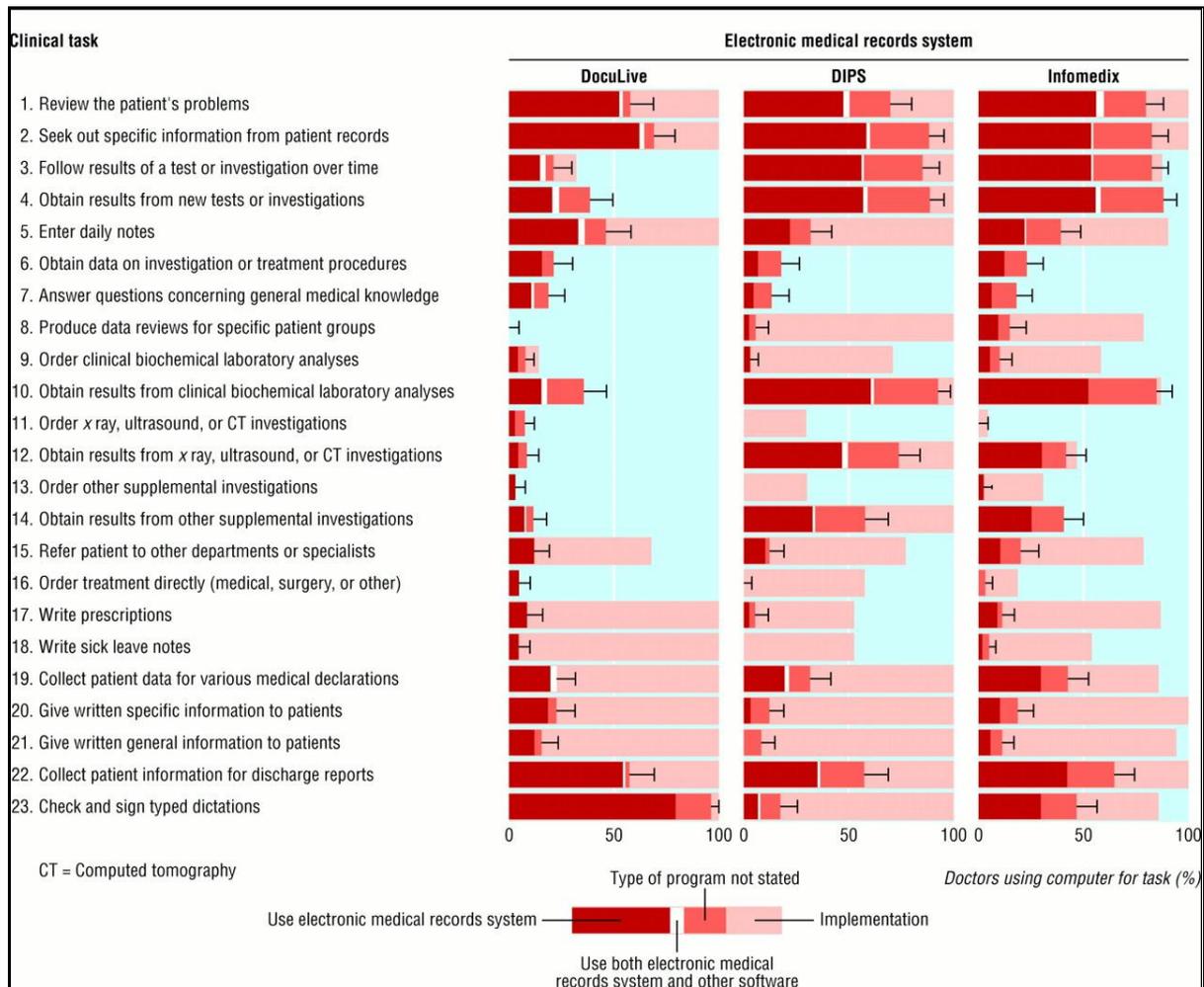
Please note that the hospital data was obtained from SAMDATA 1999. (<<http://www.samdata.sintef.no>>12 January 2001); and * Two hospital units in two hospitals represented by eight respondents were excluded post hoc.

Source: Lærum et al. (2001)

The questionnaire consisted of eight sections (see Appendix 3 for details). In the section covering use of computers, Lærum *et al.* (2001) generated the list of clinical tasks on the basis of forty (40) hours of observations in five (5) hospital sections at two (2) hospitals, taking into account the

information needs of doctors. The section asked doctors to indicate their frequency of use of computers for twenty-three (23) general clinical tasks on a five point scale ranging from 'Never or almost never' to 'Always or almost always.' In addition, they were asked to indicate whether they were using the implemented electronic medical records system or another computer program (or both) for each task.

Figure 9: Reported use of computer programs for various clinical tasks by doctors from hospitals with different electronic medical record systems



Source: Lærum et al. (2001)

Bars represent the percentage of doctors who reported using computers at least half of the time for performing each task (red areas show those who used only the electronic medical records system, white areas show those who used the system and other software, and orange areas show those who did not state what program they used) and error bars show the confidence interval. Pink bars in background show percentage of respondents for whom the electronic medical records systems offered sufficient functionality for the task.

Lærum *et al.* (2001) adapted existing, validated questionnaires to produce the sections covering computer literacy and user satisfaction. They randomly selected thirty-two (32) hospital units (each with between four (4) and twenty-two (22) doctors) in nineteen (19) of the hospitals with a license for an electronic medical records system grouped by vendor. They excluded very small (less than four (4) doctors) and very large units (greater than thirty (30) doctors) and those that had recently implemented an electronic medical records system (less than three months before). They distributed three hundred and fourteen (314) questionnaires to doctors and sent one hundred and thirty four (134) reminders one month later.

The completed questionnaires were scanned with Teleform, and the data were analysed with SPSS for Windows version 10.0.8. Lærum *et al.* (2001) categorised the doctors' graded responses on their use of computers for general clinical tasks into two (2) groups - those who used a computer for a certain task for at least half of the time normally spent on the task, and those who did not. The respondents who did use the computer for a certain task were further grouped by whether they used the electronic medical records system, another program, or both. However, as some respondents (median 7%) did not state what program they used, we do not know whether these respondents overlooked the items or could not tell what software they were using.

Key representatives of the nineteen hospitals' information technology departments, involved in implementing the local electronic medical records, indicated through semi-structured telephone interviews whether each clinical task in the questionnaire was supported locally according to certain minimal requirements.

3.5.6.1. The findings of the study were as follows: (Findings of Lærum *et al.* (2001) study)

3.5.6.1.1. Respondent demographics showed no effect on computer use

The response rate to the questionnaire was seventy-two percent (72%), but Lærum *et al.* (2001) subsequently excluded two hospital units (eight respondents) because of problems with reimplementation of the electronic medical records system, leaving two hundred and nineteen (219) respondents.

Of the two hundred and eight who answered the question, forty-seven (47, 23%) were less than thirty-five years old, ninety-eight (98, 47%) were aged between thirty-five and fifty, and sixty-three (63, 30%) were aged over fifty; fifty-seven (57, 29%: N=197) were women, and one hundred and forty (140, 71%) were men; one hundred and twenty-three (123, 60%: N=205) were consultants, seventy-four (74, 36%) were doctors, and eight (8, 4%) were senior house officers. There was no significant differences between different electronic medical records systems in terms of respondents' age, sex, or work position, nor any correlation between these terms and total computer use or user satisfaction.

3.5.6.1.2. Respondents scored high in computer literacy

To assess respondents' computer literacy Lærum *et al.* (2001) asked them about their computer ownership, typewriting ability, prior computing experience in solving specific tasks, highest prior frequency of computer use, and self rated computing skills. The mean summed score of this section was seventy two point two (72.2) out of one hundred (100), with little difference between the users of the three electronic medical records systems (69.6-76.0, analysis of variance P=0.006). The correlation with total computer use was 0.39, P<0.001.

3.5.6.1.3. Computers were available in the respondents' work places

Most respondents (203, 93%: N=218) had computers in their offices, and two hundred and nine (209, 97%: N=216) had computers available to them in other rooms used for clinical work. However, eighty-five (85, 40%: N=214) respondents were weekly or daily prevented from using these computers because others were using them, and ninety (90, 44%: N=214) were hindered monthly or weekly by computer errors or problems with passwords (three percent (3%) were hindered daily).

3.5.6.1.4. Use of the electronic medical records systems was limited

3.5.6.1.4.1. *Functionality of the electronic medical records systems*

According to the information provided by information technology staff, most of the clinical tasks

listed in our questionnaire were in some way covered by implemented functions of the electronic medical records systems. In general, fifteen of the twenty-three tasks were covered for at least half of respondents: DIPS, Infomedix, and DocuLive supported nineteen, sixteen, and eleven of the tasks, respectively (see Figure 9).

3.5.6.1.4.2. *The systems were mainly used for reading patient data*

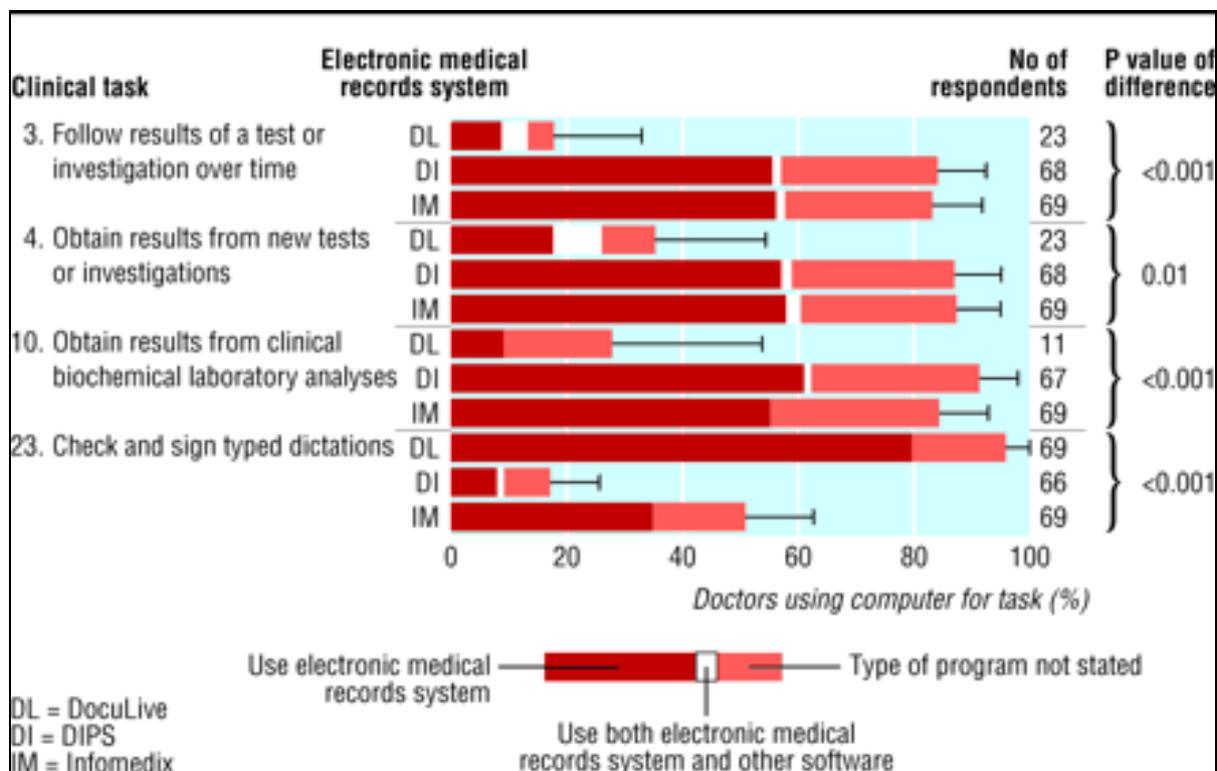
Only two tasks (Tasks 1 and 2 on Figure 9) were performed with the electronic records systems by at least half of the respondents. When Lærum *et al.* (2001) included those respondents who did not indicate what type of computer program they used, the number of tasks rose to seven (tasks 1-4, 10, 22, and 23). The median proportion of respondents using programs other than the electronic medical records systems was two percent (inter-quartile range 1-5%); the highest proportions occurred in tasks where some of the records systems were particularly lacking in functionality (tasks 4, 7, and 10).

The number of tasks for which each respondent used an electronic records system was similar for each of the systems (mean number of tasks: DIPS 4.9, DocuLive 4.9, Infomedix 5.2; analysis of variance $P=0.87$). Only when Lærum *et al.* (2001) included those respondents who did not indicate what type of computer program they used did Lærum *et al.* (2001) find significant differences (DIPS 7.4, DocuLive 5.7, InfoMedix 7.8; analysis of variance $P=0.002$).

3.5.6.1.4.3. *Considerable differences between systems in specific use*

Lærum *et al.* (2001) found considerable differences in doctors' use of the electronic medical records systems when they compared respondents who were offered similar functionality (Figure 10). Because of some functionality not being implemented locally, the groups of respondents were smaller than Figure 10, particularly for the DocuLive system.

Figure 10: Clinical tasks for which significantly different percentages of doctors reported using three different electronic medical record systems that offered equivalent functionality



Source: Larum et al. (2001)

Bars represent the percentage of doctors who reported using computers at least half of the time for performing each task (red areas show those who used only the electronic medical records system, white areas show those who used the system and other software, and orange areas show those who did not state what program they used) and error bars (±) show the confidence interval. P values were calculated with χ^2 formula (equal P values were achieved with analysis of red areas of bars only and when white and orange areas were included).

3.5.6.1.5. Moderate user satisfaction

The user satisfaction scale consisted of five factors: content, accuracy, format, ease of use, and timeliness. The mean overall score was sixty-seven point two (standard deviation of 13.8) out of hundred (mean score for each factor: 56.9, 73.4, 70.4, 64.4, and 66.6, respectively). The DocuLive system scored significantly worse than the others (overall score 61.4 v 69.8 for DIPS and 69.7 for

Infomedix; analysis of variance $P=0.001$), particularly in the content factor. The correlation of satisfaction with total computer use was 0.39 ($P<0.001$).

Despite widespread implementation of electronic medical records systems in Norwegian hospitals, the results revealed a low level of use of all three electronic medical records systems by doctors, especially in the largest hospitals. The systems were mainly used for reading patient data, and doctors used the systems for less than half of the tasks for which the systems were functional. Among these unused functions were repetitive tasks such as writing prescriptions, which are apparently well suited for computers.

Essentially the same findings applied to all three systems, which suggests that similar results might be found in other countries. When the impact of an electronic medical records system is investigated, Lærum *et al.* (2001) suggested that its actual use should be considered rather than its claimed functionality.

3.5.6.2. Limitations of the survey

Lærum *et al.*'s (2001) survey covered only doctors, but other healthcare workers may also use the electronic medical records systems. The researchers did not assess how frequently the various clinical tasks were performed nor how time consuming they were, making it difficult to weight them. Self reporting carries a risk of misinterpretation and bias, even when 'value neutral' behaviour is investigated. Finally, the distinction between using the electronic patient records system and using a different computer application might not always have been clear to doctors.

3.5.6.3. Possible reasons for low level of use of electronic medical records systems

3.5.6.3.1. *Access to computers and computer literacy*

The low level of electronic medical records system use could be explained by a lack of available computers. This would, however, affect the use for all clinical tasks in a uniform manner. In addition, the majority of respondents reported that they had some computers available to them both in their offices and in the ward. The section covering computer literacy showed high scores,

indicating at least a basic knowledge of computers. However, Lærum *et al.* (2001) did not rule out potential unmet needs for specific training in electronic medical records system usage.

3.5.6.3.2. *Flexibility of paper records*

Paper based patient records were still in daily use in Norwegian hospitals. Thus the respondents could choose whether to use the electronic medical records systems. It was argued that in some situations it might be more convenient to use paper records, such as for writing short prescriptions, spreading records on a table, or carrying documents around. Until a proper level of electronic integration is achieved, paper record will remain the most complete information source. Lærum *et al.* (2001) stated that the usefulness of an electronic records system for manipulating large amounts of data will not be apparent until historical information has accumulated for some time.

3.5.6.3.3. *Traditional work routines*

Their general findings of computer use conformed to the traditional division of labour in hospitals - with writing (task 5) associated with secretaries, mediation of requests (tasks 9, 11, and 13) associated with nurses, and reading associated with doctors. None of the electronic medical records systems seemed to have stimulated the development of new or more advantageous ways of doing medical work, they had simply reinforced existing routines. This indicated that technology alone is not sufficient to achieve a well functioning electronic information system; organisational aspects must also be taken into account.

The authors suggested that working in new ways and performing tasks normally done by other professions often means disruption to established work roles, which may lead to local resistance. Staff who take on extra duties do not necessarily enjoy the benefits of more efficient work patterns, and new reward systems may be needed for acceptance of new work roles.

3.5.6.3.4. Differences between electronic medical records systems

They found considerable differences in the frequency of use of the three record systems for certain clinical tasks (Figure 10). DocuLive was often used for checking and signing, indicating that doctors

were using it, but it was used much less than the other two systems for other tasks (3, 4, and 10). A possible explanation for this was the degree of integration with other computer software. Infomedix and DIPS were predominately installed in smaller hospitals, where the same vendor often supplied any other computer modules used, simplifying integration. DocuLive was introduced in the largest hospitals, where the organisational complexity is greatest and where many independent information systems already exist, making it difficult to develop an integrated information system.

3.5.7. Darbyshire's study (2000)

Darbyshire's study (2000) was commissioned by a CPIS software development company, Leading Management Systems Pty (LMS) in Adelaide, Australia to research Australian nurses' and midwives' experiences of the user-friendliness of CPIS. This qualitative study sought a deeper understanding of nurses' perceptions of CPIS and asked them to describe their experiences as end users. The study was significant for actively seeking the perspectives of nurses and midwives who were currently using the systems. This perspective is important for the future development of patient information systems. The central research question was 'What are nurses' and midwives' experiences of using CPIS in everyday clinical practice?' (Darbyshire 2000).

3.5.7.1. Nurses' experiences of using computers and CPIS

The most germane areas were those that explored nurses' attitudes to computers and CPIS and their evaluations of CPIS in relation to ease of use (Darbyshire 2000).

3.5.7.2. Nurses' attitudes to computerisation and CPIS

Darbyshire (2000) reported that Australian studies revealed that nurses were accepting computerisation and were optimistic that it would be beneficial to them. He stated that nurses with more computer experience had more positive views; factors such as education and training positively influenced attitudes, further that younger and less experienced nurses may have had a more positive attitude (Darbyshire 2000).

3.5.7.3. Ease of use of systems

For Darbyshire (2000) what was 'less clear and strangely under-researched' were the specific features or attributes of systems that made them user-friendly to the variety of nurses and midwives who used them in clinical settings. The literature suggested that the features that nurses wanted in a CPIS were generally well known and could be summed up in the question 'Can the system demonstrate satisfactory performance?' (Darbyshire 2000).

3.5.7.4. Where are the users' perspectives?

While quantitative and survey research are necessary to answer particular questions in health care research, Darbyshire (2000) argued that a broader research approach was needed to extend understanding of nurses' perceptions of using CPIS. The purpose of his study was to redress the over-reliance on quantitative and survey research by describing nurses' and midwives' experiences of using CPIS (Darbyshire 2000).

3.5.7.5. Research approach

Qualitative methods have not generally been used in IT research but some are now emerging. A qualitative design was proposed for Darbyshire's study because the study's research question was suited to an interpretative approach. A qualitative approach was seen to be appropriate for uncovering and interpreting 'the many ways in which people articulate and make sense of their experiences' (Darbyshire 2000).

3.5.7.6. Selecting the research participants

The selection of participants ensured the inclusion of nurses and midwives with some experience of using CPIS in their everyday work who were willing to discuss this. Colleagues in five Australian State capital cities and one regional centre were approached by either LMS or the researcher and

were asked to assist in hosting the focus groups. Thirteen (13) focus group sessions were held in all with six groups in one State, three States hosted two each, and the remaining group session took place in another State. The fifty three (53) participants were drawn from approximately twenty five (25) general and specialist, hospital and community areas such as general medical or surgical, midwifery, child health, mental health, anaesthetics, clinical support, emergency, theaters, intensive care, and community health (Darbyshire 2000).

3.5.7.7. Obtaining the research data

According to Darbyshire (2000) focus groups were an appropriate choice for this study because they were ‘a particularly good choice of method when the purpose of the research is to elicit people’s understandings, opinions and views, or to explore how these are advanced, elaborated and negotiated in a social context.’ The thirteen focus group interviews were held over a six week period during October to December 1998. Focus group sessions lasted between forty five and ninety minutes and were held in comfortable meeting rooms. Interviews were informal and allowed participants to speak freely about their experiences and perceptions of CPIS. An interview schedule was not used because a measure of openness was considered essential (Darbyshire 2000). Focus group sessions were facilitated by the researcher and began with questions about the kinds of systems that the participants had experience in using. The interviews were tape-recorded, transcribed verbatim, and later checked to ensure the accuracy and completeness of the interview data (Darbyshire 2000).

3.5.7.8. Data analysis and interpretation

Darbyshire (2000) analysed the interviews in detail. Data collection and initial analysis were concurrent because this enabled ‘emerging themes and issues from early data to guide subsequent interviews, thus maintaining a clearer focus on the central study question’. The interview data were analysed to identify ‘themes, patterns, similarities and dissimilarities, events, perceptions, understandings, and practices’ that threw light on the participants’ experiences with CPIS. No formal attempt was made at establishing reliability or validity (Darbyshire 2000).

3.5.7.9. The meaning of user-friendliness for clinicians working with CPIS

The central question in this study was ‘How do nurses experience working with CPIS in their everyday practice?’ The focus group discussions included issues such as ease and difficulties with systems, logistics of access, perceived benefits and drawbacks of various forms of CPIS. Others were the issues surrounding the collection, entry and withdrawal of information, and the balance between standardisation and individualisation. While the participants’ perceptions of what constituted ‘user-friendliness’ were many and varied there were several hardware and software features that were widely agreed on (Darbyshire 2000).

3.5.7.10. Gaining access

Participants reported difficulties with passwords, multiple passwords, and password changes were reported:

‘One of the things that drives me mad is different passwords. Different things to get into every different program’ (Participant 1).

‘And they change regularly’ (Participant 2).

‘Different user name for every program’ (Participant 4).

‘I’ve never been able to work out why if I’ve got access to those things, I cannot use a common password for all of them’ (Participant 1).

Participants clearly understood the need for security and confidentiality in the system and did not oppose the principle of passwords as such. Their concerns were about the number of passwords required and how frequently these changed, which for them, was a disincentive to actually using the systems. Faced with having to access a system in this way one participant explained:

‘The system that we have is hopeless. You’ve got to log in, then you’ve got to use your user name, your password, you know you’ve got to jump twenty hoops just to get into just basic information, and nobody uses it then’ (Participant 2).

3.5.7.11. Failing the screen test

3.5.7.11.1. Navigability

The clarity, navigability, and ease of use of computer screens were regarded as crucial to user-friendliness. The study participants described both negative and positive features of various screens and operating systems. They suggested several improvements that they believed would improve the user-friendliness of CPIS:

‘Now we go from one screen to do their bed allocation, we go to another screen to do their ward diet, we go to another screen to do their dependencies. We go to another screen to put in other information’ (Participant 3).

‘To access the screens takes time...To do their ward conditions and then their patient condition, we have to go into two different screens. And that takes time. If you could scroll down on a side bar, and not have to press enter, enter, enter to get into these other areas, that would be a time saver’ (Participant 3).

Navigability within screens was also major issue. Some systems were seen as more familiar to users, while others seemed to involve complex processes for users to undertake very simple tasks:

‘I want to be able to move easily between different screens, so that...I just click on the main title to bring up the page at the front that I want. Just something easy that way, so that if I’m on one particular screen, and I want to look at something else, it’s not going to take me ten steps to get out and ten steps to get back to what I was originally looking at’ (Participant 5).

‘Yes, you have to be able to split between the programs, you have to actually have that. When we first started in our roles ... we could not move between screens. You have to close one down and go out. ... It’s so inefficient with time. I want to be able to open everything up and also have the capacity to keep it all open, if I need it all open, and not have to close them because something else would not run’ (Participant 1).

For respondents who felt that CPIS was another burden imposed by management the impulse was to ignore CPIS if at all possible.

‘Because you’ve got to get out of that screen and get in another screen and then it takes time, and then it does not let you do it, and you think ‘stuff it, I’m too busy’ (Participant 2).

3.5.7.11.2. Help, I need somebody

Participants suggested that a 'help' or interactive tutorial program should be included:

'Yes, it's the option of some kind of help, or a prompt to staff, that they could highlight if they were a bit lost, and it would say, 'this is what you need to do next,' but (it has to be) something that is really easy to understand' (Participant 5).

For other occasions when help was needed, participants wanted someone who could come to the terminal and actually fix the problem or show the user what to do differently. A telephone helpline was regarded as useful but was a poor substitute for more immediate help:

'We do not have people up here, that you can rely on, so every time something happens with the system, I would spend two hours on the phone to someone in Adelaide, trying to fix it. And it's just too hard. We just...(gestures 'give-up')' (Participant 3).

3.5.7.11.3. Prompts and reminders

Several participants valued on-screen prompts that suggested what to do next. In such cases the warning or prompt did not just tell the participant what he or she had done wrong but gave clear instructions to rectify the situation:

'I'll tell you a good thing. I've just gotten a program for accreditation and I have to do a self-assessment on this program. It would not allow me to close the program until I've done everything right. It came up, 'You have not entered data for this,' 'You have not done this.' Even if it's a zero entry, you have to physically go in and admit that you had zero (0) amount of whatever' (Participant 3).

3.5.7.12. Paper and printing

Participants discussed the tensions existing between the notion of a paperless system and the everyday reality for many nurses who were trying to work within a system that continued to expect both paper and electronic documentation to be gathered and stored. For them one of the expected benefits of CPIS was the elimination of 'all of the paperwork,' yet this benefit seemed elusive.

A further aspect of user-friendliness raised by several participants was the ability (or lack thereof) to print clinical documentation. Systems ranged from the one extreme where systems did not allow the users to print data or screens to those where programs allowed only printouts of information, rather than allowing the nurse to view it on screen. In the middle were programs that allowed clinicians to print out screens or documents - some with greater legibility and usefulness than others.

‘We need to ensure that...when it comes in the printed format that it is actually something that is easy to read as well, because I know when we use download, on the screen, it will look good, but when it came out on paper it was a disaster’ (Participant 5).

‘So yes, the printouts have to be nice and clear’ (Participant 5).

3.5.7.13. The need for speed

Most participants required that the systems had to be fast and responsive. It appeared to be the case that for them computer time did not equate to ordinary chronological time; five minutes waiting for a screen to appear seemed more like five hours, ‘especially when there are patients ringing buzzers, telephones waiting to be answered,’ and other staff with questions to be answered:

‘Not interactive enough...The most annoying part is even if you have access, the computer is just far too flaming slow. You sit there and you are waiting for it to start. It’s really pretty rough’ (Participant 1).

‘And it is slow. We need decent computers or a system that will drive things fast. Some places are lucky enough to have Windows 95 and that is certainly a lot faster. But if I am in my office for instance and want to find out about somebody on Automated Nurse Staffing Office System and it’s a system I do not use a lot, but I want to find out somebody’s phone number or what shift they’re working, and it takes me at least four minutes. There is nothing else I can do except wait for it to click over to get in. So it’s quicker for me to pick up the telephone and say just tell me’ (Participant 1).

The speed of the system with reference to how quickly and easily screens and data appeared was seen as extremely important by participants. They saw slow response systems as less likely to be actually used in practice.

‘And on days when the computer is slow, one shift cannot get their information printed out, and the next shift then have to chase it up. That’s when it can get left out’ (Participant 3).

‘I would say it has to be quick to make it user friendly. Staff do not have time and will not persist with sitting there wading through. It needs to be quick’ (Participant 3).

3.5.7.14. Clinicians’ wish lists

The focus groups were asked what features or elements of a system would make it more user-friendly. Participants made several suggestions which ranged from using small hand-held terminals or touchpads that could be downloaded into a central system at the end of a shift to voice-activated systems that could negate much of the need for keyboard skills.

‘Drop-down boxes, light pens, or touch pads’ (Participant 1).

‘You see them now in the supermarket. They have a little screen, and you touch it, and you buy a pair of shoes’ (Participant 3).

‘A hand-held computer. That is essential to me because I will be able to have that in my pocket, and...I can just pop it in, and I do not have to go and fight for a PC, right?’ (Participant 2).

One nurse mentioned the question of the crucial area of the clinicians’ attitude to the CPIS.

‘If you do (sit in front of the screen), it’s not registering...it’s an attitude thing that, you just, Oh we’ve got to do it and you do it. That’s what it’s got down to...There’s probably a lot on that screen that it’s telling us, but you just do not; to me it might as well be in Greek, some of it’ (Participant 2).

3.5.7.15. Discussion

Darbyshire (2000) found that the study participants were generally scathing about the user-friendliness of the products with which they were working. Their dissatisfaction covered finding a terminal to work on, accessing the required program, navigability and working on screen with the various pieces of required information which seemed both slow and difficult. Few participants described systems that were ‘intuitive, easy, productive, liberating, or in any way enjoyable to use’.

The wish lists of features desired by participants included ‘drop-down menus, graphic interfaces, icons with obvious meanings, shortcuts, help menus with clear instructions, prompt signals or messages that would alert them to forgotten or incorrectly entered items, screen printouts that retained structure and did not appear as gibberish, and the ability to move between screens and scroll through documents quickly’. These features are standard on most reasonably new Windows or Macintosh home computers and for this reason the clinicians’ requests as articulated in this study seem reasonable (Darbyshire 2000).

Darbyshire’s study (2000) suggested that nurses and midwives found the everyday use of CPIS troublesome and problematic. Mounting pressures on clinicians in our era of shrinking budgets and growing expectations mean that they expect IT to be ‘a facilitative rather than a hindering force’. The responses of the participants in this study suggest that CPIS has some way to go in improving the user-friendliness of their system for these groups (Darbyshire 2000).

3.5.8. The effects of creating psychological ownership on physicians’ acceptance of clinical information systems: Paré *et al.’s* (2006) study

For Paré *et al* (2006) research in the health care context has focused primarily on aspects such as attitudes and usage, and less attention has been invested in how such beliefs are formed. They argued that an understanding of what causes physicians to hold certain beliefs about the target CIS would be of value not only to individuals responsible for overseeing implementation of these systems, but also to researchers interested in the paths through which technology use behaviour is manifested. In seeking to understand physicians’ acceptance of IT Paré *et al.’s* (2006) proposed the construct of psychological ownership. They proposed that psychological ownership was important to the study of technology acceptance behaviours among physicians because it served as a key determinant to salient beliefs about a new CIS (Paré *et al* 2006).

Paré *et al.* (2006) reviewed the literature pertaining to the concept of psychological ownership and the identified arguments supporting the hypothesised relationships between psychological ownership and both its antecedents and consequences. An operational measure of the psychological ownership construct in the particular context of CIS implementation was then developed. The research model was then examined in a study of ninety one (91) physicians who

used a regional physician order entry (POE) system implemented in early 2003. The results of the study supported the theorised relationships (Paré *et al* 2006).

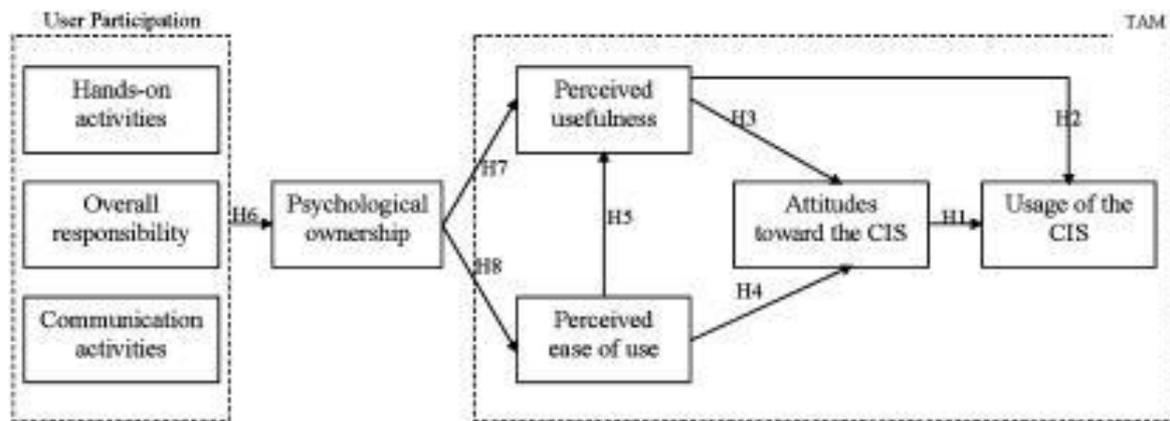
The objects of ownership, motivations to own, effects of psychological ownership on change acceptance, and the 'nomological net of psychological ownership' was discussed. Paré *et al* (2006) defined psychological ownership as 'the feeling of possessiveness and of being psychologically tied to an object' and argued that CIS can also become the object of feelings of ownership.

It was proposed that psychological ownership emerges because it satisfies three basic human motives. These are self-enhancement which refers to individuals' desires to achieve and maintain high levels of self-esteem. Individuals also have a need to maintain their own stability over time and across situations. Thirdly they wish to maintain and demonstrate a sense of control and a sense of efficacy. Each motive facilitates the development of psychological ownership (Paré *et al* 2006).

Paré *et al.* (2006) argued that psychological ownership provided understanding of why and the conditions under which individuals react to change. They proposed that psychological ownership predisposes individuals to positive or negative orientations toward change, contingent on the type of change involved. For them individuals are likely to promote change regarding a target toward which they felt ownership when the change was self-initiated (versus imposed), evolutionary (versus revolutionary), and additive (versus subtractive) (Paré *et al* 2006).

The particular CIS implementation project which they examined in the study satisfied all three conditions, favouring a positive relationship between psychological ownership and technological change acceptance. In order to investigate the role played by psychological ownership in extending our understanding of physicians' reactions to IT, Paré *et al* (2006) emphasised that it is necessary to situate the construct within a nomological net (Paré *et al* 2006).

Figure 11: Theoretical model of network of relationships for psychological ownership



Source: Paré et al. (2006)

Figure 11 presents one network of relationships for psychological ownership.

Paré et al. (2006) presented theoretical arguments supporting the proposed paths and presented data from a case study in support of these relationships. Their goal was not theory testing *per se* to establish whether one model was more powerful than another but rather, they wanted to enhance the Technology Acceptance Model (TAM), a dominant model in the IT adoption literature, by including psychological ownership as a key factor in beliefs about a new CIS (Paré et al 2006).

The TAM suggested that two particular beliefs, namely, perceived usefulness and perceived ease of use, were of primary relevance to IT acceptance behaviours. Perceived usefulness was defined as ‘the prospective user’s subjective probability that using a specific application system would increase his or her job performance’, and perceived ease of use refers to ‘the degree to which the prospective user expected the target system to be free of effort’ (Paré et al 2006).

In the TAM, system use was predicted by both attitudes (H1) and perceived usefulness (H2); the latter also influences attitudes (H3). Perceived ease of use influences both attitudes (H4) and perceived usefulness (H5). The model hypothesised that the degree to which the CIS is easy to use, as perceived by physicians, affected both their perception of the usefulness of the technology and their attitudes toward using the system. Attitude was also influenced by the level of the system’s usefulness, as perceived by physicians. Finally, the intensity of physicians’ use of the system was explained by their attitudes to using the new system and the technology’s perceived usefulness (Paré et al 2006).

Paré *et al.* (2006) stated that feelings of ownership toward a CIS may be developed through active physician involvement and participation in the system implementation process. User participation was defined as ‘the extent to which users or their representatives carry out assignments and perform various activities during information systems development’. Support for a positive relationship between user participation and their feelings of possession toward a system were found in the theory of psychological ownership as in Pierce *et al.* (2001 in Paré *et al.* 2006). Individuals were seen to develop feelings of ownership of an object when they exercised control over it, associated with it, and put a lot of time and effort into it (Paré *et al.* 2006).

The CIS to be studied was a regional POE system intended to speed up the transmission of clinical data, in the form of laboratory tests and radiology examinations, within a community health network. The network comprised thirteen (13) medical clinics, a regional community hospital and a private laboratory firm. These organisations were located in a densely-populated suburb, north of Montreal, Quebec, Canada. The CIS also offered electronic functionalities that allowed physicians to share clinical information with patient consent (Paré *et al.* 2006).

The POE system was made accessible to all one hundred and thirty two (132) general practitioners (GPs) working in the thirteen (13) clinics. Adoption of the system was not mandatory, although GPs were strongly encouraged to use it. Only two (2) physicians refused to adopt the new system and were not considered in the sample ($N=130$). The implementation process was characterised by strong participation by physicians. Indeed, in each participating clinic, a physician volunteered to act as project champion. Numerous responsibilities were assigned to these champions who were all members of a steering committee that held monthly meetings and whose objective was to conduct detailed clinical information requirements analyses. Secondly, champions also acted as experimental users and repeatedly tested the system interface in laboratory settings. Thirdly, they intervened as experts in the configuration of the POE system, adapting it to their respective clinics’ needs. Lastly, they were designated as ‘super users’ when the system was first introduced to their own colleagues. Champions were remunerated for the time they allotted to the project (Paré *et al.* 2006).

Scales for perceived usefulness and ease of use were adapted from those developed and validated by Venkatesh *et al.* (2003 in Paré *et al.* 2006), while attitudes were adapted from a three-item scale

(heightened enjoyment) developed and validated by Agarwal and Karahanna (2003 in Paré *et al.* 2006). Actual use was measured using a three-item scale adapted from Thompson *et al.* (1991 in Paré *et al.* 2006). Three dimensions of user participation, overall responsibility, hands-on activity, and communication, were assessed. These dimensions were operationalised with four-, five-, and six-item scales, respectively, developed by Barki and Hartwick (1994 in Paré *et al.* 2006). All measures used a ten-point Likert scale with anchors ranging from 'strongly disagree' to 'strongly agree.' Given the specific composition of the population, the items were operationalised to make sense in this context.

The psychological ownership scale was developed using a multistage iterative procedure. In-depth interviews with ten (10) experienced physicians in the use of various clinical systems were held to probe their own conceptualisation of the notion of ownership in the particular context of CIS development and implementation and to gather their reactions to the scale developed in stage one. As a first step, a pre-test of the questionnaire was conducted with five (5) physicians, all working in different clinics. Each respondent completed an initial version of the questionnaire and reported back on the process and the measures. The physicians indicated overall that the questionnaire was relatively clear and easy to complete.

After the pre-test some modifications were made to the instrument to improve the measures and the overall structure and clarity of the questionnaire. Physicians who took part in the pre-test were excluded from the subsequent postal survey. Early in 2005, the final version of the questionnaire, with a cover letter indicating the purpose and the importance of the study, was posted to the remaining one hundred and twenty five (125) physicians in order to assess the reliability and construct validity of the various scales as well as the strength of the hypothesised relationships. Four weeks later a follow-up letter was sent to the participants. This letter again stressed the importance of the study and provided a number to telephone if they had any questions or required a new copy of the survey (Paré *et al.* 2006).

In order to establish the nomological validity of psychological ownership, Paré *et al.* (2006) adopted a two-stage approach. Firstly, the reliability and construct (convergent and discriminant) validity of all scales were assessed. One interpretation of the reliability criterion is the internal consistency of a test, that is, the extent to which the items are homogeneous. Hence here reliability refers to the

accuracy or precision of a measuring instrument. Convergent validity refers to whether the items comprising a scale ‘behave as if they are measuring a common underlying construct’. Hence, in order to demonstrate convergent validity, items that measure the same construct (that is, trait) should correlate highly with one another. Discriminant validity is concerned with the ability of a measurement item to differentiate between concepts being measured. Paré *et al.* (2006) thus compared the square root of the variance shared by the constructs and their measures to the correlations obtained among constructs. Lastly, having assessed the measurement model, descriptive statistics were calculated using a computer package and the eight hypotheses presented in Figure 11 were tested using linear stepwise regression analyses (Paré *et al.* 2006).

The study found that a total of ninety one (91) questionnaires (response rate of 72.8%) were returned to the researchers. Twenty-three (23) questionnaires were received after the sending of the follow-up letter. Of the ninety one questionnaires, fifty seven percent (57%) were received from men and forty three (43%) from women. A vast majority of respondents were established physicians, sixty six (66%) of them having eleven years and more experience in the medical field. As expected, only one out of ten respondents acted as project champion. The respondents’ average POE system use was seven point five (7.5) hours per week, and their average experience with personal computers was six point one (6.1) on a ten-point Likert scale. Table 6 below shows the profile of the respondents.

Table 6: Profile of the Respondent (N=91)

Gender	Male	57%
	Female	43%
Age, year	30–45	36%
	46–55	38%
	56+	26%
Tenure in medical clinic, year	< 1 year	3%
	1–5	16%
	6–10	15%
	11+	66%
Champion	Yes	11%
	No	89%
System use per week, hour	Mean	7.5
	Standard deviation	10.6
	Minimum	< 1
	Maximum	48
Experience with computers in general	Mean	6.1
	Standard deviation	2.3
	Minimum	1
	Maximum	10

Source: Paré et al. (2006)

As expected, physicians who acted as champions of the POE system participated more than non-champion users and were also found to have stronger feelings of ownership toward the system. The difference between champions and non-champions was smaller for the overall responsibility dimension than those observed for the other two dimensions of participation. Partly because of their higher level of ownership, champions perceived the CIS to be more valuable and easy to use than non-champions and, hence, developed more positive attitudes toward it. However, champions' level of system use was only slightly higher than that of non-champions (Paré *et al* 2006).

Next, Paré *et al.* (2006) tested the effects of three forms of user participation on physicians' feelings of ownership. User participation was found to have a significant and positive influence on psychological ownership, scoring thirty seven percent (37%) of the variance in the criterion variable. The results indicated that communication and overall responsibility were the most important factors influencing psychological ownership. However, contrary to their expectations, the data showed that hands-on activities did not have a significant effect on the development of feelings of ownership (Paré *et al* 2006).

Despite the highly satisfactory response rate for a postal survey, Paré *et al.* (2006) note limitations on the generalisability of the findings. They recommend that the theoretical findings would benefit from being tested in organisational contexts using other technologies such as telemedicine, imaging systems, and nursing information systems, and also being tested against recent project failures where clinical systems were abandoned at some point or not used at all.

Paré *et al.*'s (2006) findings reveal that, in order to foster physicians' adoption of CIS, it is important to cultivate a positive attitude toward the use of the new system. They agree with Chau and Hu (2002 in Paré *et al.* 2006) that 'the significant role of perceived usefulness and individual attitude formulation might have been partially rooted in physicians' tool-oriented view of technology, acceptable only when demonstrating proven or desired utility in their practice'. One implication is that CIS project leaders and managers should strongly devise effective ways to communicate the clinical utility of the CIS to target physicians. Information and training sessions on the system need to focus primarily on 'how the technology *can help* improve the efficiency and effectiveness of physician's patient care and service delivery rather than on the steps or procedures of actual use of the system' (Paré *et al* 2006).

A primary objective of this study was to increase Paré *et al.*'s (2006) understanding of psychological ownership in the context of CIS implementation by testing predicted relationships between feelings of ownership and users' beliefs about the clinical system. Results demonstrated that psychological ownership of the CIS increased explained variance in perceived usefulness and perceived ease of use, two system characteristics having a strong influence in the formation of user attitudes (Paré *et al* 2006).

Through their participation, users did feel that they had greater influence on the development process, thereby developing feelings of ownership. Ownership of a system was not possible without continuous communication activities involving formal or informal exchanges of facts, needs, opinions, visions, and concerns regarding the system. Having overall responsibility for certain activities was also found to be positively related to psychological ownership. As noted by Barki and Hartwick (1994 in Paré *et al.* 2006), such responsibilities are normally assigned to a very small number of user representatives. In order to create a sense of responsibility in a larger number of users, these same authors proposed that additional development activities that lead to a sense of responsibility could be identified and assigned to different users. Responsibility activities could also be assigned to user groups (Paré *et al* 2006).

Finally the results of this study have added to physicians' IT adoption research. Acknowledging that the major challenges to CIS success often become more behavioural than technological, Paré *et al.* (2006) argued for the need to focus on the construct of psychological ownership. Psychological ownership's highly significant associations with crucial beliefs which drive technology acceptance behaviours among physicians affirm the value of this construct in extending our understanding of CIS adoption (Paré *et al* 2006).

3.5.9. Implementing tele-health to support medical practice in rural or remote regions: what are the conditions for success? Gagnon *et al.*'s (2006) study

Tele-health is regarded viewed as having the potential to increase access to, and the quality of, health care services with lower health system expenditures. The introduction of this tool to support the delivery of health care services necessitates many changes for providers, organisations, and the health system as a whole that must be taken into account during the implementation process. Systematic reviews report evidence of tele-health benefits from applications such as tele-radiology,

tele-psychiatry, transmission of echocardiograms, tele-dermatology, and tele-homecare (see Section 1.2.1.35 and Section 3.3.2.).

Results from most of the studies which have been reviewed support tele-health over other traditional modes of health services delivery. Studies have reported tele-health benefits with regard to the continuity of patient care and ability to coordinate clinical activities between various health care organisations and levels of care. Tele-health is considered as a tool that could have a positive impact on several aspects of health care services delivery in rural and remote areas. Tele-health can support the delivery of timely specialised services to remote populations, facilitate access to education for clinicians, and save travel costs for patients and professionals. As tele-health technologies become more integrated into the health care system, they could impact the reorganisation of medical workforce supply and have an influence on physician practice, especially in remote areas. Successful tele-health implementation represents the first step towards the normalisation of this technology as a means of health care delivery. According to May *et al.* (2003 in Gagnon *et al.* (2006), normalisation is ‘the move toward the routinised embedding of telemedicine in everyday clinical practice’. Tele-health implementation, however, faces major barriers with regard to structural, organisational, and professional challenges. Structural barriers are issues to do with licensure, reimbursement, policies governing telecommunication and information technologies development, and interjurisdictional collaboration. The introduction of a new technology challenges existing structural and operational features in organizations and adjustment is often required between the technology and the organization (Gagnon *et al.* 2006).

Physicians exhibit the particular characteristics of the medical profession as one of the main groups of tele-health users and these affect the introduction of this technology into their practice. The adoption of tele-health by an individual is a complex behaviour determined by a large set of psychosocial factors. Knowledge about the specific impacts of tele-health on the practice of health care professionals in rural and remote regions is still limited. A recent survey reported by Gagnon *et al.* (2006) found no direct effects of tele-health on recruitment and retention of physicians in a rural area of Canada but this study indicated that rural physicians who used tele-health had a more positive perception of the value of this technology for their community. Another study, conducted among medical residents in Quebec found a significant correlation between residents’ positive evaluation of tele-health and their intention to practice in a remote region. Taking into account the complex and multiple influences on physicians’ choice of practice location, however, it remains

difficult to assess the specific contribution of tele-health on medical practice in rural and remote regions (Gagnon *et al.* 2006).

Tele-health benefits appear to be obvious for large territories with relatively dispersed population such as rural and remote regions of the Province of Quebec. Several tele-health projects have been implemented in Quebec over the last decade. These projects have generally found that there was a positive impact on several factors relating to the quality of clinical practice and the continuity of patient care in rural, remote or isolated regions. The three projects, however, failed to normalise in their initial form. The reasons why most tele-health applications have failed to normalise in Quebec were thought to be similar to those reported in other settings. Gagnon *et al.* (2006) conclude that firstly, most were small scale pilot projects that were intended to establish feasibility, safety, effectiveness, and conditions of use for more widespread diffusion of tele-health. Several tele-health applications that formed a complex system of interactions between technologies, functionalities, information workflow, and users were tested in these projects.

Secondly, tele-health projects are characteristically ‘complex, innovative, constantly evolving, and many of their effects cannot necessarily be anticipated’ and this is a challenge for the evaluation of their various impacts on the health care system. Knowledge on the specific conditions that lead to tele-health normalisation in a given context (‘how it works’) is also essential. Evidence about global impacts of tele-health on health care professionals’ work as well as on the recruitment and retention of medical workforce in remote regions is also scarce (Gagnon *et al.* 2006).

The Quebec Ministry of Health, however, has identified tele-health as one of the means to deal with the uneven distribution of the medical workforce in the Province in the reorganisation of health services. Tele-health is not yet integrated as a routine service in the health care system (Gagnon *et al.* 2006).

To understand the conditions promoting or limiting tele-health integration, Gagnon *et al.*’s study (2006) explored tele-health’s effects on various aspects of the practice of health care professionals in rural and remote regions of Quebec. Decision-makers participated in the different phases of the research project in order to facilitate knowledge sharing and utilisation.

A qualitative field study was conducted in four regions of Eastern Quebec in order to identify the perceptions of physicians and managers in respect of tele-health benefits and limitations as well as the key conditions for successful tele-health implementation. The four regions of Eastern Quebec were chosen because of their prior involvement in tele-health experimental projects, especially in tele-radiology and tele-cardiology. The study received approval from the ethics committee of the Quebec University Medical Centre (Gagnon *et al.* 2006).

Purposive sampling was used to identify potential respondents. Selection criteria included: localisation, profession (clinician or manager), medical specialty, and tele-health experience (extensive or limited). The professionals and managers in these four regions were knowledgeable about tele-health and its effects. The regions also combined various practice settings such as urban hospitals, semi-urban hospitals, and rural and remote health centres. The initial subjects were identified through personal contacts from members of the research team, lists of tele-health conference participants, and documentation on tele-health projects. Other respondents were identified through the snowball method which works on the basis of referrals from initial participants to generate additional subjects. Some of the medical specialists (radiologists, cardiologists and paediatricians) had experience in tele-health activities. Other respondents only used it only for tele-education or meetings. Others had never used tele-health. The principles of data saturation and information redundancy were applied to determine sample size, that is, the recruitment of participants ended when additional interviews did not bring new information or opinion (Gagnon *et al.* 2006).

Interview schedules were derived and developed from the literature and previous research done by the team. A different schedule was prepared for clinicians and managers. These were pre-tested with four collaborators of the research team who had medical and/or management backgrounds. The interview schedule for physicians was divided into three separate parts which comprised firstly questions about actual practice; motivations for practicing in the remote region; motivations for staying in the region, as well as potential factors that could make one leave the region (Gagnon *et al.* 2006).

The second part covered the quality of life at work and the effects of tele-health on clinical practice. Respondents who did not have access to tele-health gave perceptions concerning its possible applications to their practice were gathered. The last part of the interview dealt with perceptions about the benefits and limitations of tele-health use in practice and the ideal conditions that would facilitate tele-health integration into clinical work. Managers from hospitals and health regions were also interviewed about the nature of their work and the strategies they were using to attract and keep medical workforce in the region. In addition managers were asked questions about the effects of tele-health on clinical practice and organisation of care. Lastly they were asked their opinion about tele-health benefits and limitations and about their perceptions about requirements to ensure tele-health integration (Gagnon *et al.* 2006).

The telephone was used by a research professional to contact potential respondents to present the study and to invite them to participate in an interview. Those who accepted and were available at the required time were sent a copy of the schedule by electronic mail in the week before interview. Written consent was obtained from all respondents prior to interview. Interviews ranged from twenty minutes to one hour. Some interviews were conducted in small groups of two to five persons for logistical reasons. Two researchers trained in social and health sciences facilitated the interviews and gathered observation notes. All interviews were tape-recorded with the consent of respondents and a verbatim transcript was made. This material was used together with the content of the interviews for analysis (Gagnon *et al.* 2006).

The data analysis method was qualitative and iterative. It was based upon the method proposed by Huberman and Miles (1994 in Gagnon *et al.* 2006). First, all interview transcripts and field notes were read to extract general impressions and preliminary classification categories. The seven (7) broad categories were created: 1) recruitment factors; 2) retention factors; 3) quality of life at work; 4) tele-health benefits; 5) tele-health limitations; 6) conditions for tele-health integration; and 7) potential impact of tele-health on recruitment and retention. Second, two researchers classified interview content into matrixes corresponding to these categories. Using an iterative approach, emerging patterns and themes were identified within each category and discussed between the researchers. Having reached consensus on coding themes, content was independently coded by the two researchers.

Analyses were compared and adjusted after a consensus discussion with the research team. Only those themes that were identified by three respondents or more were considered in this analysis. Gagnon *et al.* (2006) interviewed a total of forty (40) physicians and fourteen (14) managers. For most of the physicians and managers, tele-health was a powerful tool to improve healthcare services for populations living in remote areas. For them tele-health had the potential to facilitate access to, and availability of, services that would be difficult to obtain otherwise. Table 10 shows that many respondents agreed that tele-health implementation had brought specialised services to patients close to their home and that many transfers were avoided, saving significant travel costs for patients and their family. Respondents also reported that tele-health could be helpful to transmit information before transferring a patient to an urban centre, thus facilitating case management. Tele-health was seen as an efficient means to perform follow-up visits in order to improve continuity of care. In some cases, tele-health could also allow a first evaluation of a remote patient by a visiting specialist (Gagnon *et al.* 2006):

‘There’s a paediatric specialist who comes only once a year and he asked to use telemedicine for his first evaluation of a new patient so that his visit would be improved. That way he can operate on kids who otherwise would have to wait much longer.’
(Hospital manager, region 10).

Tele-health was perceived as an excellent means of communication for remote physicians by providing them with easy access to a second opinion and contacts with their peers (Gagnon *et al.* 2006).

Table 7: Perceived tele-health benefits and limitations

Dimension	Perceived Benefits (Frequency)*	Perceived Limitations (Frequency)*
Clinical or Patient care	Access to specialised services (5 md, 9 hm) Potential to save costs for patients (3 md, 4 hm) Facilitates management of transfers (4 md) Allows distant follow-up that improves continuity of care (3 md) Improves information circulation (3 md)	Tele-health will never replace on site physician (6md, 1 hm)
Professional	Access to a second opinion (10 md, 2 hm) Facilitates communication with peers (7 md, 3 hm) Diminishes the feeling of isolation (3 md, 2 hm)	Anticipated changes in the definition of tasks and responsibilities (2 md, 2 hm)
Educational	Knowledge development and update (7 md, 2 hm) Increases access to CME (4 md, 4 hm) Multi-disciplinary/multi-centred exchanges (3 md)	Tele-education cannot substitute for all CME activities (2 md, 1 hm)
Organisational or Systemic	Supports the hospital as a regional reference centre (6 md, 5 hm) Ensures availability of services (4 md, 3 hm) Saves time and money for meetings (4 md, 3 hm) Potential to save costs for health system (3 md, 4 hm) Better organisation of on-call duties (4 md)	Fear of replacing regional specialists (3 md, 2 hm) Heavy logistics needed in the two sites (2 md, 2 hm) Lack of commitment from the organisation (2 md, 1hm)

Gagnon et al. (2006)

* *Number of physicians (md) and hospital managers (hm) who mentioned the item.*

For the physicians feelings of isolation were common and therefore for a physician working in a remote region, tele-health could act as a way to keep in touch with peers and colleagues from other regions. Tele-health was also regarded as an efficient way to provide education and to facilitate exchanges between professionals from various sites and specialties:

‘It’s more difficult to work with a remote specialist if you do not know him or her. That’s why we’ve asked for an affiliation with another centre, like the one we have with (hospital’s name) through continuing medical education. We’ve asked to get ‘live’ access to videoconferences from all over the province.’ (Medical specialist, region 09).

Another benefit was the possibility of organising on-call duties on a regional basis for specialties such as radiology, so that instead of sharing the responsibility for on-call duties between

radiologists of a single hospital, tele-health could allow a greater number of specialists from different centres to cover the whole region:

‘Six months ago, we began regional on-call duty covering three hospitals of the region. We are four radiologists who share the responsibility each week.’ (Medical specialist, region 01).

Hospitals and health care centres located in remote regions could also benefit from tele-health since it offers a support to ensure the complete coverage of population needs in terms of health care services:

‘With tele-health we can have access to ultra specialised services without transferring the patient. The idea is not transferring patients if we can offer the service here. It does not make sense to transfer a patient only for a diagnosis when it can be done remotely.’ (Hospital manager, region 09).

Tele-health was therefore regarded as having the potential for the development of regional reference centres that would provide a wide range of services to remote populations. Tele-health was also believed to produce worthwhile savings for remote hospitals and for the health care system, for example, tele-conferencing could be used to attend administrative meetings, leading to substantial savings on travel costs.

Few limitations were found regarding the use of tele-health in remote regions. Physicians were concerned about the fact that tele-health could replace on-site human resources. Respondents also commented that some specialists would prefer to stay in university centres and to provide services via tele-health rather than moving to a remote region:

‘Telemedicine could make people want to stay where they are, in university centres, but it would not replace a radiologist in the region, who can be in contact and play a different role as consultant with other physicians.’ (Hospital manager, region 02).

There was a concern that tele-education through videoconferencing would replace all continuing medical education (CME) activities outside the region. For remote physicians, participation in scientific activities in urban centres also represented a valued occasion to enjoy social interaction with their colleagues, which could not be replaced by tele-conferences.

Physicians and managers were asked to discuss the conditions that could help tele-health integration into their practice. Responses were grouped in six dimensions representing the levels at which efforts would be needed to facilitate tele-health integration into practice. These findings are presented in Table 8. At the individual level, respondents agreed that tele-health should be easy to use and compatible with daily practice. As one physician said:

‘The system must adapt to my practice and not vice versa.’ (Medical specialist, region 01).

Table 8: Conditions for tele-health implementation

Dimension	Condition (Frequency)*
Individual	Individual perceived ease of use (4md, 3bm) Technology integrated to the daily practice (3md, 2bm) Healthcare professionals’ motivation (2md, 1bm)
Professional	System based on the needs of health care professionals (4md, 3bm) Adequate remuneration for professionals in both sites (6md, 1bm) Defining clear rules for professional liability (3md, 2bm) Participation of physicians in tele-health decision-making (3md)
Organisational	Availability of resources dedicated to tele-health (specialised nurses, technicians, etc) (5md, 4bm) Specific schedules for tele-health consultations (3md, 6bm) Referrals based upon existing collaboration networks (3md, 3bm) Availability of up-to-date equipment (2md, 3bm)
Socio-political or Systemic	Massive investments in technologies and infrastructures (1md, 4bm) Regional agreements and local development plans for health care services delivery based upon a combination of local expertise, outreach services, and access to specialists with tele-health (1md, 4bm)
Technological	Reliable, mobile, ergonomic, and user-friendly systems (4md, 5bm) Image quality to allow diagnosis (4md, 1bm)
Ethical or Legal	Ensuring data confidentiality (2md, 2bm)

Gagnon et al. (2006)

* Number of physicians (md) and hospital managers (bm) who mentioned the condition.

Motivating healthcare providers was regarded as important in the facilitation of tele-health integration. Ideally a successful tele-health network would be based upon clinicians’ needs and promote their participation in decision-making.

‘We must be involved in the whole implementation process.’ (General practitioner, region 10).

Such an approach reflects a bottom-up implementation strategy where end-users are first consulted to identify their needs and expectations. An iterative approach where they are involved in decisions at different stages of the project development then follows. Human, material, and logistical resources were seen to be core in ensuring the functioning of tele-health services. The securing of financing for equipment maintenance and upgrade was regarded as crucial. The various components of tele-health systems had to match users' expectations in terms of reliability, ergonomics, mobility, and user-friendliness. Lastly tele-health networks required a high level of security in order to protect data confidentiality and patient privacy (Gagnon *et al.* 2006).

Gagnon *et al.*'s study (2006) aimed to explore the potential of tele-health to support medical practice in rural and remote regions, as well as the conditions to ensure successful implementation of this technology into health care organisations. Tele-health has several potential benefits for rural and remote populations and could clearly be used to improve patient care as a result of increased accessibility to specialised services, better continuity of care, and it avoided transfers. The findings from this study confirm those reported in other tele-health projects. Using the framework of tele-healthcare normalisation proposed by May *et al.* (2003 in Gagnon *et al.* (2006), however, there are still many conditions that need to be addressed in order to facilitate tele-health integration into routine care (Gagnon *et al.* 2006).

These issues are: firstly, that remote and rural physicians are among the principal tele-health users. It is therefore important to emphasise tele-health's benefits on the work of health care professionals. Tele-health can improve work satisfaction by providing easier access to continuing education and facilitating contacts with colleagues. Access to CME has been demonstrated to be linked to higher satisfaction at work and better quality of care and could be a factor of physician retention in rural and remote areas. Such findings can support decision-making with respect to the diffusion of tele-health services in remote regions (Gagnon *et al.* 2006).

There is, however, a potential threat that tele-health would encourage specialists to stay in urban centres while using tele-health to provide coverage to remote regions. This has been pointed out as a possible consequence of the diffusion of tele-radiology services (Gagnon *et al.* 2006).

Secondly, tele-health is regarded as a way to support the organisation of health care delivery on a regional basis, allowing greater access to specialised resources and better distribution of on-call duties between physicians from a whole region. In this way tele-health has a positive effect on the autonomy of rural and remote regions. This could, however, generate some tension between regions and levels of care since specialised services could be directly accessed via tele-health instead of following the referral process to the regional hospital. It is thus important to respect usual referral patterns when implementing tele-health (Gagnon *et al.* 2006).

Thirdly, the involvement of key stakeholders representing professional groups, health care organisations, and health regions in the planning and development of tele-health networks appear to be essential for achieving the normalisation of services. These findings confirm several studies on tele-health adoption. These findings also support the importance of respecting existing collaborative networks between professionals in the referral processes since trust is an important element for tele-health success (Gagnon *et al.* 2006).

Lastly the concept of tele-health readiness has been proposed to describe the degree to which communities, organisations, and professionals are prepared to participate and succeed in tele-health. Readiness should be assessed before the implementation of a tele-health project to reduce the risk of its failure after introduction. The monitoring tele-health readiness could also be used to indicate where specific efforts should be made to facilitate the transition of tele-health from experimental to routine service. Gagnon *et al.* (2006) demonstrated that the success of tele-health implementation and its integration into routine health services depends upon several 'levers'. First, the physicians' needs and expectations need to be taken into account and their participation decision-making is thus central. Second, health care organisations play a role in allocating human and material resources in order to support tele-health activities. It can be said that generally, tele-health benefits are only visible over a long period of time while its development requires important investments on a short term. The study showed that successful tele-health implementation requires a progressive diffusion strategy, starting with applications that have been proved to have benefits. The strategies identified in Gagnon *et al.'s* (2006) study could be used to provide a basis to assess tele-health readiness in other rural areas (Gagnon *et al.* 2006).

3.6. SUMMARY

This chapter discusses the conceptual framework of the user-friendliness of a hospital information system using telemedicine. It demonstrates the need for the delivery of hospital information systems, in terms of technologies that are useful and workable. It defines different telemedicine applications, for example: tele-diagnostics, tele-radiology, tele-dermatology, tele-consultations, tele-cardiology, tele-pyschiatry, tele-endoscopies, tele-neurophysiology, tele-pathology, and so on. The conceptual framework around user-friendliness of a hospital information system was also discussed in relation to clinician interactions and end-users. The purpose of a literature review and the challenges of implementing a hospital information system in terms of usability, user-friendliness, and training were discussed. Studies that have been carried out in relation to user-friendliness of an information system were also discussed. Notable studies by Scott (2005), Robert (2003), Wimelius (2004), Shaik *et al.* (2006), Werth (1998) and Lærum *et al.* (2001) were presented. Other studies presented were Darbyshire's (2000), Paré *et al.'s* (2006), and Gagnon *et al.'s* (2006). One of the major challenges was to find out what needs to happen before and after implementing an information system.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1. INTRODUCTION

In this chapter the research design, methods and procedures utilised in the data collection of this study are presented. For example, the difference between qualitative and quantitative design in research is discussed. The use of questionnaires, focus group interviews and observation as research techniques to obtain information about the user-friendliness of a computerised hospital information system within a telemedicine system as implemented in the Inkosi Albert Luthuli Central Hospital, as well as procedures regarding the verification, collection and analysis of data, are addressed.

Researchers are faced with many possibilities with approaches drawn from disciplinary fields of anthropology, psychology, social psychology, sociology and education (Creswell 1994:147). Babbie and Mouton (2001:79) state that:

‘Social research serves many purposes. Three of the most common and useful purposes are exploration, description, and explanation. Although a given study can have more than one of these purposes - and most do - examining them separately is useful because each has different implications for other aspects of research design’.

After the definition of the research problem, which was to establish the user-friendliness of a hospital information system in South Africa, the next logical step was to make the decision about how to carry out the empirical investigation. While research methodologies revolved around two major approaches (Creswell 1994:1; Leedy 1997:104; Powell 1999:96), namely, quantitative and qualitative this study largely adopted the latter to explore the human interaction that doctors and nurses had with a hospital information system and telemedicine system at IALCH in order to achieve the objectives of the research study as mentioned earlier.

4.2. JUSTIFICATION OF THE PARADIGM AND METHODOLOGY

4.2.1. Qualitative-quantitative divide

Qualitative studies are distinguished from quantitative studies in a number of key ways (Babbie and Mouton 2001:309). It is important to understand quantitative and qualitative research designs because they provide direction for designing all phases of this study (Creswell, 1994:4-7). Debates about methodologies in health research have a tendency to be polarised. Baum (2006) states that:

‘The past decade or so, however, has witnessed a growing acceptance of the validity of non-quantitative research in understanding health. Qualitative techniques are being used more and there is now a journal devoted specifically to their use in the health field. These techniques are being used on their own and as part of research that combines methods. Qualitative methodology differs in a number of ways from quantitative research. The *sine qua non* is a commitment to seeing the social world from the point of view of the actor... There is a simultaneous expression of preference for a contextual understanding so that behaviour is to be understood in the context of meaning systems employed by a particular group or society... Qualitative research is deemed to be much more fluid and flexible than quantitative research in that it emphasises discovering novel or unanticipated findings and the possibility of altering research plans in response to such serendipitous occurrences’.

Patton (1990:10 in Baum 2006) defines three types of sources of qualitative data: (a) in depth, open ended interviews with individuals or groups; (b) direct observations consisting of detailed descriptions of people’s activities, behaviours, actions and interactions; (c) written data, usually from documents yielding excerpts, quotations or entire passages from organisational, clinical or program records; personal diaries; official reports or publication; and open-ended written responses to questionnaire surveys.

There are very different traditions under the heading of qualitative research including ethnography, phenomenology, ethnomethodology, symbolic interactionism, co-operative inquiry and action research, to name a few. The researcher will not be discussing the merits of these different approaches. Rather the researcher will be concentrating on what has been a greater divide, that is the difference between sciences that reduce and measure phenomena related to health and those that seek to understand social and other processes (Baum 2006).

On the other hand, a survey design provides a quantitative or numeric description of some fraction of the population – the sample – through data collection process of asking questions of people (Fowler 1988 in Creswell 1994:117). This data collection, in turn, enables the researcher to generalise the findings from a sample of responses to a population so that inferences can be made about some characteristic, attitude, or behaviour of this population (Babbie 1990 in Creswell 1994:118). The researcher will follow essential steps in designing a quantitative method for a research study. These are:

- Describe the population in the study;
- Identify whether the sampling design for this population is single or multistage (called clustering);
- Identify how individuals will be selected (randomly or non-randomly);
- Discuss whether the randomly selected population will be stratified so that specific characteristics are represented in the sample and the sample reflects the true characteristics of the population (Fowler 1988 in Creswell 1994:120);
- Identify the characteristics used in stratifying the randomly selected population (for example, gender and so on);
- Indicate the procedure for selecting the random sample from lists or the sampling frame;
- Indicate the number of people in the sample and how this number was determined;
- Identify the survey instrument to be used in the study;
- As an existing instrument will be adopted, the researcher describes the established validity and reliability of the instrument and measures to ensure its suitability in the local situation,
- Include sample items so that readers can see the actual items used;
- Indicate the major content sections in the instrument, such as the cover letter;
- Discuss plans for pilot testing the survey and provide a rationale for this procedure;
- For the mailed survey, identify steps to be taken in administering and following up the survey to obtain a high response rate;
- Include a table or discussion that cross-references the variables, the questions and specific survey items; and
- Analyse data by identifying the statistics to be used to compare groups or relate variables and answer the research questions or objectives of the study (Creswell 1994:119-122).

A combined method study is one in which the researcher uses multiple methods of data collection and analysis. These methods might be drawn from 'within methods' approaches, such as different types of quantitative data collection strategies (for example, a survey or an experiment). Alternatively, it might involve 'between methods' drawing on qualitative and quantitative data collection procedures (for example, a survey and interviews) (Jick 1979 in Creswell 1994:174). Creswell (1994:177-178) argues that:

'It is advantageous to a researcher to combine methods to better understand a concept being tested or explored. Integrating the paradigms at several phases of the research process, the researcher should use the two-phase design, the dominant-less dominant design, or the mixed-methodology design to combine qualitative and quantitative approaches in a single study. In the two-phase design, the researcher proposes to conduct a qualitative phase of the study and a separate quantitative phase of the study. In the dominant-less dominant design, the researcher presents the study within a single, dominant paradigm with one small component of the overall study drawn from the alternative paradigm. A classic example of this approach is a quantitative study based on testing the theory in an experiment with a small qualitative interview component in the data collection phase. The mixed-methodology design represents the highest degree of mixing paradigms of the three designs. The researcher would mix aspects of the qualitative and quantitative paradigms at all or many methodological steps in the design. This approach adds complexity to a design and uses the advantages of both the qualitative and the quantitative paradigms. Moreover, the overall design perhaps best mirrors the research process of working back and forth between inductive and deductive model of thinking in a research study'.

People working within a positivist approach believe that the world is stable and that there are patterns and order that can be discovered in what they are researching. Generally, positivist researchers use the scientific method of research. The scientific method of doing research has been the dominant method for many centuries, and in fact is probably still the dominant method in the natural sciences (disciplines like botany, zoology, chemistry, and physics). Positivism is based on the premise that the world exists 'out there' and as such, the relationships between things can be easily measured. This may be the case in the natural or physical sciences, but is less so in the social sciences (the disciplines which study people and their interactions, like psychology and sociology). Researchers in the social sciences research people's behaviour, attitudes, beliefs and perceptions. These are things that cannot always be easily measured. So many social scientists work within an

interpretivist approach (rather than a positivist approach). They believe that the world is changeable and that it is people who define the meaning of a particular situation. They do not believe that it is possible to discover all the rules and laws of the social world, but that it is possible to understand how people make sense of the contexts in which they live and work (Bertram 2004:39-40).

The nature and content of communication in IALCH comprised both technical and interpersonal aspects. While the technical aspects were concerned with the communication technologies used and the clinical processes enabled by those technologies, the interpersonal aspects were concerned with relationships between system personnel, providers, and the way in which those relationships were organised. A combined positivist and interpretivist evaluation strategy enabled the researcher to make better-informed connections between the MEDICOM integrated hospital information system and telemedicine, medical encounter behaviour and health outcomes as Miller (2003) has suggested.

4.3. RESEARCH PROCEDURES

This section will discuss the survey methodology followed in conducting this research study in terms of population, sample size, reliability and validity in survey measurement, data collection instruments, processing and analysis of data.

4.3.1. Survey methodology

This study is largely qualitative and used the questionnaires, the focus group interviews and observation as techniques to explore and describe the environment, circumstances, and the user-friendliness of a computerised hospital information system with a telemedicine system implemented in the Inkosi Albert Luthuli Central Hospital. Thus, the researcher studied doctors and nurses in their natural setting, attempting to make sense of, or interpret, phenomena in terms of the meanings they brought to him (Greenhalgh and Taylor 1997:740).

Since qualitative methods complement quantitative ones, the latter was also used to provide more of an overall perspective, for example, the demographic characteristics of doctors and nurses. Qualitative techniques such as observation and focus groups were used to provide a description and understanding of MEDICOM hospital information system. Thus, the researcher used triangulation to combine qualitative and quantitative methods in the research study.

Triangulation is a multi-method approach where more methods are used in combination principally as a check of validity and results compared for convergence (Mays and Pope 1995:44). It is an approach in which more than one method to study the same thing is used, for example, if you were interested in people's attitudes toward environmental issues, you could look at patterns of voting behaviours for environmental candidates and issues; or you could interview leaders of the Nature Conservancy, and similar groups; or you could conduct a survey of a representative sample of the entire population. Or you could do all three and put the results together, in which case you could say that you had used a research strategy of triangulation (ReCAPP Research Glossary 2005). Because of advantages of on-line surveys (see Shaikh *et al.* 2006), the researcher opted for this method but unable to elicit responses from the two populations, and had to resort to hardcopies of the survey (see Section 7.3.4). Raju (2005:189) discusses a tool in the data collection process, that is, electronic mail (E-mail). Electronic mail, together with the Internet, are promising methods of conducting survey research as the proportion of the population who own computers increases (Burton 2000:329). E-mail uses computer text-editing and communications tools to provide a high speed message service. It is an appropriate medium for collecting data from respondents as the researcher could easily send out questionnaires via E-mail. Recipients would simply edit in their response questions and then return the edited messages to the original sender. It would seem that researchers could collect data rapidly and conveniently this way, as postal mail causes delays (Sproull 1986:10).

As new telecommunications technologies develop, E-mail gains further impetus as a pervasive means of communication. Over the last decade, E-mail has been integrated into all spheres of life including the academic community. Academics have particular interest in E-mail as a research tool given that most academics have free access to computers and the Internet (Burton 2000:329). Although there is scarcity of discussion of E-mail as an academic research tool, Selwyn and Robson (2003:86) state that there has been a move towards using E-mail as a research tool primarily in the form of a quantitative instrument such as electronic questionnaires.

McAuley (2000:217) argues that quantitative survey methods are more conducive to online research because the data required does not rely on 'quality' interaction between the researcher and the respondent. The principal feature of the E-mail as a research tool is the speed and immediacy it offers. The E-mail creates an almost instantaneous dialogue between the researcher and the respondent (Raju 2005:190).

Therefore, the researcher used on-line surveys to collect the data. Participants were provided with an informed consent form on-line. The surveys were designed to investigate the post-implementation usability of the MEDICOM hospital information system. The surveys were divided into two parts:

- Part one (1) of the survey asked users for information on MEDICOM hospital information system.
- Part two (2) of the survey included several usability questions, followed by two open-ended questions on what users 'liked' and 'disliked' about the information system as in a similar study conducted by Robert (2003) cited in Scott (2005).

The surveys took approximately forty (40) minutes to complete and consisted of a demographic questionnaire followed by the survey about information on MEDICOM hospital information system (Part one) and another survey about usability of an information system (Part two).

4.3.2. Populations

Participants in the two (2) surveys were the doctors and nurses who used the system. The first study population consisted of one thousand eight hundred and sixteen (1816) nurses and seven hundred and eighty six (786) doctors in IALCH. The two population lists, one for nurses and the other for doctors were obtained from the Human Resource Management Unit of the hospital. Table 6 shows how the populations were broken down by domain and the departments within each domain. The method used to calculate the sample from these two populations will be explained in the next section (4.3.3).

Table 9: Doctors and nurses by department and domain

Domain	Department	Doctors	Nurses
1. Management	<ol style="list-style-type: none"> 1. Finance Management 2. Human Resource Management 3. Medical Management 4. Nursing and Quality Management 5. Office of the Chief Executive Officer 6. Systems Management 	N 001 = 0%	N 000 = 0%
2. Medical	<ol style="list-style-type: none"> 1. Cardiology 2. Dermatology 3. Endocrine 4. Haemodialysis 5. Metabolic Respiratory 6. Neurology 7. Oncology 8. Plasmapheresis 9. Renal 10. Rheumatology 	N 192 = 24%	N 417 = 23%
3. Mother and Child	<ol style="list-style-type: none"> 1. Antenatal and postnatal 2. Cardiothoracic 3. Crano Facial 4. Gynaecology ward 5. Labour ward 6. Laparoscopy 7. Nursery and Neonatal Intensive Care Unit 8. Orthopaedic and Cardiology 9. Paediatric Haematology and Oncology 10. Paediatric Medical 11. Paediatric Neurosurgery 12. Urology and Plastic 	N 141 = 18%	N 454 = 25%
4. Pams and Support	<ol style="list-style-type: none"> 1. Clinical Psychology 2. Dietetics 3. Nuclear Medicine 4. Occupational Therapy 5. Physiotherapy 6. Radiation Oncology 7. Radiology 8. Social Work 9. Speech and Audiology 	N 67 = 9%	N 363 = 20%
5. Peri-Operative	<ol style="list-style-type: none"> 1. Burns Unit 2. Catheter Laboratory 3. High Care Units 4. Intensive Care Units 5. Operating Theatres 6. Pre-Anaesthetic Assessment Clinic and Pain Clinic 7. Trauma 	N 178 = 23%	N 145 = 8%

Domain	Department	Doctors	Nurses
6. Surgical	1. Cardiac Surgery 2. Cardiothoracic 3. Ear, Nose and Throat 4. General Surgery 5. Maxillo Facial 6. Neurology Medical 7. Orthopaedics 8. Plastic Surgery 9. Urology 10. Vascular Urology 11. Vascular	N 207 = 26%	N 436 = 24%
TOTAL	55 Departments	N 786 = 100%	N 1816 = 100%

4.3.3. Sample size

The required sample size was dependent on two key factors: the degree of accuracy the researcher required for the sample and the extent to which there was variation in the population with regard to the key characteristics of the study. The researcher needed to decide how much error he was prepared to tolerate (de Vaus 1996:70-71). In a study population of seven hundred and eighty six (786) doctors the researcher sampled one hundred and fifty seven (157) doctors, and a sample size of three hundred and sixty three (363) nurses in the study population of one thousand eight hundred and sixteen (1816) nurses. The multistage cluster sampling method was used to select doctors and nurses in various departments of the domains with an exclusion of the Management domain which did not have doctors and nurses using the system for clinical care. The researcher stratified the five domains to ensure proper proportions from each domain, and a systematic sampling was used to select one hundred and fifty seven (157) doctors and three hundred and sixty three (363) nurses from the departments in each domain.

4.3.4. Reliability and validity in survey measurement

On one hand when data are obtained from a data gathering instrument or technique, the researcher needs to know what faith he can put in the data as truly indicating the person's performance or behaviour. With all data the researcher must ask:

- Was the assessment instrument or technique reliable and valid? and
- Were the conditions under which the data were obtained such that, as far as possible, only the subject's ability is reflected in the data and that other extraneous factors had as minimal an effect as possible? (Burns 2000:336-9).

The term validity refers to the extent to which a specific measurement provides data that relates to commonly accepted meanings of a particular concept; an empirical measure that adequately reflects the real meaning of the concept under construction. The subject of validity is complex, controversial, and peculiarly important in research. There are different types of validity. They are face validity, criterion-related validity sometimes called predictive validity, concurrent validity, construct validity, and content validity (Babbie and Mouton 2001:122,125,139; Burns 2000:352-7).

In face validity, the researcher looks at the operationalisation and sees whether 'on its face' it seems like a good translation of the construct. For instance, the researcher might observe a teenage pregnancy prevention program and conclude that 'this is indeed a teenage pregnancy prevention program'. In criterion-related validity, the researcher examines whether the operationalisation behaves the way it should given the theory of the construct. This is a more relational approach to construct validity. It assumes that your operationalisation should function in predictable ways in relation to other operationalisations based upon the researcher's theory of the construct. In predictive validity, the researcher assesses the operationalisation's ability to predict something it should theoretically be able to predict. For instance, the researcher might theorise that a measure of mathematics ability should be able to predict how well a person will do in an engineering-based profession. In concurrent validity, the researcher assesses the operationalisation's ability to distinguish between groups that it should theoretically be able to distinguish between. For example, if the researcher comes up with a way of assessing manic-depression, her or his measure should be able to distinguish between people who are diagnosed with manic-depression and those diagnosed as paranoid schizophrenic. Construct validity refers to the degree to which inferences can legitimately be made from the operationalisations in a study to the theoretical constructs on which those operationalisations were based. In content validity, the criteria are the construct definition itself - it is a direct comparison. In criterion-related validity, the researcher usually makes a prediction about how the operationalisation will perform based on her or his theory of the construct (Web Centre for Social Research Methods 2006).

In order to enhance reliability and validity in this study the researcher used triangulation, the writing of extensive field notes, peer review by pre-testing of the survey instruments at Addington hospital, reasoned consensus⁶ and an audit trail⁷ (Babbie and Mouton 2001:309-310). The interview schedule is also the chief instrument in contemporary studies that enhances the reliability of a study and enables lay interviewers to closely reproduce interviews. However, despite frequent references in the literature to the validity of the interview schedule, most studies fundamentally represented variations of reliability paradigms to the neglect of criterion-related validity in order to maximise the reliability and validity of the study (Malgady *et al.* 1992). According to Mouton (1996:109,144) the only feasible way to 'maximise validity' is by either minimising or eliminating all foreseeable threats to validity in the research process. The key validity criterion for data collection is 'reliability'. This is the requirement that the application of a valid measuring instrument to different groups under different sets of circumstances should lead to the same observations. As mentioned earlier, an existing instrument was adopted and the researcher described the established validity and reliability of the instrument which was measured to ensure its suitability in the local situation, for example:

- Some questions were rephrased and simplified;
- Irrelevant questions were deleted; and
- The context was changed to local language.

4.3.5. Data collection instruments

Most of the research studies in the IT adoption behaviour controversy relied on single methods. Hence, future research studies should attempt to gather data from multiple methods such as structured interviews, questionnaires, and observation (Paré *et al.* 2006).

The researcher used three (3) types of data collection instruments, they were: the questionnaires for doctors and nurses, the focus groups with doctors and nurses and an observation technique.

⁶ An agreement of opinion, testimony, and so on. A decision is deemed rational or reasonable when others, usually our peers, concur with our judgment. In other words, a decision is deemed to be a good one when there is consensus that, given the available information, it was the best decision (Mouton 1996:64).

⁷ The result of monitoring each operation on information. A chronological record of activities occurring in the system, created concurrent with user actions. Audit trails also track the progress of each operation from the point of initiation through events steps to a terminal state, for example, complete, resolved, cancelled (Kriel 2001:252).

Firstly, the researcher sent a questionnaire (Appendix 3) to one hundred and fifty seven (157) doctors and administered another questionnaire (Appendix 2) to three hundred and sixty three (363) nurses in IALCH in order to gather their views about the user-friendliness of MEDICOM integrated hospital information system. Secondly, focus groups for doctors and nurses and thirdly observation techniques were used to carry out a prospective analysis to determine the user-friendliness of the hospital information system and telemedicine as in Jithoo *et al.*'s (2003) study. The researcher developed the questionnaire (Appendix 2) for nurses from the objectives of the study using Geysler's (1992) model (see Figure 4) and he adapted an existing data collection instrument for doctors (Appendix 3). The instrument had already established validity and reliability and he ensured its suitability for this study in the local situation by assessing it against the objectives of the study and also pre-testing it.

4.3.5.1. Questionnaires

A questionnaire is a type of data collection technique handed out in paper form usually to a specific demographic group to gather information in order to provide better service or goods. The questionnaire was invented by Sir Francis Galton (Questionnaire 2006). It is a prepared set of questions designed to generate data necessary for accomplishing the objectives of the research project (Glencoe On-line 2004).

The questionnaire used to collect data from the doctors consisted of eight sections (see Appendix 3 for details). This questionnaire was adapted from an existing data collection instrument. In the section covering use of computers, clinical tasks on the basis of forty hours of observations were listed, taking into account the information needs of doctors.

The section asked doctors to indicate their frequency of use of computers for twenty three general clinical tasks on a five point scale ranging from 'never or almost never' to 'always or almost always.' In addition, they were asked to indicate whether they were using the implemented MEDICOM hospital information system for each task (Lærum *et al.* 2001). The researcher adapted Lærum's existing, validated questionnaires including the sections covering computer literacy and user satisfaction.

4.3.5.1.1. Pre-testing the questionnaires

Babbie and Mouton (2001:244) pointed out that in constructing a questionnaire there is always a possibility of an error. Pre-testing the questionnaire is necessary in order to uncover any defects in questions (Ngulube 2003:215). The questionnaires were then tried on a sample of respondents, to check ease of completion and whether the procedure had the desired effect (Burns 2000:579-580; Fowler 1998:366; Sapsford 1999:32). The recommended number for such an exercise is between fifteen and thirty-five (Fowler 1998:369; Sapsford 1999:32). Hence, a total of thirty typical respondents (fifteen doctors and fifteen nurses) were purposefully selected from Addington hospital, which also had a computerised hospital information system, to determine the accuracy and understandability of items.

The instrument pre-testing was important to make necessary improvements by removing ambiguities in the tools before going to the real survey. It was further noted that if the researcher did not pre-test research tools and the instruments could turn out to be unproductive in the real study and it would be a waste of time to everyone involved in the study (Bright 1991). The results of the pre-test were that some questions were either phrased improperly, were incomplete or irrelevant. Sometimes terminology and acronyms used were not understandable to the interviewees. Some questions were asked more than once. Once the changes had been made the questionnaires were distributed to doctors and nurses by hand and reminders sent a month later.

4.3.5.2. Focus group interviews

A focus group is a small group selected from a wider population and queried, as by open discussion, for its members' opinions about an emotional response to a particular subject or area. Typically, the focus group interview involved between six to ten people and it lasted for one to two hours (MORI 2006). Focus group interviews are being used increasingly within health and social research and are now a widely accepted qualitative research strategy. Focus groups were an appropriate choice for this study because they 'are a particularly good choice of method when the purpose of the research is to elicit people's understandings, opinions and views, or to explore how these are advanced, elaborated and negotiated in a social context.' (Darbyshire 2000) (see Section 3.5.7.7.).

The researcher randomly selected focus groups from a population of seven hundred and eighty six doctors and one thousand eight hundred and sixteen nurses and solicited in open discussion, its members' opinions about more emotional responses to user-friendliness of MEDICOM hospital information system in IALCH. One focus group of six doctors and two focus groups of nurses (group one with eleven nurses and group two with nine nurses) were conducted with six to fifteen members in each group, since more groups seldom provide new insights as advised by Morgan (1997) in Babbie and Mouton (2001:292). Members who were likely to be participative and reflective were selected.

In preparation for a focus group session, the researcher followed the steps recommended by McNamara (2007). The researcher:

- Identified the major objective of the meeting;
- Carefully developed six questions;
- Called potential members to invite them to the meeting. Sent them a follow-up invitation with a proposed agenda, session time and list of questions the group discussed;
- Planned to provide a copy of the report from the session to each member; and
- About three days before the session, called each member to remind them to attend.

The focus group interview sessions were scheduled to last for one and a half to two hours. Over lunch seemed to be a very good time for staff to find time to attend. Sessions for nurses were held in a on the 5th floor Human Resource boardroom of the administration building at IALCH with adequate air flow and lighting. Chairs were arranged around a rectangular table so that all members could see each other. Name tags for members were not provided since the nurses already had them for work purpose. All members were encouraged to participate as much as possible. Because the session was a one-time occurrence, it was useful to have a few, short ground rules to sustain participation, that is, keep focused, maintain momentum, and get closure on questions. The following agenda was considered:

- Welcome;
- Review of agenda;
- Review of goals of the meeting;

- Review of ground rules;
- Introductions;
- Questions and answers; and
- Wrap up.

A key feature of the group was that participants were able to interact with, and react to, each other. In order to facilitate this group dynamic, theoretically it was important to ensure that participants did not know each other beforehand and that the discussions were conducted in an environment conducive to interaction where there was no interruption of interviews. But practically it was likely that participants knew each other since they were working together already. The researcher ensured that the interview rooms were spacious and quiet. The separate focus groups for doctors and nurses were run by the researcher and the sessions were recorded with a tape recorder and an audio-video recorder whilst the researcher also took notes (MORI 2006; Babbie 2004:302).

The major goal of facilitation was collecting useful information to meet the goal of the meeting. The researcher followed the procedures recommended by McNamara (2007) which were:

- Introducing himself;
- Explaining the means to record the session; carried out the agenda (see 'agenda' above);
- Carefully wording each question before that question was addressed by the group (see Appendix 4);
- Allowing the group a few minutes for each member to carefully record their answers;
- Facilitating discussion around the answers to each question, one at a time;
- Carefully reflected back a summary of what the researcher heard, after each question was answered;
- Ensuring even participation, that is, if one or two people are dominating the meeting, then calling on others;
- Considering the use of a round-table approach, including going in one direction around the table, giving each person a minute to answer the question. When the domination persisted, it was noted to the group and asked for ideas about how the participation could be increased.

- In closing the session, informing the members that they would receive a copy of the report generated from their answers, thanking them for coming, and adjourning the meeting.
- Immediately after the sessions, verifying that the tape recorder was working throughout the session;
- Making any notes on the written notes, for example, clarifying any scratching, ensuring that pages are numbered, and filling out any notes that do not make sense, and so on;
- Writing down any observations made during the session, for example, where did the session occur and when, what was the nature of participation in the group? and
- Noting any surprises occurring during the session?

The focus group interviews were managed by going round in the table, thus ensuring that everyone spoke and ending up with the 'individual' responses of all members of the group. The researcher chose enough participants so that the group did not fall flat if some members chose to remain silent. The rule of thumb used was to over-recruit participants by twenty percent to compensate for members not showing up. There was no need for the researcher to steer clear of friendship pairs, 'experts' and uncooperative participants because all nurses from both focus groups participated freely although, as explained above, they knew each other since they had been working together for a while. During the interview the participants were not allowed to break off into small conversation groups or talk at once as recommended by Babbie and Mouton (2001:292). The researcher interacted with the participants in a natural, unobtrusive and non-threatening manner, modeled the interviews on a conversation between two trusting parties rather than on a formal question-and-answer session between the researcher and respondents. It was only in this manner that the researcher captured what was important in the minds of the participants themselves as advised by Burns (2000:416).

4.3.5.3. Observation

The greatest advantage of a qualitative research method is the presence of an observing, thinking researcher on the scene of the action. In qualitative research, there are usually two types of observation, namely *simple observation*, where the researcher remains an outside observer; and *participant observation*, where the researcher is simultaneously a member of the group he or she is studying and a researcher doing the study (Babbie and Mouton 2001:293).

The researcher used simple observation on the doctors and the nurses as they used the system. Subsequently, some questions were asked of them relating to their involvement in the customisation of the system, the user-friendliness of the system, the training needs relating to the use of the system, and recommendations regarding the implementation and the rollout of the hospital information system and telemedicine system to other institutions in KwaZulu-Natal as suggested by Whitten and Rowe-Adjibogoun (2003).

In both observation and interviewing, it was vital to make full and accurate notes of what was observed. The notes, which included both empirical observations and interpretations, were written down as soon possible afterward. Some of the most important observations were anticipated before the researcher began the study; others became apparent as observations progressed (Babbie 2004:304). The researcher made note taking easier by preparing standardised recording forms in advanced (see appendix 5). This was a way of coding the individual's behaviour within a group context under eight headings, which were sufficiently comprehensive to cover most behaviour exhibited in a group. In this study a more manageable system useful for observing groups was informed by the following eight categories: (see 3.3.2. for the detailed breakdown of the categories)

- 1) Physical features;
- 2) Reliability of the system;
- 3) Dialogue;
- 4) Feed back;
- 5) User support;
- 6) Handling of user errors;
- 7) User control of the system and transparency; and
- 8) Output (Burns 2000:408-9; Geysler 1992:83-7).

4.3.6. Processing and analysis of data

According to Tesch 1990 cited in Creswell (1994:153-7) the process of data analysis is eclectic; there is no 'right way'. Data analysis requires that the researcher be comfortable with developing categories and making comparisons and contrasts. It also requires that the researcher be open to possibilities and see contrary or alternative explanations for the findings. Quantitative analysis was mainly used for the questionnaires and qualitative analysis was used for focus group interviews and

observation. This data was also quantified. The following points guided the development of the analysis of the qualitative data:

- The data analysis was conducted as an activity simultaneously with data collection, data interpretation, and narrative report writing;
- An indication of how the process of qualitative analysis was based on data ‘reduction’ and ‘interpretation’ was given;
- A plan for representing the information in matrices was developed;
- Identification of the coding procedure used to reduce the information to themes or categories was taken care of.

The procedure used for extracting relevant attributes from the empirical material was to analyse the material in order to uncover concepts that were expressed (by the respondents) to have an influence on perception. Concepts that were closely connected were then condensed into single concepts by the researcher. The data was first analysed manually using conceptual content analysis (Babbie and Mouton 2001:383) and then by using a coding system whereby interviewees’ responses were grouped into categories bringing together similar ideas, concepts, or themes. Main categories were coded first, and this was followed by coding single categories. After the researcher marked the interviews with coding categories, the researcher put all the material with the same codes together. In the final stage of analysis, the researcher linked codes together to create a clear description or explanation of the experiences of the system users in IALCH and collate the data in ways that helped to formulate themes and refine concepts. Consequently, it is important to emphasise that the key attributes used below represent generalisations, such as Legible, Simple, Boring, Nice looking, Good structure, Exciting, Messy, Confusing, and Lack of structure as in Wimelius’ study (2004) described in Chapter Three.

4.4. ETHICAL ASPECTS OF THE STUDY

All forms of social research raise ethical issues. Ethics is typically associated with morality, and both words concern matters of right and wrong. Anyone involved in social scientific research needs to be aware of the general agreements shared by the researchers about what is proper and improper when conducting scientific inquiry (Babbie 2004:63,66,67). When studying any form of

human behaviour, ethical concerns are paramount. The researcher was aware of ethical aspects involved in the study such as:

- Voluntary and non-voluntary participation;
- Avoiding deception;
- Securing informed consent;
- Ensuring privacy and confidentiality;
- Respecting the right to discontinue; and
- Being mindful of investigator obligations, for instance, consent with participants (Burns 2000:18-22).

The research study was approved by the University of KwaZulu-Natal (see Appendix 1a) and Inkosi Albert Luthuli Central Hospital Ethics Screening Committees (see Appendix 1b). The participants were informed that their participation was voluntary. They were made to understand the nature and purpose of the research, and their consent to participate in the study without coercion was sought from them. The researcher was honest and open. Participants were informed that they had a right to discontinue if they did not want to respond to an item. The researcher ensured that he did not run overtime as many participants made arrangements to fit in with the time requirement which they notified about (Burns 2000:18-22).

4.5. EVALUATION OF THE RESEARCH METHODOLOGY

Evaluation is a set of research methods and associated methodologies with a distinctive purpose (Stern 2006). A research design is a plan or blueprint of how the researcher intends to conduct the research process in order to solve the research problem. Researchers often confuse 'research design' and 'research methodology', but these are two very different dimensions of research.

Research methodology refers to the methods, techniques, and procedures that are employed in the process of implementing the research design or research plan (Babbie and Mouton 2001:104). Research designs have weaknesses as well as potentials. According to Creswell (1994) research methodologists recognise that both qualitative and quantitative designs have something to offer.

The degree to which they are able to serve the desired research purpose largely depends on the researcher's understanding of their strengths and limitations. In fact, Sproull (1995:136) argued that: 'No one type of research design is universally better or worse than any other. They are different and used for different purposes'. The major strengths of survey research are the economy of design and the rapid turn around in data collection (Bickman, Rog & Hedrick 1998:15; Creswell 1994:154). However, its major limitation is that it cannot provide information on cause-effect relations like experimental studies. In addition, all survey methods are handicapped by non-response (Goyder 1987). Non-response is not only affected by the percentage of the units of analysis that fail to respond to the questionnaire, but by the way the respondents complete the questionnaires, the uneven impact of questionnaire structure and question wording as well. With careful planning and execution the effect of these limitations was minimised. Pre-testing the two questionnaires before collecting data was one way of minimising the ambiguity of the data collection instruments (Ngulube 2003:235-8).

The concepts of validity and reliability are paramount to all statistical interpretation of data. Validity is the capability of a test or tool to measure what it is intended to measure. Reliability is the ability of a test or tool to measure in a producible way what it is intended to measure (Skurka 2003:189). The researcher clearly defined all central concepts and used qualitative methods to seek for a deeper truth about MEDICOM hospital information system. During the process of operationalisation of measuring instruments, a questionnaire for nurses (see Appendix 2) was developed and a questionnaire for doctors (see Appendix 3) was identified and adapted. Ideally this instrument constituted a valid measure of the key concepts in the research question. The population from which the researcher selected items to construct the instrument was exhaustive with regard to the phenomenon being investigated. The categories used in the questionnaires were unambiguous and mutually exclusive. The methodological criteria applied in the process of sampling as suggested by Mouton (1996:110) were that:

- The population of the research study was defined clearly by the researcher;
- The sample was systematically drawn;
- The probability was drawn rather than non-probability samples; and
- The advantage of multi-stage was observed versus simple random sampling.

During data collection, the researcher collected various kinds of empirical information or data, for instance historical or statistical data. This was accomplished through various methods and techniques of observation. These included suspension of personal prejudices and biases, systematic and accurate recording of observations, establishment of trust and rapport with the participants in the focus groups and creating optimal condition in terms of location or setting for the collection of the data (Mouton 1996:110-111).

In a study population of seven hundred and eighty six (786) doctors the researcher sampled one hundred and fifty seven (157) doctors, and a sample size of three hundred and sixty three (363) nurses in the study population of one thousand eighty hundred and sixteen (1816) nurses. The multistage cluster sampling method was used to select the doctors and nurses in various departments of the domains with an exclusion of the Management domain which did not have nurses. The researcher stratified the five domains to ensure proper proportions from each domain, and a systematic sampling was used to select one hundred and fifty seven (157) doctors and three hundred and sixty three (363) nurses from the departments in each domain. The researcher had lists of doctors and nurses for each domain and he took the fifth (5th) name on the list starting from the second (2nd) name on the lists. But because of the busy schedule of doctors and nurses in various departments, the researcher chose the next available department in the domain. The attrition of both doctors and nurses also forced the researcher to take the next available participants on the lists.

The researcher analysed data by identifying patterns and themes in the data and drawing certain conclusions from them, using appropriate statistical techniques for the appropriate level measurement and so on, and drawing inferences according to principles of statistical inference (Mouton 2003:110-111).

The questionnaire used to collect data from doctors was adapted from Wimelius's (2004) study, and the questionnaire for nurses was developed by the researcher from the objectives of this research study.

4.6. SUMMARY

This chapter stressed that research procedures are fundamental to gathering data to address a research question. It outlined the methods and techniques that were used in investigating the user-friendliness of MEDICOM hospital information system in IALCH. It was revealed that research is basically done to describe or understand certain situations. The research process is commonly informed by either the qualitative or quantitative paradigm. At times a combination of both models is used. The survey research design was described as the main research procedure employed by the study. Explanations were given why each instrument for data collection was selected. Principles such as validity, reliability and ethical standards, which informed the research process, were presented. The units of analysis and the methods used for data collection and analysis were also discussed in this chapter. The results of the investigation are presented and interpreted in the chapters that follow.

CHAPTER FIVE: PRESENTATION OF DATA

5.1. INTRODUCTION

The previous chapter explained how the study was conducted, that is, what was done in order to collect data to answer the research question. Its major aim was to aid the reader to replicate the study as in the original if need be as well as to help other researchers to estimate how much confidence could be placed in the findings. Furthermore, it should be possible for other researchers to compare the procedure with methods used in similar studies and explain the differences in findings among studies on the user-friendliness of MEDICOM integrated hospital information system, the physical features of the hospital information system and telemedicine system, the reliability of the hospital information system and telemedicine system, the dialogue flexibility, the hospital information system and telemedicine system supporting users, users handling errors in the hospital information system and telemedicine system, users controlling the hospital information system and telemedicine system, the output of the hospital information system and telemedicine system in terms of layout, and the training needs relating to the use of the hospital information system and telemedicine system in terms of the differences in research methods.

This chapter presents the analysed data obtained from the two populations targeted in the study, while the next chapter is devoted to the interpretation of the results of the study. The objective of this chapter is to transform the raw data collected into meaningful facts. The survey population for both doctors and nurses was reasonably large but some members of these sampled groups did not respond while others did not answer some questions. The data presented in this chapter was obtained from questionnaires. The results are organised according to the themes of the research issues that were raised in section 1.3.2. of Chapter One. The findings are presented as descriptions and symbolic representations such as bar graphs (histograms), pie charts and figures. According to Locke, Silverman and Spirduso (1998:173) graphics are more effective than word descriptions for portraying complex relationships between or among variables.

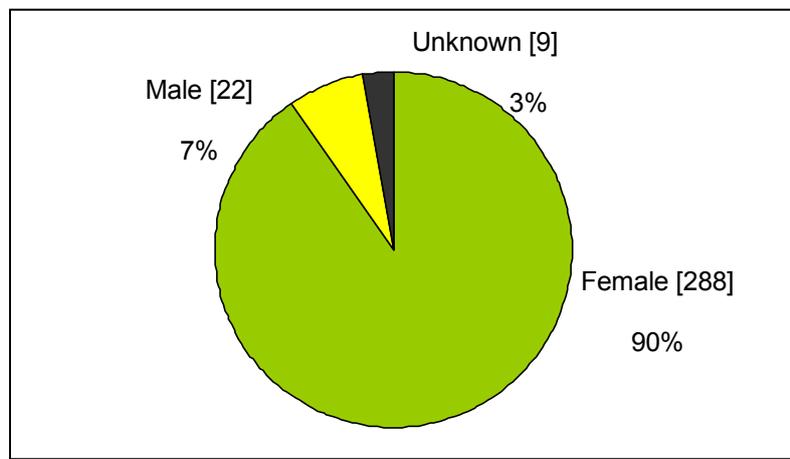
Tables are also suited for displaying primary findings (Locke, Silverman & Spirduso 1998:173). Tables were used to display the values of the results in numerical form. In most cases, tables were used where results could not be easily expressed in text (Nicol & Pexman 1999:4). The whole point

of tables is to present data in an organised fashion that makes them easier to understand and interpret. Univariate analysis discussed in the previous chapter was also used to summarise and display the data.

5.2. THE DEMOGRAPHIC DATA OF NURSES

From the population sample of three hundred and sixty-three (363) nurses, three hundred and nineteen (319) nurses responded.

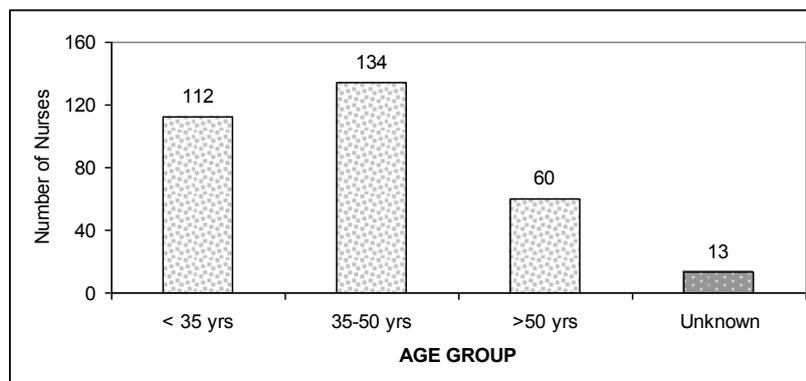
Figure 12: Nurses by gender (N=319)



Source: analysis of survey data

Figure 12 shows the preponderance of two hundred and eight-eight female nurses (90%) over that of twenty-two male nurses (7%) and nine for whom the gender was unknown (3%) from three hundred and nineteen (319) participants responded.

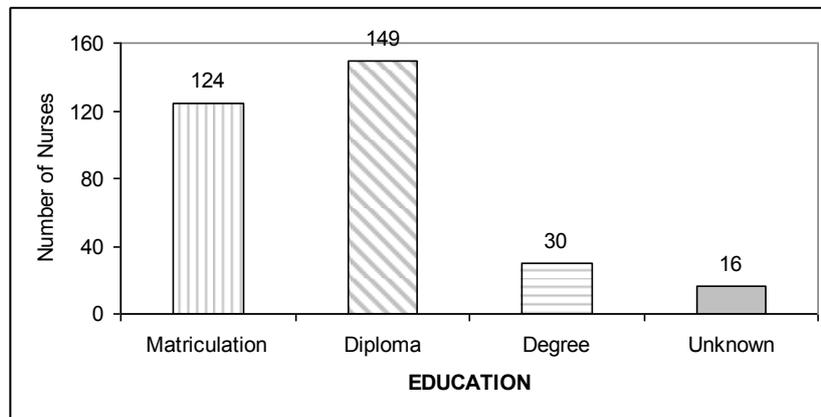
Figure 13: Nurse by age group (N=319)



Source: analysis of survey data

One hundred and thirty-four (134) nurses were between the age of thirty-five (35) and fifty (50) years old, whilst hundred and twelve (112) nurses were below thirty-five (35) years old, sixty (60) nurses were over fifty (50) years old, and there were only thirteen (13) unknown (Figure 13).

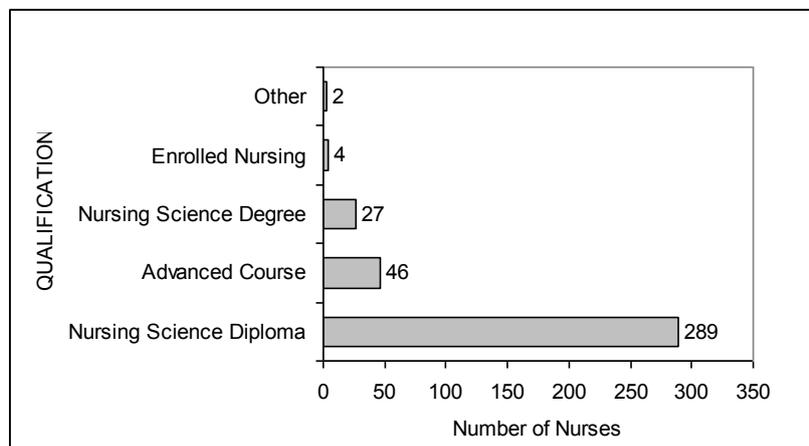
Figure 14: Nurses by education level (N=319)



Source: analysis of survey data

One hundred and forty-nine (149) nurses possessed a diploma, one hundred and twenty-four (124) enrolled nursing assistants⁸ had matriculated but had no diploma or degree, thirty (30) nurses possessed a degree, and the education level of sixteen (16) nurses was unknown (Figure 14).

Figure 15: Nurses by type of qualification (N=319)



Source: analysis of survey data

Two hundred and eighty-nine (289) professional nurses had a diploma in nursing science. This was the basic qualification for professional nursing. Forty-six (46) professional nurses had

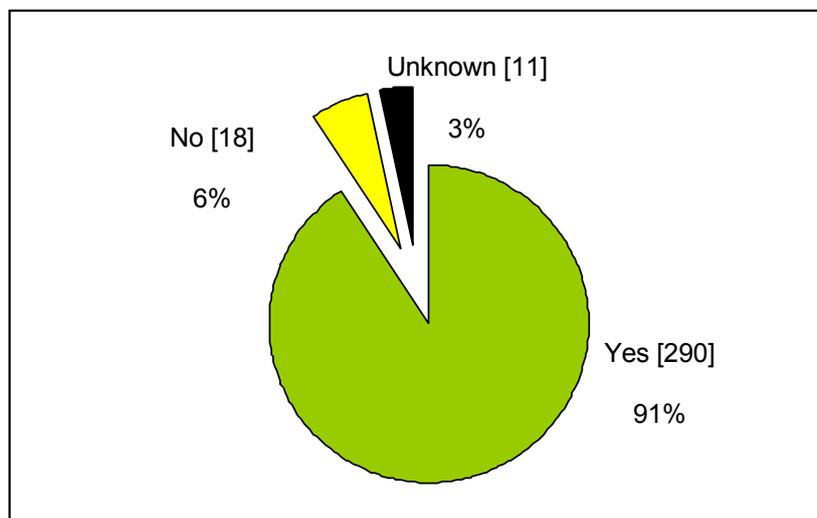
⁸ These are persons who assist professional nurses, they are not professional nurses. They are trained on a nursing assistant course for a year.

studied an advanced course, for example: midwifery, community health or psychiatry. Twenty-seven (27) professional nurses had a degree in nursing science. Four (4) enrolled nursing assistants did an enrolled nursing science course. Two (2) professional nurses studied other courses, one (1) studied business management and the other studied Microsoft Computer-of-the-shelf⁹ course and Pastel¹⁰ (Figure 15).

5.3. THE USER-FRIENDLINESS OF MEDICOM INTEGRATED HOSPITAL INFORMATION SYSTEM (HIS)

The nurses were asked whether the MEDICOM integrated HIS was easy to use.

Figure 16: Is MEDICOM integrated HIS easy to use? (N=319)



Source: analysis of survey data

Figure 16 shows that ninety-one percent of nurses (290) agreed that MEDICOM hospital information system was easy to use; three percent of nurses (11) did not answer the question; and six percent of nurses (18) did not agree that the system was easy to use (Question 2.1). Those nurses who did not agree, gave the following reasons (Question 2.2.):

- Giving of medication was not user-friendly;
- The user had to go forward and backwards on system when registering patients, ordering pharmacy stock, and receiving the item from pharmacy;
- Users needed to be trained before using the system;

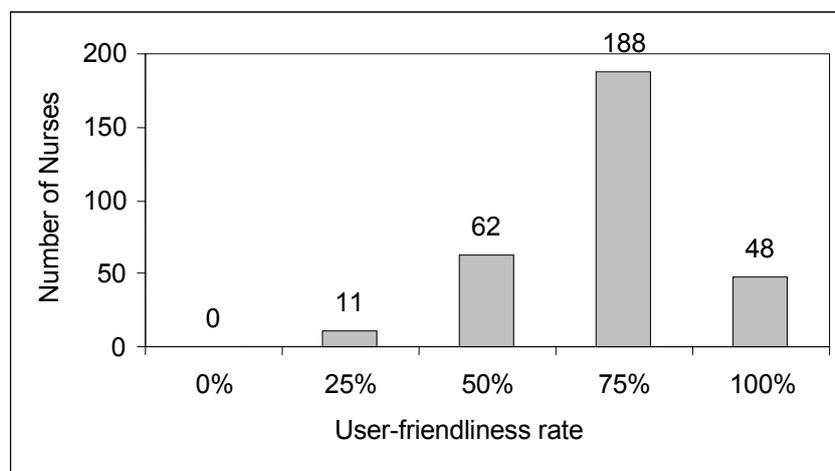
⁹ Microsoft package, for example: Introduction to Windows, Word, Excel spreadsheet and Power point presentation.

¹⁰ This is finance computer software.

- Statistics in the system were not accurate;
- There was no privacy on patient notes including staff;
- There was no space to enter the implants used on patients;
- Users complained that most of the time the system was down; and
- It took too long to log on, log off or did not log one on at all.

Nurses were asked how they would rate the user-friendliness of the MEDICOM integrated HIS.

Figure 17: The user-friendliness of MEDICOM integrated hospital information system. (N=319)



Source: analysis of survey data

Figure 17 shows that one hundred and eighty-eight (188) nurses rated the user-friendliness of the MEDICOM hospital information system at seventy-five percent (75%). Sixty-two (62) nurses rated the system at fifty percent (50%) user-friendly; forty-eight (48) nurses rated the system as one hundred percent (100%) user-friendly; and eleven (11) nurses rated the system at twenty-five percent (25%) user-friendly (Question 2.3).

The reasons for users rating the user-friendliness of MEDICOM hospital information system as low were that (Question 2.4):

- The system was not user friendly;
- The system took too long to allow users to log on their names;
- The user could not log on his or her station, he or she could only access information everywhere inside the hospital;

- Computers were slow when all departments were busy;
- Some information was hidden for certain personnel;
- Users wanted to be exposed to other information systems in the hospital¹¹;
- Confidentiality was not maintained;
- The user could not hide his or her personal information in the system;
- The system disclosed patient personal information to workers who were able to use the system;
- At the occupational clinic other people would peruse the patient's diagnosis which was totally unprofessional;
- Users wasted time moving from one screen [window] to another to access information;
- Some screens [windows] disappeared;
- Incorrect information was given on drop down choices;
- Users could not reverse information when inserted wrongly;
- Users required clarity on some issues related to the system;
- There was no way of entering theatre procedures in the system;
- The codes for other operations did not appear in the system;
- There was no enough space to write;
- Sometimes icons did not open;
- The system needed to be updated;
- Users complained that the downtime of the system caused inconvenience and users resorted a lot to paperwork;
- The system was too slow at times;
- The system delayed to open and lost information;
- The treatment of patients was delayed while waiting for the computer to process information;
- Users were not given enough training;
- Nurses experienced problems with new doctors who had a little training in hospital information systems, as a result nurses ended-up teaching them;
- The older persons had difficulties in using computers, they were slow to grasp;
- When users phoned for help, they were referred to other person; and

¹¹ Nurses want to have access to other information systems in the hospital other than MEDICOM hospital information system.

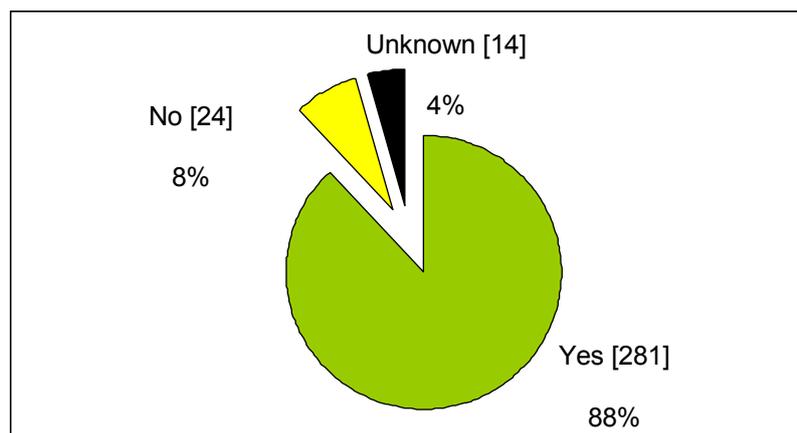
- A password always expired.

Taking the user-friendliness of MEDICOM integrated hospital information system into consideration, data was analysed according to the following categories: Physical features, Reliability, Dialogue, Feed back, User support, Handling of user errors, User control, Output, and Training.

5.4. THE PHYSICAL FEATURES OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM

Nurses were asked whether the IALCH had documentation that focused on hospital-specific business processes.

Figure 18: Whether the IALCH has documentation that focuses on hospital-specific business processes? (N=319)



Source: analysis of survey data

Figure 18 shows that two hundred and eighty-one nurses (88%) agreed that Inkosi Albert Luthuli Central Hospital did have documentation, either online or hardcopy, that focused on hospital-specific business processes (Question 2.5.); two hundred and thirty-five (235) nurses had access to a copy of the document (Question 2.7.); and forty-four (44) nurses did not have access (Question 2.6.) because (Question 2.8.):

- The document was in a read-only format;
- Some of the documents were not accessible to maintain confidentiality; and
- The documents did not concern the nursing staff.

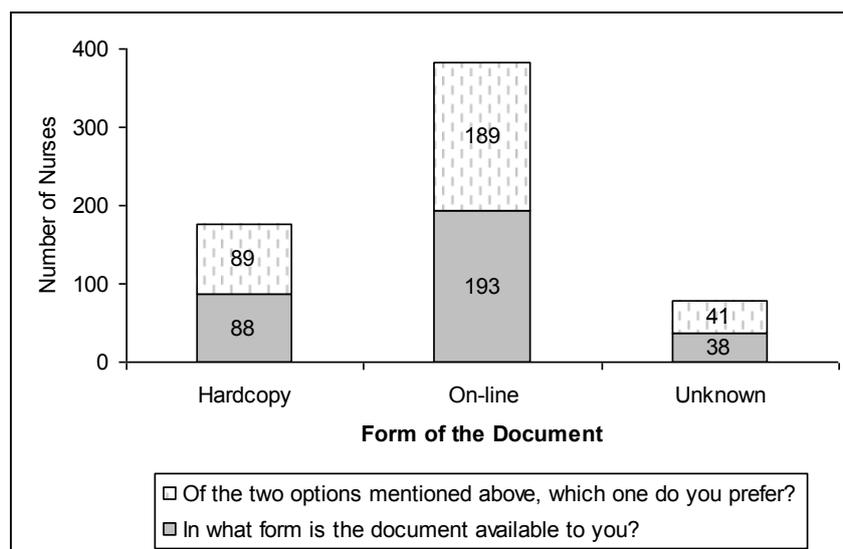
Twenty-four nurses (8%) denied the availability of the documentation at their disposal, they said that:

- They never heard of it or seen it;
- They were taught about the hospital-specific business processes during training but no hard copies were given to them; and
- Not everything was disclosed to them.

Fourteen nurses (4%) did not respond to this question.

The nurses were asked in what form the document was available to them and further which format was preferred.

Figure 19: Form that the document available is in and preferred options. (N=319)



Source: analysis of survey data

Figure 19 shows that the on-line document was available to one hundred and ninety-three (193) of nurses and one hundred and eighty-nine (189) nurses preferred the on-line document (Question 2.9.) because (Question 2.11.):

- It was quick to retrieve, easy to use for editing purposes, print or send the document to other people as long as the user had a patient’s file number and necessary details;

- It avoided the inconvenience of looking for paper documents and allowed easy access to documents at any computer station in the department;
- A user could access notes on time and all the time. They did not queue to request old notes from records and they saved time;
- There was no storage problem, such as stacks of files. Documents were easy to save and safe from getting lost;
- There was waste in the form of hardcopies;
- Online documents prevented having to store unnecessary hardcopies in the unit and kept the users informed about what was happening in the hospital;
- It limited paper on the table and it kept confidentiality;
- Documents were accessible to a number of people at the same time; and
- Users could access scanned results and see the result of any procedures.

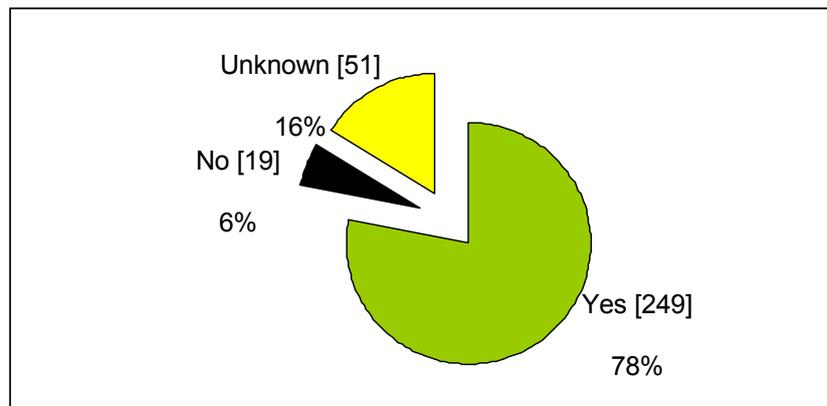
Hardcopy document were available to eight-eight percent (88%) of nurses and eighty-nine percent (89%) of nurses preferred hardcopy document (Question 2.10.) because (Question 2.11.):

- They could be kept in the files of the hospital in an easily understandable system;
- When the system was down, it was very hard to access the discharge summary for referral purposes;
- The document was always available and not affected by downtimes and virus problem;
- Sometimes the system was slow and delayed;
- The user could take a hard copy and read it at home; and
- It could be signed by hand.

Thirty-eight (38) nurses did not know in what form the document was available to them (Question 2.9.), and forty-one (41) nurses did not prefer any option, because they did not understand the difference between online and hardcopy documents (Question 2.10.).

Nurses were asked whether ergonomic design of the workstation was satisfactory.

Figure 20: Ergonomic design of the workstation. (N=319)



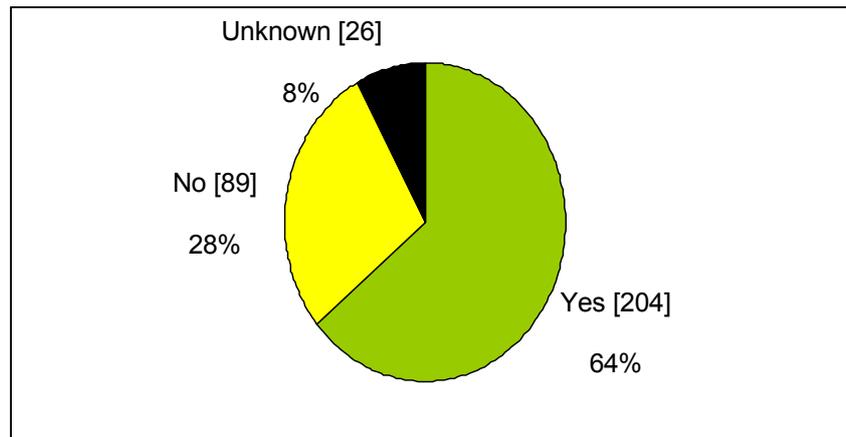
Source: analysis of survey data

Seventy-eight percent (78%) of nurses (249) were satisfied with their workstations and their working space was big enough; six percent (6%) of nurses (19) were not satisfied (Question 2.12.) because (Question 2.13.) their workstations were limited, not adjustable according to their heights, too small, cluttered, and the desks were too high; and sixteen percent (16%) of nurses (51) were not sure but they complained that built-in computers made it difficult for them to move the computers around (Figure 20).

5.5. THE RELIABILITY OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM

The nurses were asked whether the MEDICOM integrated HIS was always in operation when needed, for example, auto-start, auto-logon, help and data transfer.

Figure 21: Whether MEDICOM's integrated HIS is always in operation when needed (auto- start, auto-logon, help and data transfer). (N=319)



Source: analysis of survey data

Figure 21 shows that sixty-four percent (64%) of nurses (204) agreed that MEDICOM integrated hospital information system was always in operation when needed (Question 2.14.), for example auto-start, auto-logon, help and data transfer; twenty-eight percent (28%) of nurses (89) disagreed they said that (Question 2.15.):

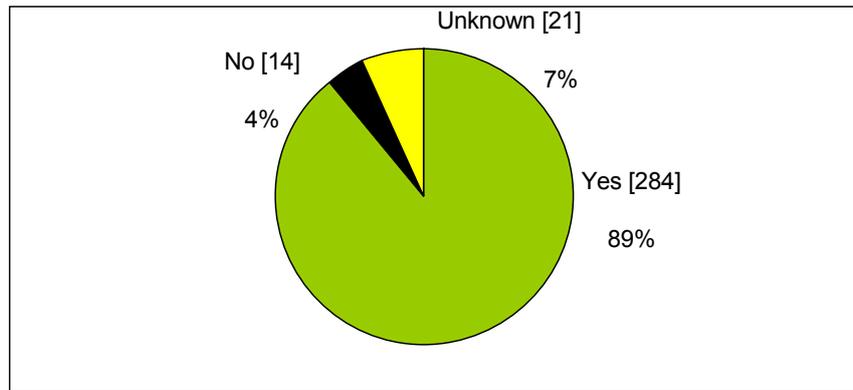
- The system was often off-line, slow when needed most;
- The system was not available when it was cleaned up or upgraded;
- The codes for other operations were not there;
- Sometimes the users could not do back up on-line, they had to print hardcopies;
- Sometimes computers refused to log the user on;
- Users were unable to record patient's progress;
- Icons did not showing [show] up sometimes;
- Sometimes the system could not print patient's transcripts such as a medical certificate;
- Sometimes the system failed and only allowed the user to enter information later after restoration; and
- Sometimes the user could not access notes from the system.

Eight percent (8%) of nurses (26) were not sure whether the system was always operational or not.

5.6. FLEXIBILITY OF THE HOSPITAL INFORMATION SYSTEM'S DIALOGUE FOR A USER

Nurses were asked whether the dialogue (language) of the system was flexible for a user.

Figure 22: Flexibility of the dialogue (language) of the system for a user. (N=319)

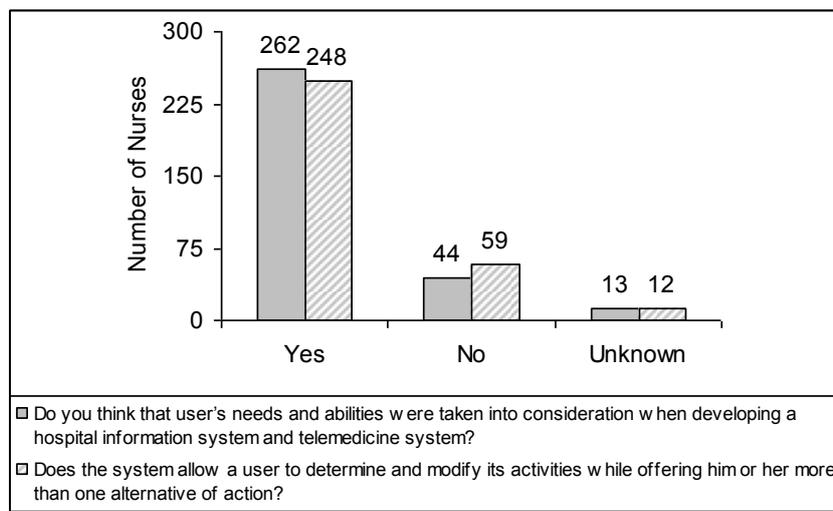


Source: analysis of survey data

Figure 22 shows that eighty-nine percent (89%) of nurses (284) agreed that the dialogue of the system was flexible to the user; four percent (4%) of nurses (14) did not agree; and seven percent (7%) of nurses did not know whether the system was flexible to the user or not (Question 2.16.).

The nurses were asked whether their needs and abilities were taken into consideration when developing a hospital information system and telemedicine system. And whether the systems allowed them to determine and modify its activities while offering him or her more than one alternative of action.

Figure 23: Whether the user's needs and abilities were taken into consideration when developing a hospital information system and telemedicine system. And whether the system allows a user to determine and modify its activities while offering him or her more than one alternative of action. (N=319)

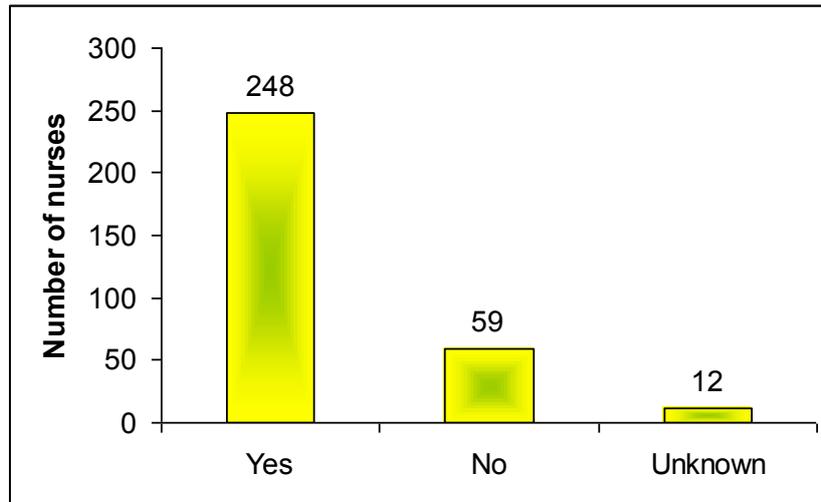


Source: analysis of survey data

Figure 23 illustrates that two hundred and sixty-two (262) nurses agreed, forty-four (44) did not agree, and thirteen (13) did not know that user's needs and abilities were taken into consideration when developing a hospital information system and telemedicine system whilst two hundred and forty-eight (248) nurses agreed, fifty-nine (59) did not agree; and twelve (12) did not know that the system allowed a user to determine and modify its activities while offering him or her more than one alternative of action (Question 2.17).

Nurses were asked whether the system allowed a user to determine and modify activities while offering more than one alternative of action.

Figure 24: Whether the system allows a user to determine and modify activities while offering more than one alternative of action. (N=319)

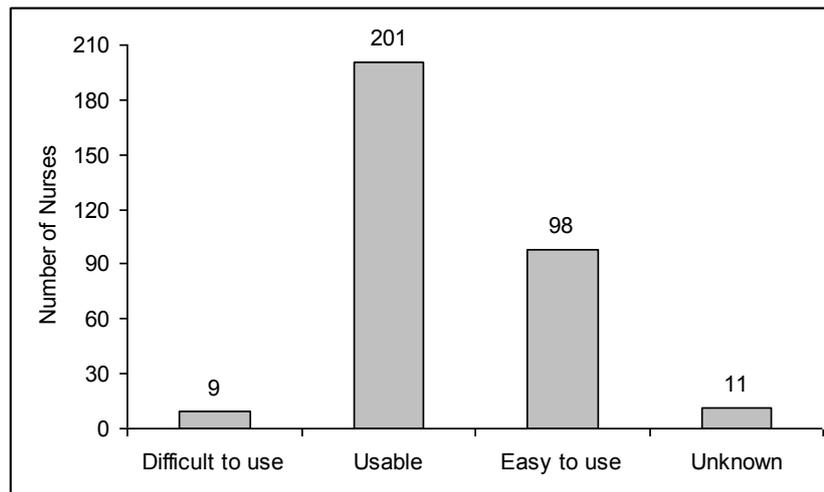


Source: analysis of survey data

Figure 24 shows that two hundred and forty-eight (248) nurses agreed that the system allowed them to determine and modify its activities while offering him or her more than one alternative of action; while fifty-nine (59) did not agree; and twelve (12) did not know (Question 2.18).

They were asked how they would describe the commands of the system.

Figure 25: The commands of the system. (N=319)



Source: analysis of survey data

Two hundred and one (201) nurses described the commands of the system as usable whilst ninety-eight (98) described the commands as easy to use. Nine (9) nurses found it difficult to use the commands. When they logged on, sometimes the system displayed the wrong PIN¹². The system often needed to be rebooted and restarted in order to allow the user to enter the data. Eleven (11) nurses could not describe the commands of the system (Question 2.19.).

With regard to the system's screen design, most nurses commented that the screen was always bright, clear, visible, user-friendly, usable, quick with command¹³, logical, well-designed, excellent, perfect, in order, easy to read and understandable, and could accommodate more than one programme at a time. The screen design did not need any upgrading whatsoever (Question 2.20.).

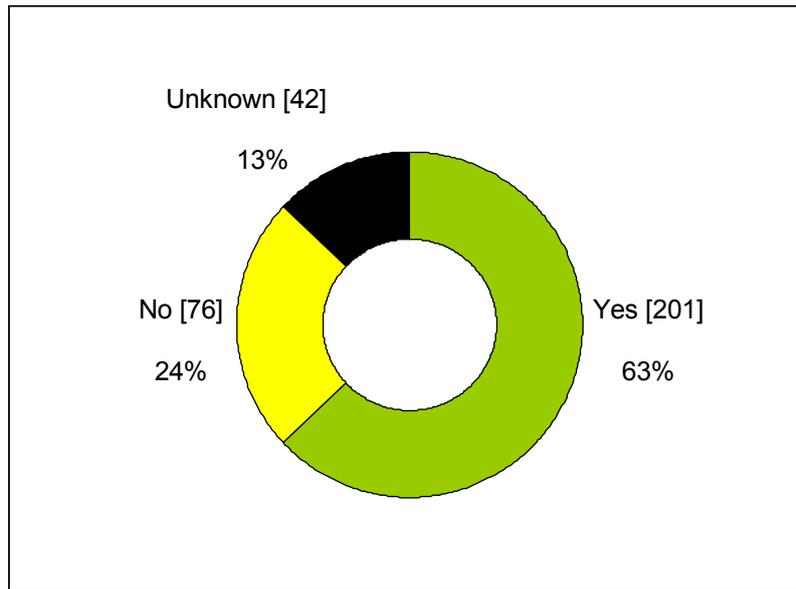
Others said icons sometimes appeared on the screen and sometimes did not, operation details required more lines to be added, other designs were too faint and needed to be changed to brighter colours especially on the menu bars, the screens differed from one another, letters, that is font sizes, were small and affected the eyes especially for visually impaired people, and the screen was busy at times and it showed things that were not called for (Figure 25).

Nurses were asked whether they could manipulate the logical operators (for example, AND, OR and NOT) of the system effectively.

¹² Personal identification number.

¹³ When the user clicks icons, they open very quickly.

Figure 26: Whether users could manipulate the logical operators (for example, AND, OR and NOT) of the system effectively. (N=319)



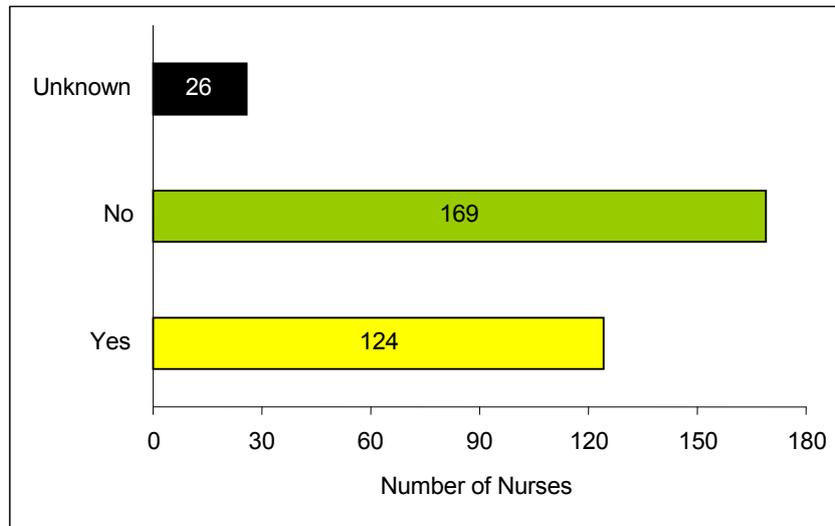
Source: analysis of survey data

Sixty-three percent (63%) of nurses (201) agreed that they could manipulate the logical operators (for example, AND, OR, and NOT) of the system effectively; twenty-four percent (24%) of nurses (76) did not agree; and thirteen percent (13) of nurses (42) did not know whether they could manipulate the logical operators of the system effectively (Figure 26) (Question 2.21).

5.7. FEED BACK FROM THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM TO THE USER

Nurses were asked to state 'yes' or 'no' as to whether the system took a long time to feed back the translation of their query to them.

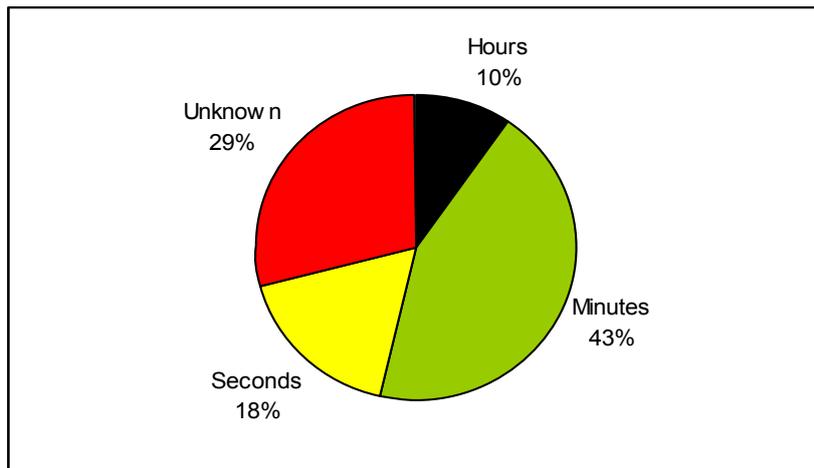
Figure 27: Whether the system takes a long time to feed back the translation of the query to the user. (N=319)



Source: analysis of survey data

One hundred and sixty-nine (169) nurses did not agree that the system took long to feed back the translation of the query to the user; one hundred and twenty-four (124) agreed and twenty-six (26) did not know whether the system took long to feed back the translation of the query to the user or not (Figure 27) (Question 2.22.).

Figure 28: Time taken to feed back the translation of a query. (N=124)



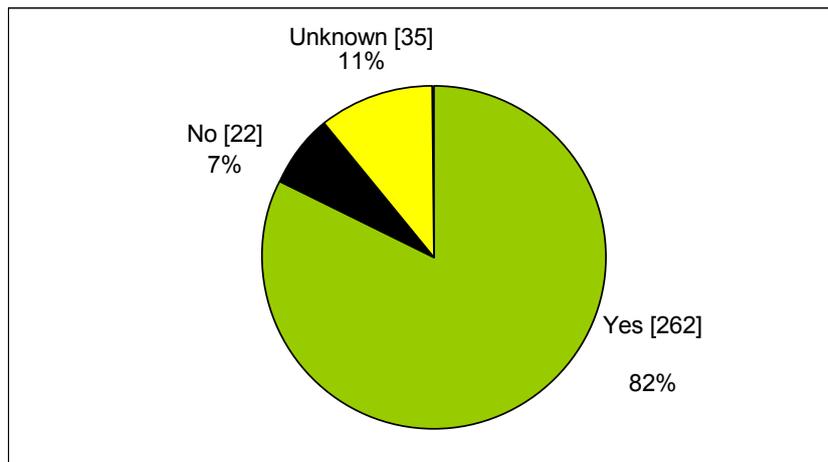
Source: analysis of survey data

Of one hundred and twenty-four (124) nurses who agreed that the system took long to feed back the translation of the query to the user, forty-three percent (43%) of nurses confirmed that the system took an average of eleven (11) minutes, eighteen percent (18%) took an average of eight (8) seconds, ten percent (10%) took an average of two (2) hours, and twenty-nine percent (29%) did not respond (Figure 28) (Question 2.23.).

5.8. SUPPORT IN THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM FOR THE USER

Nurses were asked whether the HIS supported the user.

Figure 29: Whether the hospital information system supports the user. (N=319)



Source: analysis of survey data

Eight-two percent (82%) of nurses (262) agreed that the hospital information system did support the user (Question 2.24.) because (Question 2.25.):

- Information was readily available;
- User had access to the information;
- The system provided spell-check function;
- The user could retrieve information easily;
- The system gave quick response;
- AME International staff were available 24 hours to help the user by attending to queries;
- Information could be stored on a system;
- Information could be stored on a system and used for future records;
- User had access to all department modules;
- Language was easy to use;
- It warned the user if something was wrong;
- The user could create his or her own password;
- It was user friendly;
- It saved time;
- Users were trained before using it;
- It gave updated information from time to time;
- When entering wrong operation time, the system did not allow the user to continue;
- Users might use help function;
- Users could add or delete;
- Users were notified by E-mail when there was downtime;
- It provided clear steps to follow;
- Users might log a call at 2222 to query or order anything the user did not understand or comprehend;
- Users could log a call to help desk;
- The system was easily adjustable according to the users request;
- If the user made an error, the system could allow the user to cancel it;
- All policies and forms were available in the system, and there was no need to print them;

Seven percent (7%) of nurses (22) did not agree that the hospital information system did support the user because (Question 2.26.):

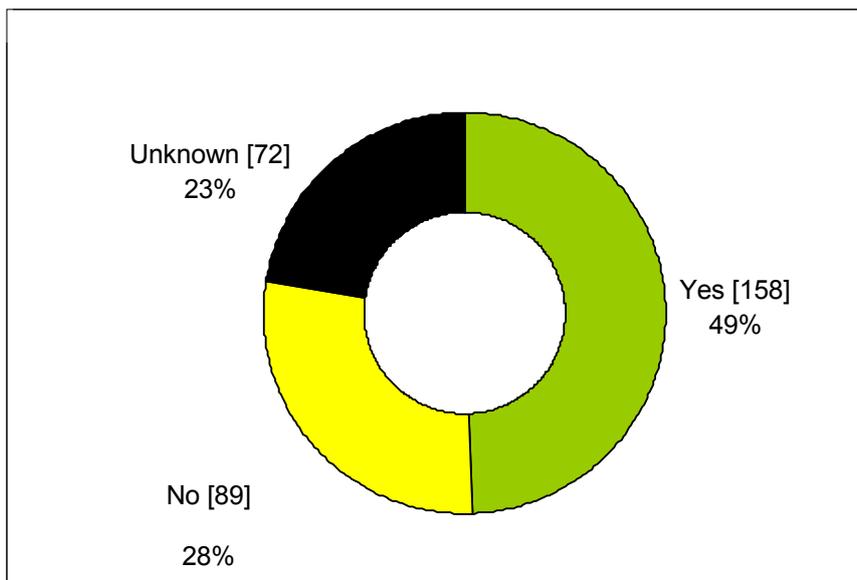
- The user was not given an option to query;
- No information was available to query;
- Access was denied to the modules of many department;
- Sometimes the definition was required in terms of graph which was not easy to draw; and
- There was no access to all laboratory results.

Eleven percent (11%) of nurses (35) did not know whether the hospital information system did support the user or not (Figure 29).

5.9. DESIGN OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM TO COPE WITH USERS' HANDLING ERRORS

Nurses were asked whether the system could interpret the user's imprecise and poorly formulated or loosely posed queries.

Figure 30: Whether the system can interpret the user's imprecise and poorly formulated or loosely posed queries. (N=319)



Source: analysis of survey data

Figure 30 shows that forty-nine percent (49%) of nurses (158) agreed that the system could interpret the user's imprecise and poorly formulated or loosely posed query; twenty-eight percent (28%) of nurses (89) did not agree that the system could interpret the user's imprecise and poorly formulated or loosely posed query; twenty-three percent (23%) of nurses (72) did not know whether the system could interpret the user's imprecise and poorly formulated or loosely posed query or not (Question 2.27.).

The users used the system because (Question 2.28.):

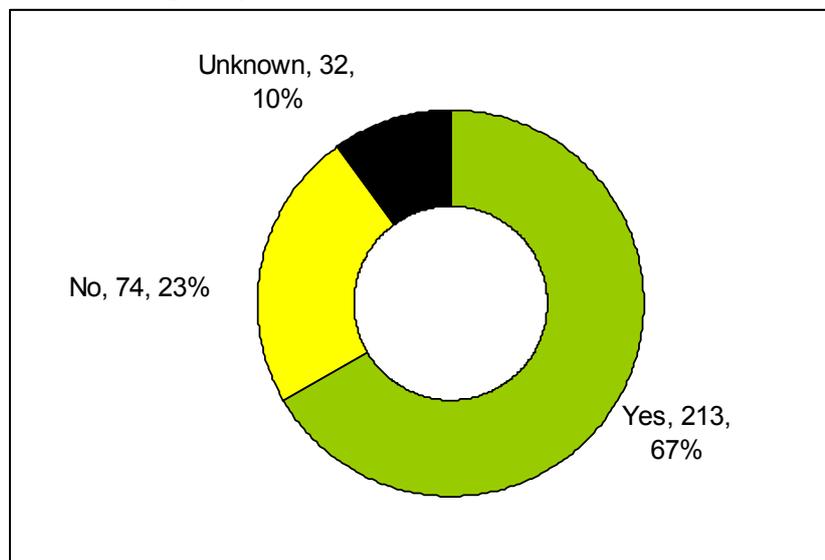
- It was useable;
- It was user-friendly and efficient;
- It was straight forward and easy to use;
- It was easy to use and it helped to improve knowledge in technology;
- It made the user's job easy;
- It was fast and reliable;
- It was convenient and saved time;
- It was easy to save information;
- The information was stored safely;
- It kept records;
- Information could not get lost;
- It gave access patient record for patient care;
- It was easy to reach [retrieve] patient information;
- It was the only tool available;
- It was a hospital requirement;
- It was the only system available and acceptable;
- There were no other options;
- There was always help when needed;
- The user gained computer skills;

- The user loved computers;
- One could not cheat the system; and
- Training was given before using the system.

5.10. CONTROL OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM BY THE USER

Nurses were asked whether they had control of the hospital information system and transparency.

Figure 31: Whether the user has control of the hospital information system and transparency. (N=319)



Source: analysis of survey data

Sixty-seven percent (67%) of nurses (213) agreed that they did have control of the hospital information system and transparency. Twenty-three percent (23%) of nurses (74) disagreed that they had control of the hospital information system and transparency (Figure 31) (Question 2.29).

The problems were (Question 2.30.):

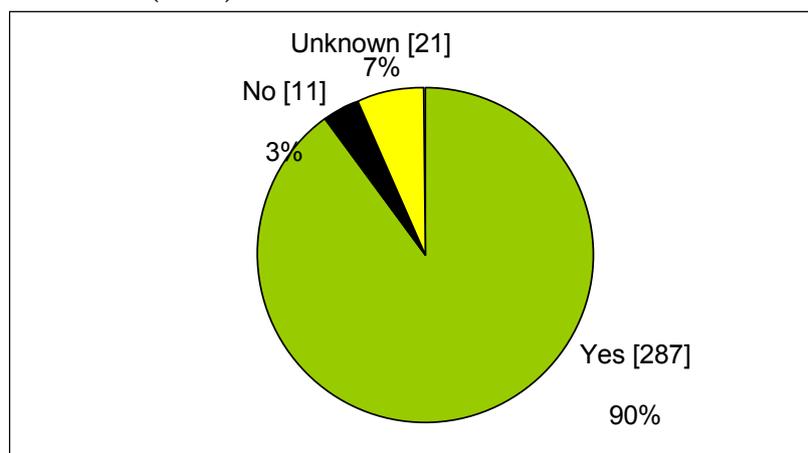
- Sometimes it took a too long to log-in;
- Some files could not be accessed;
- Certain information could not be accessed;
- The user could not access his or her own folder;
- Access to many modules was denied;

- Some of the icons on the desktop were not accessible to anyone;
- It was not right to have access to all patients' information;
- Access control was limited to authorised people, for example, AME International;
- Sometimes Internet and E-mail systems were not available;
- There was no option to hide information on the system, especially if a staff member was admitted;
- Transparency was limited to management; and
- There was no confidentiality in staff information.

Ten percent (10%) of nurses (32) did not know whether they had control of the hospital information system and transparency or not.

Nurses were asked whether they had a workable understanding of the system.

Figure 32: Whether the user has a workable understanding of the system.
(N=319)

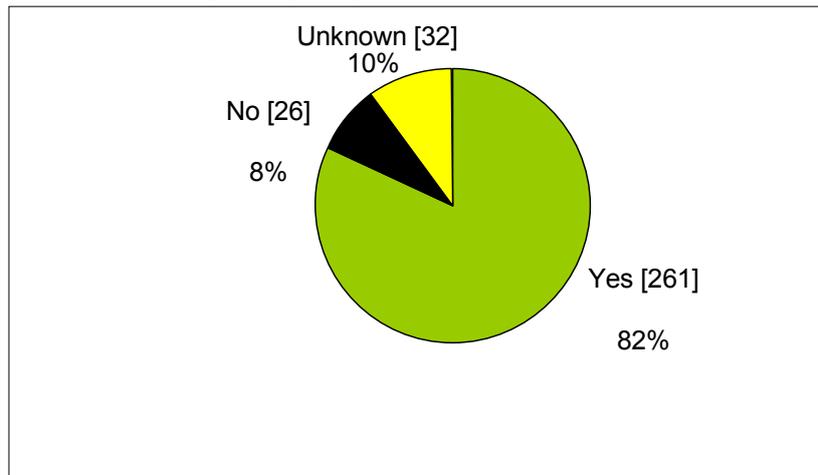


Source: analysis of survey data

Ninety percent (90%) of nurses (287) agreed that they did have a workable understanding of the system; whilst three percent (3%) of nurses (11) did not agree that they had a workable understanding of the system; and seven percent (7%) of nurses (21) did not know whether they had a workable understanding of the system or not (Figure 32) (Question 2.31.).

Nurses were asked whether they could form a clear mental picture (model) of the functioning of the system.

Figure 33: Clarity of user's mental picture (model) of the functioning of the system. (N=319)

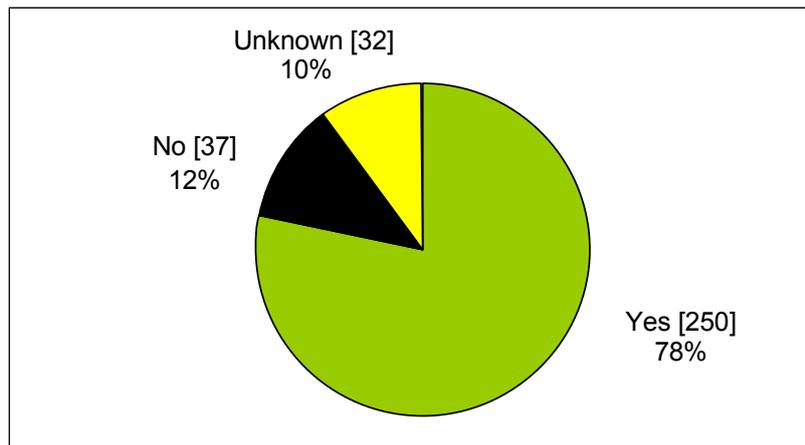


Source: analysis of survey data

Eighty-two percent (82%) of nurses (261) agreed that they could form a clear mental picture (model) of the functioning of the system; only eight percent (8%) of nurses (26) did not agree that they could form a clear mental picture (model) of the functioning of the system; and ten percent (10%) of nurses (32) did not know that they could form a clear mental picture (model) of the functioning of the system or not (Figure 33) (Question 2.32.).

Nurses were asked whether the system behaved in a predictable manner.

Figure 34: Predictability of the system's behaviour. (N=319)



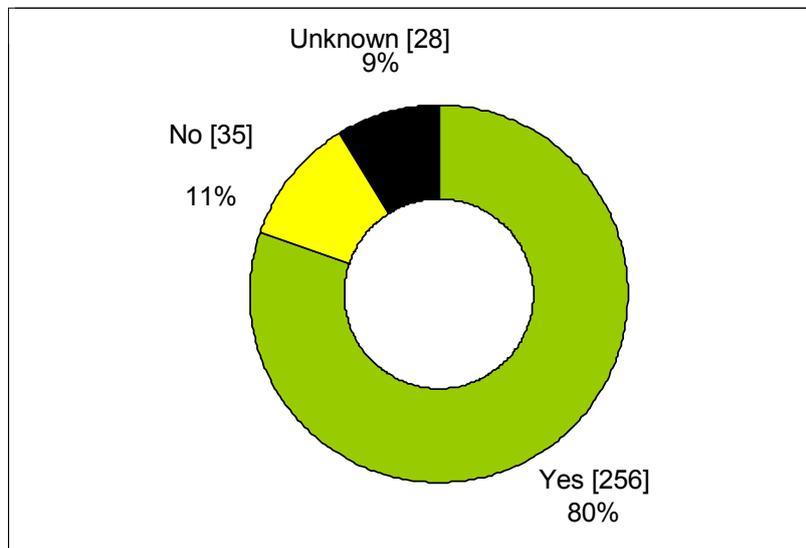
Source: analysis of survey data

Seventy-eight percent (78%) of nurses (250) agreed that the system behaved in a predictable manner, whilst twelve percent (12%) of nurses (37) did not agree that the system behaved in a predictable manner; and ten percent (10%) of nurses (32) did not know whether the system behaved in a predictable manner or not (Figure 34) (Question 2.33.).

5.11. OUTPUT OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM IN TERMS OF LAYOUT

Nurses were asked if they were satisfied with the output of the HIS in terms of layout.

Figure 35: User's satisfaction with the output of the hospital information system in terms of layout. (N=319)

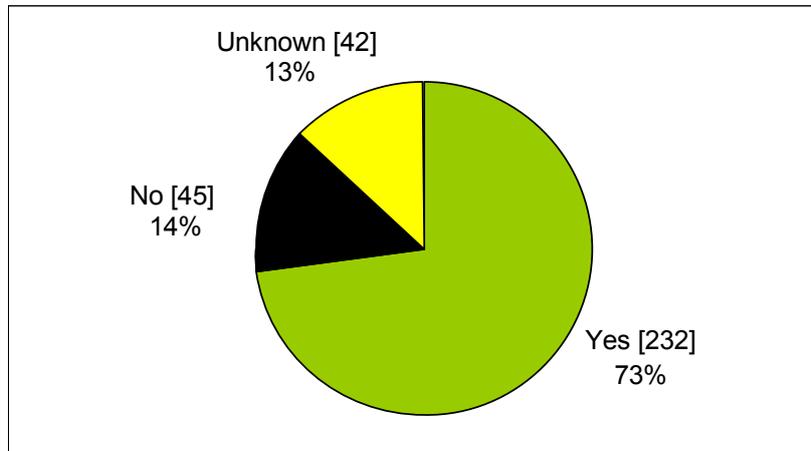


Source: analysis of survey data

Eighty percent (80%) of nurses (256) was happy with the output of the hospital information system in terms of layout; whilst eleven percent (11%) was not happy with the output of the hospital information system in terms of layout; and nine percent (9%) did not know whether they were happy with the output of the hospital information system in terms of layout (Figure 35) (Question 2.34.).

Nurses were asked if the output could be presented in more than one form.

Figure 36: Can output be presented in more than one form? (N=319)

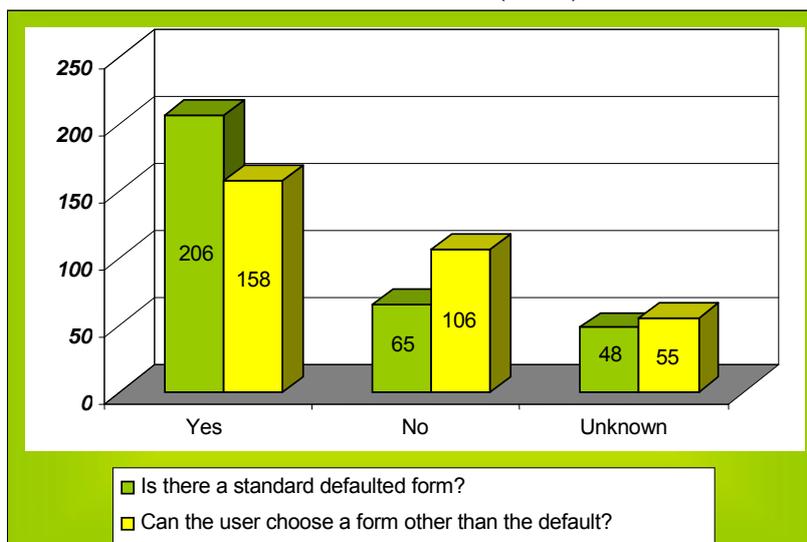


Source: analysis of survey data

Seventy-three percent (73%) of nurses (232) agreed that the output could be presented in more than one form, whilst fourteen percent (14%) disagreed that the output could be presented in more than one form; and thirteen percent (13%) did not know whether the output could be presented in more than one form or not (Figure 36) (Question 2.35.).

Nurses were asked if there was a standard defaulted form, and if they could choose a form other than the default.

Figure 37: Is there a standard defaulted form? Can the user choose a form other than the default? (N=319)



Source: analysis of survey data

Two hundred and six (206) nurses agreed that there was a standard defaulted form, whilst one hundred and fifty-eight (158) nurses chose a form other than the default; sixty-five (65) nurses disagreed there was a standard defaulted form but one hundred and six (106) nurses did not choose a form other than the default; and forty-eight (48) did not know whether there was a standard defaulted form and fifty-five (55) nurses did not know they chose a form other than the default (Figure 35) (Questions 2.36 & 2.37).

5.12. USER TRAINING NEEDS RELATING TO THE USE OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM

Nurses were then asked nine (9) questions relating to their HIS and Telemedicine training needs.

Table 10: Questions relating to user's HIS and Telemedicine training needs. (N=319)

No.	Questions	Yes	No	Unknown
1	Was the user trained on the use of the hospital information system and telemedicine system before?	260	31	28
2	Is information in the manual complete?	243	29	47
3	Would role-based training provide knowledge integration and better mapping of users' needs?	259	20	40
4	Would training manual increase perceived usability, especially learnability and task support?	256	23	40
5	Is the training-related content organised?	270	19	30
6	If the answer is YES, is the download by chapter or the entire manual?	204	27	88
7	Does the on-line version of the manual include advanced search capabilities so that users can easily find the help they need?	220	60	39
8	Does the use of colour-coding, tabs, more section breaks, and a good layout for the table of contents and index improve the presentation of the printed documentation?	231	33	55
9	Does the manual give users more control over information overload?	218	56	45

Source: analysis of survey data

Table 10 shows that two hundred and sixty (260) nurses were trained on the use of the hospital information system and telemedicine system before; thirty-one (31) were not trained and twenty-eight (28) did not know whether they were trained or not (Question 2.38).

The training needs relating to the use of the hospital information system and telemedicine system were (Question 2.39.):

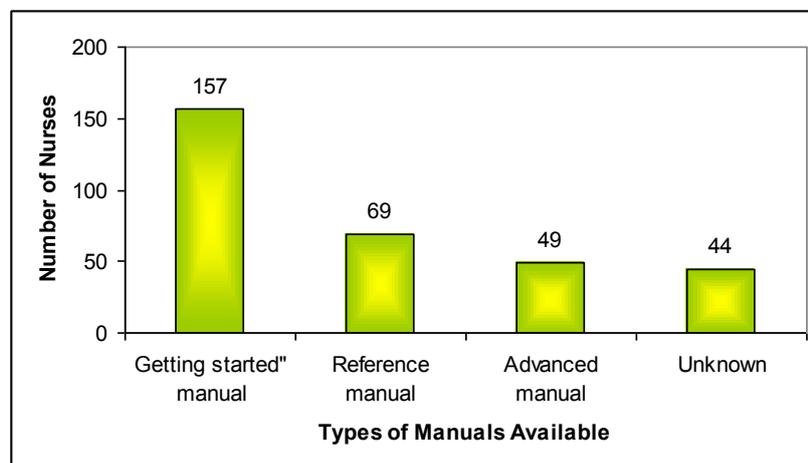
- Basic computer literacy;
- Comprehensive training;
- Refresher training course on new developments;
- How to log in and out on the system to assess information and to sign a document electronically?
- More training on the system;
- On-going in-servicing training on the system;
- All staff members should have adequate training before they use the system;
- Telemedicine system;
- Pharmaceutical module;
- Theatre module;
- Hospital document and patient records;
- Patient assessment;
- How to add more information?
- Ordering of drugs recording;

Two hundred and forty-three (243) nurses agreed that the information in the training manual was complete; whilst twenty-nine (29) disagreed and forty-seven (47) did not know whether the information was complete or not (Question 2.40.). Two hundred and fifty-nine (259) nurses agreed that the role-based training would provide knowledge integration and better mapping of their needs; twenty (20) disagreed and forty (40) did not know (Question 2.41.). Two hundred and fifty-six (256) nurses agreed that training manual would increase perceived usability, especially learnability and task support; twenty-three (23) disagreed; and forty (40) did not know (Question 2.42.). Two hundred and seventy (270) nurses agreed that the training-related content was organised, of which two hundred and four (204) nurses agreed that the content was either the download by chapter or the entire manual (Question 2.43.); nineteen (19) disagreed that the training-related content was organised and thirty (30) did not know whether the training-related content was organised or not (Question 2.44.).

Two hundred and twenty (220) nurses agreed that the on-line version of the manual included advanced search capabilities so that they could easily find the help they needed; sixty (60) disagreed and thirty-nine (39) did not know (Question 2.45.). Two hundred and thirty-one (231) nurses agreed that the use of colour-coding, tabs, more section breaks, and a good layout for the table of contents and index improved the presentation of the printed documentation; thirty-three (33) disagreed and fifty-five (55) did not know (Question 2.46.). Two hundred and eighteen (218) nurses agreed that the manual gave users more control over information overload; fifty-six (56) disagreed and forty-five (45) did not know (Question 2.48.).

Nurses were then asked about whether certain manuals were available them.

Figure 38: Available of the manuals. (N=319)



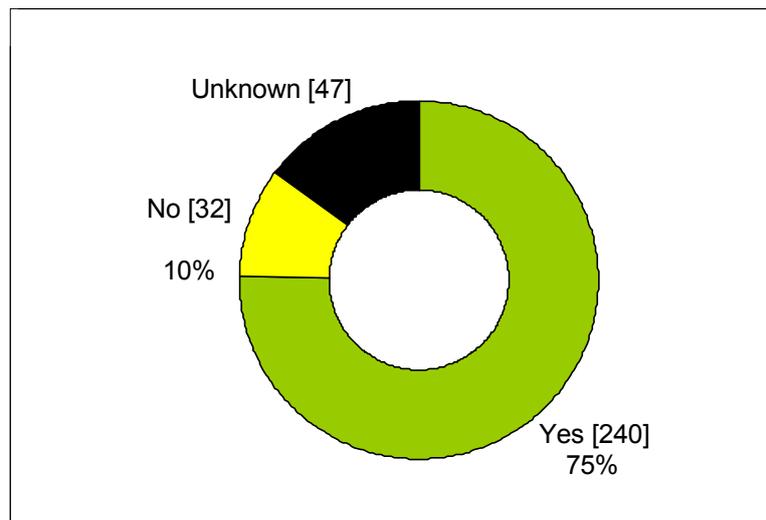
Source: analysis of survey data

Figure 38 shows that getting started manual was available to one hundred and fifty-seven (157) nurses; whilst reference manual was available to sixty-nine (69) and advanced manual was available to forty-nine (49); forty-four (44) nurses did not know which manuals were available (Question 2.47.).

5.13. USER RECOMMENDATIONS OF THE ROLLOUT OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM TO OTHER INSTITUTIONS IN KWAZULU-NATAL

Finally, nurses were asked whether they would recommend the rollout of the hospital information system and telemedicine system to other institutions in the KwaZulu-Natal.

Figure 39: Responses recommending the rollout of the hospital information system and telemedicine system to other institutions in KwaZulu-Natal. (N=319)



Source: analysis of survey data

Figure 39 shows that seventy-five percent (75%) of nurses (240) recommended the rollout of the hospital information system and telemedicine system to other institutions in KwaZulu-Natal, but stated that the system should be improved first; whilst ten percent (10%) of nurses (32) did not recommend the rollout and fifteen percent (15%) of nurses (47) did not know (Question 2.50). The following improvements were recommended (Question 2.49):

5.13.1. Telecommunication

All users of the system must have access to:

- Fax;
- E-mail;
- Intranet; and
- Internet.

5.13.2. Training

- Training manuals should be provided at work stations;
- New personnel should be trained thoroughly; and

- There should be an ongoing training, for example:
 - Computer literacy;
 - Hospital information system refresher courses every month; and
 - Advanced training.

5.13.3. New developments

- Clocking system for nurses;
- Nurses should be able to sign on system;
- Fastness and accuracy of the system;
- Inclusion of all staff names in the system;
- Information should be updated easily;
- If the user ticks a wrong medication by mistake, he or she should be able to rectify the mistake;
- Attention should be given more to patient care than notes taking;
- Information should not disappear during downtimes;
- Back-up system should be improved to prevent data lost during downtimes;
- Specific programmes should be developed for specific specialties; and
- Users should be consulted for any new development.

5.13.4. Confidentiality

- Improvement on confidentiality, especial on diagnosis;
- Maintenance of confidentiality in drug administration; and
- Staff files should be kept confidential.

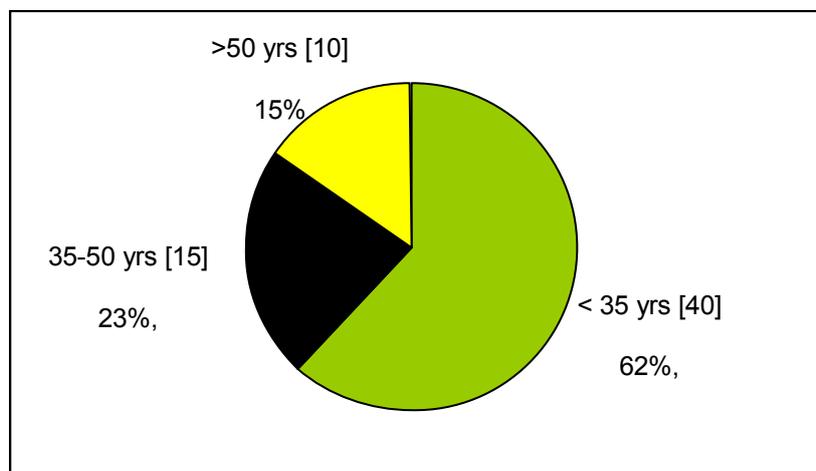
5.13.5. Information Technology

- More computers were needed;
- All nurses should have access to scanned images or documents and X-Rays; and
- Latest technology should be implemented.

5.14. THE DEMOGRAPHIC DATA OF DOCTORS

A total of one hundred and fifty-seven doctors (157) were sampled from a population of seven hundred and eighty six (786) doctors, but only sixty five (65) responded to the questionnaires. Doctors were reluctant to complete the questionnaires, complaining that IALCH served the entire province with tertiary services, as a result they were very busy caring for patients which were their core function and they did not have time to complete the questionnaires.

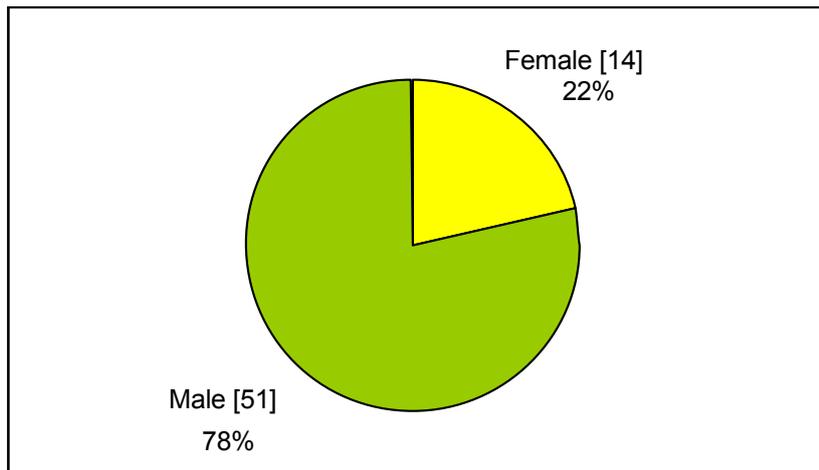
Figure 40: Doctors by age (N=65)



Source: analysis of survey data

Figure 40 shows that sixty-two percent (62%) of doctors (40) were below the age of thirty-five (35); twenty-three percent (23%) of doctors (15) were between thirty-five (35) and fifty (50) years; and fifteen percent (15%) of doctors (10) were over fifty (50) years.

Figure 41: Doctors by gender (N=65)

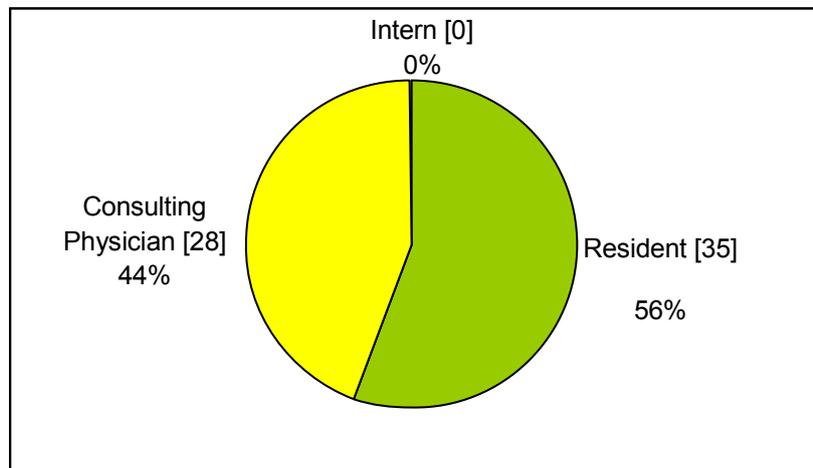


Source: analysis of survey data

Unlike the situation with the nurses there was a preponderance of male doctors (51, 78%) with female doctors at (14, 22%) (Figure 41).

5.15. WORK POSITION

Figure 42: Doctors by work position (N=65)



Source: analysis of survey data

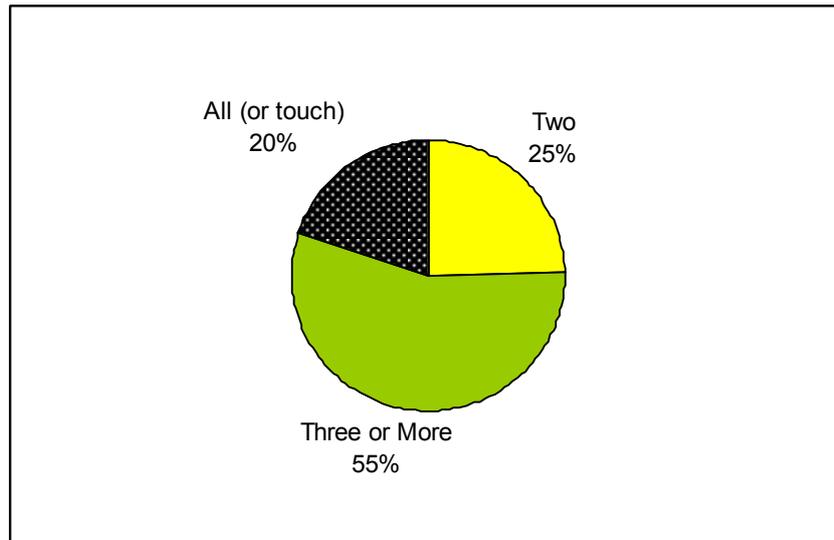
Fifty-six percent of doctors (35) worked as resident doctors; whilst forty-four percent of doctors (28) worked as consulting physician; and there were no intern doctors as IALCH was a tertiary hospital (Figure 42).

With regard to the question whether doctors used a computer or not, all doctors agreed that they used computers.

5.16. COMPUTER LITERACY

Doctors were asked about how many fingers they use when typing.

Figure 43: How many fingers do you use when typing? (N=65)

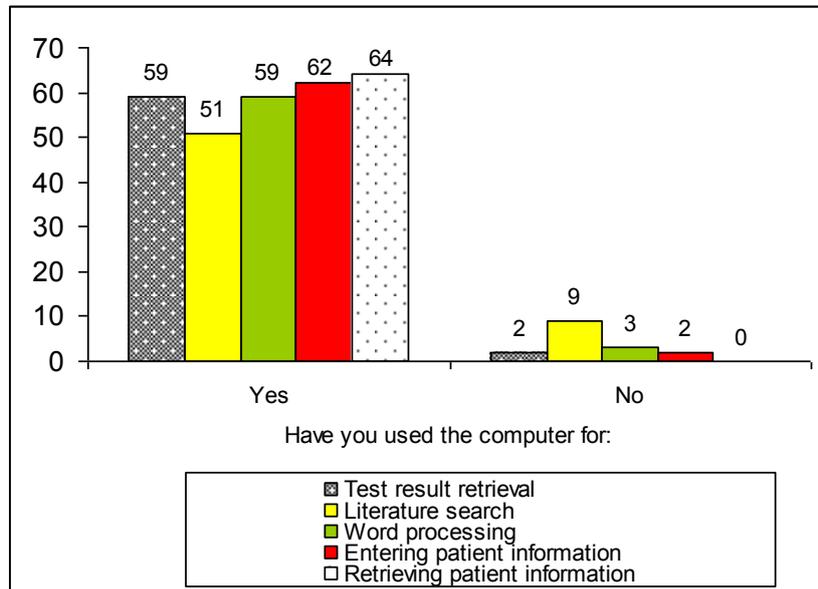


Source: analysis of survey data

Fifty-five percent (55%) of doctors agreed that they used three or more fingers when typing; twenty-five percent (25%) used two fingers; and twenty percent (20%) use all (or touch) fingers (Figure 43) (Question 2.3).

Doctors were asked whether they had used the computers for certain functions.

Figure 44: Have you used the computer for? (N=65)



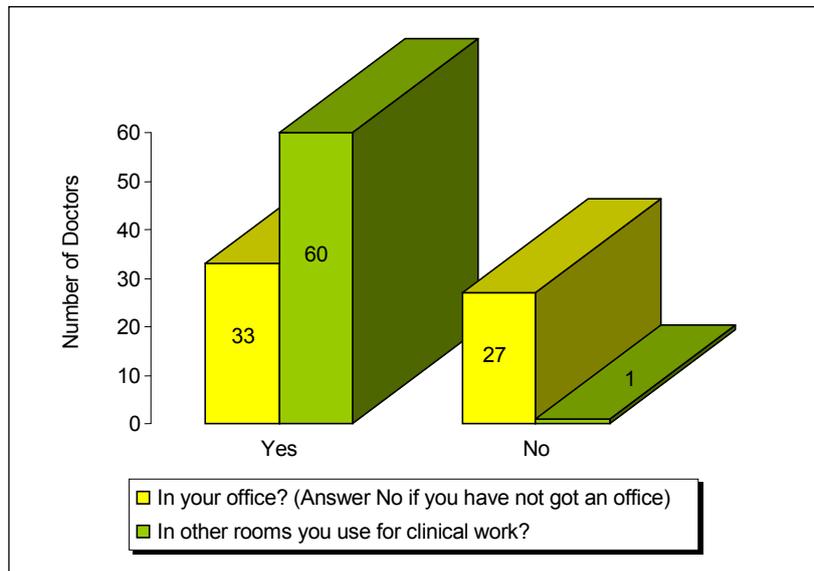
Source: analysis of survey data

Of the sixty-five (100%) doctors who responded, fifty-nine (91%) doctors used computers for test result retrieval; fifty-one (78%) used computers for literature reviewing; fifty-nine (91%) used computers for word processing; sixty-two (95%) used computers for entering patient information; and sixty-four (98%) have computers for retrieving patient information (Question 2.4).

With regard to their computer literacy fifty-three (81%) doctors had taken a computer course. Only eleven (16%) doctors could write computer programs. Sixty-one (93%) doctors used a computer daily. Seventeen (26%) doctors had high rate of computer skills; Forty-one (63%) had a average rate of computer skills; and four (6%) had low rate of computer skills. Sixty-four (98%) doctors had access to computers at the hospital (Figure 44) (Question 2.4).

Doctors were asked the whereabouts of computers made available to them.

Figure 45: Where are computers available for you? (N=65)



Source: analysis of survey data

Thirty-three (50%) doctors agreed that computers were available in their offices whilst twenty-seven (41%) disagreed. Sixty (92%) doctors agreed that computers were available in other rooms they used for clinical work; and only one (1%) doctor disagreed (Figure 45) (Question 3.2).

5.17. USABILITY OF A HOSPITAL INFORMATION SYSTEM

Doctors were then asked about their frequency of using personal computers and specific computer programs (Program) for certain tasks.

Table 11: How often (Frequency) personal computers (PC) and specific computer programs (Program) were used for certain tasks. (N=65)

TASKS	FREQUENCY						PROGRAM		
	Never / Almost Never	Seldom	About half of the time	Most of the time	Always / Almost Always	TOTAL 1	EMR	Other than EMR	TOTAL 2
(a) Review the patient's problems.	1	2	1	12	48	64	48	1	49
(b) Seek out specific information from patient records.	1	1	2	10	50	64	48	1	49
(c) Follow the results of a particular test or investigation.	2	0	2	11	49	64	47	1	48
(d) Obtain results from new tests or investigations.	1	0	3	8	52	64	47	1	48
(e) Enter daily notes.	2	6	4	12	40	64	47	1	48
(f) Obtain information on investigation or treatment procedures.	0	1	3	13	47	64	47	2	49
(g) Answer questions concerning general medical knowledge (for example,	4	12	5	14	29	64	43	3	46
(h) Produce data reviews for specific patient groups, for example, complication	14	11	5	13	21	64	45	3	48
(i) Order clinical biochemical laboratory services analyses.	5	8	7	4	41	65	46	1	47
(j) Obtain results from clinical biochemical laboratory analyses.	2	5	3	7	47	64	46	1	47
(k) Order X-Ray, Ultrasound, or CT investigations.	5	9	4	7	39	64	46	1	47
(l) Obtain the results from X-Ray, Ultrasound or CT investigations.	1	3	1	12	47	64	45	2	47
(m) Order other supplementary investigations.	5	9	6	5	39	64	46	1	47
(n) Obtain results from other supplementary investigations.	3	6	5	6	42	62	46	1	47
(o) Refer the patient to other departments or specialists.	9	8	6	10	30	63	46	1	47
(p) Order treatment directly (for example, medicines, operations and so on).	7	8	5	8	36	64	45	1	46
(q) Write prescriptions.	10	9	2	5	38	64	45	1	46
(r) Write sick-leave notes.	21	8	3	8	24	64	38	1	39
(s) Collect patient information for various medical declarations.	14	10	5	9	24	62	38	1	39
(t) Give written individual information to patients, for example, about medications,	21	13	6	5	19	64	35	4	39
(u) Give written general medical information to patients.	23	8	7	8	17	63	33	4	37
(v) Collect patient information for discharge reports.	19	3	1	7	34	64	39	1	40
(w) Check and sign typed dictations.	21	5	2	7	30	65	38	3	41
AVERAGE	8.3	6.3	3.8	8.7	36.7	63.8	43.7	1.6	45.3

Source: analysis of survey data

Table 11 shows that the majority of doctors always or almost always used a personal computer (PC) and computer program such as an electronic medical record (EMR) to assist themselves with the following tasks:

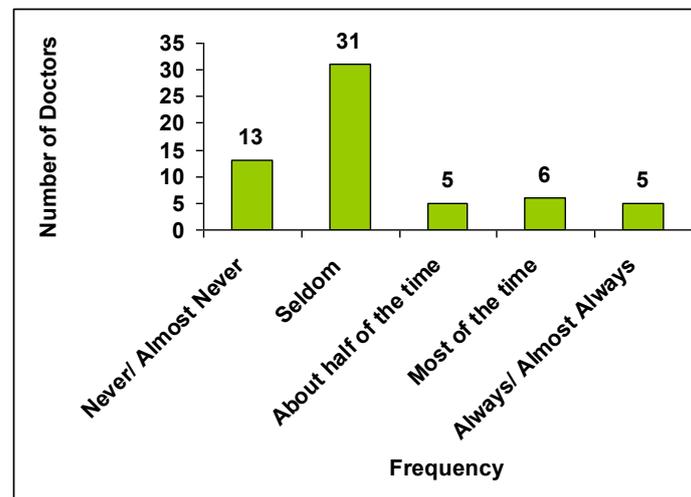
- Review the patient's problems;
- Seek out specific information from patient records;
- Follow the results of a particular test or investigation;
- Obtain results from new tests or investigations;

- Enter daily notes;
- Obtain information on investigation or treatment procedures;
- Answer questions concerning general medical knowledge, such as: concerning treatment, symptoms, and complications;
- Produce data reviews for specific patient groups, such as: complication rate, diagnoses and so on;
- Order clinical biochemical laboratory services analyses;
- Obtain results from clinical biochemical laboratory analyses;
- Order X-Ray, Ultrasound, or CT investigations;
- Obtain the results from X-Ray, Ultrasound or CT investigations;
- Order other supplementary investigations;
- Obtain results from other supplementary investigations;
- Refer the patient to other departments or specialists;
- Order treatment directly, such as: medicines and operations;
- Write prescriptions, and sick-leave notes;
- Collect patient information for various medical declarations;
- Collect patient information for discharge reports; and
- Check and sign the printouts of typed dictations.

The majority of doctors never or almost never used a personal computer (PC) and computer program such as an Electronic Medical Record (EMR) to assist themselves with giving written (a) individual information to patients, for example, about medications, disease status, and (b) general medical information to patients (Question 4). The variation in Total 1 and Total 2 of Table 11 is as a result of some doctors indicating how often they used a personal computer (Total 1) but do not mention the program they used (Total 2), for example, either an EMR or other program.

Doctors were asked about how often they used sources other than Electronic Medical Record or the paper journal or patient chart.

Figure 46: How often doctors use sources other than Electronic Medical Records or the paper journal or patient's chart. (N=65)

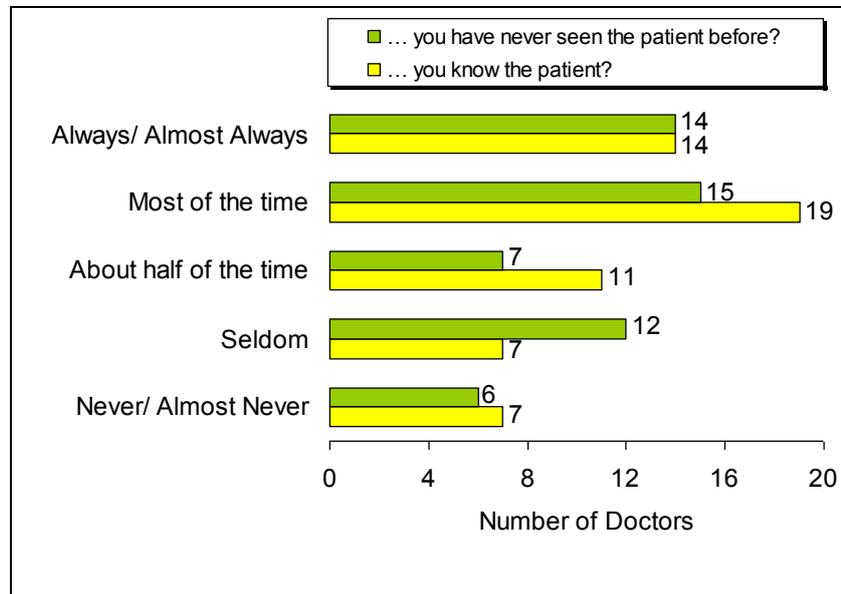


Source: analysis of survey data

The majority of doctors (31) seldom used sources other than Electronic Medical Record or the paper journal or patient chart (Figure 46) (Question 5.1).

Doctors were asked about how often they used the EMR rather than the paper journal.

Figure 47: How often doctors use the EMR rather than the paper journal. (N=65)

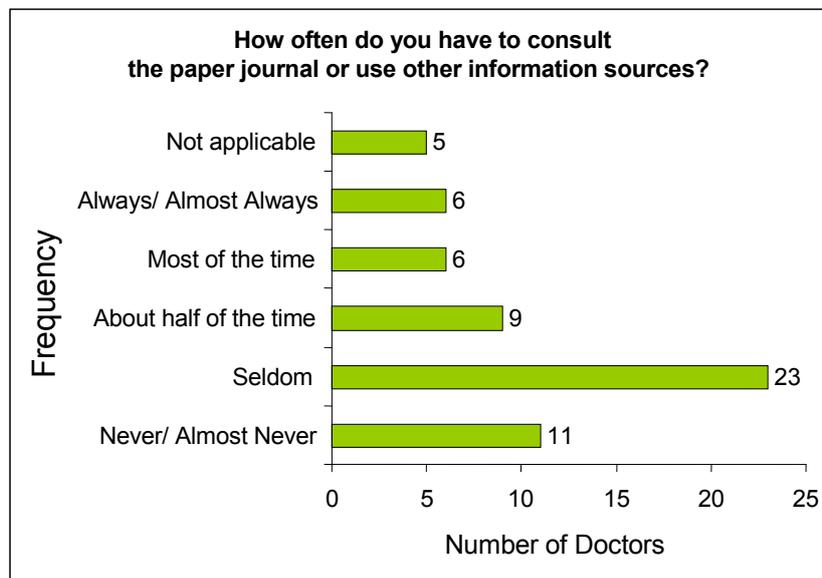


Source: analysis of survey data

EMR was the first option doctors turn to most of the time if the paper journal was available, whether they knew the patient (19) or had never seen the patient (15) before (Figure 47) (Question 5.2).

Doctors were asked whether they preferred to use the EMR first.

Figure 48: Preference for using the EMR first. (N=65)

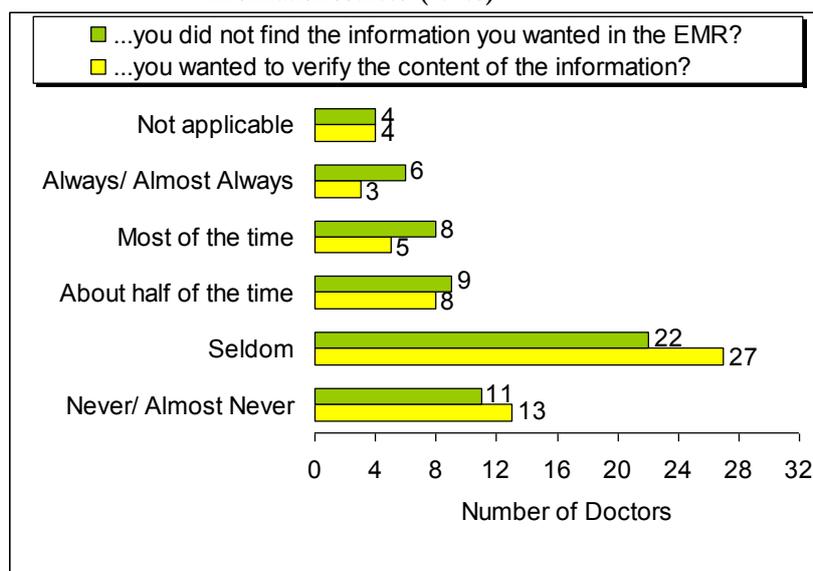


Source: analysis of survey data

Most doctors (23) seldom consulted the paper journal or used other information sources if they usually turned to the EMR first (Figure 48) (Question 5.3.).

Doctors were asked about their preference and reason for using paper journals or other information sources.

Figure 49: Preference and reason for using paper journals or other information sources. (N=65)



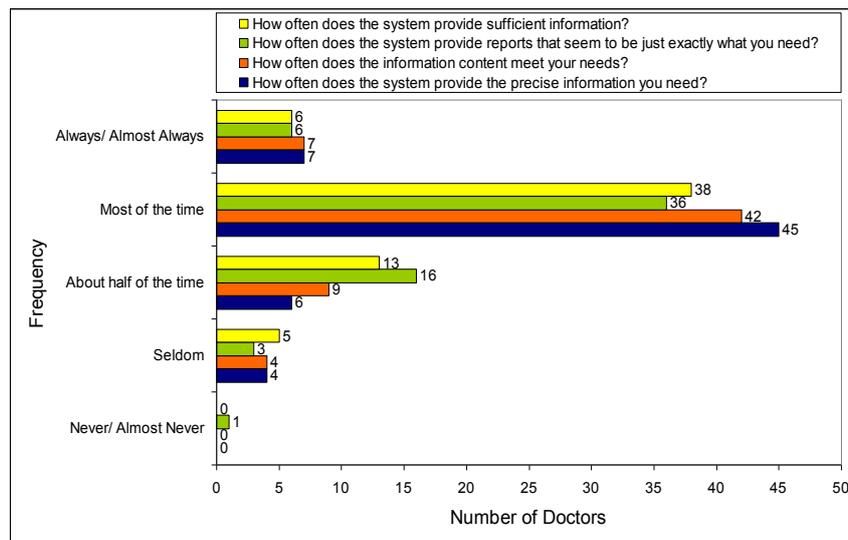
Source: analysis of survey data

The majority of doctors seldom used paper journals or other information sources because they either wanted to verify the content of the information (22, 34.4%) or did not find information they wanted in the EMR (27, 42.2%) (Figure 49) (Question 5.4).

5.18. USER-FRIENDLINESS OF A HOSPITAL INFORMATION SYSTEM

Doctors were then asked about their satisfaction with the *Content* of EMR installed in their departments.

Figure 50: Satisfaction with the *Content* of EMR installed in the department. (N=65)

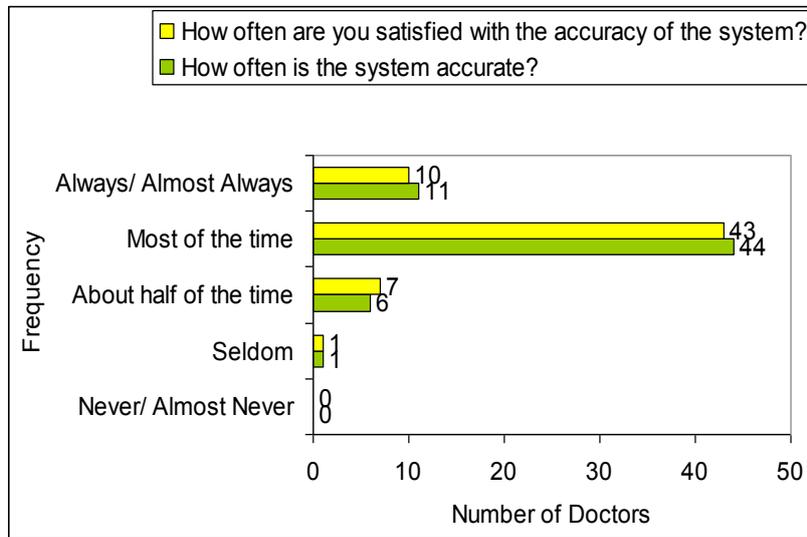


Source: analysis of survey data

The majority of doctors most of the time were satisfied with the content of Electronic Medical Record installed in their department. The system provided sufficient information; reports that seemed to be just exactly what they needed; information content that met doctors' needs; and the precise information doctors' need (Figure 50) (Question 6.1).

Doctors were then asked a series of questions about EMR.

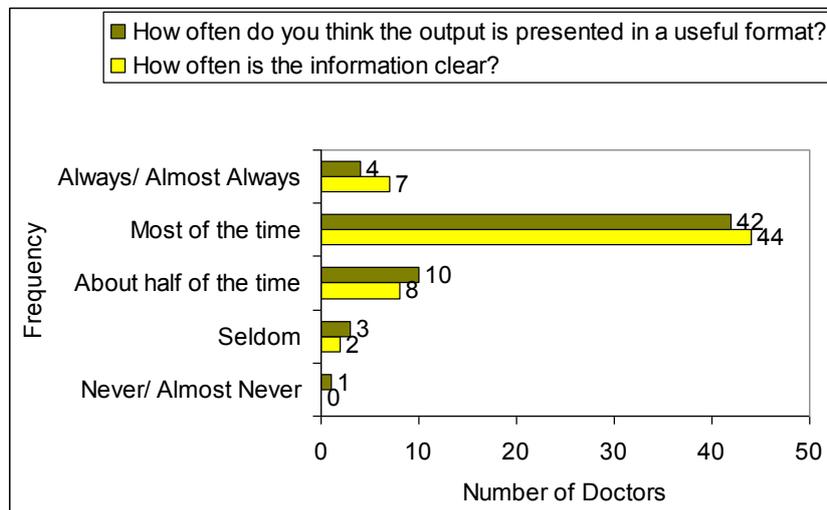
Figure 51: Satisfaction with the *Accuracy* of EMR installed in the department. (N=65)



Source: analysis of survey data

The majority of doctors most of the time were satisfied with the accuracy of Electronic Medical Record installed in their department (Figure 51) (Question 6.2.).

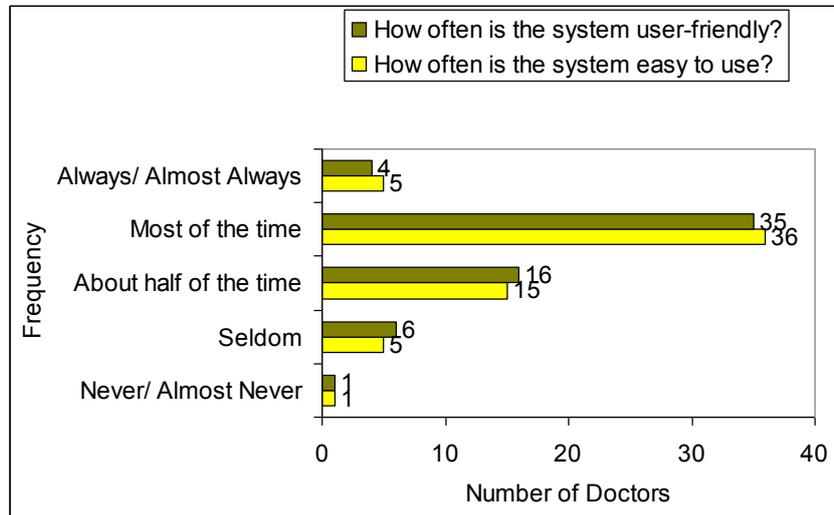
Figure 52: Satisfaction with the *Format* of EMR installed in the department. (N=65)



Source: analysis of survey data

The majority of doctors most of the time were satisfied with the format of Electronic Medical Record installed in their department. They said the clear output was, most of the time, presented in a useful format (Figure 52) (Question 6.3).

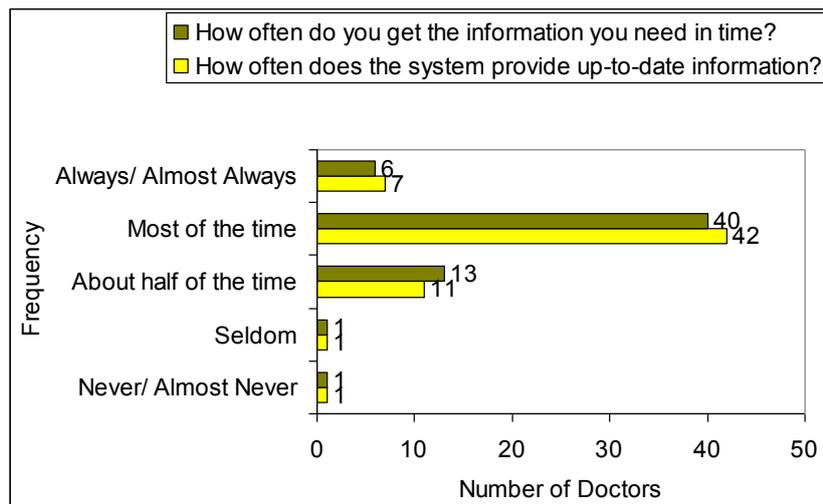
Figure 53: Satisfaction with the *Easy to use* aspect of EMR installed in the department. (N=65)



Source: analysis of survey data

The majority of doctors were satisfied most of the time with the user-friendliness of Electronic Medical Record installed in their department. They said that the system was easy to use most of the time (Figure 53) (Question 6.4).

Figure 54: Satisfaction with the *Timeliness* of EMR installed in the department. (N=65)

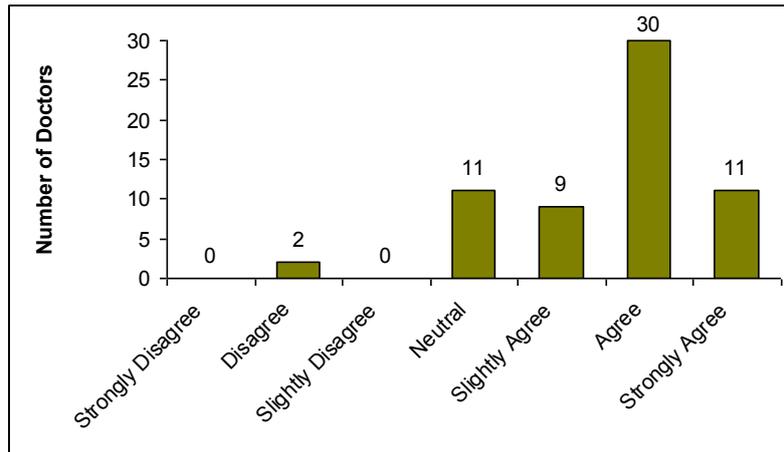


Source: analysis of survey data

The majority of doctors were most of the time satisfied with the timeliness of Electronic Medical Record installed in their department. They said most of the time the system provided them with up-to-date information they needed in time (Figure 54) (Question 6.5).

Doctors were asked about whether the EMR system was worth the time and effort required to use it.

Figure 55: Whether the EMR system is worth the time and effort required to use it. (N=65)

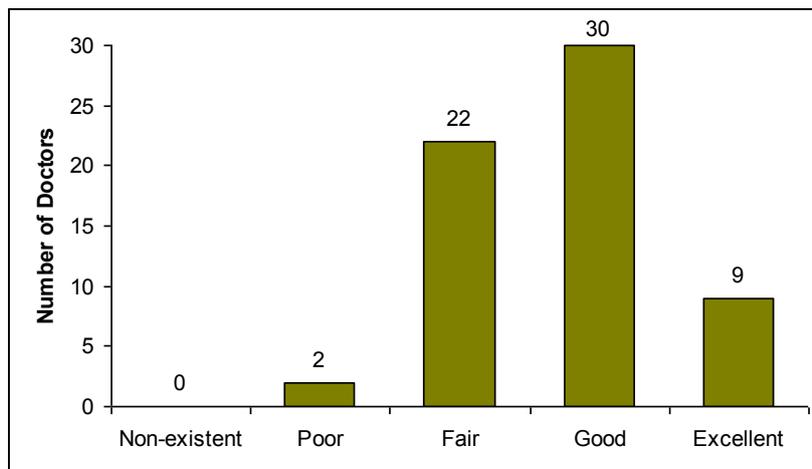


Source: analysis of survey data

The majority of doctors agreed but not strongly agreed that the EMR system was worth the time and effort required to use it (Figure 55) (Question 7.1.).

Doctors were asked about their overall satisfaction with the EMR.

Figure 56: Overall rate of satisfaction with the EMR installed in the department. (N=65)

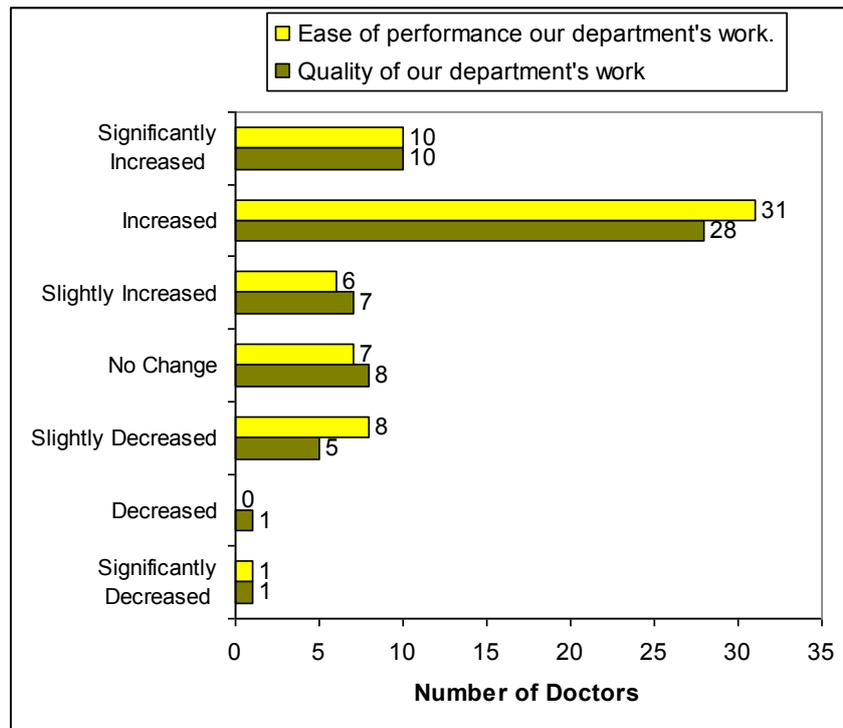


Source: analysis of survey data

The majority of doctors all considered rated their satisfaction either good (30) or fair (22) but not excellent with the EMR installed in their department (Figure 56) (Question 7.2).

Doctors were asked about the extent to which the system contributed to their work.

Figure 57: Overall the extent to which the system has changed two aspects of the department. (N=65)

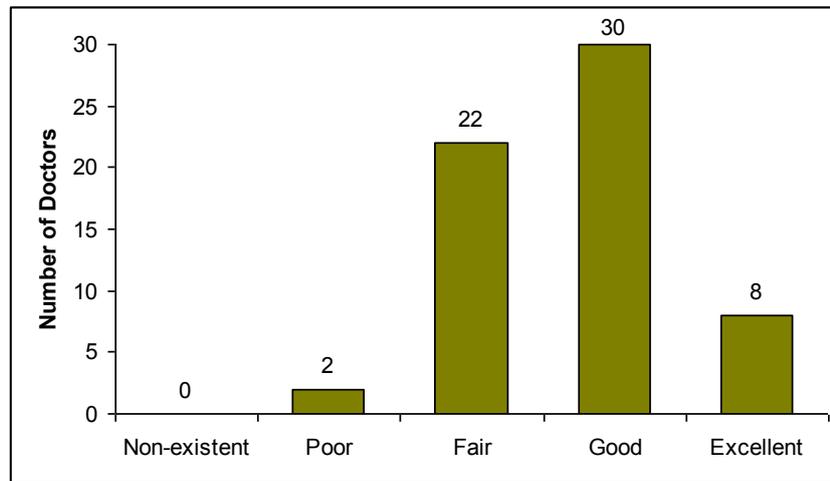


Source: analysis of survey data

The majority of doctors all considered, agreed that the system increased the ease of performance and the quality of their department's work (Figure 57) (Question 7.3).

Finally doctors were asked the success of the system.

Figure 58: Overall rating of the success of the EMR system installed in the department? (N=65)



Source: analysis of survey data

Figure 58 shows that the majority of doctors all considered, rated the success of the EMR installed in their department as either good (30) or fair (22) (Question 7.4.).

5.19. FOCUS GROUP INTERVIEWS

5.19.1. Introduction

In preparation for a focus group session, the researcher identified the major objective of the meeting as to gather information relating to the user-friendliness of MEDICOM Hospital Information System using telemedicine. Six questions were carefully developed (Appendix 4):

- 1) How does MEDICOM Integrated Information System function?
- 2) What is your assessment of MEDICOM Integrated Hospital Information System installed at the hospital in terms of user-friendliness?
- 3) What can you say about the availability of computers at the hospital and your workstation?
- 4) What motivates you to use the system?
- 5) Were you trained on the use of the hospital information system before?
- 6) What recommendations regarding the implementation of the hospital information system and telemedicine system in this hospital can you make?

Members were invited to the meeting and a copy of the report from the session was promised to be provided to each member. The focus group interview sessions were scheduled for one and a half to two hours long. Sessions were held in a Human Resource boardroom of Inkosi Albert Luthuli Central Hospital with adequate air flow and lighting. Chairs were arranged so that all members could see each other. Their employment name tags were clearly visible. All members were encouraged to participate as much as possible. The following agenda was considered:

- 1) Welcome;
- 2) Review of agenda;
- 3) Review of goal of the meeting;
- 4) Review of ground rules;
- 5) Introductions;
- 6) Questions and answers; and
- 7) Wrap up.

Three focus groups of nurses and two focus groups of doctors were planned to be conducted with six to fifteen members in each group, since more groups seldom provide new insights as advised by Morgan (1997) in Babbie and Mouton (2001:292). Two focus groups of nurses (Focus groups 1 & 2) and one focus group of doctors (Focus group 3) were conducted instead, the reason being that these professionals were always unavailable as they were inundated with work with their busy schedules and queues of patients. In the first focus group of nurses there were eleven members and nine members in the second focus group. It was not possible to break these groups into three for the same reason mentioned above. The third focus group of doctors had five members only. While being interviewed, they received two emergency calls from Ngwelezane hospital about patients who were involved in an accident, so that they could prepare themselves as these patients were going to be transferred to IALCH. However, members in all focus groups participated as much as possible.

5.19.2. How the MEDICOM Integrated Hospital Information System functions?

In responding to the question (Question 1: How does MEDICOM Integrated Information System function?), doctors and nurses understood how MEDICOM Integrated Information System functions. They explained that patients are referred to IALCH by doctors from all the regional hospitals in the KwaZulu-Natal. Scheduling is done first where the referring doctor calls the IALCH admission unit of IALCH and books the patient using a reference number (also known as KZN patient number). This number is a unique patient identifier in the province. The doctor writes a referring letter which the patient carries in his or her folder to IALCH. The patient folder has all information about the history of the patient illness. Patients are always accompanied by nurses when they are referred to another hospital.

Patients arrive at IALCH and submit their folders to admission clerks who scan these referral letters and capture patients' details into MEDICOM Integration Information System. Then the admission clerk puts a sticker on the folder, depending on whether the patient is an out-patient or in-patient, to indicate where the patient should go - a clinic or ward. Out-patients are treated in clinics and in-patients in wards. At the clinic a clerk checks whether a patient is registered and booked for that particular clinic before assigning him or her to the queue. A new patient is referred back to the admission unit for registration. But a repeat patient is registered at the clinic provided space is available. The booking system is not followed at the clinic, a patient is supposed to be given a piece of paper with a number that corresponds to the one on the system, but a patient who comes first is assessed first because some patients coming from far distant hospitals tend to arrive early. Patient chairs at the clinic are not user-friendly to allow patients to shift in the queue. Patients do not sit in any particular order, a nurse calls them by names when each patient's turn comes. A nurse assesses the patient and enters patient information into the system. Sometimes a nurse writes patient's notes on a piece of paper and captures this information later or the next day when a computer is free as some clinics have one computer that is shared between two nurses or a nurse and a doctor. The delay in capturing is sometimes caused by the shortage of computers and lack of staff to capture patient information on time (Focus Group 1&2).

Patients arrive early at the clinic but they wait too long (approximately three hours) to be seen by doctors who start at the wards seeing in-patients before they go to the out-patient at the clinics.

When doctors arrive at the clinic they enter a patient identifier in the system to call up all information entered about the patient, diagnose the patient, capture the diagnosis and refer the patient if necessary to a relevant department, for example, radiology for a CT Scan or MRI service. In the radiology department the patient information is called up on the system, the patient is X-rayed and goes back to the clinic for final diagnosis. If the patient is not admitted, he or she goes back to an admission clerk who will generate another reference number for the next review (Focus Group 1&2).

If the doctor admits the patient, the patient still goes back to an admission clerk, where he or she will be re-registered to the ward as an in-patient. In the ward the nurse re-assesses the patient, records his or her assessment of the patient and assigns the patient to the bed on the system. The head of the department assigns a doctor to a patient. The doctor orders drugs for the patient on the system and the nurses provide nursing care service, for example, checks the time of treatment, administer treatment to the patient and records the information on the system until the patient is discharged. A discharge advice is generated in the ward and the bill is printed in the admission department. The patient pays the bill or the bill is sent to the patient later if he or she does not have the money (Focus Group 1&2).

5.19.3. Assessment of the MEDICOM Integrated Hospital Information System installed at the hospital in terms of user-friendliness

When the researcher asked doctors and nurses about their assessment of MEDICOM Integrated Hospital Information System installed at the hospital in terms of user-friendliness (Question 2), they (both doctors and nurses) agreed that not all information is accessed from MEDICOM Integrated Hospital Information System. The nursing system and radiology are not linked to the MEDICOM. A doctor said:

‘Everything you need is not on a single system. I have to open MEDICOM system, work and close it, then open a nursing system work and close it, and go back to MEDICOM. This is time consuming’ (Focus Group 3).

A nurse said:

‘MEDICOM Integrated Hospital Information System is good and bad. It keeps information safe. But in case of emergency, I leave the computer and attend to that emergency, for example, a falling patient, leaving patient information unsaved on the system, when I return to my personal computer all the information I have just captured is lost. This could not have happened if I recorded the patient notes on paper’ (Focus Group 1).

Another nurse said:

‘The system replaces paper’ (Focus Group 2).

Yet another nurse said:

‘There are two different types of information systems one is used by nurses and another by doctors. Users have to close one system completely in order to open another system and vice versa’ (Focus Group 1).

All participants complained that confidentiality is a problem in the system, patients and staff information can be viewed by anyone at all workstations in the hospital, including the technicians. They all agreed that the system is often down and slow (Focus Group 1&2).

A nurse said:

‘When the system is down, we enter patient information on paper and enter it later into the system. Sometimes information gets lost when it is entered into the system’ (Focus Group 1).

Another nurse said:

‘Icons do not always appear on the computer screen, I logged the fault but the technicians take time to respond’ (Focus Group 1).

With regard to prescription of drugs, a nurse said:

‘Doctors cannot prescribe drugs to patients when the system is down because they do not have access to patient information’ (Focus Group 1).

A doctor said:

‘Ordering of medication limits us to seven days, the system does not allow us to prescribe drugs over seven days. We have to re-order after seven days’ (Focus Group 3).

Another doctor said:

‘Drug list is limited. Pharmacists do not record drugs we want to prescribe. The system dictates drugs we must to prescribe to the patient. Sometimes, pharmacists mix drugs but they do not label the mixture and we cannot prescribe the mix we do not know’ (Focus Group 3).

A nurse said that the system was useful for keeping patients’ record. Nurses could access the previous records of a patient’ (Focus Group 2). Another nurse complained that sometimes the batteries of mobile laptops ran flat and were not charged in time, but they all agreed that charging batteries was the responsibility of the user. When the mobile laptop was not in use, the user was supposed to leave the equipment on a charger. Yet another nurse complained about the lack of confidentiality. She said:

‘There is no confidentiality of patient records, these records can be viewed by anyone at any department in the hospital. This problem was reported to the AME, but nothing has happened to solve the problem’ (Focus Group 1).

Another nurse said:

‘Confidentiality is a big issue, where technicians can have access to patient, for example, age and disease profile of a patient. Contrary, the information of high profile people is blocked. You cannot even access his or her previous record. Why this cannot be done for ordinary patient?’ (Focus group 2).

Yet another doctor said:

‘There is no confidentiality and security, any doctor can access any set of doctor’s notes on a system. There is no password protection’ (Focus Group 3).

Nurses working in the Intensive Care Unit (ICU) were not happy that they could retrieve information about a patient by entering a patient reference number without calling a ward nurse and ask for information about the patient concerned. They complained that a theatre nursing module has challenges. A nurse said:

‘In the system, one minute after midnight (twelve o’clock) is the beginning of a new day, and the system does not allow us to capture time after midnight, for example, 00H30 (Focus Group 2).

Another said:

‘If a nurse at theatre enters patient information incorrect, due to patients sharing the name and surname, the system does not allow the nurse to edit that information’ (Focus Group 2).

Yet, another nurse complains:

‘Sometimes the system shows that the patient is still in a waiting room or in a theatre when the patient is already discharged. This is caused by a nurse who did not enter complete information about the patient (Focus Group 2).

Nurses agreed that the system does not allow them to change drugs that were administered incorrectly. For instance, when drugs administered to the patient in the ward subsequently needed to be changed on the system as a new drug was administered at the theatre, the old drug still appeared on the system as not administered despite the details of the drug having been entered on the system. A theatre nurse said that this creates confusion. Doctors at the referring ward should enter into the system that the patient was referred to the ICU and stopped the old drugs (Focus group 2).

A doctor objects:

‘We stop the prescription of drugs but nurses perpetuate drugs to patients’ (Focus Group 3).

Another doctor complains:

‘The new drug preferential does not appear on the drug list’ (Focus Group 3).

Yet another doctor said:

‘The system rejects cancelling of drugs’ (Focus Group 3).

The system used International Coding of Diseases (ICD 10). Nurses agreed that this coding was not user-friendly. A nurse said:

‘Sometimes a nurse picks a wrong code from the drop down list of diseases in the system. This error results to a misdiagnosis of a patient’ (Focus Group 2).

Another nurse said:

‘Each theatre is used for specific operations. Sometimes this procedure is not followed when theatres are busy. As a result, there is confusion in statistics collected and collated at theatres (Focus Group 2).

Yet another nurse said:

‘When doing an investigation, I can get a patient blood result from the system by entering a patient reference number’ (Focus Group 2).

A doctor complains:

‘The system logs you out when you are away on sabbatical leave for more than three months. In order to be logged in, you must undergo training again’ (Focus Group 3).

A nurse said:

‘When the user resigns, he or she is taken out of the system after three months. During this period, he or she can come back to the hospital, log in and out of the system. This compromises security of the system and confidentiality of information’ (Focus Group 1).

A foreign doctor said:

‘The system used to cater for foreign language, for example, Arabic. I started working here two years; the system was changed to Arabic language. Later, I was told that his workstation is going to be changed to English language, in order to protect the system from viruses’.

5.19.4. The availability of computers at the hospital and workstations

All nurses were happy with their workstations (Question 3: What can you say about the availability of computers at the hospital and your workstation?) They complained that they spent most of their time on these workstations which keeps them away from patients whom they are trained to provide nursing care for. A nurse said:

‘In some clinics, there is one laptop shared by a doctor and a nurse’ (Focus Group 1).

Doctors and nurses were not happy that they were denied the use of memory sticks or flash disks at the workstations because AME International protected the system against viruses and yet the system was still slow (Focus group 2&3). Another nurse complains:

‘My personal computer screen is not protected whilst others are protected and my eyes are affected’ (Focus group 2).

Yet another nurse complains:

‘In some clinics, the power plugs are in wrong place. My back faces that door, when I am sitting on my workstation. As a result, when somebody enters the door, I have to turn all the time’ (Focus Group 1).

Nurses were not happy that the password expires on some workstations whilst it does not on others. They further complained that sometimes when they log in a message pop up saying 'you cannot print' and sometimes folders disappear (Focus group 2).

5.19.5. Motivation to use the system

Doctors were motivated to use the system because they had to conduct research studies, audit the laboratory results, access radiology images and review patient records (Question 4: What motivates you to use the system). Nurses said they have no choice; they were forced to use the system. A nurse said:

'Sometimes, I prefer to go back to paper due to in-availability of personal computers' (Focus Group 1).

Another said:

'We do not have an alternative; we have to use the system' (Focus group 2).

Yet another nurse said:

'Sometimes, we are forced to use both paper and the system when there is a problem, like icons do not open' (Focus Group 1).

The doctors were happy with system, a doctor said:

'The system is effective and efficient. I can trace patient results, for example, laboratory for the previous five years' (Focus Group 3).

All the nurses agreed that the system cuts the storage of paper (Focus Group 1); improves computer literacy since they use computers everyday; and forces them to be at work since they cannot use the system after work. Lastly, it gives access to policies and circulars of the Department of Health on a Z-Drive (Focus group 2). Doctors complained that sometimes the Z-Drive crashes (Focus Group 3).

5.19.6. Previous training on the use of the hospital information system

Doctors and nurses agreed that they were trained on the system before they used it. A nurse said:

‘We were also trained on how to log on and off the system. We had to pass the training by 80%, if failed you are re-trained’ (Focus Group 1).

Another said:

‘Yes we were trained on the system, but we need an advanced training on excel so that we can use the formulae instead of calculating manually’ (Focus group 2).

5.19.7. Recommendations regarding the implementation of the hospital information system and telemedicine system in this hospital

Doctors and nurses agreed on the following recommendations (Question 6: What recommendations regarding the implementation of the hospital information system and telemedicine system in this hospital can you make):

- 1) Provide sufficient personal computers and laptops in all the departments (Focus Group 1);
- 2) Consider more workstations to address the issue of sharing (Focus Group 1);
- 3) Upgrade a pharmaceutical module to be more user-friendly (Focus Groups 1&3);
- 4) Address the issue of confidentiality for both patients and staff as a matter of urgency (Focus Groups 1,2&3);
- 5) Suggest an electronic signature in theatres (Focus group 2);
- 6) Allow the use of memory sticks or flash disks at a common desktop per department (Focus groups 2&3);
- 7) The system of faxing orders to companies is a problem as companies do not get these orders, this need attention (Focus group 2);
- 8) Laptops are stolen though there is an alarm system; therefore, the security issue is crucial (Focus Group 1);
- 9) Introduce on-line training (Focus Group 3);
- 10) Tailor training according to the literacy level (Focus Group 3); and
- 11) Do not change password; users should change the password when they suspect insecurity (Focus Group 3).

5.20. OBSERVATION

The researcher used semi-structured observation, followed by informal focus group interviews, with the doctors and the nurses. The researcher used informal interviews in order to understand the reasons for error messages that popped up on the computer screen as they used the system; and actions they took to address these error messages. Subsequent to that some questions were asked of them relating to the user-friendliness of the system (see Appendix 4). Fifteen (15) members from different departments were observed (see Table 12 below). The researcher planned to observe three participants in each department but the observation did not work according to the plan and the researcher had to make some adjustments depending on the business of the department.

The researcher observed participants from admissions, oncology clinic, pharmacy, revenue and cardiac surgery ward as they were using the system, and asked them questions relating to the user-friendliness of the system.

Table 12: Observation by Department

No.	Departments	Doctors		Nurses		Other Admission Clerks or pharmacists		Total
		Female	Male	Female	Male	Female	Male	
1	Admissions	-	-	-	-	3	1	4
2	Clinic	-	2	1	-	1	-	4
3	Pharmacy	-	-	-	-	2	-	2
4	Revenue	-	-	-	-	1	2	3
5	Ward	-	-	2	-	-	-	2
Total		0	2	3	0	7	3	15

Source: analysis of survey data

In both observation and interviewing, it was vital to make full and accurate notes of what was there. The researcher ensured that notes were taken during observation. The notes, which included both empirical observations and interpretations, were written down as soon possible afterwards. The researcher made note taking easier by preparing standardised recording forms in advanced (see Appendix 5). This was a way of coding the individual's behaviour within a group context under eight headings, which were sufficiently comprehensive to cover most behaviour exhibited in a group. In this study a more manageable system useful for observing groups was informed of the following eight categories: (see 3.3.2. for the detailed breakdown of the categories):

- 1) Physical features;
- 2) Reliability of the system;
- 3) Dialogue;
- 4) Feed back;
- 5) User support;
- 6) Handling of user errors;
- 7) User control of the system and transparency; and
- 8) Output (Burns 2000:408-9; Geysler 1992:83-7).

In the admission section, the researcher observed that the system was faster when the admission clerks administered repeat patients; it took them on average five minutes to administer these patients. The system showed an error message, when the admissions clerk typed the town where the patient came from incorrectly. The system knew that correct town because the information of the patient was captured on her first visit. The admissions clerk corrected the error with ease. She also complained that they have difficulty to verify the employment status of the patient. She said:

‘Patients do not want to divulge their employment status; they say they are not working so that they are exempted from paying when they or their partners are either working or have companies. The department of labour should verify patient information before they complete and sign the letter (see Appendix 11) confirming patient unemployment status’ (Member 1).

An error message, popped up when another admissions clerk was registering another repeat patient, a child. The reason for the error according to the admissions clerk was that:

‘The mother of the child did not bring the child identifier and the system does not recognise the patient. In order to continue I must override the system by putting my own password’ (Member 2).

Another admissions clerk registered two patients, one was a new patient and another was a repeat patient without the system showing any error message at all. When the researcher asked her for a reason for an error free, she said:

‘If error messages popped up on the system, I would say you brought those errors because error messages pop up when you have capture information incorrectly. I am very efficient with the system. I do not make errors’ (Member 3).

The admissions clerks also generate billing statements but they take cash, cheques, postal orders or credit cards. The admissions manager complains that:

‘When a patient comes for a bill statement at the admissions and he or she has been to the hospital for more than once on different dates, the system cannot consolidate these different accounts into one by giving a total cost of all accounts. Instead the system gives a list of all accounts on one screen. The challenge is that the admissions clerk has to open and print each account at a time, and add them all together manually’ (Member 4).

At the revenue collection department, the researcher observed all three cashiers as they were using the system collecting revenue from patients. They seemed comfortable with the system except for one error message that popped up when the cashiers erroneously selected a wrong settlement type, for example; cash, cheque, credit or partial transaction. The revenue manager explained that there were three categories of patient fees according to salary scale:

- i. Patients with salary income > R 50 000 pay R 40
- ii. Patients with salary income < R100 000 pay R120
- iii. Patients with salary income > R100 000 pay R194

(Including those with Medical Aids)

Patients who were unemployed did not fall in the above-mentioned categories; they received healthcare service free of charge. The revenue manager indicated that it was very difficult to deal with partial payments.

‘Suppose the patient has a balance of R7 from the previous account, and an outstanding amount of R194 from another account. The system only allows me to print one account individually at a time. This is time consuming especially I have to print more than two accounts. The problem was reported to AME International, they said this problem cannot be resolved’ (Member 5).

The researcher also observed that the workstations of the cashiers were not user-friendly. The common desks they used were higher than their chairs as a result they preferred to work standing. They confirmed to the researcher that the desks were high and the floor was carpeted. Cashier said:

‘We find it easy to work standing. Sometimes we get tired of sitting on these chairs’ (Member 6).

Another cashier said:

‘Chairs do not move smoothly on a carpet, tiles are preferable’ (Member 7).

In the oncology clinic two doctors, a nurse and an admissions clerk were observed as they used the system, followed by an interview where necessary in order for the researcher to understand the reason for a particular occurrence and/or action. The two doctors were sitting next to each other in one consulting room; the researcher observed and interviewed them simultaneously as they were diagnosing the one patient together at one time. The researcher observed that the doctors were using the system and folders. A doctor explains this:

‘We use folder and MEDICOM, MEDICOM is used to access patient information. We diagnose the patient and capture patient notes on MEDICOM system, print them and insert the printouts into the folder. Thereafter, we refer a patient to a regional hospital for a follow up and his or her folder follows the patient later’ (Member 8).

Another doctor said:

‘The advantage of using folders is that when the system is down we can always go back to folders and find history of patients’ (Member 9).

The researcher also observed two error messages on the system, doctors explained that the errors were caused by the ordering of the wrong drug (Member 8) and/or CT SCAN that was already

ordered (Member 9) on the system. Both doctors confirmed that to rectify an error, they had to cancel these orders and re-order respectively (Members 8&9).

A nurse in the ward said:

‘I know the system very well. We do not experience errors on the system. The only problem is downtime (Member 10).

An admissions clerk said:

‘I use an oncology system called LANTIS to register patients. I scan a patient referral letter into this system, open a folder for a new patient, take his or her picture, and capture his or her information into LANTIS. This system is not linked to MEDICOM. Doctors copy and paste patient information from LANTIS to MEDICOM. They also capture the date of a patient next return on MEDICOM’ (Member 11).

At the cardiac surgery ward B4 east, the researcher observed two nurses as they administered drugs to patients. A nurse had a mobile laptop with the system (Member 12) and the other had a mobile drug cabinet (Member 13). They realised that one patient was in the ward but she did not appear on the system. A nurse gave drugs to the patient and wrote a record on a piece of paper (Member 12). A nurse explains:

‘In order for the patient to be restored onto the system, her doctor will have to review her treatment’ (Member 13).

There are three types of prescription, the in-patient, out-patient and ward prescriptions. The researcher observed the pharmacy manager and one pharmacist as they used the pharmaceutical system to control stock and dispense drugs. Both of them were happy with the system compared to paper system. The deputy manager said:

‘I have worked with this system for seven years. The stock control system interfaces with the dispensing system and this makes our work easier. The only challenge is an electronic prescription which is medico-illegal hence we print the prescription out for signature of the doctor who prescribed the drugs’ (Member 14).

The pharmacist denied the accusation made by doctors that they do not keep stock required by doctors, she said:

‘There is no such thing; the problem is with the private doctors who order drugs that the hospital does not keep’ (Member 15).

Both the pharmacist and the deputy pharmacy manager recommended a multi-strength dispensing.

5.21. SUMMARY

This chapter reported on the results obtained from doctors and nurses separately from the questionnaires. Data from focus group interviews was combined for these groups as well as for the feed back from observation. Data was analysed according to the objectives of the study, for example: demography of doctors and nurses; user-friendliness; physical features; reliability; dialogue flexibility; functionalities; effectiveness; efficiency; training needs of the MEDICOM integrated hospital information system and telemedicine; and recommendations regarding the implementation and rollout of the system. The interpretation of data is presented in the next chapter.

6.1. INTRODUCTION

The previous chapter provided the results about the units of analysis being studied. This chapter showed us what the units of analysis shared in common, and what made them different from one another. The findings were presented according to the themes of the objectives of the study and research questions posed in relation to the purpose of the study in section 1.3.2. of Chapter One (1). The purpose of the study was to assess the user-friendliness of a hospital information system within a telemedicine context at Tertiary Inkosi Albert Luthuli Central Hospital in order to achieve the broad objective of developing a model for managing the implementation of these systems in the province. The specific objectives were to:

- 6.1.1. To assess the user-friendliness of MEDICOM integrated hospital information system;

Method: Questionnaires were used to ascertain users' comparison of a traditional system to an electronic and/or computerised system.

Indicator: User-friendliness qualities of MEDICOM integrated hospital information system as perceived by doctors and nurses compared to the traditional system.

- 6.1.2. To describe the physical features of the hospital information system and telemedicine system in terms of standardised keyboards with function keys and numeric pad, high-speed communications, large character sets and ergonomic design;

Method: Questionnaires and observation techniques were used.

Indicator: Physical features that characterise MEDICOM integrated hospital information system and telemedicine system.

- 6.1.3. To describe the reliability of the hospital information system and telemedicine system, that is, are the systems always in operation when needed?

Method: Questionnaires, observation and focus group interviews were used.

Indicator: The efficiency features of the hospital information system and telemedicine system as experienced by doctors and nurses.

- 6.1.4. To determine the dialogue flexibility, that is, whether the users' needs and abilities were taken into consideration when developing the hospital information system and telemedicine system;

Method: Questionnaires, observation and focus group interviews were used.

Indicator: User's requirements considered before, during and after the development of MEDICOM integrated hospital information system.

- 6.1.5. To assess time taken by the functionalities of MEDICOM integrated hospital information system and telemedicine system in improving patient service delivery in IALCH;

Method: Questionnaires, observation and focus group interviews were used.

Indicator: Time taken by functions performed by MEDICOM integrated hospital information system as well as subsequent actions taken by users.

- 6.1.6. To assess the effectiveness of MEDICOM integrated hospital information system using telemedicine compared to the traditional and/or manual hospital information system in King Edward VIII and Wentworth hospitals.

Method: Questionnaires, observation and focus group interviews were used.

Indicator: Quality features of MEDICOM integrated hospital information system in improving the health service delivery to patients.

- 6.1.7. To determine whether users have control of the hospital information system and telemedicine system. This means the system should enable the user to form a clear mental picture (model) of its functioning and not confront the user with complicated and unnecessary functions. The users should have a workable understanding of the system;

Method: Questionnaires, observation and focus group interviews were used.

Indicator: Layers of information presented to the user.

: Usability of the system,

: Predictability of the behaviour of the system, and

: Consistency of vocabulary for different dialogue modes.

6.1.8. To ascertain the output of the hospital information system and telemedicine system in terms of layout;

Method: Questionnaires, observation and focus group interviews were used.

Indicator: Number by type of outputs that users can choose in the system.

6.1.9. To ascertain the training needs relating to the use of MEDICOM hospital information system and telemedicine system;

Method: Focus group interviews were used.

Indicator: Training programmes attended and/or needed by doctors on the hospital information system and telemedicine system.

6.1.10. To make recommendations regarding the implementation of the hospital information system and telemedicine system in a hospital and the rollout of the system to other institutions in KwaZulu-Natal.

Method: This will emerge from findings.

Indicator: Considerations when implementing the hospital information system and telemedicine system.

The discussion of salient points was based on the analysis of the two (2) survey questionnaires, observation, focus group interviews with members of selected doctors and nurses in IALCH, review of the literature and conceptual frameworks related to their involvement in the customisation of the MEDICOM integrated hospital information system, user-friendliness of the system, and training on the system before and after its implementation.

6.2. THE DEMOGRAPHIC DATA OF DOCTORS AND NURSES

Figure 12 showed that the preponderance of two hundred and eighty-eight female nurses (90%) over that of twenty-two male nurses (7%) and nine for whom the gender was unknown (3%) from three hundred and nineteen (100%) participants responded. This meant that at the time the nursing profession at IALCH was still dominated by females.

One hundred and thirty-four (42%) nurses were between the age of thirty-five (35) and fifty (50) years old, whilst hundred and twelve (35.1%) nurses were below thirty-five (35) years old, sixty (18.8%) nurses are over fifty (50) years old, and there were only thirteen (4.1%) unknown (Figure 13). This implied that the majority of nurses (77.1%) in IALCH were below the age of fifty (50) years. Thus, the hospital could invest in these nurses because they were from young to middle age, and likely to remain in the system for some time provided a good retention strategy was developed, implemented and managed properly.

One hundred and forty-nine (46.7%) nurses possessed a diploma, one hundred and twenty-four (38.9%) enrolled nursing assistants had matriculated but had no diploma or degree, thirty (9.4%) nurses possessed a degree, and the education level of sixteen (5%) nurses was unknown (Figure 14). Two hundred and eighty-nine (90.6%) professional nurses had a diploma in nursing science. This was the basic qualification for professional nursing. Forty-six (14.4%) professional nurses had studied advanced courses, for example: midwifery, community health and psychiatry. Twenty-seven (8.5%) professional nurses had a degree in nursing science. Four (1.3%) enrolled nursing assistants had done an enrolled nursing science course. This meant that most (90.6%) nurses had the basic nursing diploma and that they had not invested in furthering their education (Figure 15). It was therefore interesting to know why this was the case. Was a shortage of financial resources a factor? Or were nurses satisfied with the qualification (diploma in nursing science) they had. These questions should be noted for further research studies.

Figure 40 showed that forty (62%) doctors were below the age of thirty-five (35); fifteen (23%) doctors were between thirty-five (35) and fifty (50) years; and ten(15%) doctors were over fifty years. This meant that the majority of doctors in IALCH were young, below the age of thirty-five (35) years old. Unlike the situation with the nurses there was a preponderance of fifty one (78%) male doctors with female doctors at fourteen (22%) (Figure 41). The profession as represented at IALCH was still dominated by males.

Thirty-five (56%) doctors worked as resident doctors; whilst twenty-eight (44%) of doctors worked as consulting physicians; and there were no intern doctors as IALCH was a tertiary hospital (Figure 42). It was not surprising to ascertain that most doctors were young as IALCH was a tertiary hospital (see Section 1.2.1.36) where doctors are trained. The factors behind the domination of male doctors over female doctors were not obvious, whether the higher percentage of males was the result of lack of interest from young females in pursuing this profession or lack of financial assistance to support them. Therefore, this, too, is a question for a further research study.

6.3. THE USER-FRIENDLINESS OF MEDICOM INTEGRATED HOSPITAL INFORMATION SYSTEM

The user-friendliness of a system means that it is easy to use - posing little or no difficulty and requiring little effort (Farlex 2007). With reference to computing, the system is user-friendly when it has been designed to be easy or pleasant to use, or easy to follow or understand (AllWords 2003). User-friendliness meant that the interface (the user interface was where users and applications collaborate) guided the users through different stages towards the accomplishment of the tasks. It lessened the difference between users and the systems, such that users could interact more with the tasks and less with the system. A user-friendly interface asks the user for details that are sufficient to complete the task. The requested details should be of a narrow scope and constrained to elicit meaningful answers. The interface should ask to confirm users' intentions before performing destructive actions (Ng 2004).

Ease of use or user-friendliness of any computerised hospital information system is clearly important. What is less clear and strangely under-researched are the specific features or attributes of systems that make them user-friendly to the variety of doctors and nurses who actually use them in a wide range of clinical settings. The literature contains several wish-list accounts of the features that doctors and nurses want in a system. In discussing the importance of technology assessment, efficacy and effectiveness, questions were asked in evaluating any system. These may subsume practical questions of ease of use under questions such as 'Can the system demonstrate satisfactory performance?' (Darbyshire 2000).

It was a general practice for admissions clerks in IALCH to generate billing statement for patients. They took cash, cheque, postal order or credit cards. The admissions manager complained that the billing module of MEDICOM system was not user-friendly. When a patient came for a bill statement at the admissions and he or she had been to the hospital more than once on different dates, the system could not consolidate these different accounts into one by giving a total cost of all accounts. Instead the system gave a list of all different accounts on one screen. The challenge was that the admissions clerk had to open and print each account at a time, and add them all together manually (Member 4: Observation). Thus, the system was not user-friendly in this regard and it was not designed to be easy or pleasant to use, or easy to follow or understand.

Stevens (1983:3) articulates a need for designers to pay more attention to the inexperienced user. In the case of IALCH, it was necessary for designers to design a billing module which was user-friendly to the users of IALCH and did not force them to interact with a module that appeared to be poorly designed by inexperienced or ill-informed designers. Therefore, it was crystal clear that users from a billing unit had not been consulted when the billing module was designed. This was a lesson for the future development of any system that users' needs should be considered before the system is implemented (Geyser 1992:84). This issue will be discussed further under section 6.6.2.

Accommodating the individualised needs of users in the specification process, and the education and training of users in the implementation process, are both expensive activities. In terms of success or failure of a system, in the spectrum between efficiency on the one hand and costliness on the other, it was true that user's view was also the one aspect which was most frequently overlooked. Too often users were taken for granted, and system experts, as Rigby (2006:115) argues, appeared to forget that the prime focus of expertise of the end users of health systems was elsewhere - for instance, in nursing or medicine.

Nurses also complained that the ICD 10 system was not user-friendly. It was easy to select an incorrect diagnosis from a drop down list of disease codes in the system. Consequently, a patient could be treated for an incorrect disease; this is called misdiagnosis (Focus Group 2). Apart from the serious consequences for patient health this phenomenon can lead to medico-legal litigation. According to Mitev (1986:115) much confusion still exists regarding the true meaning of the term 'user-friendly' and consensus as to the exact meaning of the concept 'user-friendliness' still had to be reached. One reason for the confusion is that no clearly defined terminology in this area exists

as a result of the complexity of man-machine interactions. Amidst this confusion certain aspects remain of importance. In this regard, Wallace (1985:340), referring to information systems, remarked that ‘regardless of whether the term ‘user-friendly’ has any meaning, the concept of flexibility, adaptable information systems that could be exploited by a wide variety of users with differing backgrounds and needs were of lasting importance.’ As various interpretations tend to be subjective in nature, they were not easy to describe in terms of a computerised system as Geysler (1992:80) points out. However, ICD 10 is a standard international system for coding diseases that must be incorporated in all hospital information systems. What emerged from the study was that the challenge was not with the system, the users erratically selected an incorrect disease from the drop down list. Therefore, these users needed more and better training on the use ICD 10 system. Users should differentiate a human error from a system’s error. In this case, it was a human error that could be resolved by the training of these users.

A nurse complained that sometimes the batteries of mobile laptops ran flat and were not charged on time, but they all agreed that charging batteries was the responsibility of the user. When the mobile laptop was not in use, the user was supposed to leave the equipment on a charger until it was fully charged. This showed that some users like to shift their responsibilities to another whilst others knew who was responsible for that task. For any system to work properly, each and every user was responsible for his or her part in the process. Failure for one user to perform his or her bit might result in criticism of the functioning of a system.

Doctors and nurses understood how the system functions. They explained that patients are referred to IALCH by doctors from all regional hospitals in the KwaZulu-Natal. In terms of the referral hierarchy IALCH was designated one of the tertiary and central hospitals of the Republic of South Africa providing a sub-specialist consultant service for patients referred from and to the regional hospitals. Since IALCH is at the pinnacle of the referral system it is imperative that criteria for the admission to its first world facilities be strictly controlled to maintain its tertiary level status (IALCH 2006). This is in order in terms of the referral system which is characterised by the district hospital services providing the basis for hospital care and therefore being the most accessible to the surrounding communities whilst the regional, tertiary and the national central hospitals provide the specialist, super-specialist and highly specialised care respectively (see Figure 3).

To assess how well MEDICOM integrated hospital information system functioned in this tertiary hospital situation, its functioning was discussed in terms of its accessibility, integration, confidentiality, security, usability and electronic medical record.

6.3.1. Accessibility

The aim of the hospital information system project was to implement the system successfully in Inkosi Albert Luthuli Central Hospital. One of the objectives was to improve the accessibility of patient related information to health care professionals during the treatment process, through improved medical record handling and shorter turnaround time for the release of diagnostic information such as laboratory and special investigation results. One of the basic assumptions and the logic underlying the potential contribution of a computerised hospital information system and telemedicine in Inkosi Albert Luthuli Central Hospital was the enhancement of accessibility. This meant that extensive information about a patient should be readily available in the MEDICOM system, which was meant to be reliable in order to enhance the efficiency and coordination of patient care, and could serve as a highly effective tool for clinical decision support for all doctors (Bashshur *et al.* 2002:6-7).

Darbyshire's study (2000) found that some clinicians' information technology (IT) difficulties began immediately, at the point of access. Difficulties with passwords, multiple passwords, and password changes were reported:

'One of the things that drives me mad is different passwords. Different things to get into every different program' (Participant 1).

'And they change regularly' (Participant 2).

'Different user name for every program' (Participant 4).

'I've never been able to work out why if I've got access to those things, I cannot use a common password for all of them' (Participant 1).

Participants understood the need for security and confidentiality in the system and did not oppose the principle of passwords. Their concerns were rather that the number of passwords required and their frequent changes were a disincentive to actually using the systems. Faced with the 'hassle' of actually accessing a system configured this way, it was often easier to ignore the system. As this

participant explained:

‘The system that we have is hopeless. You’ve got to log in, then you’ve got to use your user name, your password, you know you’ve got to jump twenty hoops just to get into just basic information, and nobody uses it then’ (Participant 2).

A further aspect of access was actually having a terminal to work on. The range of facilities reported was dramatic, and one participant described what she called the widening gap in nursing between the ‘Information Rich and the Information Poor.’ Participants were very clear that adequate terminal access was vital to the acceptance and ease of use of any system.

‘You’ve got this department which has over a twenty four (24) hour period twenty nine (29) nurses processing through it and maybe fifteen (15) or twenty (20) doctors as well. I mean you’ve got to have more, you’ve got to have a lot more, and so the terminal access becomes a huge issue’ (Participant 2).

‘It took us twenty (20) minutes per person to get to the terminal, and adjust care plan time. Now when you’ve got like twelve (12) patients, each one for twenty (20) minutes, to relieve everyone to get to the terminal, you’re talking about three (3) hours (Participant 1).

‘Half the shift. The time just was not there...I can remember a couple of shifts...it had been so busy the EXCELCARE was not done and I can remember ringing the nurse manager and saying ‘Sorry it’s not done; I’m changing shifts.’ All the data for that entire shift is lost, but you’re not going to stay there for another hour just to do EXCELCARE (Participant 3).

The system at the Inkosi Albert Luthuli Central Hospital was called a paperless and filmless hospital implementation and involved documenting and managing all types of information, like character data, graphs, X-Ray images, MRI or CT scan images through the use of electronic media and computers. Information pertaining to a patient, be it administrative or clinical, was captured directly on the computer system at the point of origin of the data. The information was then available across the entire hospital on computers over a networked facility. Any authorised user could access the patient information from anywhere in the hospital (see Section 2.2). The current study, however revealed that doctors and nurses refuted this fact by saying that not all the information they required for their work was accessed from MEDICOM Integrated Hospital Information System.

The majority of nurses (188, 59%) rated the user-friendliness of MEDICOM hospital information system high (75%) and very few nurses (11, 3%) rated the user-friendliness of the system very low

(25%) in Figure 17 (Question 2.3.) because they sometimes could not log on to their stations. They moved from one screen [window] to another to access information and they felt this was wasting their time.

The reasons for the user being unable to log on the system were either that the user had forgotten the password, the password had expired or because access had been blocked (see Section 6.3.4.). Users should not have to waste their time by opening one window, closing the first and opening another one, closing the second and going back to the first one. Ideally the second window should be linked to the first one, so that a click of a button on the first window leads the user to the second window, and a close button on the second window returns the user to the first window.

The majority (281, 88%) of nurses agreed that Inkosi Albert Luthuli Central Hospital did have documentation, either online or in hardcopy that focused on the hospital-specific business processes (Figure 18) (Question 2.5.). Two hundred and thirty-five (73.7%) nurses had access to the copy of the document (Question 2.7.). Forty-four (13.8%) nurses did not have access (Question 2.6.) because these documents were confidential and were not made available to them. The reason for non-availability could be that these nurses did not request access to these documents according to the procedure stipulated in Section 6.3.3. or they did not know that there were procedures to be followed at all. Therefore, if that is the case, processes and procedures should be communicated to all staff members in the hospital. An on-line document was available to one hundred and ninety-three (60.5%) nurses and one hundred and eighty-nine (59.2%) nurses preferred the on-line document (Question 2.9.) because (Question 2.11.) it avoided the inconvenience of looking for paper documents and allowed easy access to documents at any computer station in the department.

Other noted advantages of MEDICOM system were that (i) nurses could access notes on time and at any time; (ii) they did not queue to request old notes from records as a result they saved time; (iii) documents were accessible to a number of people at the same time; and (iv) nurses could access scanned results and see the results of any procedures (Figure 19). Furthermore, the majority (262, 82%) of nurses agreed that the MEDICOM system did support them (Figure 19) (Question 2.24.) because (Question 2.25.) information was readily available and accessible to them. Nurses in

IALCH were supposed to have access to the information that they were authorised to view for security reasons. No nurse should have access to information that was not relevant to him or her. This issue will be discussed in detail under section 6.3.4.

The majority (204, 64%) of nurses agreed that MEDICOM integrated hospital information system was always in operation when needed (Question 2.14.), for example auto-start, auto-logout, help and data transfer (Figure 21). They (262, 82%) also agreed that the MEDICOM system did support them (Figure 29) (Question 2.24.) because (Question 2.25.) information was readily available. They had access to the information from all departmental modules that gave updated information from time to time and they could retrieve this information easily. These nurses used the MEDICOM system because (Figure 30) (Question 2.28.) the system could give them access to patient records for patient care and it was easy to reach [retrieve] patient information, and they had control of the hospital information system and transparency (Figure 31). Accessibility to information was easy when modules in MEDICOM system were integrated and also when MEDICOM was integrated with other systems.

6.3.2. Integration

The Public Private Partnership which was awarded on the basis of a fifteen (15) year-contract to the consortium charged with the responsibility of delivering a fully functioning hospital, was paid a set yearly amount by the province for hospital facility management, administration, medical equipment and the IT system. The model was meant to offer a totally integrated health facility that incorporated the latest in information and management systems such as electronic patient records as well as leading edge medical equipment, including imaging modalities, laboratory equipment and patient monitoring. To ensure that the consortium kept to its side of the contract, a heavy penalty regime applied in the event of under performance or a failure to deliver:

The main focus of the penalty regime centres around the availability of critical hospital areas, the response to calls for assistance, the time taken to restore a service, and the quality of service delivery... Given that the nature of the consortium is to make a profit, the penalty regime places pressure on the private sector company to run the facility efficiently and according to the agreed deliverables in terms of quality healthcare and standards (Siemens 2005).

A MEDICOM system was defined as a comprehensive information system dealing with all aspects of information processing in a hospital. This encompassed human (and paper-based) information processing as well as data processing machines.

The integrated, computer-assisted system was designed to store, manipulate and retrieve information concerned with the administrative and clinical aspects of providing services within the hospital (Centc251 2006). The computer system was intended to extend the concept of integrated software to all end users. Integrated software was also defined as a group of programs that perform different tasks but share data (see Section 1.2.1.15). A major advantage was seen to result from different applications all updating the one common database and in this way, keeping it current (Held 1995:213). MEDICOM Solutions executive vice-president (business development) Ashwini Kumar said:

‘It is a matter of great honour and pride for MEDICOM integrated hospital information system to be implemented at the prestigious IALCH. MEDICOM integrated hospital information system at IALCH has delivered the full spectrum of clinical and administrative care functions across the connected enterprise providing for clinical and operational efficiency, decreased paperwork, reduced clinical errors and improved quality of care.’ (Kumar 2003)

Doctors and nurses, however, disagreed with Kumar as they said MEDICOM was not a totally integrated system. Other systems were not linked into MEDICOM system. An admissions clerk in the oncology clinic said:

‘I use an oncology system called LANTIS to register patients. I scan a patient referral letter into this system, open a folder for a new patient, take his or her picture, and capture his or her information into LANTIS. This system is not linked to MEDICOM. Doctors copy and paste patient information from LANTIS to MEDICOM. They also capture the date of a patient next return on MEDICOM’ (Member 11: Observation).

A doctor said:

‘Everything you need is not on a single system. I have to open MEDICOM system, work and close it, then open a nursing system work and close it, and go back to MEDICOM. This is time consuming’.

In the oncology clinic two (2) doctors, a nurse and an admissions clerk were observed and interviewed. The two doctors were sitting next to each other in one consulting room; the researcher observed and interviewed them simultaneously as they were diagnosing a single patient together at one time. The researcher observed that the doctors were using both the system and folders.

A doctor explained that they used a folder and the MEDICOM system, for example, MEDICOM was used to access patient information. They would diagnose the patient and capture patient notes on MEDICOM system, print them and insert the printouts into the folder. Thereafter, they would refer a patient to a regional hospital for a follow up and his or her folder followed the patient later (Member 8: Observation). Another doctor said that the advantage of using folders was when the system was down, they could always go back to folders and find history of patients (Member 9: Observation).

It was surprising for doctors and nurses to use dual systems when the MEDICOM integrated hospital information system was connected to various types of medical equipment like laboratory analysers, radiology equipment and critical care units at IALCH to create a paperless and filmless environment. The system was meant to enable results and outputs from the afore-mentioned equipment to be automatically captured into the electronic medical record (see Section 2.2). A paperless and filmless environment should not have papers or films. If it has papers and films then it is not paperless or filmless. Thus, MEDICOM was found to be neither integrated nor user-friendly to the satisfaction of all users. The confidentiality of the system is reported on next.

6.3.3. Confidentiality

Inkosi Albert Luthuli Central Hospital was committed to the preservation of patient confidentiality and the safe storage of all patient related documentation. No patient related information was released other than with approved consent. Patient data was divulged to authorised persons only. The supply of data to anyone else only occurred with the patient's written consent. All requests for access of medical records were made to the Chief Executive Officer (CEO) in writing and accompanied by the written consent of the patient, parent or legal guardian and curator *ad ilitem* in the case of minors and other patients. The request should state clearly the reason as to why copies of such records were required. Medical reports were furnished provided that the CEO was satisfied

that the reason was not litigation against the Department, the Province or the State (see Section 2.4.2).

The findings of the research study indicated that the majority (88%) of nurses (281) agreed that Inkosi Albert Luthuli Central Hospital did have documentation either online or hardcopy that focused on hospital-specific business processes (Figure 18) (Question 2.5.). The majority of nurses (235) had access to the copy of the document (Question 2.7.) and (i) the document was in a read-only format, (ii) some of the documents were not accessible to maintain confidentiality and (iii) those documents did not concern the nursing staff (Question 2.8.).

A contrary finding was that some nurses complained that confidentiality was a problem in the system, patients and staff information could be viewed by anyone at all workstations in the hospital, including the technicians (Focus Group 1&2). The nurses rated the user-friendliness of MEDICOM hospital information system low (Figure 16) (Question 2.4.) because confidentiality was not maintained. Nurses indicated that although the on-line document was available to one hundred and ninety-three (193) nurses of these one hundred and eighty-nine (189) nurses preferred the on-line document (Question 2.9.) because (Question 2.11.) it limited paper on the table and it kept confidentiality (Figure 19). Although sixty-seven percent (67%) of nurses (213) agreed that they did have control of the hospital information system and transparency, twenty-three percent (23%) of nurses (74) disagreed that they had control of the hospital information system and transparency (Figure 31) (Question 2.29.) because (Question 2.30.) (i) there was no confidentiality of staff information; (ii) it was not right to have access to all patients' information; (iii) there was no option to hide information on the system, especially if a staff member was admitted. Nurses also complained about the lack of confidentiality in patient records. These records could be viewed by anyone at any department in the hospital, and technicians could also access patient information, for example, age and disease profile (see Section 6.3.4.). Although the problem was reported to the AME International, 'they did nothing to solve the problem' (Focus Group 1).

The information of high profile people could not be accessed as it was blocked. Nurses could not even access these people's previous records (Focus group 2). This meant that the system had a feature to deal with the issue of confidentiality but only for high profile people; or the information of high profile people was deleted from the system and nurses did not know what had been done

in the background. This posed a debate about when to be confidential and when to be transparent (see Section 6.9.). In this case, management was confidential enough about information of high profile people but at the same time were not transparent in their dealings with nurses about the same information.

The Promotion of Access to Information Act 2 of 2000 (PAIA) (Human Rights Commission 2009) gave the citizen of South Africa the right of access to any information held by the State; and any information that was held by another person which was required for the exercise or protection of any rights. This meant people could request access to information held by public bodies, as well as from a natural or juristic person (private body). In the case of a request for access to information held by a natural or juristic person, people had to indicate that the information requested was required for the exercise or protection of any rights. The right of access to information was the right of IALCH staff members in terms of section 32 of the Constitution and PAIA.

Inkosi Albert Luthuli Central hospital complied with PAIA by providing and detailing the procedures that must be followed in order to make a request for information, stating from whom you could make a request. These procedures detailed the duties of the body (CEO's office) from whom you had made a request. But the CEO of the hospital should also have described what information could be requested, when the requested information must or may be refused; and what mechanisms and procedures were available to staff if his or her request for access to information was refused.

6.3.4. Security

Information security meant protecting information and information systems from unauthorised access, use, disclosure, disruption, modification or destruction. The terms information security, computer security and information assurance are frequently and incorrectly used interchangeably (Information Security 2009). These fields are often interrelated and share the common goals of protecting the confidentiality, integrity and availability of information; however, there were some subtle differences between them. These differences lay primarily in the approach to the subject, the methodologies used, and the areas of concentration. Information security is concerned with the confidentiality, integrity and availability of data regardless of the form the data may take: electronic,

print, or other forms. Computer security can focus on ensuring the availability and correct operation of a computer system without concern for the information stored or processed by the computer, for example, hospitals amass a great deal of confidential information about patients in IALCH.

Most of this information was collected, processed and stored on electronic computers and transmitted across networks to other computers. Should confidential information about a patient fall into the hands of an unauthorised person, such a breach of security could lead to litigation. Protecting confidential information was a requirement of IALCH and in many cases also an ethical and legal requirement. For the individual, information security had a significant effect on privacy, which was viewed very differently in different cultures.

A password was defined as a secret word or code, which a user must supply during a login to demonstrate that he or she was, in fact, the person he or she claimed to be (Hitachi 2009). It was an unspaced¹⁴ (for example, m@gaqa#47&vuma!) sequence of characters used to determine that a computer user requesting access to a computer system was really that particular user. Typically, users of a multi-user or securely protected single-user system claimed a unique name (often called a *user ID*¹⁵) that could be generally known. In order to verify that someone entering that user ID really was that person, a second identification, the password, known only to that person and to the system itself, is entered by the user. A password is typically somewhere between four and 16 characters, depending on how the computer system is set up. When a password was entered in the MEDICOM system, the computer system was careful not to display the characters on the display screen, in case others might see it (SearchSecurity.com 2009). Many networks required that the user change his or her password on a periodic basis. Good criteria when choosing a password include the following:

- Do not pick a password that someone can easily guess if they know who you are (for example, not your Social Security number, birthday, or maiden name);
- Do not pick a word that can be found in the dictionary (since there are programs that can rapidly try every word in the dictionary);

¹⁴ No space between the characters or combination of characters, figures and/or signs.

¹⁵ Identification, for example, 'magaqavuma'

- Do not pick a word that is currently newsworthy;
- Do not pick a password that is similar to your previous password ;
- Do pick a mixture of letters and at least one number; and
- Do pick a word that you can easily remember.

In order for users to familiarise themselves with the above-mentioned criteria of choosing passwords, they should have computers at their disposal. According to Lærum *et al.* (2001) the findings of their study, showed that most respondents (203, 93%) had computers in their offices, and two hundred and nine (97%) had computers available to them in other rooms used for clinical work. While, eighty-five (40%) of the two hundred and fourteen respondents were prevented on weekly or daily basis from using these computers because others were using them, ninety (44%) of two hundred and fourteen were on a monthly or weekly basis hindered by computer errors or problems with passwords (three percent (3%) were hindered daily).

Doctors and nurses in IALCH complained about lack of security in the system. They said that any doctor, nurse or technician could access any set of doctor's notes on a system because there was no password protection on the system. One doctor opposed password protection, he complained that passwords should not be changed; users should change the passwords only when they suspected a security breach (Focus Group 3). This doctor did not understand the importance of a password in relation to accessibility, confidentiality and security. He needed to be trained on the three concepts.

An error message, popped up when one admissions clerk was registering a repeat patient, a child. The reason for the error, according to the admissions clerk, was that the mother of the child did not bring the child identifier and the system did not recognise the patient. In order to continue she had to override the system by putting her own 'password' (Member 2: Observation). In this case, a password was not only used for accessibility, confidentiality and security but as a control measure to allow the user to bypass an error message.

The majority of nurses (188, 58.9%) rated the user-friendliness of the MEDICOM hospital information system high (75%); sixty-two (19.4%) nurses rated the system fifty percent (50%) user-friendly; and forty-eight (15%) nurses rated the system very high 100% user-friendly; and the minority of nurses (11, 3.4%) rated the user-friendliness of the system low (25%) (Question 2.3.)

because (Question 2.4.) passwords always expired (Figure 17). Nurses were not happy that passwords expired on some workstations whilst it does not on others (Focus group 2).

Two hundred and sixty-two (82%) nurses agreed that the hospital information system did support the user (Question 2.24.) because (Question 2.25.) the user could create his or her own password (Figure 28). Many networks required that the user change his or her password on some periodic basis for protecting the confidentiality, integrity and availability of information as discussed above. Password protection was not an option but a must in any hospital information system. It was not acceptable that nurses working in the Intensive Care Unit (ICU) could retrieve the information of a patient by entering a patient reference number without calling a ward nurse and ask for information about the patient concerned (Focus group 1). However, while passwords were used in IALCH the security had flaws that needed to be corrected and standardised across the departments in the hospital.

6.3.5. Usability

Usability in simple terms is making sure that something works well, and that a person of average ability could use it for its intended purpose without frustration (Krug 2000 in Scott 2005). Usability has been applied not only to the design of everyday products, but also to computer interfaces and training manuals. For example, Wilmelius (2004) identified attributes that seem to have an impact on how people perceive information systems' applications, and subsequently tried to relate these attributes to more general attributes that have been found influencing perception of real world environments. The positive attributes were 'legibility' which was connected to the attribute 'simple', 'nice looking', and 'good structure'; and the negative attributes are 'messy' and 'confusing'. Evaluation studies based on cognitive and usability engineering methods have also proved very effective in improving the healthcare applications' quality (Kushniruk *et al.* 2004; Beuscart-Z'ephir *et al.* 2002).

Paré *et al.* (2006) suggested that psychological ownership serves as a key determinant of salient beliefs about a new CIS. Indeed, since having psychological ownership means being psychologically tied to an object and having a feeling of possessiveness for that object, it seems reasonable to argue that the more a user expresses feelings of ownership toward a new system, the

more he or she will perceive it to be of high quality. Such an argument would also be consistent with cognitive dissonance theory¹⁶ to the extent that individuals are more likely to find ownership of high-quality objects more consonant than ownership of poor-quality objects. For instance, Paré *et al.* (2006) showed that people evaluated ideas and objects more favourably when they feel a sense of ownership of the target. Users perceived usefulness and ease of use figure among the system characteristics with the strongest influence in the formation of attitudes. Therefore the more physicians develop feelings of ownership toward a new CIS, the greater their perception that the system is valuable and easy to use (Paré *et al.* 2006)

The International Standards Organisation (ISO) defined usability as ‘the extent to which a product could be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use’ (ISO 9241-11). It related (ISO 9241) the effectiveness, efficiency, and satisfaction with which specified users could achieve specified goals in a particular environment. Effectiveness was the accuracy and completeness with which users achieve specified goals; efficiency was the accuracy and completeness of goals in relation to resources expended; and Satisfaction was the comfort and acceptability of the system (Usability Net 2009; Abran *et al.* 2003). Smith (1997:250) points out that most users of computer systems would easily be able to differentiate between systems that were easy to use and those that were not. What they would find more difficult was being able to quantify how much more easy it was to use one system as it was to use another.

Effectiveness measures the ‘goodness’ of the output by the user or whether users can perform their tasks, whereas efficiency has more to do with the quantity of work output in relation to the time, effort, and resources involved (Dillon and Morris 2001 in Scott 2005). The satisfaction of a user is a measure of the user’s attitudes and perceptions about the usability of an item. Products with good usability allow users to complete their tasks well in a timely manner and with minimum frustration. Prior research in this area used a practitioner instrument to assess the usability (Agarwal and Venkatesh 2002 in Scott 2005). Similarly, in the study conducted by Scott in 2005, the items assessing usability of the training manuals were adapted from the Questionnaire for Usability Evaluation (QUE), designed by United States West Information Technologies (1996) to assess the

¹⁶ **Cognitive dissonance** is an uncomfortable feeling caused by holding two contradictory ideas simultaneously. The ‘ideas’ or ‘cognitions’ in question may include attitudes and beliefs, the awareness of one’s behaviour, and facts. The theory of cognitive dissonance proposes that people have a motivational drive to reduce dissonance by changing their attitudes, beliefs, and behaviours, or by justifying or rationalizing their attitudes, beliefs, and behaviours.

usability of interfaces. The dimensions of usability assessed using QUE were navigation, presentation, learnability, and task support.

Navigation refers to the methods by which users moved around a system or documentation. Usability research recognises the importance of navigability (Gillan and Bias 2001; Nielsen 2000; Palmer 2002 in Scott 2005). Documentation should be easy to search (Nielsen 1994), so efficiently finding information in the training manuals is not a problem. The manual should facilitate finding, what was needed quickly without too many steps. Effective presentation uses good graphic design principles for fonts, colours, layout, graphics clarity, and white space, while making sure not to distract users from their primary task (Gillan and Bias 2001; Keirnan *et al.* 2002; Nielsen 2000; Palmer 2002; Shneiderman 1998 in Scott 2005). Presentations are organised with tabs, a table of contents, and an index to help with navigation. Structure and organisation facilitate ease of use (Agarwal and Venkatesh 2002 in Scott 2005).

Learning is an important issue for usability (Gillan and Bias 2001 in Scott 2005). Unnecessary technical jargon and confusing acronyms deter learning. Terminology should use the language of its users (Keirnan *et al.* 2002 in Scott 2005). In QUE, learnability was defined as how easy a system was to learn so that users could begin to get their work done quickly. In the QUE study, learnability was applied to how helpful the manuals were to users in learning the ERP system. Documentation should not be too large (Nielsen 1994 in Scott 2005), as a large manual with too many details was likely to cause information overload and hinder learning. Reactions to information overload included frustration and stress. As a result, users might avoid using the manuals. The use of hyperlinks in on-line documentation was a potential solution to information overload. Task support referred to the capability to help users perform their tasks quickly, effectively, and economically (Keirnan *et al.* 2002 in Scott 2005). Documentation should focus on the user's task, and list concrete steps to be carried out (Nielsen 1994 in Scott 2005). The content should be relevant, have the appropriate depth and breadth, and have current and timely information (Agarwal and Venkatesh 2002 in Scott 2005). Tailoring content would be effective for increasing relevance. Navigation, presentation, learnability, and task support dimensions contribute to users' effectiveness, efficiency, and satisfaction. While the terminology sometimes varies, QUE dimensions were analogous to those proposed by other usability experts and researchers (Agarwal and Venkatesh 2002; Gillan and Bias 2001; Krug 2000; Nielsen 1993, 1994, 2000; Palmer 2002; Shneiderman 1998 in Scott 2005).

The majority (290, 91%) of nurses agreed that MEDICOM hospital information system was easy to use whilst very only eighteen (6%) nurses did not agree that the system was easy to use (Question 2.1.) because (Question 2.2.) the giving of medication using the system was not user-friendly. This meant that for most of the nurses surveyed the MEDICOM system was effective and efficient; and most nurses were satisfied with the system, a requirement specified by Dillon and Morris (2001 in Scott 2005). A few nurses could not use the system for its intended purpose without frustration, a point noted by Krug (2000 in Scott 2005). They had to go forwards and backwards on the system when registering patients, ordering pharmaceutical stock, and receiving items from the pharmacy (Figure 16). This meant that the MEDICOM system was legible for most users and confusing to a few in terms of the guidelines of Wimelius (2004). Therefore, the study suggests that the AME International designers should have ensured that the design of the system as well as computer interfaces were usable for all users of MEDICOM system. Users should be able to navigate a system (Gillan and Bias 2001; Nielsen 2000; Palmer 2002 in Scott 2005) that used good graphic design principles for fonts, colours, layout, graphics clarity, and white space (Gillan and Bias 2001; Keirnan *et al.* 2002; Nielsen 2000; Palmer 2002; Shneiderman 1998 in Scott 2005).

Doctors used computers for different clinical tasks. The majority (64, 98%) of doctors used computers for retrieving patient information; sixty-two (95%) for entering patient information; fifty-nine (91%) doctors for test result retrieval; fifty-nine (91%) for word processing; and fifty-one (78%) for literature reviewing (Question 2.4.).

The majority (53, 81%) of doctors were computer literate having taken a computer course. Some (41, 63%) doctors had an average rate of computer skills, about a quarter (17, 26%) of doctors had high rate of computer skills; and very few (4, 6%) doctors had low a rate of computer skills. Only a minority (11, 16%) doctors could write computer programs (Figure 43) (Question 2.4.). The use of computers was widespread; most (61, 93%) doctors used a computer daily and the majority (64, 98%) had access to computers at the IALCH. The next section describes what doctors used a personal computer and computer program (EMR) for.

6.3.6. Electronic Medical Record (EMR)

The Electronic Medical Record is a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting. Included in this information were patient demographics, progress notes, problems, medications, vital signs, past medical history, immunisations, laboratory data and radiology reports. The EMR automated and streamlined the clinician's workflow. The EMR had the ability to generate a complete record of a clinical patient encounter - as well as supporting other care-related activities directly or indirectly via an interface - including evidence-based decision support, quality management, and outcomes reporting (HIMSS 2009).

The findings of the study showed that the majority of doctors always or almost always used a personal computer (37, 57.8%) and computer program such as an electronic medical record (48, 75%) to assist in the review of patients' problems, to seek out specific information from patient records and follow the results of a particular test or investigation. They used them to obtain results from new tests or investigations; enter daily notes; obtain information on investigation or treatment procedures; answer questions concerning general medical knowledge, such as: concerning treatment, symptoms, and complications; produce data reviews for specific patient groups, such as complication rate, diagnoses and so on. Furthermore, the personal computer and the computer program were used to order clinical biochemical laboratory services analyses; obtain results from clinical biochemical laboratory analyses; order X-Ray, Ultrasound, or CT investigations; obtain the results from X-Ray, Ultrasound or CT investigations; order other supplementary investigations; obtain results from other supplementary investigations; and refer the patient to other departments or specialists. The personal computer and the computer program were also used to order treatment directly, such as: medicines and operations, write prescriptions, and sick-leave notes; collect patient information for various medical declarations; collect patient information for discharge reports; and check and sign the printouts of typed dictations (Table 11).

The Electronic Medical Record was the first option doctors in IALCH turned to most of the time even if a paper journal was available, whether they knew the patient (19, 29.7%) or had never seen the patient (15, 23.4%) before (Figure 47) (Question 5.2.). Most doctors (23, 35.9%) seldom consulted the paper journal or used other information sources as they usually turned to the EMR

first (Figure 48) (Question 5.3.). The majority of doctors seldom used paper journals or other information sources. When they used them it was because they either wanted to verify the content of the information (22, 34.4%) or did not find information they wanted in the EMR (27, 42.2%) (Figure 49) (Question 5.4.).

The majority of doctors were satisfied with the content of EMR installed in their department most of the time because it provided them with sufficient information; reports that seemed to be just exactly what they needed; information content that met their needs; and the precise information they needed (Figure 50) (Question 6.1.). They were most of the time satisfied with the accuracy of Electronic Medical Record (Figure 51) (Question 6.2.); the format of Electronic Medical Record (Figure 52) (Question 6.3.) because the clear output was presented in a useful format; the user-friendliness of Electronic Medical Record because the system was easy to use (Figure 53) (Question 6.4.); the timeliness of Electronic Medical Record because the system provided them with up-to-date information they needed in time (Figure 54) (Question 6.5.).

Most doctors agreed, but did not strongly agree, that the EMR system was worth the time and effort required to use it (Figure 55) (Question 7.1.). They all rated their satisfaction (Figure 56) either good (30) or fair (22) but not excellent (with the EMR (Question 7.2.). They agreed that the system increased the ease of performance and the quality of their department's work (Figure 57) (Question 7.3.); and rated the success of the EMR installed in their department as either good (30) or fair (22) (Figure 58) (Question 7.4.).

Taking the user-friendliness of MEDICOM integrated hospital information system into consideration, data was analysed in the next section according to physical features, reliability, dialogue, feed back, user support, handling of user errors, user control, output and training; and it will be interpreted in the same order.

6.4. THE PHYSICAL FEATURES OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM

The physical features of the hospital information system and telemedicine system was discussed in terms of standardised keyboards with function keys and numeric pad, high-speed communications, large character sets and ergonomic design. The physical class of features referred to the devices of information retrieval systems and their facilities. Aspects such as standardised keyboards with function keys and numeric pad, high speed communications, large character sets and ergonomic design were of importance (Geyser 1992:84).

In IALCH the majority (249, 78%) of nurses were satisfied with their workstations and their working space was big enough and very few (19, 6%) nurses were not satisfied (Question 2.12.). Those who were not satisfied said it was because (Question 2.13.) their workstations were limited, not adjustable according to their heights, too small, cluttered, and the desks were too high. Only a minority (51, 16%) of nurses were not sure about their satisfaction about their workstations but they complained that built-in computers made it difficult for them to move the computers around (Figure 19). Although all nurses were happy with their workstations, they complained that they spent most of their time on these workstations which kept them away from patients whom they were trained to provide nursing care to (Focus group 1&2). Overall, their responses implied that workstations in IALCH were in good order.

On the contrary, the workstations of the cashiers were not user-friendly. The common desk¹⁷ they used was high and the chairs too low as a result they preferred to work standing on their feet (Member 6: Observation). This meant that the desks of the cashiers were not at the right level. The floor of their office was carpeted and the chairs did not move smoothly on a carpet hence tiled floor was preferable (Member 7: Observation). There was no doubt that cashiers were not considered when designing their desks hence the ergonomic design of these desks was poor (Kushniruk *et al.* 2004; Beuscart-Z'ephir *et al.* 2002; Geysers 1992:84). Impilo Consortium consulted various specialists from different disciplines in order to ascertain their requirements before finalising the customisation of MEDICOM integrated hospital information system (see Section 2.2). This meant that consultation was done as far as system's development and clinical service points or centres but not the design of the cashiers' office. Because an environment constitutes an

¹⁷ One long built-in desk which the computers were put on.

important factor in the lives of humans (Wimelius 2004) all staff categories in IALCH should have been consulted in regard to the design of their working spaces.

6.5. RELIABILITY OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM

A reliable system could be described as a system which was always in operation when needed. Furthermore the response time of a reliable system had to be fast, the user's data had to be protected and no side or hidden effects should be allowed. A reliable system therefore also implied the hardware was readily available and reliable. Operational features should include auto-start, auto-logout, help and integration and data transfer. Without auto-logout the user had to logon manually in which case as Geysers (1992) argues that 'making a connection to an on-line information system should be easy'. (Geysers 1992: 84). This means that the user should open an information system with a click of a button instead of logging on the system manually. But this will pose a security threat to confidential information and security of the information as discussed in sections 6.3.3. and 6.3.4.

Computers in hospitals perform a wide range of activities, such as processing and storing the data necessary to support daily operations, facilitating clinical and financial decision making, and satisfying internal and external documentation requirements. These computer systems are variously referred to as hospital, health and medical information systems (Ralston, *et al.* 2000:788). It is the people and not the technology alone that determines the operational success of the system (South Africa 2002:25). Therefore, a primary factor in providing high-quality medical care was the expertise of the care provider.

It is hard to imagine health care without information technology. The introduction of IT has radically affected health care organisation, health care delivery and outcome. It seems evident that the use of modern IT offers great opportunities and appropriateness of care. However, there could also be hazards associated with information technology in health care: IT could be inappropriately specified, have functional errors, be unreliable, user-unfriendly, ill-functioning or the environment might not be properly prepared to accommodate the IT in the working processes, leading to sub-optimal support or even to negative effects on patient care.

It was therefore deemed good practice to identify both benefits as well as potential side effects of IT on quality of health care by conducting systematic evaluation studies. Evaluation could be understood as ‘the act of measuring or exploring properties of health information system (in planning, development, implementation, or operation), the result of which informed a decision to be made concerning that system in a specific context (Ammenwerth 2006:16).

With regard to the reliability of the hospital information system and telemedicine system the study found out that the majority (204, 64%) of nurses agreed that MEDICOM integrated hospital information system was always in operation when needed (Figure 21) (Question 2.14.) (Geysler 1992:84) but twenty-eight percent (89, 28%) of nurses disagreed (Question 2.15.). The reasons for disagreeing were that the system was slow and often off-line when needed most or not available at all when it was cleaned up or upgraded; the codes for other surgical operations were not on the system; sometimes computers refused to log the user on; icons did not always appear; sometimes the user could not access notes from the system; sometimes the system failed and only allowed the user to enter information later after restoration; users were unable to record patient’s progress; sometimes the system could not print patient’s transcripts such as a medical certificate; and sometimes the users could not do back ups on-line, they had to print hardcopies. In general, the system was considered reliable because it was a minority (28%) of nurses who made the above-mentioned complaints.

6.6. THE FLEXIBILITY OF THE DIALOGUE OF THE SYSTEM FOR THE USER

Geysler (1992) stated that the dialogue of the system should allow the user to determine and modify its activities while offering him or her more than one alternative of action. The system should cater for different classes of users. The user should be able to choose a specific entry mode from the selection of various modes and it should be possible for him or her to enter data by means of only one stroke (Geysler 1992:84). Thus, the dialogue of the system should be flexible for a user.

According to (Geysler 1992), ‘computer output should be factual, positive and polite’ and the messages should never be hostile to the user. Dialogue should be natural and without computerisms which implies that it should be easy to understand. Geysler (1992) listed the following aspects which were relevant to the tone of dialogue as: (i) avoid library jargon and especially avoid computer jargon; avoid cuteness; and (iii) do not tell users they have done

something wrong. Rather, let the results speak for themselves and provide positive suggestions, and assume that users were in control (Geysler 1992:85).

The majority (284, 89%) of nurses agreed that the dialogue of the system was flexible to them and only twenty-one (4%) nurses did not agree (Figure 22) (Question 2.16.). At the cardiac surgery ward B4 East of IALCH two (2) nurses administered drugs to patients. A nurse had a mobile laptop with the system (Member 12: Observation) and the other had a mobile drug cabinet (Member 13: Observation). They realised that a patient in the ward did not appear on the system. A nurse gave drugs to this patient and wrote a record on a piece of paper (Member 12: Observation). She (a nurse) explained that in order for the patient's details to be restored onto the system, her doctor would have to review her (the patient's) treatment (Member 13: Observation). This meant that the system was not flexible for the nurses who administer drugs to patients. They could not restore a patient who had been deleted from the system and they needed a doctor's intervention.

At the pharmacy there were three (3) types of prescription: the in-patient, out-patient and ward prescriptions. The pharmacy manager and a pharmacist were happy with the pharmacy system they used to control stock and dispense drugs compared to the paper system they were used to. The deputy manager had worked with the pharmacy system which interfaced with the stock control system with the dispensing system for seven years and the system made their work easier. The only challenge were electronic prescriptions in electronic form which were not allowed for medico-legality reasons hence a pharmacist had to print the prescription out for the signature of the doctor who had prescribed that particular drug (Member 14: Observation). This showed that the pharmacy system was not flexible to electronic signature and its practicality and security needed further investigation.

6.6.1. Does the flexible dialogue structure of the system allow the user to back-track, jump forward or terminate a function as he or she wishes?

Flexibility in dialogue structure should allow users to back-track, jump forward or terminate a function at any time they wish. The issuing of demands should not be set in a specific order (Geysler 1992:85).

According to Geysler (1992) (i) the user should have the chance to return or to go on to some distinct points in the procedure (a 'forced jump'); (ii) closing of operations must be possible at (nearly) any moment, and it must be easy; (iii) and at the moment of closing the session, the user should be informed about the time and cost of the session'.

Geysler (1992), referring to information systems, remarked that 'regardless of whether the term 'user-friendly' had any meaning, the concept of flexible and adaptable information systems that could be exploited by a wide variety of users with differing backgrounds and needs were of lasting importance.' As various interpretations of user-friendliness of information systems tended to be subjective in nature, they were not easy to be described in terms of a computerised system. Therefore, it was important to know, who should find the system easy to use? When is a system really easy? And who is the novice? Is the system considered friendly when it is helpful or when it offers no threat to the user or should it be both helpful and non-threatening? (Geysler 1992:80)

An admissions clerk was very fast when administering to repeat patients; it took them on average five (5) minutes to administer to these patients (Member 3: Observation). The system showed an error message because the admissions clerk typed the town where the patient came from incorrectly. The system rejected an incorrect town because the information of the patient was previously captured on her first visit and the admissions clerk corrected the error with ease (Member 2: Observation). This meant that the flexible dialogue structure of the admissions module allowed the user to enter her password and jump forward.

On the contrary, doctors and nurses complained that the MEDICOM system was not flexible enough. There were some challenges about some of its components, for example, a nursing module in the theatre. In this module, one minute after midnight (twelve o'clock) was the beginning of a new day, and the system did not allow nurses to capture time after midnight, for example, 00H30. Another example was if a nurse at theatre entered patient information incorrectly, due to patients' sharing the name and surname, the system did not allow the nurse to edit that information' (Focus Group 2).

Nurses also complained that the system did not allow them to rectify incorrect details about the drugs administered. Drugs were administered to the patient at the ward before the patient was referred to the theatre but when a new drug was administered and entered into the system by another doctor at the theatre; the old drug still appeared on the system as not administered. A theatre nurse said that this created confusion. In order to rectify this, a doctor at the referring ward had to stop the prescribing of the old drugs that were administered to the patient on the system, to allow another doctor at the ICU to administer new drugs (Focus group 2). Doctors in the oncology clinic were able to correct an error message caused by the ordering of the wrong drug (Member 8) and a CT SCAN that had been already ordered (Member 9) on the system by cancelling these orders and then re-ordering (Members 8&9: Observation). This appears to be cumbersome for the user; the system should be re-designed to allow for editing an incorrect order instead of cancelling and re-ordering drugs, images and blood results.

Therefore, the dialogue structure of the nursing system was not flexible enough to allow the theatre nurses to capture time after midnight and edit information; not flexible enough to allow nurses to rectify incorrect details about drugs; the dialogue was not sufficiently flexible to allow doctors to back-track a wrong order and rectify it, instead the system forced them to cancel an order and make a new order.

6.6.2. Consideration of user's needs and abilities when developing a hospital information system and telemedicine system

According to Geyser (1992:84) dialogue flexibility as discussed in the previous section meant that the users' needs and abilities should be taken into consideration. With regard to user support Geyser (1992) was of the opinion that the needs of users should be seriously taken into account when systems were designed. It should not be expected of the user that he or she thinks like a computer but the system should be designed in accordance with the human mode of thinking. Therefore, the user's needs and abilities should have been taken into consideration when developing or customising MEDICOM hospital information system and telemedicine system in IALCH.

On one hand, the majority of nurses (262) agreed and only forty-four (44) did not agree that the user's needs and abilities were taken into consideration when developing a hospital information system and telemedicine system, whilst two hundred and forty-eight (248) nurses agreed and only fifty-nine (59) did not agree that the system allowed them to determine and modify its activities while offering them more than one alternative of action (Figure 23) (Question 2.17).

On the other hand two incompatible systems were used in the oncology clinic at IALCH, for example, LANTIS and the MEDICOM information system. The process was explained by an admissions clerk as follows: she used an oncology system called LANTIS to register patients; scanned a patient's referral letter into the system; opened a folder for a new patient; took the picture of the patient, and captured information into LANTIS. Doctors copied and pasted patient information from LANTIS into MEDICOM and captured the date of a patient's next return on MEDICOM (Member 11: Observation). The two systems were supposed to be integrated and this could have been achieved if the needs and abilities of doctors and nurses in an oncology department had been considered when developing a hospital information system and telemedicine system so as to avoid disintegration of LANTIS and MEDICOM systems as discussed in 6.3.2.

6.6.3. Does the system allow a user to determine and modify its activities while offering him or her more than one alternative action?

A user-friendly system should allow a user to determine and modify its activities while offering him or her more than one alternative of action (Geysler 1992:84). The study found that the majority of nurses (248) agreed and few nurses did not agree that the system allowed them to determine and modify its activities while offering them more than one alternative of action (Figure 24) (Question 2.18).

6.6.4. How would the user describe the commands of the system?

Less strict demands on the part of the computer as far as spelling and punctuation were concerned, should offer relief to the user. As regards user commands, the following points were of importance in the list of characteristics of a user -friendly on-line system such as: (i) the command language should be simple, logical and mnemonic, that is, the syntax and structure of commands should be based on the same principles; (ii) generic commands triggering a set of instructions might be

advantageous; and (iii) the user should have a chance to create his or her own generic commands and save them for later or repetitive use (Geyser 1992:85).

Depending on the needs and sophistication level of the user, the system should allow the user an acceptable mode communication, be it a menu mode, command mode or form filling mode. In addition, the maintenance of an acceptable response time was essential (Geyser 1992:84). The finding of the study was that the majority of nurses (201) described the commands of the system as usable whilst ninety-eight (98) described the commands as easy to use. Very few nurses (9) found it difficult to use the commands. When they logged on, sometimes the system displayed the wrong pin. The system often needed to be rebooted and restarted in order to allow them to enter the data (Question 2.19.). These nurses, therefore, needed to be trained again on the use of the system.

6.6.5. What can the user comment about the system's screen design?

According to Geysers (1992) in relation to screen design: (i) the screens must be kept uncluttered; (ii) a cursor be provided at the spot where user typing will appear, and make that spot consistent from screen to screen; (iii) blinking fields or reverse video should not be used; (iv) the style of the system should be kept consistent; and (v) attention should be paid to the layout as well as content.

In this regard, most nurses (201) commented that the screen was always bright, clear, visible, user-friendly, usable, quick with command¹⁸, logical, well-designed, excellent, perfect, in order, easy to read and understandable, and could accommodate more than one programme at a time. Thus, the screen design did not need any upgrading whatsoever (Question 2.20.).

A few others complained that icons were sometimes present on the screen and sometimes not; other designs were too faint and needed to be changed to brighter colours especially on the menu bars; the screens differed from one another; letters were small and affected the eyes especially for visually impaired people, and the screen was busy (with too many icons scattered all over the screen) at times as it showed icons that were not necessary (Figure 25). This meant that the majority of users were satisfied with the screen design of the system. Users needed to be patient when booting¹⁹ up a computer, sometimes it took a while to show all the icons on the screen as

¹⁸ When the user clicks icons, they open very quickly.

¹⁹ Set the computer on.

some computers were faster than another. Users needed training on how to increase and decrease the brightness and the font of a screen; arrange and re-arrange icons on the screen; and add or delete icons on the screen.

6.6.6. Can the user manipulate the logical operators of the system effectively?

What was of importance here was that not only one command should be considered as the single correct one, but more than one command, if correctly keyed in, should be interpreted by the computer as a correct command. This, of course, would relieve the user from having to memorise strictly prescribed unique words. 'INQUIRY' and 'Q' could, for instance, be interpreted by the system as being synonymous. The novice would most probable type in 'INQUIRY' while the more sophisticated user would key in the letter 'Q'. Less strict demands on the part of the computer as far as spelling and punctuation were concerned, should also offer relief to the user. As regards user commands, the command language must be simple, logical and mnemonic as discussed on 7.6.4. (Geyser 1992:85).

Logical operators (also referred to as Boolean operators AND, OR and NOT) were often handled poorly. The problem could be sidestepped by 'making some of the logic specification implicit so that in many cases users were unaware that they were effectively manipulating logical entities' (Geyser 1992:84).

A nurse in the oncology ward was very happy with the system. She could move between the two systems with ease. She claimed not to experience any challenges except the downtime (Member 10: Observation). An admissions clerk registered two patients, one was a new patient and another was a repeat patient without the system showing any error message at all, when asked for a reason for an error free process, she claimed to know the system in and out. She said error messages popped up when the user captured information incorrectly, otherwise she was very confident with her efficiency (Member 3: Observation). It could happen that some users were fast learners and enjoyed using computers as a result they found out ways and means of manipulating illogical operations themselves.

6.6.7. How long does the system take to feed back the translation of the query to the user?

Feed back could be considered as a sub-category of dialogue, but because a diversity of aspects was of relevance here, it was best considered an independent category. Feed back could mean that the system's translation of the query should be fed back to the user to enable him or her to establish whether he or she was understood correctly. The input should be set in context and should be a mere repetition of the input of the user. Users tended to feel abandoned when they received no response. An interim response should therefore be used to put them at ease when lengthy processing was taking place. Response time was also of importance and should normally not exceed more than two seconds (Geysler 1992:84-85).

The study found that some nurses (169, 52.9%) did not agree that the system took a long time to feed back the translation of the query to the user whilst others (124, 38.9%) agreed and twenty-six (8.2%) nurses did not know whether the system took long to feed back the translation of the query to the user or not (Figure 27) (Question 2.22.). Of one hundred and twenty-four (124) nurses who agreed that the system took long to feed back the translation of the query to the user, fifty-three (43%) nurses confirmed that the system took an average of eleven (11) minutes, twenty-two (18%) nurses took an average of eight (8) seconds, thirteen (10%) took an average of two (2) hours, and thirty-six (29%) did not respond (Figures 28) (Question 2.23.).

There was no major difference (45) between nurses who agreed (124) and those who did not agree (169) that the system took long to feed back the translation of the query to them. Very few nurses (13, 10%) exaggerated the time (two hours) that they wait for a system to respond to their queries. It does not sound possible for a nurse to wait two hours for a feed back translation of a query of any kind.

6.6.8. Does the system point out clearly certain irreversible consequences of some demands by means of feed back to prevent the user from taking incorrect actions?

Data and system's integrity should be protected by feed back in the sense that certain irreversible consequences of some demands should be pointed out clearly by means of feed back to prevent incorrect action being taken by the user. Only after confirmation from the user should specific action be taken by the machine.

This aspect of feed back would be experienced as a safety device, protecting the user from unpleasant consequences (Geysler 1992:84). According to Geysler (1992) (i) the system should always give information that was needed, only the information that was needed, and at the moment when it was needed; (ii) more detailed information must be given on request or if the user has apparently misunderstood a message; (iii) the system should acknowledge the receipt of a command if it was not executed immediately; (iv) It should inform that a command, if given in advance, has been saved for later execution; (v) the user should always be kept informed about the stage of processing; (vi) the system should never let the user wait longer than a few seconds; (vii) if the waiting time was longer, the user should be informed about the expected to time of operations; and (viii) during long waiting times the user should be regularly informed about the progress of operations. The findings of the study showed no evidence where the system pointed out clearly certain irreversible consequences of some demands by means of feed back to prevent the user from taking incorrect actions.

6.7. SUPPORT OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM TO THE USER

Geysler (1992) stated that the user should never be ignored by the system but should be constantly guided and thus be supported by it. The user should never feel deserted. The system should provide sufficient assistance that would also not allow the user to enter illegal commands because the user would be prompted efficiently to enter the correct data. Geysler (1992:84) regarded user support as one of four requirements which she called main features of a user-friendly system. According to her a user-friendly system should not allow the user to get 'lost'. By this requirement it meant that the user should be made aware of the functions which were being performed by the system as well as subsequent action which was to be taken by himself or herself. According to Geysler (1992) an information system (i) should be conversational but instructional at the same time; (ii) use consistent format and technology; (iii) use mnemonic devices whenever possible; (iii) use formats which facilitate understanding of information presented on screen; (iv) eliminate as many steps as possible; (v) be positive in response statements; (vi) be forgiving of errors in entry; (vii) accommodate many user punctuation and spacing inputs; and (viii) provide computer response time averaging three seconds or less'. The study found that the only support of the hospital information system and telemedicine system offered to the user was the technical support and none of the above-mentioned support was applicable.

Geyser (1992:84) stated that the needs of different groups of users should be borne in mind and that the system should be able to accommodate these needs by means of different dialogue modes, search strategies and 'help' instructions and messages. He considered user support as a criterion for user-friendliness. He therefore believed that 'Help' should always be available on-line. The user should be prompted concerning the kind of input that was expected of him. He should also be able to determine at what stage the man-machine dialogue finds itself at any specific moment. According to Geysler (1992), the system (i) should inform the user about the options available, and a suitable option technique should be used (command, menu, YES or NO reply, and so on.). The MEDICOM system had this kind of user support, where doctors could command an order of (a) drugs to the pharmacy and (b) images to radiology department (see Section 5.19.2.) (Focus Group 1&2); (ii) there should always be a default action in case the user did not want or was not able to give a specific command; (iii) the system must yield help when the user asks for it; (iv) it must help spontaneously if the user apparently needs help; and (v) dangerous operations should be protected (for example, command to delete a large file should not be executed without confirmation) – this was discussed in section 6.3.4. The findings of the study found no evidence of user support (ii), (iii) and (iv) mentioned above.

In Stevens' analysis of 'a new approach to the design of the software-interface', he allocated user support to the role of the intermediary in system usage. Two intermediaries were discussed (Stevens 1983:11-13): the technical intermediary and the management intermediary. Technical intermediary referred to the ability of the machine to translate the user's request into the systems inputs. This intermediary played an important role when an IR system was used. The management intermediary, on the other hand, referred to the person who helped the user to formulate his or her request for system use. It was expected that the intermediary would actually carry out the request for the user. As the user was not expected to understand the intricate structure, content and semantics of the database, it remained the responsibility of the system to guide him or her through the available choices to retrieve wanted information. The system had to be able to interpret the user's imprecise and poorly formulated or loosely posed query which often ignored the semantics of the database (Geysler 1992:86).

The study found that about half (158, 49%) the nurses agreed that the system could interpret their imprecise and poorly formulated or loosely posed query; twenty-eight percent (89, 28%) of nurses did not agree that the system could interpret their imprecise and poorly formulated or loosely posed query; and twenty-three percent (72, 23%) of nurses did not know whether the system could interpret their imprecise and poorly formulated or loosely posed query or not (Figure 30) (Question 2.27). Therefore, MEDICOM was not convincing (49%) that it could totally interpret the user's imprecise and poorly formulated or loosely posed query.

Support could also be provided by means of motivation. Increased user motivation could be viewed as an inspiration of user-friendliness. According to Stevens (1983:14) the man-machine interface could be directed towards the use of motivation; maintenance of motivation over time; or assistance to motivated users. The study found that the nurses used the system because it was a hospital requirement; the only tool available for keeping (patient) records; acceptable (they had to accept it) and no other option; user-friendly and efficient; convenient and saved time; fast and reliable; easy to save [store] and reach [retrieve] patient information. Other reasons were that there was always (technical) help when needed; the information was stored safely; information could not get lost and no-one could cheat the system [secured]; it made the user's job easy; the user loved computers; the user gained computer skills; and training was given before using the system; (Question 2.28). This showed that nurses resisted using the system in the beginning and later realised its benefits hence change management was critical in the implementation of any system.

6.8. DESIGN OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM

One of the qualities for user-friendliness discussed by Geysler (1992:84) was the elimination of errors by the design of the system whenever possible. Where errors could not possibly be eradicated, the system should be designed to cope with them and to take remedial action when and where necessary. Some errors could only be detected by the user which necessitates system feed back to the user about its 'understanding' of a query before actually carrying it out. Errors were to be dealt with intelligently. In the case of faulty input of just inputting part of a query the user should, for example, not be forced to re-enter the query in its entirety. Error messages should be simple and should not only clearly state that an error has been made, but should also provide subsequent action which should be taken.

The system should be able to tolerate minor errors or clarify the user's intentions by means of constructive and intelligent dialogue. Remedies should be offered by the system in the case of more serious errors. According to Geyser (1992) the system should advise the user and inform him or her about the options available in case of error or potential error; and messages, warning and error signals should be clearly distinguished, they must not be vague (for example, 'ERROR DETECTED' or 'ERROR CODE D901')'.

In one case, an error message popped up when an admissions clerk was registering a repeat patient, a child. The reason for the error according to the admissions clerk, was that the mother of the child did not bring the child identifier and the system did not recognise the patient. In order to continue, an error message gave her an option to override the system by putting in her own password (Member 2: Observation). In another case, three cashiers were using the system to collect revenue from patients at the revenue collection department. They seemed comfortable with the system except for one error message that popped up when the cashiers erroneously selected a wrong settlement type, for example; cash, cheque, credit or partial transaction. There were three categories of patient fees according to salary scale²⁰.

Patients who were unemployed did not fall in the above-mentioned categories; they received healthcare service free of charge. The revenue manager indicated that it was very difficult to deal with partial payments, for example, if a patient had a balance of R7 from the previous account, and an outstanding amount of R194 from another account. The system could only allow the user to print one account individually at a time. This was time consuming especially if the user had to print more than two (2) accounts. The problem was reported to the Consortium who said the problem 'could not be resolved' (Member 5: Observation). Therefore, the billing module of MEDICOM hospital information system was poorly designed in an unacceptable way.

²⁰ As explained by the revenue manager.

6.9. CONTROL OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM AND TRANSPARENCY

On one hand, the user should be in control of the system. This means that the user should have a mental model of the system as a result of sufficient information being at his or her disposal. The user would thus have a workable understanding of the system (Geysler 1992:84). The user should also be able to determine the time and cost of an expensive operation before the execution thereof (Geysler 1992:85). On the other hand, the system could be considered as a transparent system if it enabled the user to form a clear mental picture (model) of its functioning and if it behaved in a predictable manner. According to Geysler (1992) the user could form a consistent model of a system that was not burdened with unnecessary layers of information, if the user was not confronted with complicated and unnecessary functions, if the behaviour of the system was predictable, and the vocabulary for different dialogue modes is consistent.

The study found that the majority (213, 67%) of nurses agreed that they did have control of the hospital information system and transparency; and just less than a quarter (74, 23%) of nurses disagreed that they had control of the hospital information system and transparency (Figure 31) (Question 2.29). The reasons were that some files or information could not be accessed; access to many modules was denied; it was not right to have access to all patients' information; the user could not access his or her own folder; access control was limited to authorised people, for example, AME International; some of the icons on the desktop were not accessible to anyone; sometimes Internet and E-mail systems were not available; there was no confidentiality of staff information; there was no option to hide information on the system, especially if a staff member was admitted; sometimes it took a too long to log-in; and transparency was limited to management (Question 2.30).

The majority (287, 90%) of nurses agreed that they did have a workable understanding of the system; whilst very few (11, 3%) nurses did not agree that they had a workable understanding of the system (Figure 32) (Question 2.31). Most (261, 82%) nurses agreed that they could form a clear mental picture (model) of the functioning of the system and very few (26, 8%) of nurses did not agree that they could form a clear mental picture (model) of the functioning of the system (Figure 33) (Question 2.32).

Furthermore, the study found that the majority (250, 78%) of nurses agreed that the system behaved in a predictable manner, whilst few (37, 12%) nurses did not agree that the system behaved in a predictable manner (Figure 34) (Question 2.33.).

6.10. THE OUTPUT OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM

Geyser (1992) stated that input, output and stored data need no longer be identical, as it had been in the case of manual or mechanised systems. As stated, output data could vary in a similar fashion to input data. Output could be presented in more than one form in terms of layout. The form of output layout need no longer be rigid as was the case before the advent of computers. Although many of the basic rules should still prevail (for example, related data should be grouped together, important data should be placed prominently, and layout should enforce orientation) the user should be able to choose a form other than default. Short, standard and full variants had become possibilities (Geyser 1992:85).

The finding of the study revealed that the majority (256, 80%) of nurses was happy with the output of the hospital information system in terms of layout and few (35, 11%) nurses were not happy with the output of the hospital information system in terms of layout (Figure 35) (Question 2.34.). Most (232, 73%) of nurses agreed that the output could be presented in more than one form and few (45, 14%) nurses disagreed that the output could be presented in more than one form (Figure 36) (Question 2.35.).

The standard form was a default form while other variants of the form could be explicitly or indirectly chosen by the user (Geyser 1992:85). The majority of nurses (206, 64.6%) agreed that there was a standard default form and sixty-five (65, 20.4%) nurses disagreed there was a standard default form (Figure 37) (Question 2.36). Some nurses (158, 49.5%) chose a form other than the default whilst other nurses (106, 33.2%) did not choose a form other than the default (Figure 37) (Question 2.37).

6.11. TRAINING ON THE USE OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM

The most critical component of a hospital information system is the end users – the health care providers and the patients (Bashshur *et al.* 2002:26-7). It is the people and not the technology alone that determines the operational success of the system (South Africa 2002:25). Therefore, a primary factor in providing high-quality medical care is the expertise of the care provider. One factor is the quality of training available and expert skills did not come cheap (Medenis 1997). In terms of success or failure of a system, in the spectrum between efficiency on the one hand and costliness on the other, the user's view is also the one aspect which is most frequently overlooked. Too often users are taken for granted, and system experts forget that the prime focus of expertise of the end users of health systems is elsewhere - for instance, in nursing or medicine. Secondly, accommodating the individualised needs of users in the specification process, education and training of users in the implementation process, are both expensive activities (Rigby 2006).

Siemed Services (Pty) Ltd mandated that a program be provided to ensure that all IALCH employees were thoroughly trained in the operation of appropriate equipment, associated risks, and appropriate procedures to follow when medical equipment failed. Siemed Services (Pty) Ltd provided and managed a training program for the initial and ongoing training of operators of all medical equipment as supplied by Siemed Services (Pty) Ltd, for the period of the contract. The program incorporated mechanisms to ensure that employees remain competent with respect to the operation of equipment that they were using on daily basis. All employees of IALCH completed appropriate training during orientation on medical equipment they were expected to operate as employees. The frequency of re-training was determined by the frequency with which the employee used the medical equipment and by episodes of improper operation of equipment (see Section 2.4 3.).

The study found that the most nurses (260, 81.5%) had been trained in the use of the hospital information system and telemedicine system and very few (31, 9.7%) had not been trained (Table 10) (Question 2.38.). Their training needs related to the use of the hospital information system and

telemedicine system were basic computer literacy; the telemedicine system; the pharmaceutical module; the theatre module; comprehensive training; a refresher training course on new developments; hospital document and patient records; patient assessment; ordering of drugs recording; more training on the system; on-going in-service training on the MEDICOM system; adequate training before using the system; how to log in and out on the system to assess information and to sign a document electronically, as well as how to add more information? (Question 2.39.)

The majority of nurses (243, 76.2%) agreed that the information in the training manual was complete and very few nurses (29, 9.1%) disagreed (Question 2.40.). Most nurses (259, 81.2%) agreed that the role-based training would provide knowledge integration and better mapping of their needs and few nurses (20, 6.3%) disagreed (Question 2.41.). The majority of nurses (256, 80.3%) agreed that a training manual would increase perceived usability, especially learnability and task support and few nurses (23, 7.2%) disagreed (Question 2.42.). Most of the nurses (270, 84.6%) agreed that the training-related content was organised, of which two hundred and four (63.9%) nurses agreed that the content was either the download by chapter or the entire manual (Question 2.43.); very few nurses (19, 5.9%) disagreed that the training-related content was organised (Question 2.44.).

The majority of nurses (220, 68.9%) agreed that the on-line version of the manual included advanced search capabilities so that they could easily find the help they needed whilst sixty (3.5%) nurses disagreed (Question 2.45.). Most nurses (231, 72.4%) agreed that the use of colour-coding, tabs, more section breaks, and a good layout for the table of contents and index improved the presentation of the printed documentation and only thirty-three (10.3%) nurses disagreed (Question 2.46.). The majority of nurses (218, 68.3%) agreed that the manual gave users more control over information overload and fifty-six (17.5%) nurses disagreed (Question 2.48.).

Therefore, it is extremely important for information technology companies to ensure that the hospital information system is user-friendly before they implement it, for example, (i) users must be able use the system without experiencing major difficulties that will hinder them to deliver patient healthcare service. The user should be able to fix the minor problems himself or herself; (ii)

The physical features of the information system are of good quality in terms of standardised keyboards with function keys and numeric pad, high-speed communications, large character sets and ergonomic design; (iii) the information system is reliable, that is, it is always in operation when needed; (iv) user's requirements are considered before, during and after the development of the information system; (v) users must have control of the information system; (vi) the output of the information system should be flexible in terms of layout; and (vii) the training needs relating to the use of information system and telemedicine system must be addressed. The recommendations regarding the implementation of the hospital information system and telemedicine system in a hospital will be discussed next.

6.12. RECOMMENDATIONS REGARDING THE IMPLEMENTATION OF THE HOSPITAL INFORMATION SYSTEM AND TELEMEDICINE SYSTEM

With regard to the implementation of the MEDICOM system in IALCH and the rollout of the system and telemedicine system to other institutions in KwaZulu-Natal the study found that the majority (240, 75%) of nurses recommended that MEDICOM system could be rolled out to other institutions in KwaZulu-Natal, but the system should be improved first whilst very few (32, 10%) of nurses did not recommend the rollout and fifteen percent (47, 15%) of nurses did not know (Question 2.50). The following improvements were recommended (Question 2.49):

6.12.1. Confidentiality

Confidentiality especial on diagnosis should be improved; confidentiality in drug administration to be maintained and staff files should be kept confidential.

6.12.2. Information Technology

More computers were needed; all nurses should have access to scanned images or documents and X-Rays; and the latest technology should be implemented.

6.12.3. Telecommunications

All users of the system must have access to Fax, E-mail, Intranet, and Internet.

6.12.4. Training

Training manuals should be provided at all work stations; new personnel should be trained thoroughly; and there should be an ongoing training, for example, in computer literacy, with hospital information system refresher courses every month and advanced training on the MEDICOM system.

6.12.5. New developments

The following developments were recommended, for example, a clocking system for nurses, electronic signature for nurses, speed and accuracy of the system, inclusion of all staff names in the system, easy update of information, flexibility of the system (if the user ticks the incorrect medication by mistake, he or she should be able to rectify the mistake), more attention should be given to patient care than note taking, the system should retain information during downtimes, a back-up system should be improved to prevent data lost during downtimes, specific programmes should be developed for specific specialties and users should be consulted for any new development.

6.12.6. Other

It was observed that patients did not want to divulge their employment status. They claimed to be unemployed in order to avoid payment of patient fees since unemployed patients were exempted even though their partners were either working or had their own companies. The Department of Labour should verify patient information before they complete and sign the letter confirming patient' unemployment status (Member 1: Observation).

6.13. SUMMARY

This chapter discussed the interpretation of the findings of the research study in terms of user-friendliness of MEDICOM integrated hospital information system; physical features of the hospital information system and telemedicine system; the reliability of the hospital information

system and telemedicine system, the dialogue flexibility, that is, whether the users' needs and abilities were taken into consideration when developing the hospital information system and telemedicine system; time taken by the functionalities of MEDICOM integrated hospital information system and telemedicine system in improving patient service delivery in IALCH; the effectiveness of MEDICOM integrated hospital information system using telemedicine; whether users have control of the hospital information system and telemedicine system; the output of the hospital information system and telemedicine system in terms of layout; the training needs relating to the use of MEDICOM hospital information system and telemedicine system; and recommendations regarding the implementation of the hospital information system and telemedicine system in a hospital and the rollout of the system to other institutions in KwaZulu-Natal. The next chapter will summarise the study findings, conclusions and recommendations.

CHAPTER SEVEN: SUMMARY OF STUDY FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

7.1. INTRODUCTION

Computers in hospitals perform a wide range of activities, such as processing and storing the data necessary to support daily operations, facilitating clinical and financial decision making, and satisfying internal and external documentation requirements. These computer systems are variously referred to as hospital, health and medical information systems. The term hospital information system (HIS) encompasses both patient care and patient management systems, which support healthcare delivery, and the financial and resource management systems, which support the business and strategic operations of the hospital. The core HIS applications perform basic hospital information functions, including patient registration and administration, discharge, and transfer (ADT). Other components of a HIS perform a variety of clinical and operational tasks and these include the pharmacy system, laboratory system, and radiology information system (Ralston, *et al.* 2000:788).

A hospital information system is a comprehensive information system dealing with all aspects of information processing in a hospital. This encompasses human (and paper-based) information processing as well as data processing machines. It is an integrated, computer-assisted system designed to store, manipulate and retrieve information concerned with the administrative and clinical aspects of providing services within the hospital (Centc251 2006). Telemedicine is the remote communication of information to facilitate clinical care. The exchange of information can be accomplished using voice, image, or data. Telemedicine enables the use of telecommunications technology for medical diagnosis and patient care when the provider and client are separated by distance. Telemedicine includes pathology, radiology, and patient consultation from a distance (Texas A&M University 2006). The mission of the South African Telemedicine System is to facilitate the provision of high quality and cost effective health care to all the citizens of South Africa (South Africa 2002:14). The role of a hospital information system in telemedicine is dependent on using the power of the computerised database to use the epidemiological and statistical information in the database to improve decision making and ultimately patient care. The computer is also a powerful tool for facilitating the standardisation and monitoring of patient care. When applied in continuous quality improvement methodology a computer can enhance the improvement process well beyond what can be done by hand. By coupling a hospital information

system with telemedicine allows sophisticated hospital information systems to be applied in remote areas (Clemmer 1995).

The study investigated the user-friendliness of a computerised hospital information system with implemented telemedicine system in the Inkosi Albert Luthuli Central Hospital. These computerised information systems in IALCH were in contrast to the traditional systems used in King Edward VIII, Wentworth and other public hospitals in KwaZulu-Natal province, with the exception of Addington Hospital which uses the MEDITECH hospital information system. King Edward VIII hospital has been a central hospital for KwaZulu-Natal, and an academic hospital for the Nelson Rolihlahla Mandela School of Medicine. Between 1989 and 1990 after the hospital information system became obsolete, the Informatics Section of the Department of Health developed a Patient, Administration and Labelling System (PALS) that was first implemented in King Edward VIII Hospital. The expansion of this hospital has been impossible due to lack of space where this hospital is located. Prior to 1994 KwaZulu-Natal was the only province out of four (Transvaal, Cape, Orange Free State and KwaZulu-Natal) without a modern central hospital. Therefore, a decision was taken by the previous Government to identify and buy a site for the development of a new central hospital. The new democratic government stalled the process and then decided to proceed with the original plan of building a new central hospital for the KwaZulu-Natal province. Thus, the Inkosi Albert Luthuli Central Hospital admitted the first patient on the 28th July 2002 and it was officially opened in the same year as a highly technological hospital in terms of medical equipment, information system and information technology as well as service delivery. The decision of implementing MEDICOM integrated hospital information system in IALCH was taken by the Provincial Department of Health and supported by the National Department (Van der Merwe 2002).

The vision of Inkosi Albert Luthuli Central Hospital is to provide world-class tertiary and central hospital services. Its mission is to ensure the highest possible quality of tertiary and central services healthcare, through the provision of first class facilities and services, provided by trained and competent people working together, always putting the needs of the patients first. The hospital is managed by a Senior Management Team (see Figure 1) and the Impilo Consortium Management Team. The main management meetings are the Senior Management Team Meeting (SMT Meeting) and the Joint Committee Team Meeting (JCT Meeting). The hospital has a unique management structure to ensure efficiency and effectiveness in the delivery of services. There are six domains

(see Figure 2) providing various services (see Table 9) in this hospital, each headed by the Domain Manager assisted by the Business Manager and the Nurse Manager.

Inkosi Albert Luthuli Central Hospital provides a tertiary or quaternary service to patients and ensures that the patients arriving at IALCH are attended to. All patients are accepted via an electronic appointment and booking system. The hospital recognises the need to render treatment to patients in an emergency situation, and even if they are not in possession of a referral note, the patient is referred to the Medical Emergency Department where treatment will be rendered. If the patient's condition warrants an admission the patient will be admitted to IALCH and if the patient's condition warrants stabilisation the patient will receive treatment and then be referred back to a step down hospital. Inkosi Albert Luthuli Central Hospital is striving to be paperless and it is the first hospital in country and on the entire continent of Africa to adopt this concept. Some of the medical specialists and nursing staff in this hospital were drawn from the traditional King Edward VIII and Wentworth hospitals in phases. The staff transferred to IALCH were first acquainted with state-of-the-art equipment through intensive training until they could use it efficiently. The working environment in King Edward VIII was totally different from that of IALCH. The former had no computerised patient-based hospital information system (HIS) whilst the latter had a system namely MEDICOM. In IALCH, the radiology information system (RIS) was interfaced into the HIS using Picture Archiving and Communication Systems (PACS) for storing and forwarding images to any computer in the hospital, that is, any authorised user would access patient radiological images in her or his computer instantly. The system allowed users to diagnose or examine images, write and send medical reports electronically.

The aim of implementing the MEDICOM hospital information system in Inkosi Albert Luthuli Central Hospital was stipulated in Chapter Two as to: (a) Improve patient care by (i) making information belonging to patients seen at other departments available at the hospital where the patient was being treated, (ii) improving the accessibility of patient related information to health care professionals during the treatment process, through improved medical record handling and shorter turnaround time for the release of diagnostic information such as laboratory and special investigation results, and (iii) improving patient administration procedures resulting in shorter waiting times and better service to patients; (b) Form an integral part of a larger quality improvement program in the hospital through the re-engineering and standardisation of patient

administration and management procedures across departments; (c) Improving the management efficiency of hospitals through (i) improving revenue collection, (ii) improving management decision-making through the availability of integrated management information, and (iii) cost savings through the identification of primary cost-drivers at hospital level and the monitoring of mechanisms introduced to lower costs.

The research issues that the study addressed are explained. The problem with the Hospital Information System (HIS) implemented in IALCH is that doctors have difficulties in accessing the X-Ray images; ordering drugs, making patient notes, and accessing patient records at a later date in the format they want. This raises the following questions: How doctors have adapted to change from traditional to a computerised Hospital Information System implemented in IALCH? Have nurses adapted to a HIS change? How user-friendly is the HIS at IALCH? Has the level of training been adequate?

Humans are the most important factor as far as the environment of information systems is concerned. Systems should be geared towards accommodating the needs of their potential users. The human factor demands systems to be user-friendly. User-friendliness of an information retrieval system is determined by the following categories: (i) Physical features – devices of IR systems and their facilities. For example, standardised keyboards with function keys and numeric pad, high-speed communications, large character sets and ergonomic design; (ii) Reliability of the system – a system which is always in operation when needed; (iii) Dialogue – a system should allow the user to determine and modify its activities while offering him or her more than one alternative of action; (iv) Feed back – the system translation of the query should be fed back to the user to enable him or her to establish whether he or she was understood correctly; (v) User support – the user should be constantly guided and thus be supported by the system; (vi) Handling of users errors – the design of the system should eliminate errors whenever possible, tolerate minor errors and offer remedies in case of serious errors; (vii) User control of the system and transparency – the user should be in control of the system and the system should enable the user to form a clear mental picture (model) of its functioning; and (viii) Output – should be presented in more than one form and the user should be able to choose a form other than the default (Geysler 1992).

With the MEDICOM integrated hospital information system in IALCH data was captured in Patient Registration, Appointments Scheduling, Out-patients Management, Trauma, In-patients Management, Medical Records and Patient Billing by clerks, secretaries, doctors and nurses.

Human factor issues in clinical applications are critical, and they need to be emphasised in any future research agenda. An improved and comprehensive understanding pertaining to technology-based barriers for patients and providers in clinical telemedicine was needed. In order for an implementation of a hospital information system and telemedicine system to be successful, three aspects should be considered, that is, the hardware, software and humanware. Hardware refers to computers, printers and file servers; software refers to applications, programs and systems installed in computers; and humanware refers to the users of software. The users are the key in the implementation of any system. They need to understand the entire system; therefore they should be trained properly on the system. Therefore, this research study assessed the human-technology interface at IALCH in an effort to reduce technology-based barriers for providers and patients.

Doctors and nurses were transferred from the traditional culture of hospital information system (paper) in King Edward VIII and Wentworth hospitals to a computerised and integrated hospital information system (paperless) in IALCH. The information technology of the two (2) environments was different. The study determined the extent to which the MEDICOM integrated hospital information system was user-friendly, appropriate and productive in improving patient outcomes. Therefore, there was an important need to investigate the effectiveness and efficiency of telemedicine in relation to its participation in health and health care-related activities.

The purpose of the study was to assess the user-friendliness of a hospital information system within a telemedicine context at Tertiary Inkosi Albert Luthuli Central Hospital in order to achieve the broad objective of developing a model for managing the implementation of these systems in the province. The objectives of the study were:

- 1) To assess the user-friendliness of MEDICOM integrated hospital information system.
- 2) To describe the physical features of the hospital information system and telemedicine system in terms of standardised keyboards with function keys and numeric pad, high-speed communications, large character sets and ergonomic design;

- 3) To describe the reliability of the hospital information system and telemedicine system, that is, are the systems always in operation when needed?
- 4) To determine the dialogue flexibility, that is, whether the users' needs and abilities were taken into consideration when developing the hospital information system and telemedicine system;
- 5) To assess time taken by the functionalities of MEDICOM integrated hospital information system and telemedicine system in improving patient service delivery in IALCH;
- 6) To assess the effectiveness of MEDICOM integrated hospital information system using telemedicine compared to the traditional and/or manual hospital information system in Wentworth and King Edward VIII hospitals.
- 7) To determine whether users have control of the hospital information system and telemedicine system. This means the system should enable the user to form a clear mental picture (model) of its functioning and not confront the user with complicated and unnecessary functions. The users should have a workable understanding of the system;
- 8) To ascertain the output of the hospital information system and telemedicine system in terms of layout;
- 9) To ascertain the training needs relating to the use of MEDICOM hospital information system and telemedicine system; and
- 10) To make recommendations regarding the implementation of the hospital information system and telemedicine system in a hospital and the rollout of the system to other institutions in KwaZulu-Natal.

The conceptual framework and literature review of the study was presented in Chapter Three (3), looking at the need for a hospital information system and the framework around user-friendliness of a hospital information system. Scientific studies of provider (both consulting and referring) performance were needed to determine which technologies are useful and workable and how existing ones could be improved. The more mature clinical telemedicine applications had brought to the forefront another area of research that is crucially important, namely the evaluation of how the clinician interacts with the digital display and the impact of this new modality on diagnostic performance. The most critical components of a hospital information system are the end users – the health care providers and the patients (Bashshur *et al.* 2002:26-7). Building upon previous studies the purposes for which the literature was used in the current study was addressed and then the paradigm shift that had occurred in hospital information systems was shown. The purpose of

building upon earlier research clarified which research had previously been carried out that provide answers to the research questions, to establish if this research was needed and to choose an appropriate methodology for the research (Ngulube 2003:29).

The effectiveness and efficiency of the MEDICOM hospital information system and telemedicine system at IALCH was investigated using Geysers' (1992) framework for a user-friendly information system and frameworks from Coiera *et al.* (2006), Rigby (2006) and IMIA (2006). Insights were gleaned from the contributions of Darbyshire (2000), and the more recently available research of Paré *et al.* (2006) and Gagnon *et al.* (2006). The population of the study were seven hundred and eighty six (786) doctors and one thousand eight hundred and sixteen (1816) nurses working at Inkosi Albert Luthuli Central Hospital. Pertinent questions regarding the user-friendliness of the MEDICOM hospital information system and telemedicine system were addressed and answered. Based on surveys by questionnaire survey, focus group interviews and observation the factors that affect the user-friendliness of MEDICOM hospital information system and telemedicine system were identified.

The research design, methods and procedures utilised in the data collection of this study were presented in Chapter Five (4). For example, the difference between qualitative and quantitative design in research was discussed. The use of questionnaires, focus group interviews and observation as the research techniques to obtain information about the user-friendliness of a computerised hospital information system within a telemedicine system as implemented in the Inkosi Albert Luthuli Central Hospital, as well as procedures regarding the verification, collection and analysis of data, were addressed. Firstly, the researcher sent questionnaires to all doctors and nurses in IALCH in order to gather some views about user-friendliness of MEDICOM integrated hospital information system. The researcher used this information to construct the questionnaire he used to collect data. Secondly, the researcher used focus group interviews for doctors and nurses, and thirdly observation technique (triangulation²¹) to carry out a prospective analysis to determine the user-friendliness of the hospital information system and telemedicine (Jithoo *et al.* 2003). The researcher observed the doctors and the nurses as they used the system. Subsequently

²¹ This is a multi-method approach where three or more methods are used in combination principally as a check of validity and results compared for convergence (Mays and Pope 1995:44). Using more than one method to study the same thing. For example, if you were interested in people's attitudes toward environmental issues, you could look at patterns of voting behaviours for environmental candidates and issues; or you could interview leaders of the Sierra Club, the Nature Conservancy, and similar groups; or you could conduct a survey of a representative sample of the entire population. Or you could do all three and put the results together, in which case you could say that you had used a research strategy of triangulation. Available at <http://www.etr.org/recapp/research/researchglossary.html> (Accessed 29 December 2006).

to that some questions were asked from them relating to their involvement in the customisation of the system, the user-friendliness of the system, the training needs relating to the use of the system, and recommendations regarding the implementation and the rollout of the hospital information system and telemedicine system to other institutions in KwaZulu-Natal (Whitten and Rowe-Adjibogoun 2003).

In interviewing, the researcher kept records so that the report he wrote would be based on accurate renditions of what was said. The data collection instruments were pre-tested on doctors and nurses in Addington hospital, which also had a computerised hospital information system called Meditech, to determine the accuracy and understandability of items. The instrument pre-testing was important to make necessary improvements by removing ambiguities in the tools before going to the real survey (Bright 1991).

According to Tesch (1990 cited in Creswell 1994:153-7) the process of data analysis is eclectic; there is no 'right way'. Data analysis required that the researcher be comfortable with developing categories and making comparisons and contrasts. It also required that the researcher be open to possibilities and see contrary or alternative explanations for the findings. The data was analysed manually using first content analysis and then a coding system, that is, grouping interviewees' responses into categories that bring together similar ideas, concepts, or themes. Subsequent to the data manual analysis data was input into the computer and analysed. The results were organised according to the themes of the research, that is issues that were raised in section 1.3.2. of Chapter One. The findings were presented as descriptions and symbolic representations such as tables, bar graphs (histograms), pie charts and figures. Finally, the findings of the study were used to develop recommendations, refine and improve the IALCH model.

This chapter explained how the study was conducted, that is, what was done in order to collect data to answer the research question. Its major aim was to aid the reader in replicating the study as in the original if need be as well as to help other researchers to estimate how much confidence could be placed in the findings. Furthermore, it had to be possible for other researchers to compare the procedures with methods used in similar studies and explain the differences in findings among studies on the user-friendliness of MEDICOM integrated hospital information system, the physical features of the hospital information system and telemedicine system, the reliability of the hospital information system and telemedicine system, the dialogue flexibility, the hospital information system and telemedicine system supporting users, users handling errors in the

hospital information system and telemedicine system, users controlling the hospital information system and telemedicine system, the output of the hospital information system and telemedicine system in terms of layout, and the training needs relating to the use of the hospital information system and telemedicine system in terms of the differences in research methods.

It was found by Smith (1997:247) that ‘most computer software today was unnecessarily difficult to understand, hard to learn, and complicated to use’; ‘difficult to use software wastes the user’s time, causes worry and frustration and discourages further use of the software’. Responding to a question why ‘the usability of most computer software was so poor?’ The response was that ‘in spite of a recent acknowledgement that usability was an important part of software quality; it had remained a fuzzy concept’ (Smith 1997:247). So many developments have taken place in the IT since Smith (1997:247) but still the problems remain. The problem with the Hospital Information System implemented in IALCH was that doctors had difficulties in accessing the X-Ray images; ordering drugs, making patient notes, and accessing patient records at a later date in the format they required. This raised the following questions: how had doctors and nurses adapted to change from a traditional to the computerised Hospital Information System implemented in IALCH? How user-friendly is the HIS at IALCH? Had the level of training been adequate?

However, computers in IALCH performed a wide range of activities, such as processing and storing the data necessary to support daily operations, facilitating clinical and financial decision making, and satisfying internal and external documentation requirements. The MEDICOM hospital information system encompassed both patient care and patient management systems, which supported healthcare delivery, and financial and resource management systems, which support the business and strategic operations of the hospital. The core HIS applications performed the basic hospital information functions, including patient registration and administration, discharge, and transfer (ADT). Other components of the MEDICOM hospital information system performed a variety of clinical and operational tasks and these include the pharmacy system, laboratory system, and radiology information system (Ralston, *et al.* 2000:788).

Telemedicine is the remote communication of information to facilitate clinical care. The exchange of information between doctors and nurses in IALCH was accomplished using voice, image, or data. The role of a hospital information system in telemedicine is dependent on using the power of the computerised database to use the epidemiological and statistical information in the database

to improve decision making and ultimately patient care.

Therefore the computer is also a powerful tool to facilitate the standardising and monitoring of patient care. When applied in a continuous quality improvement methodology the computer can enhance the improvement process well beyond what can be done by hand. Then coupling of the MEDICOM hospital information system with telemedicine allowed sophisticated hospital information systems to be applied in remote areas (Clemmer 1995). For rural, remote or isolated regions, tele-health is considered as a tool that could exert a positive impact on several dimensions of health care services delivery. For instance, tele-health can support the delivery of specialised services in a timely fashion for remote populations, facilitate access to education for clinicians, and save travel costs for patients and professionals. Moreover, as tele-health technologies become more integrated into the health care system, they could increasingly contribute to the reorganisation of medical workforce supply and exert a profound influence on physician practice, especially in remote areas. Tele-health has the potential to improve work satisfaction by providing easier access to continuing education and facilitating contacts with colleagues. Access to CME has been associated with higher satisfaction at work and better quality of care and could be a factor of physician retention in rural and remote areas. These findings can support decision-making with respect to the diffusion of tele-health services in remote regions (Gagnon *et al.*'s 2006).

The study revealed that the nursing, pharmacy and billing modules of MEDICOM hospital information system were not user-friendly, but the system was reliable and always in operation when needed. The users could manipulate the logical operators of the system effectively, generally could control the system and handle errors. They were happy with the output of the hospital information system in terms of layout. However, the system provided technical support only and users wanted more training on the system.

The study was confined to the user-friendliness of the MEDICOM integrated hospital information system in Inkosi Albert Luthuli Central Hospital. It was limited to doctors and nurses. It did not cover staff members in the administrative and technical offices. Inkosi Albert Luthuli Central hospital was chosen because it was the only paperless hospital in the country as far as integrated hospital information system was concerned. As with all surveys, the generalisability or external validity of these findings beyond South Africa depended on the logic of replication (Campbell and

Stanley 1963:30; Kaplan 1964:23). That is, to the extent that additional future studies replicated these findings in other environments, one could have confidence that the results were generalisable. It was important to emphasise that the survey data would form an important baseline for shaping and formulating further study on the design of a hospital information system for other hospitals. The assumption was that trained and skilled staff was the key to effective hospital information systems.

The study covered the user-friendliness of the hospital information system and telemedicine system at Tertiary Inkosi Albert Luthuli Central Hospital. The anticipated problem was that since hospital information systems and telemedicine were new and complex concepts, the researcher struggled to get literature relevant to this research study. The research studies conducted in this field were very limited.

The basic assumption and logic underlying the potential contribution of a computerised hospital information system and telemedicine in Inkosi Albert Luthuli Central Hospital were: accessibility enhancement, cost containment and quality improvement. In theory, access to specialty would be available regardless of the relative location of the patient, a potentially great benefit to the patient. Technological advances in testing, diagnosis, and treatment produced significant improvements in health, not however, without increased cost. The ready availability of extensive information about information in electronic form and reliance on efficient information technology might enhance efficiency and coordination of care. A hospital information system and telemedicine could serve as a highly effective tool for clinical decision support for all providers (Bashshur *et al.* 2002:6-7).

The lack of information technology policies was one of the major obstacles to the effective planning of health services in South Africa; the system model that developed from this study was expected to contribute to the development of information technology policies and legislation regarding the implementation of a hospital information system and telemedicine in South Africa. Thus, this study could inform projects for future developments and help the Department of Health to rollout an integrated hospital information system to other hospitals in the KwaZulu-Natal, South Africa and Southern African Developing Countries (SADEC).

This chapter will discuss the conclusions about the research questions; the conclusions about the research problems; the implications for theory; the implications for policy and practice; the limitations; and the implications for further research.

7.2. CONCLUSIONS ABOUT RESEARCH QUESTIONS

The research questions were developed from the objectives of the research study which are to assess the user-friendliness of MEDICOM integrated hospital information system; describe the physical features of the hospital information system and telemedicine system in terms of standardised keyboards with function keys and numeric pad, high-speed communications, large character sets and ergonomic design; describe the reliability of the hospital information system and telemedicine system, that is, whether the systems are always in operation when needed; determine the dialogue flexibility, that is, whether the users' needs and abilities were taken into consideration when developing the hospital information system and telemedicine system; assess time taken by the functionalities of MEDICOM integrated hospital information system and telemedicine system in improving patient service delivery in IALCH; assess the effectiveness of MEDICOM integrated hospital information system using telemedicine compared to the traditional and/or manual hospital information system in Wentworth and King Edward VIII hospitals; determine whether users have control of the hospital information system and telemedicine system. This means the system should enable the user to form a clear mental picture (model) of its functioning and not confront the user with complicated and unnecessary functions.

The users should have a workable understanding of the system; ascertain the output of the hospital information system and telemedicine system in terms of layout; ascertain the training needs relating to the use of MEDICOM hospital information system and telemedicine system; and make recommendations regarding the implementation of the hospital information system and telemedicine system in a hospital and the rollout of the system to other institutions in KwaZulu-Natal.

The humanware is the most critical factor compared to the software and hardware in the implementation of hospital information systems in South Africa. The hardware cannot function without the software and the software cannot function without the humanware, but the humanware can function without both the software and the hardware as was the case in the traditional culture of hospital information system in King Edward VIII and Wentworth hospitals. The human factor demands systems to be user-friendly. Successful system's implementation requires a progressive diffusion strategy, starting with systems that have proven benefits (Gagnon *et al* 2006). The attitude of humanware towards using the system and their perception of the usefulness of the system should be changed through motivation, participation and communication. It is important to encourage and cultivate a positive attitude towards using the new system. Doctors and nurses in IALCH should have been involved and participated in MEDICOM system's development and implementation process (Gagnon *et al* 2006). The more information and the better knowledge they have about the system, the deeper the relationship between them and the system, hence the stronger the feeling of ownership towards it. This association is not possible without continuous communicating activities related to the system. The more doctors and nurses perceive MEDICOM system to be important and personally relevant, the more they will develop feeling of ownership and control (Paré *et al.* 2006).

Therefore, South Africa needs to consider the needs of humanware when designing or customising a hospital information system. The physical features, reliability, dialogue, feed back, user support, handling of user errors, user control, output and training need to be taken into an account to ensure that the system is user-friendly. Conclusions about each research question are given in the following sections using Geyser's model illustrated in Chapter Three.

7.2.1. The physical features of the hospital information system and telemedicine system

The conceptual framework of this research refers to the physical class of features or the devices of information retrieval systems and their facilities such as standardised keyboards with function keys and numeric pad, high speed communications, large character sets and ergonomic design which are of importance (Geyser 1992:84). The finding of this research agrees that the workstations and the working space of the users were big enough (Question 2.12.). But the workstations of the cashiers

were not user-friendly. The common desk²² they used was high and the chairs too low as a result they preferred to work standing on their feet (Member 6: Observation). This meant that the desks of the cashiers were not at the right level. The floor of their office was carpeted and the chairs did not move smoothly on a carpet hence a tiled floor was preferable (Member 7: Observation). There was no doubt that cashiers were not considered when designing their desks hence the ergonomic design of these desks was poor (Kushniruk *et al.* 2004; Beuscart-Z'ephir *et al.* 2002; Geysers 1992:84). Impilo Consortium consulted various specialists from different disciplines in order to ascertain their requirements before finalising the customisation of MEDICOM integrated hospital information system (see Section 2.2). This meant that consultation was done as far as system's development and clinical service points or centres but not design of the cashiers' office. Because an environment constitutes an important factor in the lives of humans (Wimelius 2004) all staff categories in IALCH should have been consulted in regard to the design of their working spaces.

7.2.2. The reliability of the hospital information system and telemedicine system

A reliable system, according to the conceptual framework of the research, is a system which is always in operation when needed. Furthermore the response time of a reliable system has to be low, the user's data have to be protected and no side or hidden effects should be allowed. A reliable system therefore also implies the hardware is readily available and reliable (Geysers 1992:84). The finding of this research study found out that the MEDICOM integrated hospital information system was always in operation for the majority (204, 64%) of nurses when needed (Figure 21) (Question 2.14.) (Geysers 1992:84). Therefore, the system was reliable.

The conceptual framework of the research study revealed that operational features (Geysers 1992:84) are meant to auto-start, auto-logon, help and integration and data transfer. Without auto-logon the user has to logon manually in which case 'making a connection to an on-line information system should be easy' (Geysers 1992:85). This research used Geysers's (1992) framework of user-friendliness throughout and other updates of user-friendliness were discussed in the literature review (see Chapter Three). This finding of the research was consistent with the conceptual framework, which revealed that the majority (204, 64%) of nurses agreed that MEDICOM

²² One long built-in desk which the computers were put on.

integrated hospital information system was always in operation when needed (Question 2.14.), for example auto-start, auto-logon, help and data transfer (Figure 21).

7.2.3. The dialogue of the hospital information system and telemedicine system

Geyser (1992:84) found that the dialogue flexibility, which means that the users' needs and abilities should be taken into consideration, should allow the user to determine and modify his or her activities while offering him or her more than one alternative of action. The research study revealed that the dialogue of the system was flexible to the majority (284, 89%) of nurses (Figure 22) (Question 2.16.). The user's needs and abilities had been taken into consideration for the majority of nurses (262, 82.1%) when developing a hospital information system and telemedicine system, and the system allowed them (248, 77.7%) to determine and modify its activities while offering them more than one alternative of action (Figure 24) (Question 2.17.). The commands of the system were usable for the majority of nurses (201, 63%), and easy to use to most nurses (98, 30.7%). This finding was consistent with the characteristics of a user -friendly on-line system. Geyser (1992:85) found in section 3.3.2.3. (b) of the conceptual framework of this research where the command language was simple, logical and mnemonic and the syntax and structure of commands were based on the same principles.

The screen was always bright, clear, visible, user-friendly, usable, quick with command²³, logical, well-designed, excellent, perfect, in order, easy to read and understandable, and could accommodate more than one programme at a time. Thus, the screen design did not need any upgrading whatsoever (Question 2.20.). Users need to be patient when booting²⁴ up a computer, and a few nurses needed training on how to increase and decrease the brightness and the font of a screen; arrange and re-arrange icons on the screen; and add or delete icons on the screen.

The study revealed that users could manipulate the logical operators of MEDICOM system effectively. A nurse in the oncology ward was very happy with the system. She could move between the LANTIS and MEDICOM systems with ease without experiencing any challenge except the downtime (Members 3&10: Observation). It happens that some users are fast learners

²³ When the user clicks icons, they open very quickly.

²⁴ Set the computer on.

and enjoy using computers as a result they found out ways and means of manipulating illogical operations themselves.

There were some challenges about some of its components of MEDICOM hospital information system, for example, a nursing module in the theatre did not allow nurses to capture time after midnight, for example, 00H30. The MEDICOM system did not allow the nurse to edit that information that was captured incorrectly (Focus Group 2), for example, incorrect details about the drugs administered. The only way to rectify an error was to delete the order of drugs and re-order (Members 8&9: Observation). This appears to be cumbersome for the user; the system should be re-designed to allow for editing an incorrect order instead of cancelling and re-ordering drugs, images and blood results.

The system was not flexible for the nurses who administered drugs to patients. They could not restore a patient who had been deleted from the system and they needed a doctor's intervention to do this. The pharmacy system was also not flexible concerning electronic signature and its practicality and security needed further investigation. Therefore, the pharmacy system needs to be re-engineered or a new pharmacy system needs to be investigated taking into consideration the needs of the doctors, the nurses and the pharmacists.

The billing module of the hospital information system was not well designed as the revenue manager in IALCH experienced difficulties in dealing with partial payments, for example, if a patient had a balance of R7 from the previous account, and an outstanding amount of R194 from another account. The system could only allow the user to print one account individually at a time. This was time consuming especially if the user had to print more than two (2) accounts. The consortium could not resolve this problem (Member 5: Observation). Therefore, the billing module of MEDICOM hospital information system need re-engineering in order to generate consolidated finance reports.

7.2.4. The feed back of the hospital information system and telemedicine system

Users tend to feel abandoned when they receive no response from a system. An interim response

should therefore be used to put them at ease when lengthy processing is taking place. Response time is also of importance and should normally not exceed more than two seconds (Geysler 1992:85). The research study found that there was no major difference between nurses who agreed (124, 38.9%) and those who did not agree (169, 52.9%) that the system took long to feed back the translation of the query to them. Only few a nurses (13, 10%) exaggerated the time (two hours) that they waited for a system to respond to their queries (Figure 27). It does not sound possible for a nurse to wait two hours for a feed back translation of a query of any kind. The findings of the study showed no evidence where the system pointed out clearly certain irreversible consequences of some demands by means of feed back to prevent the user from taking incorrect actions.

7.2.5. The user support of the hospital information system and telemedicine system

The user should be assisted continuously by means of information which clearly informs him or her where her or his particular action fits in. He or she could be allowed to make inquiries by feeding a question mark into the machine (Geysler 1992:86). But this research study found that the only support of the hospital information system and telemedicine system offered to the user was technical support, and there was no evidence of other user support. Therefore, the research study had different results from Geysler's point of view.

The user is not expected to understand the intricate structure, content and semantics of the database, it remains the responsibility of the system to guide him through the available choices to retrieve wanted information. The system has to be able to interpret the user's imprecise and poorly formulated or loosely posed query which often ignores the semantics of the database (Geysler 1992:86). The research study revealed that the system could interpret their imprecise and poorly formulated or loosely posed query to about half (158, 49%) of nurses (Figure 30) (Question 2.27.).

Therefore, MEDICOM was not convincing (49%) on the issue that it could totally interpret the user's imprecise and poorly formulated or loosely posed query. The nurses used the system because it was a hospital requirement; the only tool available for keeping (patient) records; acceptable (they had to accept it) and had no other option; user-friendly and efficient; convenient and saved time; fast and reliable; easy to save [store] and reach [retrieve] patient information. Other reasons were

that there was always (technical) help when needed; the information was stored safely; information could not get lost and no-one could cheat the system [secured]; it made the user's job easy; the user loved computers; the user gained computer skills; and training was given before using the system; (Question 2.28.). This showed that nurses resisted using the system in the beginning and later realised its benefits hence change management is critical in the implementation of any system.

7.2.6. The handling of user errors in the hospital information system and telemedicine system

The system should be able to tolerate minor errors or clarify the user's intentions by means of constructive and intelligent dialogue. Remedies should be offered by the system in the case of more serious errors (Geyser 1992:85). The findings of this research study (see Section 5.20; Members 1, 2&3: Observation) concurred with (Geyser 1992:85) in that (i) the system should advise the user and inform him or her about the options available in case of error or potential error; messages, warning and error signals should be clearly distinguished; and they must not be vague (for example, 'ERROR DETECTED' or 'ERROR CODE D901').

Therefore, besides the trouble shooting training received by users to handle errors; users are able to develop their own ways and means of handling errors of the MEDICOM hospital information system, such as through user support – when a user log a fault, the technician will come and give him or her support, then that user will not call for a technician when the same fault prevails. Some users solve the errors through trial and error.

7.2.7. The user control and transparency of the hospital information system and telemedicine system

The user should be in control of the system. This means that the user should have a mental model of the system as a result of sufficient information being at her or his disposal. The user will thus have a workable understanding of the system.

A system can be considered as a transparent system if it enables the user to form a clear mental picture (model) of its functioning and if it behaves in a predictable manner. The user can form a consistent model of a system: (Geyser 1992:84) if he or she is not burdened with unnecessary layers of information; not confronted with complicated and unnecessary functions; the behaviour

of the system is predictable; and the vocabulary for different dialogue modes is consistent. This study is in agreement with the conceptual framework of Geysler on this fact, the majority of nurses (213, 67%) had control of the hospital information system and transparency (Figure 31) (Question 2.29.); they (287, 90%) had a workable understanding of the system (Figure 32) (Question 2.31.); they (261, 82%) could form a clear mental picture (model) of the functioning of the system (Figure 33) (Question 2.32.); and they (250, 78%) behaved in a predictable manner (Figure 34) (Question 2.33.). Therefore, the users had control of MEDICOM system, meaning that they had a mental model of the system as a result of sufficient information being their disposal. The users also had a workable understanding of the functioning of the system.

7.2.8. The output of the hospital information system and telemedicine system

The form of output layout need no longer be rigid as was the case before the advent of computers. Although many of the basic rules should still prevail (for example, related data should be grouped together, important data should be placed prominently, and layout should enforce orientation) the user should be able to choose a form other than default. Short, standard and full variants have become possibilities (Geysler 1992:85). The finding of this research study revealed that the majority (256, 80%) of nurses was happy with the output of the hospital information system in terms of layout (Figure 35) (Question 2.34.), and the output could be presented in more than one form to most of them (232, 73%) (Figure 36) (Question 2.35.). The majority of nurses (206, 64.6%) agreed that there was a standard default form (Figure 37) (Question 2.36) and some nurses (158, 49.5%) chose a form other than the default (Figure 37) (Question 2.37).

7.2.9. The training on the use of the hospital information system and telemedicine system

Robert's (2003) research study identified users' perceived usability of Enterprise Resource Planning training documentation for the University of Colorado's PeopleSoft implementation. Because user-training issues were common in Enterprise Resource Planning implementations, it was likely that the results of his study were generalisable to other organisations and other industries.

The results were also applicable to training in other categories of complex software that have large

numbers of enterprise-wide users whose jobs have changed radically. The survey responses confirmed a need for process-centric documentation. This was the most important finding for both research and practice. However, his study clearly showed that organisations should not neglect the usability of their documentation after go-live, because it impacts on the future returns of their investment in the ERP system.

This research study found that most nurses (260, 81.5%) had been trained in the use of the hospital information system (Table 10) (Question 2.38.). Their training needs related to the use of the hospital information system and telemedicine system were basic computer literacy; the telemedicine system; the pharmaceutical module; the theatre module; comprehensive training; a refresher training course on new developments; hospital document and patient records; patient assessment; ordering of drugs recording; more training on the system; on-going in-servicing training on the MEDICOM system; adequate training before using the system; how to log in and out on the system to assess information and to sign a document electronically, as well as how to add more information? (Question 2.39.).

The information in the training manual was regarded as complete by the majority of nurses (243, 76.2%) (Question 2.40.). Role-based training would provide knowledge integration and better mapping of most nurses' (259, 81.2%) needs (Question 2.41.). The training manual would increase perceived usability for the majority of nurses (256, 80.3%), especially regarding learnability and task support (Question 2.42.). The training-related content was organised for the majority of nurses (270, 84.6%), for whom the content was either the download by chapter or the entire manual in the case of most nurses (204, 63.9%) (Question 2.43.). The on-line version of the manual included advanced search capabilities so that the majority of nurses (220, 68.9%) could easily find the help they needed (Question 2.45.). The use of colour-coding, tabs, more section breaks, and a good layout for the table of contents and index improved the presentation of the printed documentation to most nurses (231, 72.4%) (Question 2.46.). The manual gave the majority of nurses (218, 68.3%) more control over information overload (Question 2.48.).

It is a fact that users tend to learn more quickly when they have had hands-on training while looking over someone's shoulder or working with someone else rather than using a manual. It is easier to ask than look in a book. Sometimes the book is just too cumbersome and what one needs

is an abbreviated outline to recall how an entry is made. The on-line training, step by step guides, manuals, and the call centres are all necessary to learn the system.

Therefore, it is extremely important for information technology companies to ensure that the hospital information system is user-friendly before they implement it, for example, (i) users must be able use the system without experiencing major difficulties that will hinder them to deliver patient healthcare service. The user should be able to fix the minor problems himself or herself; (ii) The physical features of the information system are of good quality in terms of standardised keyboards with function keys and numeric pad, high-speed communications, large character sets and ergonomic design; (iii) the information system is reliable, that is, it is always in operation when needed; (iv) user's requirements are considered before, during and after the development of the information system; (v) users must have control of the information system; (vi) the output of the information system should be flexible in terms of layout; and (vi) the training needs relating to the use of the information system and the telemedicine system must be addressed.

7.3. CONCLUSIONS ABOUT THE RESEARCH PROBLEMS

The aim of this study was to assess the user-friendliness of a hospital information system within a telemedicine context at Tertiary Inkosi Albert Luthuli Central Hospital in order to achieve the broad objective of developing a model for managing the implementation of these systems in the province.

7.3.1. Population

Participants were the doctors and nurses who used the system. The study population consisted of seven hundred and eighty six (786) doctors and one thousand eight hundred and sixteen (1816) nurses in IALCH. The population figure was not constant; it varied every year as a result of staff attrition. Therefore, the researcher decided to refer to the above-mentioned populations throughout the research.

7.3.2. Sample size

In a study population of seven hundred and eighty six (786) doctors the researcher sampled one hundred and fifty seven (157) doctors, and a sample size of three hundred and sixty three (363) nurses in the study population of one thousand eight hundred and sixteen (1816) nurses. The multistage cluster sampling method was used to select doctors and nurses in various departments of the domains with the exclusion of the Management domain which did not have doctors and nurses using the system for clinical care. The researcher stratified the five domains to ensure proper proportions from each domain, and a systematic sampling was used to select 157 doctors and 363 nurses from the departments in each domain. The response rate of nurses was 0.87 (319/363) and 0.36 (56/157) for doctors.

7.3.3. Reliability and validity in survey measurement

The interview schedule is the chief instrument in contemporary studies that enhances the reliability of a study and enables lay interviewers to closely reproduce interviews. However, despite frequent references in the literature to the validity of the interview schedule, most studies fundamentally represent variations of reliability paradigms to the neglect of criterion-related validity in order to maximise the reliability and validity of the study (see Section 4.3.4. of Chapter Four) (Malgady *et al.* 1992). As mentioned earlier an existing instrument was adopted, the researcher described the established validity and reliability of the instrument and assessed its suitability in the local situation, for example: some questions were rephrased and simplified; irrelevant questions were deleted; and the context was changed to local language usage.

7.3.4. Data collection instruments

The researcher used three (3) types of data collection instruments, they were: the questionnaires for doctors and nurses, the focus group interviews and observation. In-depth interviews were not possible because of the non-availability of doctors and nurses. Doctors and nurses could not afford the time for interviews as they were always busy with patients. On-line surveys (Shaikh *et al.* 2006)

for both doctors and nurses were developed but after eight months despite reminders still not a single participant had responded and the researcher resorted to distributing hardcopies of questionnaires so that both doctors (appendix 3) and nurses (appendix 2) could complete them in their own time.

7.3.4.1. Questionnaires

The questionnaire designed with a prepared set of questions, was used to generate data necessary for accomplishing the objectives of the research project (Glencoe On-line 2004; Fowler 1998:366; Sapsford 1999:32). The total of thirty (30) typical respondents (fifteen doctors and fifteen nurses) were selected from Addington hospital for a pre-test because it was a second hospital that also had a computerised hospital information system in the province, to determine the accuracy and understandability of items. The results of the pre-test were that some questions were either found to be phrased improperly, or to be incomplete or irrelevant. Some terminology and acronyms used were not understandable to the interviewees. Some questions were asked more than once. All these pre-test results were corrected in the development of the final questionnaires.

7.3.4.2. Focus group interviews

Focus groups are a powerful means to evaluate services or test new ideas and the researcher obtained a great deal of information during a focus group session. One (1) focus group of doctors and two (2) focus groups of nurses were conducted. The problem was that only four doctors in the radiology department were available. Although there were sufficient nurses to be split into three focus groups, they had to be grouped into two focus groups due to their unavailability at certain times. Theoretically, it was important to ensure that participants did not know each other beforehand but in practice participants knew each other since they had been working together for a while. The tape recorder and the audio-video recorder were not allowed to be used in the hospital for security and confidentiality reasons. Therefore, the researcher relied solely on taking notes (MORI 2006; Babbie 2004:302).

7.3.4.3. Observation

The researcher used simple observation on the doctors and the nurses as they used the system. Subsequently some questions were asked of them relating to their involvement in the customisation of the system, the user-friendliness of the system, the training needs relating to the use of the system, and recommendations regarding the implementation and the rollout of the hospital information system and telemedicine system to other institutions in KwaZulu-Natal as suggested by Whitten and Rowe-Adjibogoun (2003).

One problem the researcher experienced was not being allowed to come close to the computer to prevent his accessing patient information. As a result, the researcher asked the participants to let him know when there was an error message popping up on the screen and explain its causal factor and the remedial action.

7.3.5. Processing and analysis of data

Quantitative analysis was used for the data from the questionnaires mainly and qualitative analysis was used for the data from the observation and focus groups. This data was also quantified. The data was analysed manually using first content analysis and then a coding system, that is, grouping interviewees' responses into categories that bring together similar ideas, concepts, or themes. Main categories were coded first, and this was followed by coding single categories. Subsequent to the manual analysis, the data was input into the computer and analysed using Microsoft Excel spreadsheet.

7.4. IMPLICATIONS FOR THEORY

This study did not contribute to the theory as such but did confirm the applicability of Geysers' model of user-friendliness of a system in terms of the physical features of the system, reliability of the system which includes operational features, dialogue between the user and the system, feedback of the system to the user, user support, handling of user errors, user control of the system and transparency, and choice of output and flexibility of output layout (see Section 7.2.).

In addition findings from Rigby (2006), Coiera *et al.* (2006) and IMIA (2006), were relevant to the application of evaluating the user-friendliness of this key MEDICOM system in an emerging country situation. Insights were also added by the studies of Darbyshire (2000), Paré *et al.* (2006) and Gagnon *et al.* (2006)

7.5. IMPLICATIONS FOR POLICY AND PRACTICE

The study contributed to the policy and practice in terms of domination of the medical and nursing profession by staff of a particular gender, training, security and confidentiality, user consultation in the design of Hospital Information Systems and workstation design.

7.5.1. Domination of the medical and nursing profession by staff of a particular gender

The study has the potential to influence the development of policies to reduce the domination of nursing profession by females and the domination of clinical profession by males. Medical schools should enrol fifty percent (50%) of female students and nursing colleges to enrol fifty percent (50%) of male students in the first year of every study period. The Department of Education and the Department of Health must monitor the practicality of implementing of this policy.

Females dominate the nursing profession and males dominate the clinical profession, therefore females should be encouraged to pursue a clinical profession and males to pursue a nursing profession. Nursing science is the basic qualification for professional nursing. Nurses should further their studies to advanced courses and degrees in order to specialise in different nursing categories.

7.5.2. Training

The incorporation of the ICD 10 system into the curriculum of medical schools and nursing training colleges needs to be legislated in order to assist both doctors and nurses to understand the importance of the system and to ensure accurate use of the system in practise. The Department of Health should develop a policy for doctors and nurses to undertake a refresher course on ICD 10 system before they practice medicine and nursing respectively. When the system is upgraded, for

example, from ICD 10 to ICD11 and so on, the curricula and refresher courses also need to be updated. The refresher courses should be conducted at least once a year. With regard to the implementation of ICD 10 system in all hospitals in South African, the National Department of Health should organise regular training sessions of this system for both doctors and nurses. The ICD 10 system should be incorporated into the curriculum of medical schools and nursing training colleges.

7.5.3. Security and confidentiality

Security and confidentiality of patients' and staff information are not negotiable. The development of any information system must comply with this rule.

7.5.4. User consultation in the design of Hospital Information System

The integrated hospital information system helps doctors and nurses to manage patients' healthcare more efficiently and effectively in hospitals. Poor management of information systems results in poor management of healthcare services. In order to ensure integration of information systems in a hospital, all users from different departments must be consulted for their input before designing any hospital information system. The input will assist the designer to integrate the different departments' information systems into a single hospital information system using telemedicine. Confidentiality of patients' and staff information is critical. The security measures must be enforced at all costs in a hospital information system in order to protect patients' and staff information.

7.5.5. Workstation design

The workstations of systems should be user-friendly and flexible to allow the users to (i) edit information that was captured incorrectly and (ii) capture time after midnight, for example, 00H30. Because an environment constitutes an important factor in the lives of humans (Wimelius 2004) all staff categories in IALCH should be consulted in regard to the design of their working spaces in order to ensure that the desks are at the right level, the floors are carpeted or tiled in a manner that allows the chairs to move smoothly and computer equipment is installed in user-friendly positions

(Kushniruk *et al.* 2004; Beuscart-Z'ephir *et al.* 2002; Geysers 1992:84). Although the screen design was user-friendly, users should wait for their computers to boot up completely and they should be trained on how to increase and decrease the brightness and the font of a screen, arrange and re-arrange icons on the screen, and add or delete icons on the screen.

In order to prevent users capturing incorrect drugs onto the system which leads to incorrect administering of drugs to patients, validation rules should be incorporated into the system during the development stage. These validation rules should reject the capturing of incorrect drugs by showing an error message which says that the drug captured does not treat the diagnosed illness. This will force the user to double check the prescription and capture the correct drug. If the error message rejects the correct prescription, the system should allow the user to proceed with a click of a button. The LANTIS and MEDICOM systems should be integrated to assist doctors copying patient information from LANTIS to MEDICOM. Therefore, the Department of Health in KwaZulu-Natal should not roll-out the MEDICOM hospital information system to all hospitals in the province before the above-mentioned changes are made.

7.5.6. Billing system

The billing module of a hospital information system should be designed so that a single financial statement can be generated.

7.6. LIMITATIONS

There have been a number of research studies conducted in hospital information systems but very limited studies have been undertaken in human engineering, user-friendliness and telemedicine, as a result the literature in these fields was generally dated and limited. Triangulation was used to collect data, for example, the administration of questionnaires, interviews with focus groups and observation. The use of on-line survey that was originally planned did not work. Not a single participant responded to the on-line survey as a result hardware questionnaires were administered. Few doctors, however, completed the questionnaires and availed themselves for focus group interviews because of their pressing workloads. A satisfactory response was obtained with the handing out of print copies. Nevertheless these obstacles were overcome and the research was completed successfully.

7.7. IMPLICATIONS FOR FURTHER RESEARCH

Implications for further research are as follows:

- 7.7.1. Most nurses had the nursing diploma but they had not sought to further their education. It was therefore interesting to know why this was the case. Was a shortage of financial resources a factor, or were nurses satisfied with the qualification (diploma in nursing science) they had?
- 7.7.2. There was a predominance of male doctors over female doctors. This may have been due to a lack of interest on the part of females or a lack of financial assistance.
- 7.7.3. The information of high profile people was blocked and could not be accessed from the MEDICOM system. Nurses could not even access the previous records for these people (Focus group 2). This meant that the system had a feature to deal with the issue of confidentiality but only for high profile people; or the information of high profile people was deleted from the system and nurses did not know what was done in the background. This posed the question when to be confidential and when to be transparent (see Section 6.9.). In this case, management was confidential enough about the information of high profile people on one hand, but on the other hand management was not transparent to nurses about the same information. Therefore, further research study should be conducted on confidentiality of information versus transparency of that information.
- 7.7.4. At the pharmacy there were three (3) types of prescription: the in-patient, out-patient and ward prescriptions. The pharmacy manager and a pharmacist were happy with the pharmacy system they used to control stock and dispense drugs compared to a paper system they were used to. The deputy manager worked with the pharmacy system which interfaced the stock control system with the dispensing system for seven (7) years and the system made their work easier. The only challenge was an electronic prescription which was not allowed for medico-legality

reason, hence a pharmacist had to print the prescription out for signature by the doctor who prescribed that particular drug (Member 14: Observation). This showed that the pharmacy system was not flexible for electronic signatures and its practicality and security needed further investigation.

7.8. IN CONCLUSION

There was a need to investigate the effectiveness and efficiency of the hospital information system and telemedicine system at IALCH for the consumers in relation to their participation in the hospital information system and telemedicine system's related activities. The study provided advanced approaches to promulgate evidenced-based²⁵ hospital information systems and telemedicine system guidelines, standards and policies.

The study addressed and answered, as best it could, all pertinent questions regarding the user-friendliness of the hospital information system and telemedicine system. It also addressed programmatic issues about optimal systems for the efficient delivery of healthcare and the overall effects of the hospital information system and telemedicine system on access of care as well as cost and quality. Lastly, the study made recommendations regarding the implementation of the user-friendly hospital information system and telemedicine system in a hospital and the rollout of the systems to other institutions in KwaZulu-Natal.

The study achieved its purpose of assessing the user-friendliness of a hospital information system within a telemedicine context at tertiary Inkosi Albert Luthuli Central Hospital in order to achieve the broad objective of developing a model for managing the implementation of these systems in the province. It also answered the study's exact questions for providing basic and practical information needed to plan and implement a single integrated hospital information system that is user-friendly to all health workers in the country and contribute to the development of national health information systems policy. Recommendations based on the study's findings have been made both for action in South Africa and for further research. The importance of the findings of the research can be deduced from the critical role played by hospitals in the HIV and AIDS pandemic in South Africa. IALCH is the first of its kind in South Africa.

²⁵ Evidence-based hospital information system is a system that has been tested and proved to be successful in another environment.

The most critical components of a hospital information system are the end users – the health care providers and the patients (Bashshur *et al.* 2002:26-7). It is the people and not the technology alone that determines the operational success of the system (South Africa 2002:25). Therefore, the humanware is the most critical factor compared to the software and hardware in the implementation of any information system. The hardware cannot function without the software and the software cannot function without the humanware, but the humanware can function without either the software or the hardware. The study shows that the user-friendliness of the MEDICOM system can be improved in certain quite specific ways which have been described.

In summary the Department of Health in KwaZulu-Natal should not roll-out the MEDICOM hospital information system to all hospitals in the province. The study should undergo some key improvements as detailed above. Furthermore, since there is no single hospital information system or health information system in South Africa, it is therefore time for the national Department of Health to develop an eHealth²⁶ Strategy for South Africa to enable a patient-centric focus to health care delivery across a networked model of care. The availability of integrated and comprehensive hospital information system is critical to the achievement of this eHealth vision. It is critical that the point of departure for implementing eHealth must be a common Network infrastructure thus providing the tool that allows each of the components in the national health system to talk to each other (Ebrahim 2009:21). Various recommendations in this regard have been made in section 7.5. Therefore, a single integrated and comprehensive hospital information system can be implemented in South Africa.

²⁶ There are definitions of eHealth. The World Health Organisation defines eHealth as ‘combined use of electronic communication and information technology in the health sector.

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Appendix 1(a): Approval of research proposal

14 November 2003

Mr VLL Magaqa
PO Box 1958
PIETERMARITZBURG
3200



**Faculty of Human and Management Sciences
Higher Degrees**

Private Bag X01 Scottsville
Pietermaritzburg 3209 South Africa
Telephone (033) 260-5699 Fax (033) 260-5715
e-mail: jacobsen@nu.ac.za

Dear Mr Magaqa

APPROVAL OF RESEARCH PROPOSAL

I hereby confirm that your proposal entitled

IMPLEMENTATION OF TELEMEDICINE IN A TRADITIONAL PERSONNEL
CULTURE: THE RADIOLOGY DEPARTMENT AND PAEDIATRIC WARD AT
TERTIARY INKOSI ALBERT LUTHULI CENTRAL HOSPITAL, KWAZULU-NATAL,
SOUTH AFRICA

has been approved by the Faculty Higher Degrees Committee. Your
supervisors are Professor C Stilwell, Professor R Lawrence and
Mr A Leach.

Please let me know **if you change your title** before submitting
your thesis, as your new title will also have to be submitted
to the Faculty Higher Degrees Committee for approval.

Your provisional registration has now lapsed and you have been
fully registered for your doctoral degree for 2003. Please
ensure that your fees are now updated.

Yours sincerely


MRS B JACOBSEN
HIGHER DEGREES OFFICER

Appendix 1(b): Ethics clearance

From: Richard Burrows [RichardBur@ialch.co.za]

Sent: 31 March 2004 07:44 AM

To: MAGAQA VUMA

Subject: RE: LLV Magaqa PHD proposal approval

Ethics committee ratified the university ethics committee decision and agreed you can continue.

Cheers

Dr Burrows

> -----Original Message-----

> From: MAGAQA VUMA [mailto:MAGAQAV@DOHHO.KZNTL.GOV.ZA]

> Sent: 30 March 2004 10:06

> To: Richard Burrows

> Subject: LLV Magaqa PHD proposal approval

>

>

> Dear Dr Burrows

>

> Please find a copy of a letter from the University of KZN as promised

>

> Mr. Vuma Magaqa

> Director: Information Technology

> DOH, KwaZulu-Natal

> Tel: +27 (033) 395 2486;

> Fax: +27 (033) 394 0004

> Cell: +27 0 83 457 1232

> <<MAGAQA VUMA.vcf>>

> > -----Original Message-----

> > From: NAIDOO TANYA

> > Sent: 30 March 2004 09:57 AM

> > To: MAGAQA VUMA

> > Subject: FW: University of KZN

> >

> > -----Original Message-----

> > From: FMC

> > Sent: Tuesday, March 30, 2004 9:55 AM

> > To: NAIDOO TANYA

> > Subject:

> >

> > <<tan.pdf>>

>

Appendix 2: Questionnaire for Nurses.

1. Demographic Information

1.1. Department:

1.2. Ward:

1.3. Gender:

- Female
 Male

1.4. Age:

Choose one of the following answer

- < 35
 35 - 50
 > 50

1.5. Education:

Check any that apply

- Matriculation
 Diploma
 Degree

1.6. Specify Diploma:

1.7. Specify Degree:

2. User-friendliness of MEDICOM
integrated hospital information system

2.1. Is MEDICOM integrated hospital information system easy to use?

Please tick an appropriate box provided below.

- Yes
 No

2.2. If the answer is NO, why?

2.3. How would you rate the user-friendliness of MEDICOM integrated hospital information system? *Please tick an appropriate box provided below. Choose one of the following answers*

- 0%
 25%
 50%
 75%
 100%

2.4. Please give a reason(s) for your answer:

2.5. Does the IALCH have documentation (either on-line or hardcopy) that focuses on hospital-specific business processes? Please tick an appropriate box provided below.

- Yes
- No

2.6. If the answer is NO, give a reason(s) why?

2.7. If, the answer is YES, do you have access to the copy of the document?

Please tick an appropriate box provided below.

- Yes
- No

2.8. If the answer is NO, give a reason(s) why?

2.9. In what form is the document available to you?

Please tick an appropriate box. Choose one of the following answers

- Hardcopy
- On-line

2.10. Of the two options mentioned above, which one do you prefer?

Please tick an appropriate box provided below. Choose one of the following answers

- Hardcopy
- On-line

2.11. Please give a motivation for your answer.

2.12. How is your workstation satisfactory (ergonomic design)?

Please tick an appropriate box provided below.

- Yes
- No

2.13. If the answer is NO, please give a reason(s) why?

2.14. Is MEDICOM integrated hospital information system always in operation when needed, for example, auto-start, auto-logon, help and data transfer?

Please tick an appropriate box provided below.

- Yes
- No

2.15. If the answer is NO, what are the problems?

2.16. Is the dialogue (language) of the system flexible to a user? For example, the user commands, the screen design, and so on. Please tick an appropriate box provided below.

- Yes
- No

2.17. Do you think that user's needs and abilities were taken into consideration when developing a hospital information system and telemedicine system?

Please tick an appropriate box provided below.

- Yes
- No

2.18. Does the system allow a user to determine and modify its activities while offering him or her more than one alternative of action? Please tick an appropriate box provided below.

- Yes
- No

2.19. How would you describe the commands of the system? Please tick an appropriate box provided below. Choose one of the following answers

- Difficult to use
- Usable
- Easy to use

2.20. What can you comment about the system's screen design?

2.21. Can you manipulate the logical operators (for example, AND, OR and NOT) of the system effectively? *Please tick an appropriate box provided below*

- Yes
 No

2.22. Does the system take long to feed back the translation of the query to the user? *Please tick an appropriate box provided below.*

- Yes
 No

2.23. If the answer is YES, how long?

Hours
Minutes
Seconds

Only numbers may be entered in these fields

2.24. Does the hospital information system support the user?

Please tick an appropriate box provided below.

- Yes
 No

2.25. If the answer is YES, please motivate how?

2.26. If NO, why not?

2.27. Can the system interpret the user's imprecise and poorly formulated or loosely posed query?

Please tick an appropriate box provided below.

Yes

No

2.28. What motivates you to use the system?

2.29. Does the user have control of the hospital information system and transparency?

Please tick an appropriate box provided below.

Yes

No

2.30. If the answer is NO, what are the problems?

2.31. Do you have a workable understanding of the system?

Please tick an appropriate box provided below.

- Yes
- No

2.32. Can the user form a clear mental picture (model) of the functioning of the system? Please tick an appropriate box provided below.

- Yes
- No

2.33. Does the system behave in a predictable manner?

Please tick an appropriate box provided below.

- Yes
- No

2.34. Are you happy with the output of the hospital information system in terms of layout? *Please tick an appropriate box provided below.*

- Yes
- No

2.35. Can output be presented in more than one form?

Please tick an appropriate box provided below.

- Yes
- No

2.36. Is there a standard defaulted form? *Please tick an appropriate box provided below.*

- Yes
- No

2.37. Can the user choose a form other than the default?

Please tick an appropriate box provided below.

- Yes
- No

2.38. Was the user trained on the use of the hospital information system and telemedicine system before?
Please tick an appropriate box provided below.

- Yes
- No

2.39. What are the training needs relating the use of the hospital information system and telemedicine system?

2.40. Is information in the manual complete? *Please tick an appropriate box provided below.*

- Yes
- No

2.41. Would role-based training provide knowledge integration and better mapping to users' needs?
Please tick an appropriate box provided below.

- Yes
- No

2.42. Would training manual increase perceived usability, especially learnability and task support? *Please tick an appropriate box provided below.*

- Yes
- No

2.43. Is the training-related content organised? *Please tick an appropriate box provided below.*

- Yes
- No

2.44. If the answer is YES, is the download by chapter or the entire manual?

Please tick an appropriate box provided below.

- Yes
- No

2.45. Does the on-line version of the manual include advanced search capabilities so that users can easily find the help they need? *Please tick an appropriate box provided below.*

- Yes
- No

2.46. Does the use of colour-coding, tabs, more section breaks, and a good layout for the table of contents and index improve the presentation of the printed documentation?

Please tick an appropriate box provided below.

- Yes
- No

2.47. Which of the following manuals is available to you? Please tick appropriate boxes provided below. You can tick more than one manual. Check any that apply

- 'Getting started' manual
- Reference manual
- Advanced manual

2.48. Does the manual give users more control over information overload?

Please tick an appropriate box provided below.

- Yes
- No

2.49. What recommendations regarding the implementation of the hospital information system and telemedicine system in a hospital can the user make?

2.50. Would you recommend the rollout of the hospital information system and telemedicine system to other institutions in KwaZulu-Natal? Please tick an appropriate box provided below.

- Yes
- No

Appendix 3: Questionnaire for Doctors.

1. Age, gender and work position

1.1. Age

Choose one of the following answers:

- < 35
- 35 - 50
- > 50

1.2. Gender

- Female
- Male

1.3. Work position

Choose one of the following answers:

- Intern
- Resident
- Consulting physician

2. About your experience with computers

2.1. Do you use a computer?

- Yes
- No

2.2. If, No, give the reason why?

2.3. How many fingers do you use when typing?

Choose one of the following answers:

- Two
- Three or more
- All (or touch)

2.4. Have you used the computer for:

	Yes	No
Test result retrieval	<input type="radio"/>	<input type="radio"/>
Literature search	<input type="radio"/>	<input type="radio"/>
Word processing	<input type="radio"/>	<input type="radio"/>
Entering patient information	<input type="radio"/>	<input type="radio"/>
Retrieving patient information	<input type="radio"/>	<input type="radio"/>

2.5. Have you ever taken a computer course?

- Yes
- No

2.6. Can you write computer programs?

- Yes
- No

2.7. How often do you use a computer?

Choose one of the following answers:

- Never
- Rarely
- Monthly
- Weekly
- Daily

2.8. How would you rate your computer skills?

Choose one of the following answers:

- Low
- Average
- High

3. About the availability of computers at your working place at the hospital

3.1. Are there any computers available for you at the hospital?

Yes
 No

3.2. Where are computers available for you?

	Yes	No
In your office? (Answer No if you have not got any office)	<input type="radio"/>	<input type="radio"/>
In other rooms you use for clinical work? (For example, ward, out-patient clinic offices, investigation rooms, and so on)	<input type="radio"/>	<input type="radio"/>

4. About your use of personal computers for clinical tasks in the hospital

How often [Frequency] do you use a personal computer (PC) and what computer program [Program] do you use to assist yourself with the following tasks:

	Frequency						Program	
	Never/ Almost Never	Seldom	About half of the time	Most of the time	Always/ Almost Always		EMR	Other than EMR
(a) Review the patient's problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>
(b) Seek out specific information from patient records.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>
(c) Follow the results of a particular test or investigation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>
(d) Obtain results from new tests or investigations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>
(e) Enter daily notes.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>

(f) Obtain information on investigation or treatment procedures.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(g) Answer questions concerning general medical knowledge (for example, concerning treatment, symptoms, complications, and so on).	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(h) Produce data reviews for specific patient groups, for example, complication rate, diagnoses and so on.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(i) Order clinical biochemical laboratory services analyses.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(j) Obtain results from clinical biochemical laboratory analyses.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(k) Order X-Ray, Ultrasound, or CT investigations.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(l) Obtain the results from X-Ray, Ultrasound or CT investigations.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(m) Order other supplementary investigations.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(n) Obtain results from other supplementary investigations.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(o) Refer the patient to other departments or specialists.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(p) Order treatment directly (for example, medicines, operations and so on).	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(q) Write prescriptions.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(r) Write sick-leave notes.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(s) Collect patient information for various medical declarations.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
(t) Give written individual information to patients, for example, about medications,	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				

disease status, and so on.								
(u) Give written general medical information to patients.	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>				
(v) Collect patient information for discharge reports.	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>				
(w) Check and sign typed dictations.	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>				

Other (specify)

5. About choice of information source

When working with diagnosis and treatment:

5.1. How often do you use sources other than Electronic Medical Record or the paper journal or patient chart? *Choose one of the following answers:*

- Never/Almost Never
- Seldom
- About half of the time
- Most of the time
- Always/Almost Always

5.2. How often is EMR the first you will turn to if the paper journal is available and ...

	Never/Almost Never	Seldom	About half of the time	Most of the time	Always/Almost Always
... you know the patient?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... you have never seen the patient before?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5.3. If you usually turn to the EMR first:

	Never/Almost Never	Seldom	About half of the time	Most of the time	Always/Almost Always	Not applicable
How often do you have to consult the paper journal or use other information sources?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5.4. How often did you use paper journals or other information sources because ...

	Never/Almost Never	Seldom	About half of the time	Most of the time	Always/Almost Always	Not applicable
...you wanted to verify the content of the information?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...you did not find the information you wanted in the EMR?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. About your satisfaction with the EMR installed in your department

6.1. Content					
	Never/Almost Never	Seldom	About half of the time	Most of the time	Always/Almost Always
How often does the system provide the precise information you need?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often does the information content meet your needs?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often does the system provide reports that seem to be just exactly what you need?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often does the system provide sufficient information?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6.2. Accuracy					
	Never/Almost Never	Seldom	About half of the time	Most of the time	Always/Almost Always
How often is the system accurate?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often are you satisfied with the accuracy of the system?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6.3. Format

	Never/Almost Never	Seldom	About half of the time	Most of the time	Always/Almost Always
How often do you think the output is presented in a useful format?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often is the information clear?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6.4. Easy to use

	Never/Almost Never	Seldom	About half of the time	Most of the time	Always/Almost Always
How often is the system user-friendly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often is the system easy to use?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6.5. Timeliness

	Never/Almost Never	Seldom	About half of the time	Most of the time	Always/Almost Always
How often do you get the information you need in time?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often does the system provide up-to-date information?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. Global assessment of the EMR installed in your department

7.1. How much do you agree with the following statement about the system?

The EMR system is worth the time and effort required to use it.

Choose one of the following answers:

- Strongly Disagree
- Disagree
- Slightly Disagree
- Neutral
- Slightly Agree
- Agree
- Strongly Agree

7.2. All considered, how would you rate your satisfaction with the EMR installed in your department?

Choose one of the following answers:

- Non-existent
- Poor
- Fair
- Good
- Excellent

7.3. All considered, to what extent has the system changed these two aspects of your own department?

	Significantly Decreased	Decreased	Slightly Decreased	No Change	Slightly Increased	Increased	Significantly Increased
Ease of performance our department's work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quality of our department's work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7.4. All considered, how would you rate the success of the EMR system installed in your department? *Choose one of the following answers:*

- Non-existent
- Poor
- Fair
- Good
- Excellent

Appendix 4: Semi-structured focus group's interview questions

1. How does MEDICOM Integrated Information System function?
2. What is your assessment of MEDICOM Integrated Hospital Information System installed at the hospital in terms of user-friendliness?
3. What can you say about the availability of computers at the hospital and your workstation?
4. What motivates you to use the system?
5. Were you trained on the use the hospital information system before?
6. What recommendations regarding the implementation of the hospital information system and telemedicine system in this hospital can you make?

Appendix 5: Standardised record form of the observation checklist (Burns 2000:409)

Interviewees	Categories (see 5.3.9)								Total
	1	2	3	4	5	6	7	8	
Member 1									
Member 2									
Member 3									
Member 4									
Member 5									
Member 6									
Member 7									
Member 8									
Member 9									
Member 10									
Member 11									
Member 12									
Member 13									
Member 14									
Member 15									
Total									
Please note that these categories only describe the behaviour and not the content.									

Appendix 6: Research objectives and sources of data.

Objectives	Research questions	Sources
1. To assess the user-friendliness of MEDICOM integrated hospital information system.	1.1. Is MEDICOM integrated hospital information system easy to use? 1.2. How would you rate the user-friendliness of MEDICOM integrated hospital information system?	Appendix 2. Questions: 2.1 and 2.3. Observation. Focus group interviews. Appendix 3. Questions: 6.3, 6.4, 7.3, and 7.4.
2. To describe the physical features of the hospital information system and telemedicine system in terms of standardised keyboards with function keys and numeric pad, high-speed communications, large character sets and ergonomic design.	2.1. What are the physical features of the hospital information system and telemedicine system in terms of standardised keyboards with function keys and numeric pad, high-speed communications, large character sets and ergonomic design?	Appendix 2. Questions: 2.12, 2.19 and 2.20. Observation. Focus group interviews Literature.
3. To describe the reliability of the hospital information system and telemedicine system, that is, are the systems always in operation when needed?	3.1. How reliable is the hospital information system and telemedicine system? 3.2. Are the hospital information system and telemedicine system always in operation when needed, for example, auto-start, auto-logon, help and data transfer?	Appendix 2. Questions: 2.14, 2.21, 2.24 and 2.27. Observation. Focus group interviews. Literature. Appendix 3. Questions: 6.1 and 6.2.
4. To determine the dialogue flexibility, that is, whether the users' needs and abilities were taken into consideration when developing the hospital information system and telemedicine system.	4.1. Is the dialogue of the system flexible to a user? 4.2. Were users' needs and abilities taken into consideration when developing the hospital information system and telemedicine system?	Appendix 2. Questions: 2.16 and 2.17. Observation. Focus group interviews.
5. To assess time taken by the functionalities of MEDICOM integrated hospital information	5.1. Does the system allow a user to determine and modify its activities while offering him or her more than one alternative of action?	Appendix 2. Questions: 2.18, 2.19 and 2.22. Observation. Focus group interviews.

Objectives	Research questions	Sources
system and telemedicine system in improving patient service delivery in IALCH.	5.2. Does the functionalities of MEDICOM integrated hospital information system and telemedicine system respond quick enough to the user's commands?	Literature. Appendix 3. Question: 6.5.
6. To assess the effectiveness of MEDICOM integrated hospital information system using telemedicine compared to the traditional and/or manual hospital information system in Wentworth and King Edward VIII hospitals.	6.1. What is your assessment of MEDICOM integrated hospital information system using telemedicine compared to the traditional and/or manual hospital information system in Wentworth and King Edward VIII hospitals?	Observation. Focus group interviews. Appendix 3. Questions: 5.1-5.4, 7.1. and 7.2.
7. To determine whether users have control of the hospital information system and telemedicine system. This means the system should enable the user to form a clear mental picture (model) of its functioning and not confront the user with complicated and unnecessary functions. The users should have a workable understanding of the system.	7.1. Does the user have control of the hospital information system and telemedicine system and transparency? 7.2. Does the user have a workable understanding of the system? 7.3. Can the user form a clear mental picture (model) of the functioning of the system? 7.4. Does the system behave in a predictable manner?	Appendix 2. Questions: 2.29-2.33. Observation. Focus group interviews.
8. To ascertain the output of the hospital information system and telemedicine system in terms of layout.	8.1. What is the output of the hospital information system and telemedicine system in terms of layout? 8.2. Can output be presented in more than one form? 8.3. Is there a standard defaulted form? 8.4. Can the user choose a form other than the default?	Appendix 2 Questions: 2.34-2.37. Observation.

Objectives	Research questions	Sources
<p>9. To ascertain the training needs relating to the use of MEDICOM hospital information system and telemedicine system.</p>	<p>9.1. Was the user trained on the use of the hospital information system and telemedicine system before?</p> <p>9.2. What are the training needs relating the use of the hospital information system and telemedicine system?</p>	<p>Appendix 2. Questions: 2.38-2.48. Focus group interviews.</p>
<p>10. To make recommendations regarding the implementation of the hospital information system and telemedicine system in a hospital and the rollout of the system to other institutions in KwaZulu-Natal.</p>	<p>10.1. What recommendations regarding the implementation of the hospital information system and telemedicine system in a hospital can the user make?</p> <p>10.2. Would you recommend the rollout of the hospital information system and telemedicine system to other institutions in KwaZulu-Natal?</p>	<p>Appendix 2. Questions: 2.49, 2.50 Focus group interviews.</p> <p>This will emerge from findings. There was a need to investigate the effectiveness and efficiency of the hospital information system and telemedicine system at IALCH for the consumers in relation to their participation in the hospital information system and telemedicine system related activities.</p> <p>The study provided advanced approaches to promulgate evidenced-based²⁷ hospital information system and telemedicine system guidelines, standards and policies.</p> <p>The study addressed and answered, as best it could, all pertinent questions regarding the user-friendliness of the hospital information system and telemedicine system. It also addressed programmatic issues</p>

²⁷ Evidence-based hospital information system is a system that has been tested and proved to be successful in another environment.

Objectives	Research questions	Sources
		<p>about optimal systems for the efficient delivery of healthcare and the overall effects of the hospital information system and telemedicine system on access of care as well as cost and quality.</p> <p>Lastly, the study made recommendations regarding the implementation of the user-friendly hospital information system and telemedicine system in a hospital and the rollout of the systems to other institutions in KwaZulu-Natal.</p>

Appendix 7: Covering letter for the interviews.

Humanities, Development and Social Sciences
University of KwaZulu-Natal
King Edward Avenue, Scottsville
Pietermaritzburg
3200
Telephone: 033-846 7002
E-mail: vuma.magaqa@kznhealth.gov.za

16 July 2009

Dear Sir or Madam

To Whom It May Concern:

I am writing to you to ask for your assistance in the completion of a survey of the review of the user-friendliness of a hospital information system using telemedicine in a traditional personnel culture at tertiary Inkosi Albert Luthuli Central Hospital of KwaZulu-Natal in South Africa.

The survey is concerned with questions relating to the user-friendliness of a MEDICOM hospital information system implemented in IALCH to assist doctors and nurses to perform their duties better, the advantages and problems associated with the system. The result of the survey will be fed back to the participants. I hope to stimulate a debate through focus groups amongst doctors and nurses using MEDICOM hospital information system in their work. Software developers will become more aware of the use to which their software product is being put and developments that need to take place to satisfy the users.

An electronic questionnaire is attached. All parts of the questionnaire must be completed. Your response must please be received no later than 30 days after your receipt of this letter. If you feel you need additional time to complete the survey, please request an extension in writing no later than 30 days after receiving this questionnaire. Written requests may be sent to Vuma Magaqa via E-mail at vuma.magaqa@kznhealth.gov.za and magaqavuma@yahoo.com. Therefore, I would be grateful if you could complete the questionnaire and return it to the above mentioned E-mail addresses. Any responses, even if incomplete, would be greatly appreciated. Confidentiality of individual responses is assured. Responses will be collated and analysed, and there is no need to supply your name. Participation is, of course, voluntary - but I encourage you to take part. The results of the survey will be made available to you.

Yours sincerely,

Vuminkosi 'Vuma' Magaqa
The Researcher

Appendix 8: Follow up postcard (Adapted from Dillman 1978:184)

21 September 2009

Last month a questionnaire asking for your views about the user-friendliness of a hospital information system using telemedicine in a traditional personnel culture at tertiary Inkosi Albert Luthuli Central Hospital of KwaZulu-Natal in South Africa was E-mailed to you.

If you have completed and submitted the questionnaire already please accept my sincere thanks. If not, could you please return it before the due date? Because it was sent to small representative sample, it is important that your views are included in the study if I am to represent people's view adequately.

If by any chance you did not receive the questionnaire or it is corrupted, please call me at 0834571232 or send me an E-mail to magaqavuma@yahoo.com and I will send you another copy today.

Yours sincerely,

Vuminkosi 'Vuma' Magaqa

The Researcher

Appendix 9: Top three (3) fonts for each personality adjective

	Top Three		
Stable	TNR	Arial	Cambria
Flexible	Kristen	<i>Gigi</i>	<i>Rage Italic</i>
Conformist	Courier New	TNR	Arial
Polite	<i>Monotype Corsiva</i>	TNR	Cambria
Mature	TNR	Courier New	Cambria
Formal	TNR	<i>Monotype Corsiva</i>	Georgia
Assertive	Impact	Rockwell Xbold	Georgia
Practical	Georgia	TNR	Cambria
Creative	<i>Gigi</i>	Kristen	<i>Rage Italic</i>
Happy	Kristen	<i>Gigi</i>	Comic Sans
Exciting	<i>Gigi</i>	Kristen	<i>Rage Italic</i>
Attractive	<i>Monotype Corsiva</i>	<i>Rage Italic</i>	<i>Gigi</i>
Elegant	<i>Monotype Corsiva</i>	<i>Rage Italic</i>	<i>Gigi</i>
Cuddly	Kristen	<i>Gigi</i>	Comic Sans
Feminine	<i>Gigi</i>	<i>Monotype Corsiva</i>	Kristen
Unstable	<i>Gigi</i>	Kristen	<i>Rage Italic</i>
Rigid	Impact	Courier New	Agency FB
Rebel	<i>Gigi</i>	Kristen	<i>Rage Italic</i>
Rude	Impact	Rockwell Xbold	Agency FB
Youthful	Kristen	<i>Gigi</i>	Comic Sans
Casual	Kristen	Comic Sans	<i>Gigi</i>
Passive	Kristen	<i>Gigi</i>	Comic Sans
Impractical	<i>Gigi</i>	<i>Rage Italic</i>	Kristen
Unimaginative	Courier New	Arial	Consolas
Sad	Impact	Courier New	Agency FB
Dull	Courier New	Consolas	Verdana
Unattractive	Impact	Courier New	Rockwell Xbold
Plain	Courier New	Impact	Rockwell Xbold
Coarse	Impact	Rockwell Xbold	Courier New
Masculine	Impact	Rockwell Xbold	Courier New

Source: Shaikh et al. (2006)

Appendix 10: The top three fonts for each use. The lowest scoring font is also presented ('Last')

Percentage Saying They Would Use Font								
Use	1st	%	2nd	%	3rd	%	Last	%
Web Graphics	<i>Monotype Corsiva</i>	64.4	Kristen	54.4	Comic Sans	52.9	Courier New	20.3
Web Texts	TNR	72.0	Calibri	70.2	Cambria	70.0	<i>Rage Italic</i>	3.4
Web Ads	Candara	53.7	Calibri	52.7	Century Gothic	52.0	Courier New	21.2
Web Headlines	TNR	60.0	Impact	58.0	Arial	57.0	<i>Gigi</i>	5.3
Business Docs	TNR	78.2	Cambria	75.6	Georgia	67.9	<i>Gigi</i>	0.8
Technical Docs	TNR	69.2	Cambria	64.0	Georgia	60.0	Kristen	1.3
Children Docs	Kristen	78.2	Comic Sans	77.3	Century Gothic	48.2	Impact	12.4
Math Docs	TNR	52.3	Verdana	49.7	Cambria	44.7	<i>Rage Italic</i>	0.9
E-Books	TNR	61.2	Cambria	59.1	Constantia	53.8	<i>Rage Italic</i>	5.6
E-Magazines	TNR	67.0	Cambria	65.1	Calibri	61.4	<i>Gigi</i>	5.8
E-Scientific Articles	TNR	64.5	Cambria	58.7	Georgia	54.6	<i>Gigi</i>	0.4
Online News	TNR	68.9	Cambria	63.6	Georgia	61.0	<i>Rage Italic</i>	1.9
E-ShortStory	Cambria	61.2	TNR	61.2	Constantia	58.2	Impact	8.3
Email	Calibri	63.2	Corbel	60.6	Candara	60.6	Impact	13.1
Instant Messaging	Calibri	54.4	Verdana	54.2	Corbel	53.8	Impact	16.1
Letter	Cambria	62.9	TNR	61.7	Constantia	58.7	<i>Gigi</i>	10.9
E-TextBooks	TNR	67.9	Cambria	63.6	Georgia	57.4	<i>Gigi</i>	1.7
Online Assignments	TNR	68.1	Cambria	66.0	Georgia	58.7	<i>Gigi</i>	3.8
Online Tests	TNR	62.7	Cambria	61.4	Verdana	58.2	<i>Gigi</i>	1.1
Digital Scrapbooking	<i>Monotype Corsiva</i>	67.0	Kristen	65.9	Comic Sans	61.7	Courier New	16.5
Online Brochures	Georgia	54.8	Constantia	54.6	Cambria	53.3	Courier New	22.1
Computer Programming	TNR	46.3	Verdana	41.8	Cambria	41.5	<i>Gigi</i>	0.8
Spreadsheet	TNR	50.5	Verdana	45.8	Arial	45.0	<i>Rage Italic</i>	1.1
E-Greeting	<i>Monotype Corsiva</i>	73.7	Comic Sans	58.2	<i>Gigi</i>	56.1	Courier New	17.4
PowerPoint	Calibri	53.5	Verdana	51.6	Arial	51.4	<i>Rage Italic</i>	8.8
Would NOT Use	Agency FB	27.6	<i>Rage Italic</i>	24.2	<i>Gigi</i>	23.3	TNR	4.5

Source: Shaikh et al. (2006)



DEPARTMENT OF LABOUR: KZN

Enquiries: _____
Tel. Direct: _____
Reference: _____
Date: _____

To Whom It May Concern

This serves to confirm that according to the records reflected on our database

Mr/Mrs/Ms: _____

ID No.: _____

Residing at: _____

Is unemployed/employed/no record shown on our database.

Signature: _____
(Client Service Officer)

Print Initials & Surname: _____

Office Date Stamp

Labour Centre: _____