Preface

INFORMATION AND COMMUNICATION TECHNOLOGIES AND HEALTHCARE

Many Information and Communications Technology (ICT) practitioners, including healthcare professionals and managers, find themselves struggling and challenged with problems of integration, consolidation, configuration, development, technology planning, software management, management of hardware and processes. These widely shared problems have remained within the healthcare environment across the globe over the last decade.

The need for improved healthcare services continues to increase in both developing and developed countries around the world and in consequence, governments along with various non-governmental and private organisations continue to strive to improve upon the healthcare services that they provide to their citizens and clients. In this book factors influencing the delivery of healthcare services have therefore been explored from both technical and non-technical perspectives, making use of case studies from a number of different countries.

Healthcare information systems and related technologies are now widely used to support and improve both clinical and administrative process in the provision of healthcare services. As revealed in this book, information systems and technologies aim to promote the quality of healthcare through improving access to information and its use as well as to its transmission and storage. Through improved information systems and technologies, accuracy of information will be improved and data-related errors will be reduced as well as improving decision making by practitioners and managers of healthcare services.

This book presents details of how various information systems and technologies are used to examine, understand and provide solutions to some of the challenges that are currently experienced by both healthcare service providers and receivers. The need for reliable and accurate information which continues to prevail in the healthcare sector makes the roles and actions of the agents (both technical and non-technical) even more critical. The impacts of various technologies for healthcare services are covered in the book.

Empirically, the book reveals that the activities and processes within the healthcare sector are not as straightforward as some agents had originally expected. This complexity is attributed to the fact that healthcare data comes from many different sources, is used for various purposes, and has numerous different users. Another factor that makes the data even more complicated is its heterogeneous nature in its form, accessibility and storage. The book pays great attention to heterogeneity and roles of agents in the use and management of information systems and technologies for the delivery of healthcare services. The inevitably diverse nature of agents and the structure of the healthcare sector in many countries all work to increase this complexity as a societal phenomenon. The healthcare sector in some countries, particularly in developing countries, adopts and uses only minimal technologies. This can often be attributed to lack of know-how and accessibility.
Preface

The book presents a combination of the factors, rigour and relevance related to healthcare and technology from the perspectives of in-depth theory and practice, looking at how information technology can add value to the development of healthcare in a bid to continually improve services. The quality and the credibility that are instilled in the delivery of healthcare services through rigour and relevance increase the level of stakeholder confidence. This book will therefore benefit both academics and professionals in the healthcare sector in the continued process of improving the services to healthcare through information systems and technologies. This includes the development of human skills in the area of healthcare informatics.

The book is truly international with authors from Australia, USA, South Africa, India, Namibia, Tanzania, Pakistan, Indonesia, UK and Cyprus, and chapters covers a diverse set of issues ranging from healthcare risk management and non-invasive data acquisition to rabies surveillance.

The first chapter: ‘Intelligent Risk Detection in Healthcare Contexts of Hip and Knee Arthroplasty and Paediatric Congenital Heart Disease’ was contributed by Hoda Moghimi and Nilmimi Wickramasinghe from Epworth Healthcare and RMIT University, Melbourne, Australia and Jonathan L. Schaffer from Cleveland Clinic, USA. The chapter notes that a rapid increase of service demands in healthcare contexts today requires a robust framework enabled by information and communication technology (ICT) solutions as well as real-time service handling in order to ensure superior decision making and successful healthcare outcomes. With the challenges facing healthcare, at the same time in other areas we are witnessing development of sophisticated intelligent tools and technologies such as Business Analytics techniques and so it would be prudent to investigate the possibility of applying such tools and technologies into various healthcare contexts to facilitate better risk detection and support superior decision making. The chapter discusses this in the context of Total Hip and Knee Arthroplasty and Congenital Heart Disease.

Next, Sharol Sibongile Mkhomazi from Tshwane University of Technology, South Africa and Tiko Iyamu from University of the Western Cape, South Africa discuss: ‘Managing Knowledge towards Enabling Healthcare Service Delivery’. The chapter describes how, at one point or another, health-related matters are embedded into strategic, tactical and operational activities of In every living being including humans. Healthcare services have increasingly essential to individuals, groups and organisations in their daily life activities due to factors such as food consumption and weather effect. This chapter applies Structuration Theory to examine the different types of knowledge within the healthcare environment, using one of South African healthcare service providers as a case study example so as to gain better understanding on how knowledge is managed.

‘Non-invasive Data Acquisition and Measurement in Bio-Medical Technology’ by Sandeep Patil HG from Manipal University, India, Ajit N. Babu from Saint Louis University, USA and Ramkumar PS, Applied Cognition Systems Pvt Ltd, Bangalore, India looks at how non-invasive medical measurements have expanded into several types of diagnostic and monitoring activities in healthcare delivery, including handling a number of non-infectious diseases such as diabetes, asthma, hypertension, congestive heart failure and cardiac arrhythmia, as well as infectious diseases such as cholera and malaria. Non-Invasive medical devices are preferred over invasive methods for considerations of patient convenience, reduced patient risk, increased speed and operational simplicity. Non-invasive methods are often perceived to be less accurate than their invasive counterparts, but over the last decade, technological advances and mathematical techniques have improved significantly, challenging this perception across the board.

Suama Hamunyela from Namibia University of Science and Technology then discusses: ‘Healthcare Services for Nomadic through a Mobile Framework’. In many counties both the rural and urban communities are spread across geographical locations and there is significant mobility of individuals and groups
within the country. Even though healthcare services are intended to spread across the whole country these services are not always as mobile as individuals are, creating a need for mobility of healthcare services at both primary and secondary healthcare levels, particularly in the developing countries such as Namibia.

The following chapter: ‘An Investigation of the Role of Using IS/IT in the Delivery of Treatments for ADHD in University Students’, is by Bader Binhadyan from RMIT University, Melbourne, Australia and Nilmini Wickramasinghe from RMIT University and Epworth HealthCare, Australia. Their chapter points out how, over the last decade, the popularity of incorporating advances in information systems and information technology into healthcare has been steadily growing. ICT can improve the delivery of better intervention and treatment in relation to many different mental illnesses, but there appears to be great potential for its use in the context of young adults with mental disorders such as Attention Deficit Hyperactivity Disorder (ADHD) which affects approximately 11% of the university population. It negatively impacts students’ academic performance, study skills, and social life. This chapter outlines a study that suggests a possible role for ICT in the delivery of treatments and management of ADHD in university students. Their research involved collecting data from psychologists in the form of semi-structured interviews and a grounded theory methodology using multiple cases.

Chandana Unnithan and Arthur Tatnall from Victoria University, Melbourne, Australia next present a chapter titled: ‘Radio Frequency Identification Technology in an Australian Regional Hospital’. In the chapter they present a case study of a large an Australian regional hospital, focusing on socio-technical factors, through an innovation translation perspective informed by Actor-Network Theory. Radio Frequency Identification (RFID) a wireless automatic identification and data capture technology and in the last few years Australian hospitals have been exploring use of RFID for improving the quality of their services. After many unsuccessful pilots a breakthrough for large hospitals came in 2010 when a large regional hospital began not only experimented with the technology, but also making it all pervasive in their operations. The chapter presents a case study of the use of RFID in this hospital.

Again returning to mobile technology, Phathutshedzo Nemutanzhela and Tiko Iyamu from University of the Western Cape, Cape Town, South Africa present: ‘Introducing Mobile Device for Health Services: the Semantics of Language Translation’. They point out how healthcare has taken centre stage of attention in recent years, due to many activities, both natural and man-made. The use of mobile technologies including phones and computers is increasingly growing across the world, and particularly in developing countries. ICT and mobile devices have become significant tools for many activities and process of healthcare service delivery in both urban and rural areas, and are used by organisations and individuals. The nature of the diverse tribes and languages within some developing countries makes it difficult to deliver or receive the services which are provided by some Healthcare organisations and this is particularly so because languages such as English in the case of South Africa are often used for communication and the media of communication exchange is English language. Due to the sensitivity, confidentiality and private nature of healthcare information and services, a one-on-one use of a language with which the patient is comfortable is critical as otherwise services and objectives of the healthcare organisations continue to be challenged. The chapter then stresses that there is need to address the semantics of language through the use of electronic devices for healthcare services.

Chinese Medicine has come into increasing demand globally in recent times and is a fascinating topic. Catherine Han-Lin, Angela Wei Hong Yang and Siddhi Pittayachawan from RMIT University along with Nilmini Wickramasinghe from RMIT University and Epworth HealthCare, Melbourne, Australia offer a chapter titled: ‘Utilisation of Health Information Technology to Support Clinical Operation of Chinese Medicine’. They note that a recent World Health Organisation traditional and complementary
medicine strategy of integrating Chinese Medicine to Western Medicine indicates that it is crucial that Chinese Medicine developments have strong literature, scientific, and evidence-based medical approval and support and to achieve this there is the need to form a synthesis foundation or platform for future studies. This chapter serves to discover a synthesis that is suitable for Chinese Medicine by discussing the basics of inquiring and Knowledge Management systems. The authors suggest that Chinese Medicine should follow a combination of Hegelian and Kantian inquiring systems with the support of Singerian and Leibnizian inquiring systems and knowledge management features. They claim that this proposed synthesis is one of the first, if not the first study to apply Churchman’s inquiring systems into the context of Chinese Medicine and differentiate them from Western Medicine.

‘Strengthening Implementation of Guidelines at Primary Health Care: Decision support in primary health care’, by Vincent Horner and Alfred Coleman from the University of South Africa, discusses how decision support systems can support healthcare. The authors begin by noting that the implementation of guidelines in the health system is a complex and considerable undertaking, as after health administration has developed guidelines, a dissemination strategy needs to be put in place. This dissemination involves distribution of printed guidelines booklets, training of nurses, provision of the equipment needed for implementing the guidelines, improvements to facilities and supervision and monitoring by managers. The chapter reports on the Basic Antenatal Care Information System (Bacis) study in South Africa which relates to an e-health decision support systems that is intended as an aid for nurses and managers at primary health care. This Bacis program study is important because there are few published studies from developing countries on implementation of e-health decision support systems at primary health care and their effectiveness in improving care.

Perhaps the most obvious aspect of healthcare to many people is their General Practitioner (Family Doctor). Different factors influence the General Practitioner (GP) to use ICT. The next chapter, by Quazi Omar Faruq from Victoria University, Melbourne, Australia: ‘General Practitioners’ Adoption and Use of ICT’ discusses the issue of how the influence of ICT in General Practice varies from a solo practice to a GP specialist of a primary healthcare team. In Australia, national legislative requirements influenced more GPs to adopt ICT, of which most important was Medicare or the Medicaid payment. The shift to group practice or corporate level practices requires ICT support to handle automated actions like completing repetitive jobs and answering frequently asked questions. The role of telecommunication and IT service providers, and that of entrepreneurs for information management are discussed in the chapter. While discussing the challenges in implementing ICT in GP service it focuses on the slow uptake of computers and other IT products by doctors over the past decade.

Ronald Karon from Namibia University of Science and Technology next offers a chapter on: ‘Utilisation of Health Information Systems for Service Delivery in the Namibian Environment’. The author begins with the statement that the use of Health Information Systems is considered to be a major contributing factor to healthcare service delivery but that this, which includes use and management, is critically challenging in the public health sector in many developing countries, resulting in poor service delivery including patient deaths. The main motivation for the reported study was to investigate how Health Information Systems can be used to improve service delivering in the hospitals from a developing country perspective. The study was carried out in Namibia, using two hospitals in the public healthcare sector and involved a qualitative case study which revealed that the use of parallel systems, lack of systems integration, lack of portable devices and users’ competency are some of the factors which impact the use and management of Health Information Systems in hospitals.
The term ‘Rabies’ is one that strikes fear into many people’s minds and a chapter by Anna Geoffre from Sokoine University of Agriculture, Tanzania discusses ‘A Web Based System for Rabies Surveillance in Kilosa District’. She points out that Rabies is a viral zoonotic disease that affects all warm blooded animals and that the rabies virus belongs to the Lyssavirus genus of the family Rhabdoviridae, and order Mononegavirales. Ninety nine percent of human rabies cases are caused by dog bites but weak surveillance systems, attributed to lack of proper records and co-ordinated mass vaccination programs of domestic dogs, poor reporting systems, detection of rabid animals, mapping of endemic areas and prompt response to treatment of rabies victims in Kilosa compound the problem. The chapter describes a project whose objective is to improve the communication of rabies surveillance information by enhancing awareness and supporting a more rapid and timely response to rabies incidences through a web based system. The data for this project is based on the information gathered from various print and electronic resources and also on data collected from the Kilosa district through questionnaires and interview. Result showed that the false perception that rabies impacts on society are low is due to under-reporting and limited awareness of the disease burden.

‘RFID Applications in Healthcare-State-of-the-Art and Future Trends’ by Amir Manzoor from Bahria University in Pakistan a thorough, systematic review of the existing literature discussing current trends and future directions in this domain. Implementation of RFID technology-based healthcare services is on the rise and findings indicate that tracking is the key RFID enabling function. Automatic data collection and transfer is an RFID function also frequently used in relation to assets, staff, and patients and is also employed for sensing, most often in relation to patients, but also to assets. The chapter concludes by highlighting future research directions where the deployment of RFID technology is likely to transform the healthcare sector.

The next chapter ‘Integrated Hospital Information System Architecture Design in Indonesia’ was contributed by from Universitas Indonesia: Putu Wuri Handayani, Puspa Indahati Sandhyaduhita, Achmad Nizar Hidayanto, Ave Adriana Pinem, Haya Rizqi Fajrina, Kasiyah M. Junus, Indra Budi and Dumi-lah Ayuningtyas. Implementing Hospital Information Systems is an important practice that should be performed by hospitals in order to deliver accurate, timely, complete, and easily accessible information in an integrated manner. Given the specific characteristics of Indonesia, the objective of the research described in this chapter was to design an Information System Architecture as part of the Enterprise Architecture based on The Open Group Architecture Framework in order to support Hospital Information System implementation in Indonesia. This research focused on hospital basic processes such as emergency processes, in-patient processes and out-patient processes and found that the integration aspect of the architecture should connect the hospitals with other related stakeholders. The reported research was a qualitative study which involved conducting interviews and observations in three government public hospitals, several directorate generals of the Indonesian Ministry of Health and a representative from the WHO. The result of this research is an integrated Information System Architecture model.

The chapter: ‘Lessons Learned from the Implementation of an Emergency Department Information System’ is by Paraskevas Vezyridis from Frederick University in Cyprus and Stephen Timmons and Heather Wharrad from the University of Nottingham, UK. The chapter describes how Clinical Information Systems are increasingly being used in emergency departments across the English National Health Service, but that the implementation outcome of this is unpredictable and its success is not guaranteed. The chapter reports a qualitative study, using interviews with 30 emergency department clinicians, administrators and managers. Project management documents, user guides, design blueprints and internal reports were also analysed. The reported study identifies facilitating social and technical factors for
implementing an Emergency Department Information System. Lessons learned from the study include the importance of acquiring an established, customised and user-friendly system, attracting funding, establishing communication channels between stakeholders, developing detailed implementation plans and tailored training programmes, investing in peer-support and analysing the workflow impact of the system. The study also found that socio-technical factors, both in and out of the hospital, influenced the success of the implementation but by being systematic in addressing these socio-technical factors certain implementation barriers can be overcome.

A chapter by Irja N Shaanika from Namibia University of Science and Technology is concerned with human interactions in the use of ICT in healthcare. Titled: ‘Human Interaction in the Use of Health Information Systems: A Case of a Developing Country’ the chapter begins by stating that in developing countries, Health Information Systems are increasingly used to enable and support both clinical and administrative processes for healthcare services, but that the use of these systems in developing countries’ healthcare centres is influenced and impacted by humans’ interactions which manifests from culture and traditions. Due to the diverse nature of culture and traditions, it is near impossible to have single formula in addressing the patients’ needs and as a result the aim to improve quality of healthcare through Health Information Systems is challenged with many stakeholders not able to understand the problem. As the need for healthcare services increases this challenge continues to significantly contribute to poor service delivery. This study focused on the interaction between the healthcare professionals and the Health Information Systems in order to understand how and why the challenges of using the ICT systems exist. This includes examining the implications and how the challenges impact the recipients of healthcare services.

‘Toward Integrating Healthcare Data and Systems: A Study of Architectural Alternatives’ is a chapter by Timoteus B. Ziminski, Steven A. Demurjian and Eugene Sanzi from the University of Connecticut, USA and Thomas Agresta from University of Connecticut Health Center, USA. In the chapter they point out that the adoption of health information systems and the integration of healthcare data and systems into efficient cross-institutional collaboration workflows of stakeholders, including physicians, hospitals, clinics and labs a challenging problem for the healthcare domain. Their chapter studies the way that well-established software engineering concepts and architectural styles can be employed to satisfy requirements of the healthcare domain and ease health information exchange between stakeholders. The chapter proposes a hybrid health information exchange architecture that leverages the studied styles that include service-oriented architecture, grid computing, a publish/subscribe paradigm and data warehousing to allow the health information systems of stakeholders to be integrated to facilitate collaboration among medical providers. To demonstrate the feasibility and utility of this, a realistic regional healthcare scenario in introduced that illustrates the interactions of stakeholders across an integrated collection of health information system.

The final chapter: ‘On Piloting a Web-Based Rabies Surveillance System for Humans and Animals’ also deals with Rabies. Maulilio J. Kipanyula, Anna Geoffrey, Kadeghe Fue and Camilus Sanga from Sokoine University of Agriculture, Tanzania. They describe how there is a high prevalence of reported rabies in different parts of Tanzania and how the disease has continued to cause a public health threat to communities due to weak passive and active surveillance systems. The data reported in this study was based on the information gathered from various sources and those collected from the Kilosa district council through interviews. The geo information collected was used to develop a geospatial based system that can easily show the hotspots of rabies and the use of web-based interactive maps is likely to strengthen disease surveillance in the area and offers an opportunity for application of such technologies
Throughout Tanzania. This approach offers a model for sharing both human and animal diseases surveillance information and adoption of this approach is likely to increase awareness and a timely response to rabies incidences. The results from the analysis showed that the false perception that rabies impacts on society are low is due to under-reporting and limited awareness of the disease burden.

It is important to provide empirical insights on the utilisation of ICT in healthcare services. The goal of this book is to consider various aspects of the use of ICT in healthcare, ranging from uptake of ICT to the use of RFID in equipment tracking. This includes the development, implementation and diffusion of technologies for healthcare purposes and also the roles and account of agents in systems and healthcare technologies deployments.

The recent contributions of ICT to healthcare have been enormous and ICT continues to offer huge opportunities for improved service. ICT is now used in a large range of areas in healthcare from diagnostics and delivery to administration. We hope that this book will encourage even greater use of this technology in order to further improve healthcare services.

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