# Factors Influencing the Implementation of ICD-10-AM and Clinical Coding in Saudi Public Hospitals: A Concurrent Triangulation Mixed Methods Research Design

**Musaed Ali Alharbi**

A thesis submitted for the degree of Doctor of Philosophy in the School of Health at the University of New England in Australia

November 2020

# Certificate of Originality

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Musaed Ali Alharbi

[redacted]

05/11/2020

# Dedication

*I dedicate this thesis to my father Ali, who shared with me his transcendental knowledge and philosophy to guide me when he was no longer physically among us; to my mother Aljazi for her stream of endless love, unconditional support and encouragement; to my wife Badriah for her calm and devoted support; to my late sons Bassam and Hatem, who walk arm-in-arm alongside me always; and to my exquisite daughter Refan.*

# Acknowledgements

First and foremost, I would thank Allah for the blessings and mercies showered on me in the form of creativity and strength, to enable me to earn a PhD degree.

I would especially like to thank Associate Professor Godfrey Isouard and Professor Barry Tolchard, my supervisors. Their contributions and constant guidance kept me on track. I am indebted to the two of them for their selfless support and constructive criticism throughout the process. My deep appreciation is also extended to Professor David Briggs for his generosity in taking time out of his busy schedule to read the whole thesis and provide invaluable comments.

I am very grateful to the Ministry of Health (Kingdom of Saudi Arabia) for providing financial support, without which the thesis would have remained a mere dream.

I am indebted to the study participants and other employees who contributed to the data collection. Most notable among the employees in terms of intellectual insights and support during the data collection process Dr Saud Deafalh Aldalah, the general director of Directorate General of Salaries and Regulations in the Saudi Ministry of Health. I would also like to acknowledge the assistance provided by the chairperson of the Information Standardisation Department at King Fahad Medical City, Ms. Manal Al Khaliefah. I am truly grateful for her invaluable advice in the questionnaire design process and her patience and support during the data collection process at the hospital. My deep appreciation is also extended to my colleagues at the Ministry of Health, Dr Nasser Altalhi and Dr Mohammed Almasabi, for their valuable practical advice during the proposal defence. My sincere thanks go to the University of New England library and School of Health staff for their support. In addition, I would like to thank Richard Benjamin and Juliet Middleton for their assistance in editing and proofreading my thesis.

No human language offers the vocabulary to adequately describe the emotional depth of gratitude I feel towards my beloved parents, who are the source of every successful achievement of my life. My father Ali (may Allah have mercy on him) shared with me, throughout the years we spent together, his transcendental knowledge and philosophy, to guide me when he was no longer physically among us. For those gifts, I am eternally indebted. Equally, I thank my beautiful mum Aljazi for the stream of endless love, unconditional support, and encouragement that has flowed from her into my life. On a practical level, she taught me the necessity of education as an essential step toward the attainment of personal goals and fulfilment in my life. My sincere thanks also go to my stepmother Munirah for all her love and prayers she has extended to us.

A very special expression of gratitude goes to my beloved wife, Badriah, for her truly devoted support. Though immersed in her master's degree, she gave her all in terms of affirmation and spiritual nourishment, as well as consistently creating a calming ambience to aid my concentration. Without her, the research may have never been transformed into this thesis.

No matter how powerful the support, there are ahead of all of us steps to be climbed alone. My conviction that I am fulfilling my destiny stems from an intensification of my faith in Allah and the cognition that sacrifice is the catalyst for abundant gain. Hurdles that I could so easily have allowed to eclipse my goal arose just as I embarked on this thesis. Learning to endure these with patience has produced in me a degree of flexibility, so necessary in parenting. During the master's degree and a year before commencing my PhD journey, our son Bassam, an apparently healthy baby, was diagnosed with a very rare, life-threatening condition, and his younger brother Hatem followed him afterward on the same pathway. I experienced the lowest ebb of my life and throughout the first year of my research remained hopeless and shattered. Self-doubt and guilt overwhelmed me, and I vacillated between the need to devote as much time as possible to my studies and as much time as I could to my sons. When I resolutely made the needs of my sons my priority, I was able to find the strength to sustain the research. Outwardly counteractive forces harmonised through the realisation that my responsibility toward my sons and my academic ambitions were interlocked. The boys and I walked the path together, arm in arm through every moment of the research and writing, and I am forever grateful to them.

My last and littlest dedicatee is Refan, our exquisite daughter, born two years after the thesis had begun. I so eagerly await witnessing her reading my work and comprehending its contents, despite the fact that by then it will certainly have been superseded.

Further invaluable contributions came from my brothers and sisters, who deserve a special note of appreciation for inspiring me to find the extra strength and motivation to get things done. Our best friend Gwen Killen and her lovely family deserve a special note of appreciation for the support and sympathy they have extended to us. I would also like

to express my gratitude to my friend Hussein Megahed and his wife Maureen Heffernan for their love and support through our tough times.

As a family, we would like to express both a parental and professional thanks to the medical teams, physicians, nurses, physiotherapists, occupational therapists, play therapists, social workers, volunteers, and palliative care teams who treated our sons. While the foremost need was medical, the psychological support offered the two of us, as well as the boys, was incredible. A mention must also be made of the volunteers running the non-profit flying organisation, Little Wings, for their unwavering support in transferring the boys from Armidale to Sydney Children’s Hospital. We will always be indebted to the pilots, help desk officials, and drivers who made the journey smooth and memorable. I also extend my thanks to all the lovely nurses in the children's hospice in Sydney, Bear Cottage, for their special care and assistance they provided for us. Last but not the least, I would like to thank our dear friend, Helen Stevens, paediatric clinical nurse consultant at Armidale Hospital, for constantly caring for the boys. We will forever be indebted to her and to all the other paediatric clinical nurses at Armidale Hospital who provided my sons with such special tender care.

When I saw the successful end in sight and put the last word in the final draft of my thesis, the shocks began: the life without my beloved sons. Alas, Hatem passed away on 28 September 2019 and Bassam followed him on 24 March 2020 after a long illness with respiratory complications in the last two years of their lives. So, I am deeply grateful to Nora O'Loughlin, bereavement coordinator at Sydney Children’s Hospital and the volunteers running the non-profit organisation, Starlight Children's Foundation, for all the support they have given us during this time.

# Abstract

Rapid economic growth resulting from the ascendancy of Saudi Arabia as an international oil producer, and the recognition by the government of the right of all citizens and most expatriate workers to free healthcare facilitated the development of a three-tier health system ranked 26th in the world by the World Health Organisation in 2000. Concurrently, the increasing financial burden of interwoven demographic and socioeconomic factors such as unprecedented population growth, increased life expectancy, and the rise of noncommunicable diseases, necessitated the diversification of health funding in the form of mandatory healthcare insurance. The coding of the clinical documentation of diagnoses and interventions of patient health episodes by clinical coders has become the international standard for submitting health insurance claims and in 2013, a contract was negotiated with the Australian government to adopt the complete ICD-10-AM package.

A mixed methods approach was selected to determine the factors impacting on the ICD-10-AM implementation in seven public hospitals, which had not previously submitted claims or employed clinical coders. Data were obtained from a quantitative Likert scale questionnaire completed by a random sample of 283 respondents and a qualitative semi-structured interview was conducted with seven purposively selected experts while only one physician indicated a desire to be interviewed. Instrument design and content were based on factors drawn from ICD-10 implementation literature representing developed and developing nations. The reviewed Saudi literature covered healthcare management, staffing conditions, inadequate technology and interoperability, and the failure to follow through with previous reform attempts.

Derived factors were categorised as organisational (planning, staffing, training, and technology); Health information (purpose, benefits, practice, and a knowledge of anatomy, pathology, and interventions); National (implementation support, funding, maintenance, upgrading, and the unified system). SPSS computation of the 5-point Likert scale (1 = strongly agree; 5 = strongly disagree) yielded an overall mean of 4.01 for the 23 items, foreshadowed by a strong negative response to three demographic items querying prior clinical coding certification or ICD-10 training, and implementation status. A 9% minority of highly qualified professionals differed from the majority. Three years after the original implementation date, factors deemed essential, particularly organisational awareness, training, and adequate staff specialists were still being ignored.

Most respondents had been excluded from job-specific training, showed little understanding of the relevance of ICD-10 and clinical coding in health information management, or a vision of their hospital as a component of a national system. In the only hospital practicing clinical coding it was tasked to the physicians, continuing a Saudi pattern of mediocre reform attempts symptomatic of a fragmented health system lacking leadership.

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# List of Abbreviations

| Acronyms | Meaning |
|---|---|
| ACHI | Australian Classification of Health Interventions |
| ACS | Australian Coding Standards |
| AHIMA | American Health Information Management Association |
| AIH | Al-Iman Hospital |
| APN | Asia Pacific Network |
| AR-DRGs | Australian Refined Diagnosis Related Groups |
| AYH | Al-Yamamah Hospital |
| BCH | Buraidah Central Hospital |
| CCHI | Council of Cooperative Health Insurance |
| CDI | Clinical Documentation Improvement |
| CFA | Confirmatory Factor Analysis |
| CHS | Council of Health Services |
| CORE HIM | Health Informatics and Medical Records Professionals |
| CVI | Content Validity Index |
| DICOM | Digital Imaging and Communications in Medicine |
| DRGs | Diagnosis Related Groups |
| EPRs | Electronic Patient Records |
| GCC | Gulf Cooperation Council |
| HER | Electronic Health Records |
| HI | Health Informatics |
| HIE | Health Information Exchange |
| HIM | Health Information Management |
| HIMAA | Health Information Management Association of Australia |
| HIS | Hospital Information Systems |
| HIT | Health Information Technology |
| HL7 | Health Level Seven |
| IAAH | Imam Abdulrahman Al-Faisal Hospital |
| ICD | International Classification of Diseases |
| ICD-10 | International Classification of Diseases, Tenth Revision |
| ICD-10-AM | International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification |
| ICD-10-PCS | International Classification of Diseases 10th Revision Procedure Coding System |
| ICD-10-TM | Thai Modification |
| ICD-10-TTM | Thai Traditional Medicine |
| ICD-9-CM | International Classification of Diseases, 9th Revision, Clinical Modification |
| ICPM | International Classification of Procedures in Medicine |
| IFHIMA | International Federation of Health Information Management |
| ILCD | International List of Causes of Death |

| | |
|---|---|
| KAMC | King Abdulaziz Medical City |
| KFMC | King Fahad Medical City |
| KFSH&RC | King Faisal Specialist Hospital and Research Centre |
| KSH | King Salman Hospital |
| MBS | Medicare Benefits Schedule |
| MCH | Maternity and Children Hospital in Buraidah |
| MOH | Ministry of Health |
| NCCC | Australian National Casemix and Classification Centre |
| NCCH | National Centre for Classification in Health |
| NTP | National Transformation Program |
| SHIMA | Saudi Health Information Management Association |
| SPSS | Statistical Package for Social Scientists |
| US | United States |
| WHO | World Health Organisation |
| WHO-FIC | WHO Family of International Classifications |

# List of Publications

**Published Articles:**

Alharbi, M. A., Isouard, G., & Tolchard, B. (2020). Health Information Literature across the Cultural Evolutionary Divide. *Cogent Social Sciences*. https://hdl.handle.net/1959.11/28050

Alharbi, M., Isouard, G., & Tolchard, B. (2019). The Development of ICD Adaptations and Modifications as Background to a Potential Saudi Arabia's National Version. *Global Journal of Health Science*, *11*(11), 158-167. https://hdl.handle.net/1959.11/27698

Alharbi, M. A., Tolchard, B., & Isouard, G. (2019). Developing and Measuring the Reliability and Validity of the Factors Influencing the Implementation of ICD-10-AM and Clinical Coding in Saudi Public Hospitals. *Global Journal of Health Science*, *11*(10), 1-15. https://hdl.handle.net/1959.11/27410

Alharbi, M. A. (2018). An Overview of the Reality of Healthcare Reform in Saudi Arabia with Emphasis on Public Hospitals: A Critical Appraisal. *Research Journal of Medical Sciences*, *12*(1), 12-25. https://hdl.handle.net/1959.11/23310

Alharbi, M. A. (2018). The Status Quo of Health Information Technology and Health Information Management Efficiency in Saudi Arabia: A Narrative Review. *International Journal of Health Research and Innovation*, 6(1), 11-23. https://hdl.handle.net/1959.11/23228

**Submitted Articles:**

Alharbi, M. A., Tolchard, B., & Isouard, G. (2020). Historical Development of the Statistical Classification of Causes of Death and Diseases. *Cogent Medicine Taylor & Francis Group* [209097737 - 25/02/2020]

# 1 Chapter One: Introduction

## 1.1 The context of the research

### 1.1.1 A history of uncompleted healthcare improvements

All progress in the field of healthcare delivery, aspires ultimately to facilitate the enhancement of services to the patient in need of care. In the most recently published study dedicated to assessing quality improvements in Saudi hospitals by Alaraki (2018), the author states:

> Despite the use of different quality improvement models to improve healthcare in Saudi hospitals during the last two decades, consistent improvements have not yet been achieved and the results are still far below expectations. This may reflect the presence of hidden organizational factors in the local contexts that hinder quality improvement efforts. (p.8)

The study sets out to examine this statement in terms of Saudi Arabia's unique wealth among developing nations and the government's proven record of preparedness to fund healthcare improvements generously.

In 2006, the World Health Organisation (WHO) health system profile for Saudi Arabia outlined a series of planned reforms, established by Royal Decree in 2002, with the long-term goal of improving the quality of healthcare available to the people of Saudi Arabia. These included the extending of healthcare funding resources, which till then had relied solely on funding by the Saudi government, by means of the establishment of a national health insurance system and the privatisation of specific areas which were the responsibility of the Ministry of Health (MOH) (Regional Health Systems Observatory, 2006).

In a review of the status of Saudi healthcare published in the journal of the WHO Eastern Mediterranean region nearly a decade later, the researchers pointed to the fact that the three-phase planned implementation of the insurance scheme had encountered problems and only the first stage had been implemented. The review noted that the 2009 revised strategy of the Council of Ministers was preceded by a budget allocation of US$ 1.1 billion to support the implementation of eHealth which, at the time of the review, was only being utilised in a few hospitals, none of which fell under the MOH. None of these electronic systems could be integrated and the researcher concluded that the fragmentation went together with a lack of coordination (Almalki, Fitzgerald, & Clark, 2011).

These implementation failures traversed a decade marked by a general acceleration of global technological development and its application to healthcare, as developed nations assisted developing nations in achieving the targets of the Millennium Development Goals. The outcome was a refinement of statistical data methods facilitated by more powerful technology, applied to highlight the specific healthcare areas to be targeted.

The 2011 review exposed the interplay of a complexity of technological, human, and organisational factors that required resolution to facilitate the intended Saudi healthcare reforms. Alsadan et al. (2015) argued that technologically, most developing countries, including the Arab world, have not managed to keep pace with the developed nations. The failure to keep pace with Health Information Technology (HIT) developments has severely restricted general healthcare improvements. The authors pointed a finger at the Saudi MOH.

'In Saudi Arabia, around 60% of the healthcare sector is funded by the [MOH] itself but still the ministry has not made enough initiatives in implementing and adopting e-health applications and systems within their hospitals' (Alsadan et al., 2015, p. 37). The failure to achieve intended reforms, in a decade of global acceleration of the development of information technology, is the result of a combination of poor MOH coordination and the opportunism of vendors to exploit this, in the provision of technological components and systems that lack interoperability.

### 1.1.2 Announcement of the implementation of the ICD-10-AM classification and coding

On 4 July 2012, the MOH website posted an announcement by Dr. Mohammed Khoshaim, the former Deputy Minister of Health and chairman of the committee appointed to supervise the implementation of the Australian modification of the tenth revision of the WHO International Statistical Classification of Diseases, (ICD-10-AM/ACHI/ACS) as adopted by the Kingdom of Saudi Arabia, of the inaugural training course in this classification:

> This course comes as an episode of the first stage of a series of specialized training courses and workshops meant to train hundreds of the MOH technicians working at medical records departments on the application of the standards set by the [WHO] through the ICD-10, which have to do with diseases only. The Australian

> revision (ICD-10-AM) includes, beside diseases, certain codes for health interventions, such as surgical and diagnostic operations (such as magnetic resonance imaging – MRI, and anaesthesia) (Ministry of Health, 2012, para.3).

This represents the first official Saudi training course in clinical coding, which may be defined as the translation into codes of the diagnosis and related procedures of a healthcare episode, as described in the clinical documentation of an individual patient record. Clinical coding provides a universal means to gather statistical data on morbidity and is used almost globally as the method of submission of healthcare claims to insurers and the basis of allocating funding to hospitals.

Dr Khoshaim's statement also covered the planned transformation of MOH hospital medical record departments into clinical coding units, immediately following completion of such courses by individual staff members. Elsewhere on the website, there are references to the ongoing interactivities of the Australian National Casemix and Classification Centre (NCCC) and representatives of the Saudi MOH ICD-10 implementation committee.

Nonetheless, a number of Saudi researchers, for at least five years following the 2012 MOH website bulletins, have continued to cite the 'chicken-and-egg' situation, claiming that Saudi Arabia still lacks the essential health data standards and application interoperability to support the full usage of ICD-10 and clinical coding. They also noted that the autocratic, top-down approach to reform, consistently fails to facilitate participatory structures to hear the inside story, as experienced by healthcare staff (Alkadi, 2016; Alkraiji, Jackson, & Murray, 2013; Alkraiji, Jackson, Murray, Irani, & Irani, 2016).

It is against this backdrop of failed or incomplete MOH projects, followed by revisions incorporating additional factors resulting in an apparent 'vicious circle', that this thesis sets out to examine the factors that will influence the implementation of clinical coding, based on the ICD-10-AM classificatory and coding schedules.

The study examines the unique national characteristics and historical development of Saudi Arabia, followed by outlining the relationship of clinical coding to the components of healthcare technology, healthcare information systems, and Health Information Management (HIM), before examining the ICD-10 classification and its national modifications. The literature review covers ICD-10 implementation in both developed and developing nations, followed by a mixed methods approach combining a quantitative survey and qualitative semi-structured interview to obtain data from a representative sample of staff members in the study hospitals, regarding their observations of the process, as well as their personal responses to its validity and level of success.

The remainder of this introductory chapter presents the status quo of the application of technology and management of information in healthcare systems, including the vital role of clinical coding in translating clinical documentation into codes, and its implementation in Saudi Arabia. This is followed by an elucidation of the aims and objectives of the research and the associated research question, the problem statement, and the rationale and significance of the study. The final section outlines the overall structure of the research, its logic, and presentation.

## 1.2 Background to the research

### 1.2.1 The emergence of health information technology and management

The new millennium was accompanied by an acceleration in the development of information technology, enhancing the power and speed of data processing. Its application to healthcare led to the emergence of a distinct new field, known as HIT. HIT improved the methods of disseminating and sharing health information data between organisations and professionals, ultimately contributing to greater efficiency in healthcare. HIT has also improved data security, privacy, and integrity and is considered the dominant factor in the global improvement in healthcare systems. The extended networks of HIT, and greater capacity to link, necessitated HIM (Al Kiyumi, Walker, Tariq, & FitzGerald, 2017; Narayanan & Rose, 2017). Hersh (2009, p. 3) offered the following definition: 'HIM is the discipline that has historically focused on the management of medical records. As the medical record has become electronic, this field has been in transition and increasingly overlaps with informatics.'

HIM has a central role in the modern healthcare system and refers to the control and management of healthcare data, which includes the coding of diagnoses and procedures, the storage of medical records and other individual patient data, as well as the billing process (Adeleke et al., 2015). Fiorito and Edens (2016, p. 2) proposed the following definition: 'HIM is the practice of acquiring, analysing, and protecting digital and traditional medical information vital to providing quality patient care.'

Recent trends in the HIM revolution, especially in ‘clinical coding’ which has become an integral HIM practice, have led to a proliferation of studies highlighting its role in promoting efficiency in healthcare delivery systems. Wager, Lee, and Glaser (2009) emphasised that clinical coding is a fundamental property of HIM, which plays a vital role in bringing about the best health information and ultimately contributes to improving healthcare delivery services. Consequently, implementing clinical coding in health organisations is an essential tool to improve HIM data systems by reducing medical errors and potential costs, managing health insurance, improving tracking of health services, incorporating research, and other purposes (Sanders et al., 2012).

### 1.2.2 Introduction to the clinical coding

In everyday practice, the term ‘clinical coding’ refers to the process of reading the patient's file to identify the diseases diagnosed and medical procedures carried out during a period of admission to hospital or visit to an outpatients clinic; thereafter translating this information into the appropriate statistical code, based on the standard clinical coding for the diseases and procedures (Heywood et al., 2016). A more technical definition of the clinical coding process is given by Farhan, Al-Jummaa, Alrajhi, Al-Rayes, and Al-Nasser (2005, p. 46): ‘The coding process involves steps that include a review of the medical record, selection of items to code, assignment of the code, sequencing of the code, abstracting, entry, storage and retrieval of the coded data in a database.’

The standard diagnostic classification and coding schedule used almost universally is the International Classification of Diseases (ICD), a series of publications by the WHO, structured anatomically in chapters such as diseases of the circulatory system, respiratory system, nervous system, etc. However, ICD is regarded as multi-axial as not all disease can be described anatomically; for example, mental disorders are classified according to behaviour and other psychiatric criteria. The ICD has undergone significant development and change over the decades between its original and latest version, the International Classification of Diseases, Tenth Revision (ICD-10) (Moriyama, Loy, Robb-Smith, Rosenberg, & Hoyert, 2011).

As the WHO publishes only the diagnosis classification and codes, several countries, namely Australia, the United States (US), Canada, Germany, Thailand, and Korea, have produced a separate classification incorporating the procedures or interventions used in hospitals and modified the WHO diagnosis classification to suit their national medical practices (De Coster, Li, & Quan, 2008; Jetté et al., 2010; Latimer, 2010; Walker et al., 2012).

The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM), the Australian Classification of Health Interventions (ACHI) and the Australian Coding Standards (ACS) represent the Australian modification of the WHO ICD-10. ICD-10-AM is used to assign the appropriate alphanumerical codes to in-patient medical records in Australia and a growing body of licensed countries (Shepheard, 2009). Currently, five other countries, including Saudi Arabia, are using ICD-10-AM (McKenzie et al., 2009; McKenzie & Scott, 2011).

It is important at this point to draw attention to the usage of the term *ICD-10*. While by definition, ICD-10 refers to the WHO diagnosis-only classification and ICD-10-AM (or other national modification) refers to the modified classification with added procedure classification; in practice, many researchers use the terms interchangeably, such that an Australian may refer to ICD-10-AM as ICD-10 when writing in the context of Australian healthcare, with the inherent assumption that readers will know that it is ICD-10-AM that is being discussed. Two sentences from the article 'ICD-10: an update on the worldwide implementation. The Australian Experience' by Rosemary Roberts, director of the Australian National Centre for Classification in Health (NCCH) at the University of Sydney, clarify this point. The first sentence: 'ICD-10 implementation has provided a turning point for Australian health information managers and clinical coders', clearly refers to the implementation of ICD-10-AM in Australia. The next paragraph opens: 'ICD-10-AM is being used in whole or in part in other countries outside Australia, for example New Zealand, Germany, Romania and next year, in Ireland' (Roberts, 2004, p.4). Had the author not specified ICD-10-AM, it would not have been possible to decide which version was being referred to. Elsewhere in the article, the author uses the term WHO ICD-10 to distinguish the classification from the Australian modification. A similar interchangeability in the literature on ICD-10-CM, the US diagnosis classification, and the other national modifications. Hence, the term *ICD-10* is not necessarily a reference to the WHO diagnosis classification but represents a related classification that can be identified contextually.

### 1.2.3 Unfolding the Saudi plan to implement a national classification and coding system

The Saudi Arabian government took a step forward in establishing the HIM mechanisms to implement clinical coding in all Saudi healthcare provider hospitals. The implementation was initiated by the Saudi Council of Health Services (CHS), to establish a unified, national clinical coding system for all health providers in Saudi Arabia, to be followed by the implementation of the medical payment system, known as the Australian Refined Diagnosis Related Groups (AR-DRGs) (Ministry of Health, 2013). The AR-DRG healthcare payment system is used globally as a reimbursement system in health insurance. Currently, fourteen additional countries, including Saudi Arabia, have adopted the AR-DRG for health insurance systems (Lucyk, Lu, Sajobi, & Quan, 2016).

A Deed of Agreement, relating to the implementation of clinical coding in health institutions of all healthcare providers in Saudi Arabia, was concluded between the Saudi Arabian government, represented by the CHS, and the Australian government. This agreement represented the first formal step toward obtaining the Australian clinical coding system license, in preparation for its implementation in Saudi hospitals (Ministry of Health, 2013; Albishi ,2014a). The Saudi Arabian government appointed a committee to supervise the implementation, in cooperation with the NCCC based at the University of Wollongong in Australia (Ministry of Health, 2013). The NCCC is the Australian organisation responsible for updates to Australian coding schedules, including the electronic format versions, and publishes new editions in line with WHO revisions (Health Information Management Association of Australia, 2015). The Saudi supervisory committee focused on:

1) Reviewing the current national state of clinical coding in health sectors.
2) Preparing a strategic plan to implement clinical coding.
3) Preparing a vision for an integrated plan, particularly regarding training.
4) Preparing awareness and education programs for health workers on the importance of medical encoding.
5) Preparing a blueprint to ensure continuity in the execution of the plans (Ministry of Health, 2013a).

Thus, the MOH in Saudi Arabia launched the implementation, in terms of the CHS resolution to introduce clinical coding systems in all healthcare providers. At ground level, this has resulted in apprehension, far more so than with the introduction of other HIM applications used in Saudi public hospitals. A study by Albishi (2014a) revealed that, despite the Saudi government's best intentions, there exists a lack of awareness and general ignorance about ICD-10 among healthcare professionals in Saudi Arabia. This has led to the MOH's recent development of compulsory training courses for all MOH Saudi public hospital personnel (Ministry of Health, 2013a).

To date, there has been no comprehensive research identifying the factors impacting on the implementation of clinical coding in Saudi public hospitals. At the time of this study, few Saudi hospitals from all healthcare providers, had started the actual process of implementation and most had encountered difficulties in the preparatory stages (Alkraiji et al., 2016).

The study by Alkraiji et al. (2016) concluded that of the total number of Saudi Arabian hospitals that had actually commenced the implementation process, King Fahad Medical City (KFMC) was the only public health sector hospital that had started to use the clinical coding system, together with two government health sector organisations; King Abdulaziz Medical City (KAMC) in Riyadh, belonging to the Ministry of National Guard Health Affairs; and King Faisal Specialist Hospital and Research Centre (KFSH&RC).

Noting the history of uncompleted projects and the poor national awareness of the value of clinical coding, the current study has been designed to remedy the low implementation rate in Saudi public hospitals, by generating knowledge and awareness on the benefits of clinical coding for healthcare professionals.

## 1.3 Research aims

An efficient and unified implementation of clinical coding will enhance the practice of HIM in public hospitals in Saudi Arabia, providing the data essential for improving the quality of the national healthcare system. From this perspective, the aim of this study is to increase knowledge and understanding of the factors influencing the implementation of clinical coding in Saudi public hospitals, which in turn will impact on the efficiency of the implementation of clinical coding. This adds practical value to the study and, in turn, will impact on the efficiency of the implementation. The investigation will simultaneously assess the current status of the implementation process.

## 1.4 Research question

In accordance with these research aims and noting that healthcare professionals who have served their entire professional careers in Saudi public hospitals can have had no previous exposure to the practice and benefits of clinical coding, nor its implementation as a health information system, whose value is dependent on training healthcare professionals performing specific hospital functions to input data accurately reflecting patient healthcare episodes, this study examines a single research question:

- What are the factors influencing the implementation of ICD-10 and clinical coding in Saudi Public Hospitals?

## 1.5 Problem statement

The international professional healthcare community has unanimously acknowledged that clinical coding plays an important qualitative role in health information management. The factors influencing the introduction of ICD-10-AM and clinical coding in Saudi public hospitals have not previously been researched and assessed in a comprehensive study, which motivates the rationale and direction for this study. Although no dedicated research on the status quo of ICD-10-AM implementation in Saudi Arabia exists, Alkraiji, Jackson, and Murray (2014) concluded in their study entitled, 'Steps towards the Development of National Health Data Standards in Developing Countries: An Exploratory Qualitative Study in Saudi Arabia', that the majority of Saudi tertiary hospitals across all health providers had failed to implement ICD-10-AM at that point in time.

At the time of execution of this research, no information had been collated and published on the extent to which healthcare professionals in Saudi public hospitals had implemented ICD-10-AM and commenced clinical coding or on difficulties that may have been encountered during the implementation process. Such empirical research, based on the proven experience of similar institutions in a similar environment, provides valuable time and cost-saving guidelines to facilitate the implementation in other hospitals. This study, therefore, is designed to support the implementation of clinical coding, as well as to highlight, for Saudi healthcare professionals, that it is an obligatory process with indisputable benefits, rather than an optional issue. As De Lusignan (2005, p. 93) asserted: ‘Healthcare professionals need to see positive benefits from coding clinical data.’

## 1.6 Significance of the research

There is a recognition among healthcare professionals globally that healthcare organisations are in a mode of perpetual change and that healthcare is becoming increasingly complex (Griffin et al., 2016; Rouse, 2008). This complexity may be addressed by researching health issues and problems (Polgar & Thomas, 2008).

An abundance of health researchers confirms that the process of health research impacts positively on healthcare services. Minichiello (2004) argued that health research is fundamental to healthcare system improvement, through the investigation of solutions to overcome the needs and problems of health organisations, and ultimately contribute to improving services by addressing single components that form part of a complex system. Minichiello (2004) also noted that health research gives the opportunity for constructing predictions regarding future health issues, which ultimately assists health service providers in designing solutions and modifications to fit these predictions.

A crucial issue to address, before conducting any research, is the practical value of the projected outcomes. The potential value of this study became evident as the researcher developed a greater understanding of the multifunctionality of clinical coding and noted that no empirical research exploring the factors impacting on the implementation of clinical coding in Saudi Arabia exists in current healthcare literature. This realisation coincided with the Saudi MOH decision to implement clinical coding in all public hospitals.

Returning to the definition of clinical coding as the process of reading the patient file, to identify the diseases diagnosed and medical procedures carried out during a period of admission to hospital and, thereafter, translating this information into the appropriate statistical code; this demands medical knowledge and accurate classification and transformation of data, in the process of assigning unique numbers to procedures and diagnoses, for the purpose of storage and retrieval for reimbursement, further treatment, and value for research purposes (Wing, 2016).

A study by Jackie Moczygemba and RHIA (2012) identified the uses of clinical coding in health organisations, as its value in health insurance claims management systems, the identification of diseases recorded in hospitals, dispensing with manual reviews of health records, and moving to the complete electronic availability of all medical data. Other research lists similar benefits. A study by Stephens, Ledlow, and Fockler (2016) described the purposes of using ICD-10 in healthcare systems as classifying diseases, retrieving healthcare data, tracking healthcare delivery, simplifying payments, and comparing healthcare data between regional hospitals, or at the national and international levels.

This study makes an original contribution to the body of knowledge on the clinical coding implementation process by identifying and investigating the factors facilitating and hindering the process. Deriving these factors using both quantitative and qualitative sources of data will further highlight the following structures and their relationships within healthcare organisations:

a) The overall integrated Saudi HIT network and the functional relationships of its technological components, as well as human resources structure of the HIM system; and
b) The parameters of essential knowledge, duties, and practice of all hierarchical levels of healthcare professionals and hospital administrative officials in Saudi Arabia, essential to a successful of ICD-10-AM implementation.

The researcher is optimistic that this research will contribute to a broad realisation among healthcare professionals in Saudi public hospitals that clinical coding, once implemented, will offer clear advantages in daily healthcare practice, as well as promote an appreciation of the role of HIM in Saudi public hospitals. In turn, an understanding of the benefits will enable health professionals to make a positive contribution to the overall implementation process.

## 1.7 Thesis outline and logic

Phillips and Pugh (2010) proposed a conceptual research model comprising four phases (1) background theory, (2) focal theory, (3) data theory, and (4) contribution. These phases may, to some extent, overlap or run concurrently. Together, they reflect the overall logical strategy and development that culminates in the research product. The background theory describes the initial step of discovering the extent of the study by covering the literature, in this case the factors relating to the implementation of a classification and clinical coding system within a hospital system. Focal theory refers to the process of selecting and defining the shape of the specific study to be undertaken and defining its parameters. Data theory covers the methodological foundations of the research design and the selection of an appropriate research method, an implementation strategy, the sampling processes, and the development of appropriate study instruments for data collection. The execution of the three phases culminates in the contribution of the study to the body of knowledge in the chosen discipline. The study is structured into nine chapters, as outlined in Figure 1-1.

**Chapter One** covers the context of the research and its importance in Saudi Arabia; the background to the information technology explosion and its application in healthcare; the related emergence of HIM and the expansion of international medical classification and the associated clinical coding process; the research aims, research question, problem statement, significance of the study, and outline of the thesis structure.

**Chapter Two** provides a brief historical overview of Saudi Arabia, including its healthcare structures, providers, and hospitals including the MOH as the public healthcare provider; Saudi health insurance and the importance of clinical coding as the universally-accepted method of insurance claims reimbursement; challenges facing healthcare providers in Saudi Arabia and potential strategies to provide solutions. In line with the Saudi government decision to implement the ICD-10-AM Australian modification nationally, the final section introduces the Australian Healthcare System model.

**Chapter Three** provides an overview of Health Information Technology and Management, outlining the roles of HIT and HIM applications in the sharing of data in healthcare systems, and the importance of these to the functionality of clinical coding.

**Chapter Four** provides a general overview of the historical development of the classification of diseases, the roots of the WHO ICD in the statistical classification of mortalities, the emergence of national modifications of ICD classification and coding, and the advantages of national modifications.

**Chapter Five** explores the factors that influence the ICD implementation process through the healthcare literature of developed nations and developing nations; the former covered by the US, Australia, and Canada; the latter by Thailand, its Asia Pacific neighbours, and Saudi Arabia. The factors fundamental to the research question are derived systematically and the gaps in the Saudi literature uncovered. The final section discusses a potential theoretical framework for the study.

**Chapter Six** presents the methodology of the study, dealing with the research design and methodology, rationale for the mixed methods research approach and the impact of this on the research design. The sampling methods, sampling procedures, and study instruments are outlined with the rationale for their selection. The ethical issues applicable to the study, and their enforcement are followed by sections establishing the validity and examining the reliability of the study instruments. The final section outlines the data collection and analysis processes.

**Chapter Seven** presents the structure and piloting of the quantitative instrument through specific experimental and developmental steps. The outcomes of the content validation and pilot study, including the internal consistency reliability and factor analysis test, follow. The final section covers the development and piloting of the qualitative instrument.

**Chapter Eight** presents the results drawn from the analysis of the data of the quantitative and qualitative instruments, including the respondent demographic data, Likert survey results, open-ended question, and semi-structured interview following the three factor categories established in the literature review.

**Chapter Nine** discusses the factors found to influence the Saudi implementation of ICD-10-AM and clinical coding in relation to the factors agreed as essential in the literature covered. The hierarchical dependency of the factor categories is confirmed, leading to the conclusion that underestimating the value of human resources and their inclusion in the management process appears to be counterproductive to healthcare innovative processes. The recommendations and suggestions offered in terms of the findings are, thus, of immediate value in pinpointing the overall challenges to healthcare reform in Saudi Arabia, as well as overcoming the challenges of the implementation of ICD-10-AM and clinical coding. The final sections cover the study limitations and recommendations for further related healthcare research before gives a short conclusion of the study.

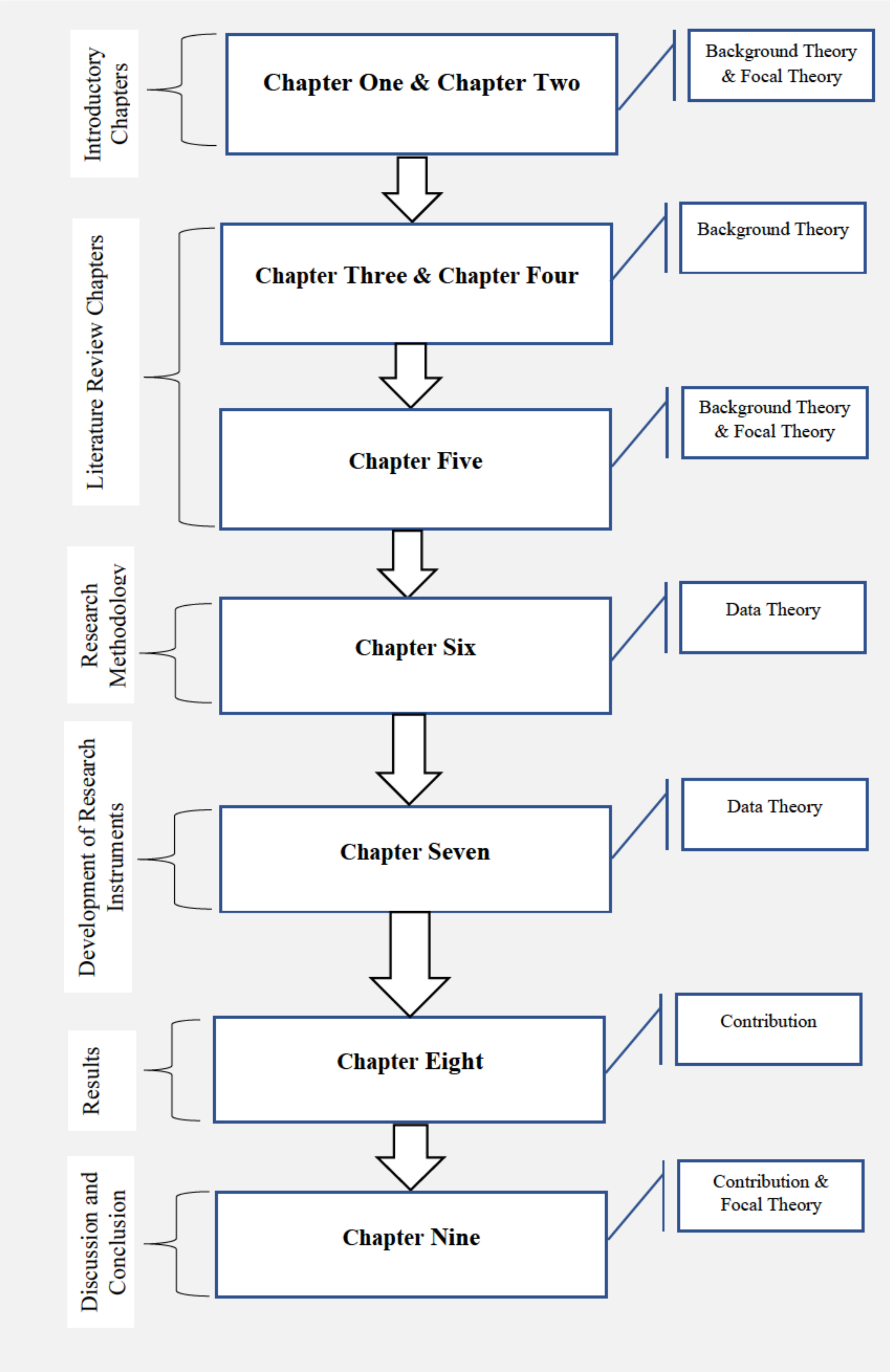



**Figure 1-1 Conceptual model of the thesis development**

# 2 Chapter Two: An Overview of Saudi Arabia and Healthcare Reform

## 2.1 Introduction

The discovery of oil in 1938 that enabled the agrarian Saudi Arabia's ascent to become the world's largest exporter of oil in 1970. The period saw the continuous development of the national public healthcare system and a change in individual lifestyle marked by road accident fatalities becoming the major cause of Saudi premature deaths (Institute for Health Metrics and Evaluation, 2017).

Saudi Arabia, the largest and most populous member of the Gulf Cooperation Council (GCC), shares with its five fellow members, Bahrain, Kuwait, Oman, Qatar, and the United Arab Emirates, several factors that have led to escalating healthcare costs. These are rapid population growth, decreasing infant mortality, increasing life expectancy, and an extremely high incidence of chronic, enduring non-communicable diseases. GCC country statistics rank among the highest in the world on risk factors related to lifestyle-related ailments such as diabetes, cardiovascular conditions, and obesity. All six GCC countries rate among the ten nations with the highest prevalence of diabetes. Additionally, Saudi Arabia carries an enormous, unique burden; the constitutional promise of free healthcare to the approximately five million pilgrims participating in the annual Hajj and Umrah to the holy mosques in Mecca and Medina (Khoja et al., 2017).

The chapter commences with a chronology of key developments in the country's history, establishing the national background. An examination of the existing healthcare framework follows, focusing on the public hospitals which provide the healthcare setting of this study. The partial implementation of the national health insurance scheme, intended to reform healthcare funding and relieve the burden on the Saudi government, is followed by coverage of studies evaluating current Saudi Arabian public healthcare system reform policies. The chapter closes with a summary of the development of the Australian healthcare system and its funding mechanisms, in the light of the Saudi government's decision to purchase a licence to use the ICD-10-AM package as the national standard for classification and coding throughout Saudi healthcare.

## 2.2 An overview of Saudi Arabia's history

Several historical and cultural factors have a bearing on the current national healthcare environment. Modern Saudi Arabia, covering an area of 2,240,000 square kilometres, is the largest country in the Middle East. It occupies nearly 80% of the Arabian Peninsula (Wynbrandt, 2010), bordered to the west by the Red Sea, to the north-east by the Arabian Gulf and on land, by Jordan, Iraq, Kuwait, Qatar, United Arab Emirates, Oman, and Yemen, as shown in Figure 2-1. The country’s official language is Arabic. Saudi Arabia is considered one of the fastest-growing nations in the Middle East and exudes a general renaissance atmosphere (Almasabi, 2013).

At the beginning of the 20th century, the dwindling Ottoman Empire still controlled most of the Arabian Peninsula, which comprised many small territories ruled by the dominant tribal ruler. In 1902, Abdulaziz Abdulrahman Al Saud, founder of the modern Saudi state and generally known in the West as Ibn Saud, regained control of Riyadh for the Al Saud dynasty marking the founding of Saudi Arabia. Ibn Saud spent the next thirty years in conquest, combining the surrounding territories into a single nation, the Kingdom of Saudi Arabia, officially constituted and recognised in September 1932 (Bowen, 2014). The population during this period of establishment gradually moved away from tribal affiliations towards a national identity (Determann & Al-Semmari, 2010).

The nation at that stage remained an agrarian society and one of the poorest in the world. However, paramount was the fact that the Saudis had regained control of the Islamic Holy Cities of Mecca and Medina from the Hashemite government, which had been supported by the British government in 1920 after subduing the Ottoman Empire in Al Hasa and its ally, Ibn Rashid, in the central and northern territories. Thus, Saudi Arabia became the focal nation of the Hajj, the visit of millions of Islamic pilgrims from around the world to Mecca, the city of the Holy Prophet Mohammed, and to his tomb in nearby Medina. The major territorial objective for Ibn Saud in annexing the holy cities was to eliminate the abuses of Hajj administration in that time, which constituted the only external source of Saudi national revenue (McHale, 1980).

During the early 20th century, oil was discovered in Persia (now Iran), the first of many similar discoveries in the Arabian Gulf region (Bird, Brown, & Lusignan, 2005). The Arabian Peninsula had generally been discounted as a potential source; however, after the granting of a prospecting concession to an American company by King Abdulaziz

Abdulrahman Al Saud, oil was discovered in 1938. That discovery was followed by a sequence of new oil wells emerging, paralleling a growing global demand for oil which began during WW1 and continued throughout the century. After the Yalta Conference which ended WW2 in 1945, President Roosevelt met the Saudi monarch aboard a US warship on a lake linked to the Suez Canal and the two nations signed a coalition treaty, the foundation of the strong relationship enjoyed by Saudi Arabia and the US (McHale, 1980).

By 1970, the national picture of Saudi Arabia and its international importance had changed forever. The country maintained nearly 25% of global oil reserves and was ranked as the world's largest oil exporter (Jannadi, Alshammari, Khan, & Hussain, 2008; Safi, 2016a, 2016b). The infrastructure has undergone enormous changes in recent years, supported by comprehensive developments in sectors, such as industry, education, and health (Almasabi, 2013).

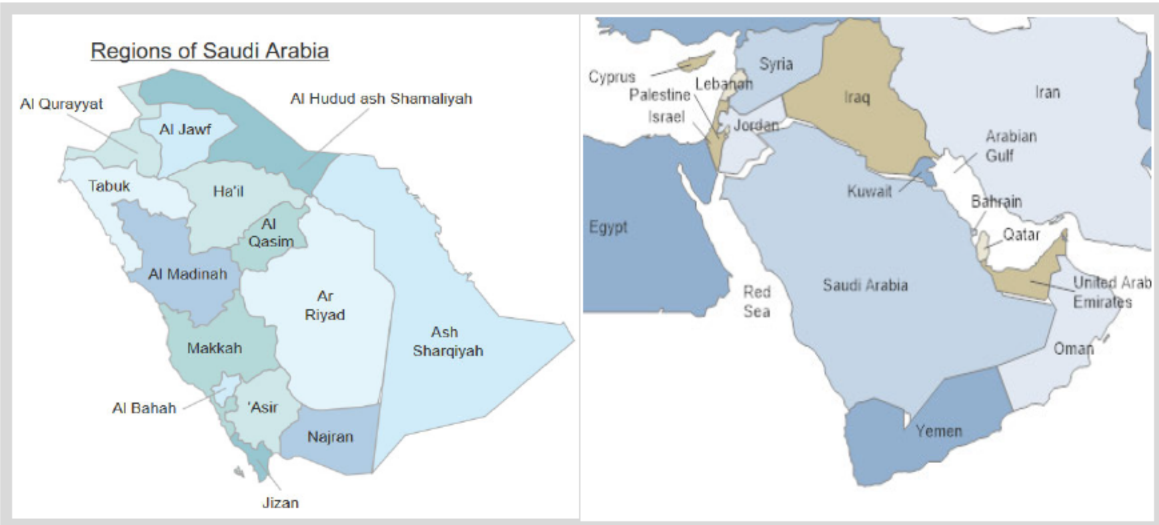



**Figure 2-1 Map of Saudi Arabia and its regions**
Designed by SmartDraw

## 2.3 Saudi Arabia's healthcare framework

Official healthcare services in Saudi Arabia commenced in 1926 when the Department of Health was established and mandated to provide healthcare for citizens and pilgrims visiting the two holy mosques (Al-Harthi, Alenad, Baitalmal, & Alkhurashi, 1999; Al-Sharqi & Abdullah, 2013). The MOH was established in 1954 (Niblock, 2004) when the population numbered 3.4 million (De Wulf, 2016). Oil wealth provided the funding to improve national healthcare services, which had previously focused on traditional methods for treating diseases (Saati, 2000).

The Saudi Arabian Government has consistently extended national healthcare services, which are spread across thirteen healthcare agencies. Most healthcare services fall under the public healthcare provider, the MOH, with the remainder administered by the National Guard and Ministries of Education, Defence, and the Interior; Aramco, KFSH&RC, Royal Commission for Jubail and Yanbu, General Sports Authority, Red Crescent Society, Saline Water Conversion Corporation, and the healthcare services provided by Saudi Airlines at the country’s airports (Ministry of Health, 2015). Whereas the MOH serves the public, the other healthcare agencies provide services to specific groups, mainly sector employees and their families, as well as emergency services when necessary (Alghamdi & Urden, 2016). In addition to the governmental healthcare agencies, private healthcare service providers play an important role in the delivery of billed healthcare to citizens and expatriates, effectively decreasing the pressure on government health organisations, especially in the larger cities (Almalki et al., 2011).

Thus, the current provision of healthcare in Saudi Arabia falls into three categories: the public healthcare provider, other government healthcare providers, and private healthcare providers (Ministry of Health, 2017). The Saudi Arabian constitution stipulates free healthcare services for citizens, as well as expatriates working in the government sector. Health services for expatriate workers employed in the private sector are provided by their sponsors (Walston, Al-Harbi, & Al-Omar, 2008). According to the Health Statistical Yearbook (2017), there are 282 MOH-affiliated public hospitals in Saudi Arabia with a capacity of 43,080 beds, representing about 58% of the country’s total of 487 hospitals. Consequently, the MOH is considered the main provider of healthcare services in Saudi Arabia, as shown in Figure 2-2 and Figure 2-4. A further 47 hospitals, with a capacity of 12,279 beds, are affiliated to other government healthcare agencies, with the remainder constituting 158 private hospitals, with a capacity of 17,622 beds, as shown in Figure 2-2 and Figure 2-4 (Ministry of Health, 2017).

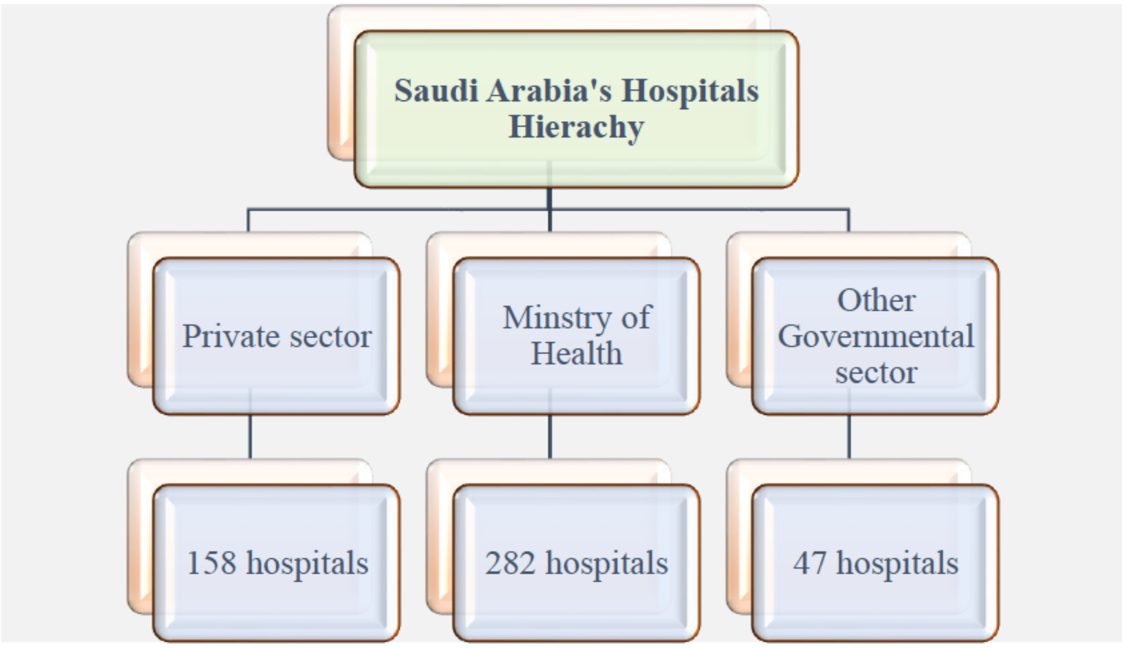



**Figure 2-2 Saudi hospital providers**

Source of data: Heath Statistical Yearbook (2017)

The countrywide expansion of national healthcare services and improved healthcare quality over the past few decades was paralleled by an increase in the birth-rate and accelerated population growth, which has necessitated annual increases healthcare funding, as illustrated in Figure 2-3 (Ministry of Health, 2015). According to the 2011 *Health Statistical Yearbook* and the Central Department of Statistics and Information (2016), the population increased from 28,376,355 to 31,742,580, between 2011 and mid-2016, with expatriates representing an average of 36.7% of the total population. A noteworthy comparison is that while the population of Saudi Arabia increased ten-fold between 1954 and 2016, the US population doubled from 163 million to 325 million, between the same two years (De Wulf, 2016).

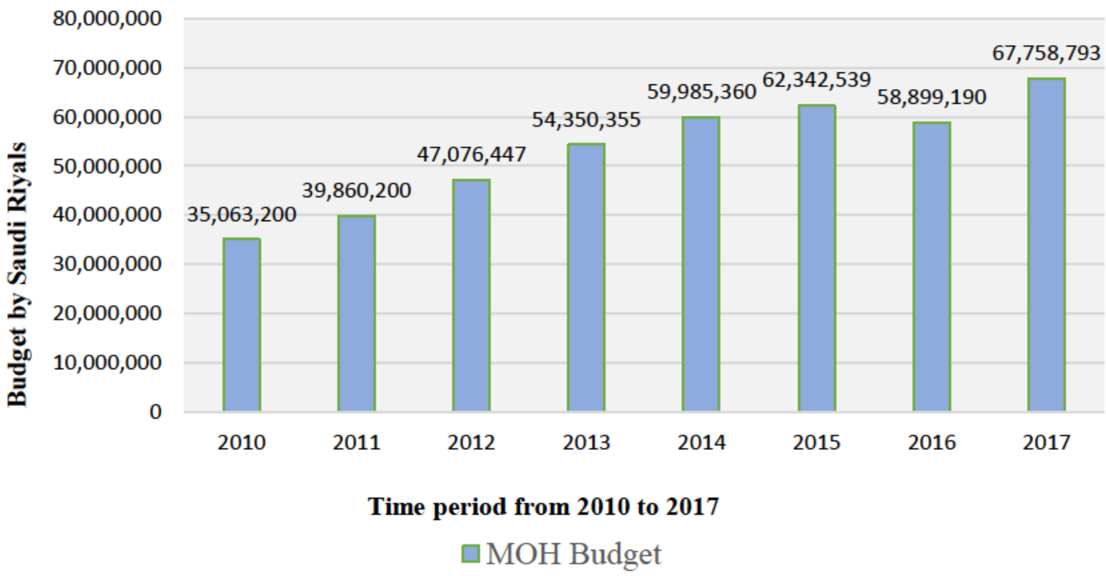



**Figure 2-3 Ministry of health budget from 2010 to 2017**

Sources of data: (Ministry of Health, 2010, 2011, 2012, 2013b, 2014, 2015, 2016, 2017)

The oil transformation of the Saudi Arabian economy enabled the elevation of healthcare as a government priority. A comparison of healthcare statistics between 2005 and 2017 reveals consistent annual increases in the number of hospital beds, especially in MOH-affiliated hospitals, as shown in Figure 2-4. In 2005, MOH hospitals had 30,489 hospital beds, other government hospitals 10,156 beds, and private hospitals 12,547 beds. In 2017, these numbers had increased to 43,080 beds in MOH hospitals, 12,279 in other governmental hospitals and 17,622 in private hospitals (Ministry of Health, 2005, 2017).

Based on a 2000 report by the WHO, improvements in healthcare over the last two decades have seen Saudi Arabia achieve an international a ranking of 26th out of 190 countries for efficiency of performance in terms of available resources, as well as ranking 61st in overall standard of the healthcare system (World Health Organisation, 2000). This survey of WHO member nations was based on the following five indicators: (1) general health level of the population, (2) general level of distribution of health services among the population, (3) general level of healthcare system responsiveness to the population, (4) distribution of health services responsiveness across regions and the total population, and (5) equity in the distribution of financial resources. This ranking prompted some debate among Saudi healthcare researchers. Alkhamis (2012) contended that no subsequent international reports had supported this 2000 ranking. However, the WHO report clearly defined the factors over the previous decades, leading to the significant improvement in some fundamental indicators. Life expectancy increased from 66 years in 1983 to 73.5 in 2009 (Al-Sharqi & Abdullah, 2013). Additionally, evidence over a few years following the report indicated further significant developments. Gallagher (2002) asserted that despite the vast geographical area and rapid population growth, Saudi Arabia has achieved consistent advancement in its healthcare system, both in quality and quantity.

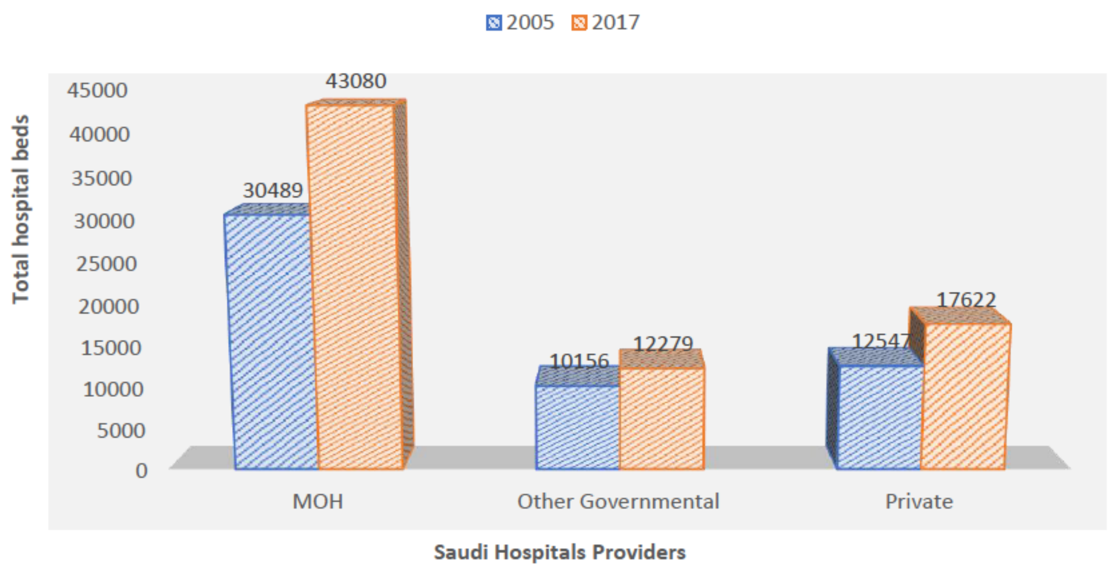



**Figure 2-4 Proportion of hospital beds from 2005 to 2017 across all Saudi health providers**
Sources of data: (Ministry of Health, 2005, 2017)

## 2.4 Public healthcare structure

Saudi Arabia's MOH is the primary provider of healthcare services to citizens, as well as expatriates in government sector employment. MOH healthcare services have a three-tier structure of primary, secondary, and tertiary levels (Balla, Ahmed, & Sebiany, 2002). The primary level evaluates all medical conditions, after which a case may be transferred to the secondary level for more sophisticated care (Almalki, 2012). Similarly, the tertiary level receives patients referred from the secondary level, when the highest level of treatment is required (Mulla, 2001).

### 2.4.1 Primary healthcare level

Following the Alma Ata Declaration of 1978 that classified healthcare as a fundamental human right, the WHO resolved to strive towards the global provision of primary healthcare (World Health Organisation, 1978a). In response to Alma Ata, the Saudi MOH prioritised the establishment of a system of integrated primary healthcare centres, providing maternal, child, and community healthcare services, including management of people with chronic illnesses, in both urban and rural localities (Al-Ahmadi & Roland, 2005). The MOH offers primary healthcare through nationwide centres linked to a wide range of secondary and tertiary services, available on referral (Aldossary, While, & Barriball, 2008). Over recent decades, primary healthcare has undergone notable improvements. The annual *Health Statistical Yearbooks* from 2010 to 2017 provide clear statistical evidence of the construction of additional MOH primary healthcare centres over the period. As illustrated in Figure 2-5, the number of primary healthcare centres increased from 2,094 in 2010 to 2,361 in 2017.

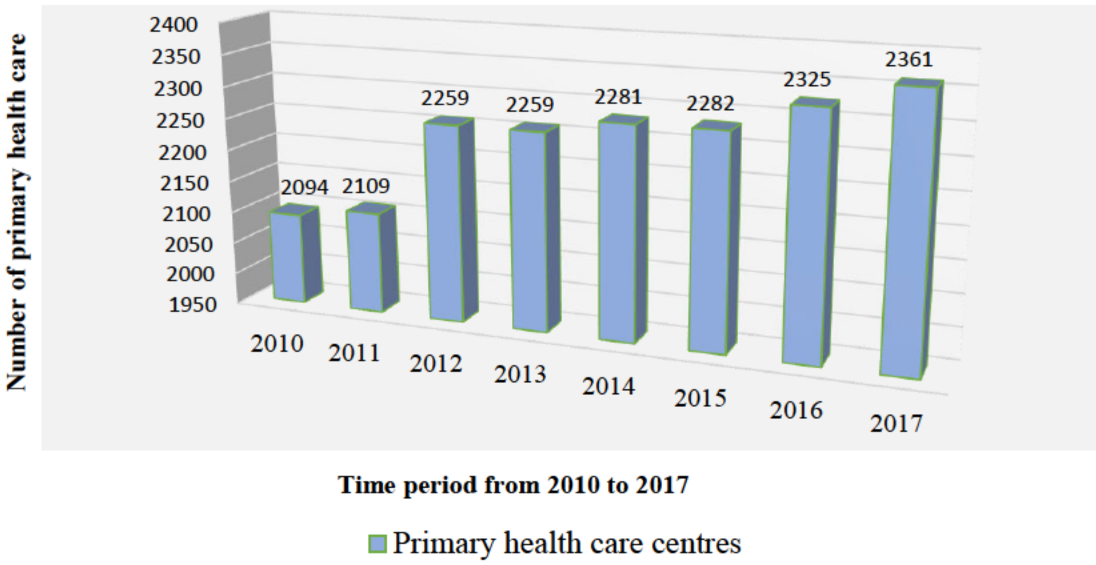



**Figure 2-5 Number of primary healthcare centres in Saudi Arabia**
Sources of data: (Ministry of Health, 2010, 2011, 2012, 2013b, 2014, 2015, 2016, 2017)

## 2.4.2 Secondary and tertiary healthcare levels

Saudi Arabia's secondary healthcare level treats patients referred from the primary level, while the tertiary level specialist hospitals treat patients with advanced forms of disease, on recommendation from the secondary level. According to the Health Statistical Yearbook (2017), the total number of public hospitals for these two levels was 282, distributed across 13 health directorates. Figure 2-6 illustrates the increase in the number of public hospitals from 249 to 282, between 2010 and 2017.

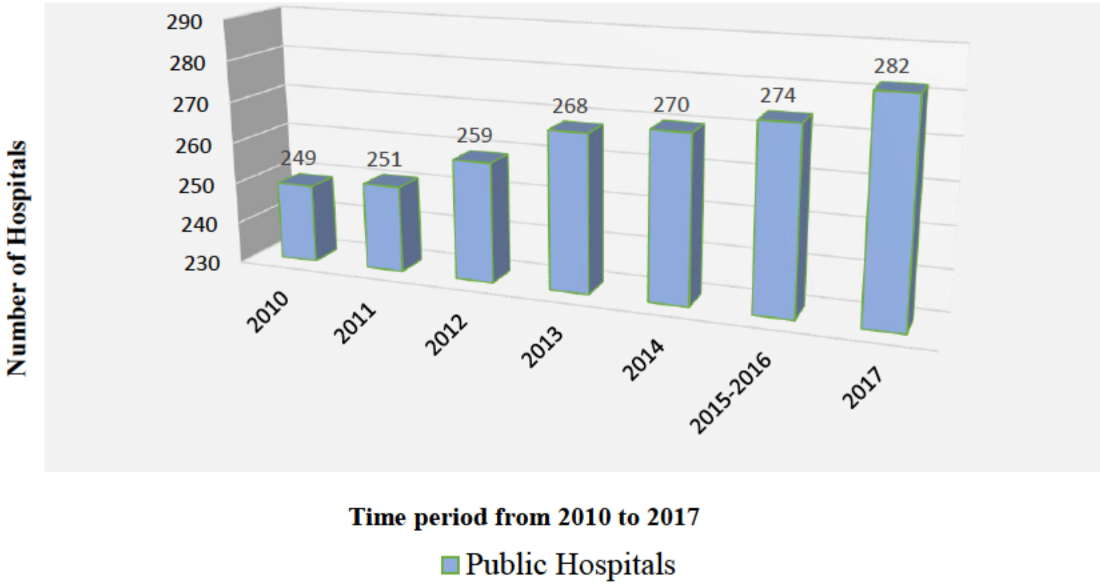



**Figure 2-6 Number of public hospitals in Saudi Arabia**

Sources of data: (Ministry of Health, 2010, 2011, 2012, 2013b, 2014, 2015, 2016, 2017)

## 2.5 Health insurance scheme

At present, health insurance is a major factor in terms of improving healthcare service delivery, which is considered a basic human right in most societies (Dawoud, Ahmad, Alsharqi, & Al-Raddadi, 2016). In line with the global growth of health insurance since the early 1990s, Saudi Arabia has employed progressive healthcare management strategies to reduce the overall financial load on the government and has implemented a national health insurance scheme (Aboul-Enein, 2002). At the end of 1995, the government introduced a mandatory health insurance policy for expatriate employees, with 80% of the costs contributed by employer and 20% by employee (Aboul-Enein, 2002). Saudi healthcare literature shows few studies that have assessed the current status and progress of health insurance implementation, though these have provided important insights into its low rate of incorporation into the healthcare system.

With its increasing oil revenue, the Saudi Arabian Government budgeted millions of dollars for socio-economic developments, including the adoption of health insurance, by establishing the Council of Cooperative Health Insurance (CCHI) in 1999 with the intention of making national healthcare insurance mandatory, through a three-phase implementation plan (Almalki et al., 2011; Barakah & Alsaleh, 2011; Ishfaq, Qadri, Abusaleem, & Al-Zyood, 2016). The CCHI's primary role has been to monitor the national health insurance strategy (Boulanouar, Alqahtani, & Alqahtani, 2016). The first phase involved implementing a cooperative health insurance scheme funding private sector healthcare services for citizens and expatriates working in non-government sectors and institutions with more than 500 employees, with their sponsors or employers paying the premiums (Ishfaq et al., 2016).

Alnaif (2006) reported that the health insurance scheme offered standard charges for consultations, treatment, and medication, as well as benefits for preventive care, maternity healthcare, vaccinations, parental care, radiology and laboratory tests, in-patient services and operations, and treatment of gum and tooth disease. Alsharif (2008) described the second phase, which covered citizens and expatriates working in the government sector, with the government covering a major portion of the costs. The third stage covered groups residing temporarily in Saudi Arabia, such as visiting pilgrims. Between adoption of the strategy in 1999 and March 2001, the first phase of the health insurance plan was implemented and piloted on expatriates (Aboul-Enein, 2002). According to Almalki (2012), a major criticism of the scheme was that by 2012, only the first stage had been implemented, with no sign of progress towards implementing the second and third phases.

The positive effect of health insurance on the quality of healthcare in developing countries, particularly Vietnam, has been substantiated (Wagstaff & Pradhan, 2005). However, conflicting policies among healthcare sectors and a lack of collaboration between healthcare providers and organisations prevented the completion of phases two and three of the Saudi health insurance model (Alhusaini, 2006; Almalki et al., 2011). The initial private sector phase implementation was hampered by substandard and neglected, essential components of a medical reimbursement system, such as a clinical coding system, all of which constituted a barrier to a complete implementation in this sector (Bah et al., 2015).

As late as 2017, a study that included a survey of householder opinion on the status quo of public health indicated an almost equal division in terms of whether the system was satisfactory or not. Many respondents were reserved about the impact of health insurance on their pockets and a few who worked in the private sector complained of a definite bias by doctors towards giving preference to patients paying cash. In terms of the government's burden in providing free healthcare to the millions of pilgrims visiting the country annually, a number of participants opined that this was an inviolable service, representing the principles of Islamic hospitality to be accorded every Muslim who makes the effort to visit the Holy Places and this gives the Saudis a sense of national pride (Al-Hanawi, Alsharqi, Almazrou, & Vaidya, 2018).

### 2.5.1 The vital role of clinical coding in health insurance funding

Almalki et al. (2011) revealed that despite many attempts by the MOH to improve the public healthcare sector, there was a perpetual shortage of healthcare professionals and the unresolved issue of the privatisation of public hospitals. However, a focus on developing the HIT infrastructure to facilitate the integration of the cooperative health insurance scheme was now apparent. Clearly, the current international conception of integrated health insurance requires the development of an infrastructure that includes diagnosis and procedure classifications and the practice of clinical coding to assign the correct codes, as the building-blocks of Diagnosis Related Groups (DRGs). In Australia, ICD-10-AM diagnosis codes and ACHI procedure codes form the foundation of the AR-DRG system and necessitate good quality clinical documentation and coding to assign accurate DRGs. The complete ICD-10-AM classification and coding package and associated refined AR-DRGs system were selected as the model for service provider claims and reimbursement under the national health insurance in Saudi Arabia (Ministry of Health, 2013; Independent Hospital Pricing Authority, 2015).

DRGs have effectively replaced the traditional 'itemised billing' or 'cost plus percentage profit' reimbursement structure with a 'fixed case rate', based on the diagnostic group category of an inpatient episode of hospitalisation. There is no change of rate for length of stay, or number of procedures, as these factors are averaged into DRG costing (Spragens, 2013). Khouja (2013) claimed that the Saudi CCHI had motivated private healthcare providers and health insurers to implement clinical coding by 2014. At that time, the CCHI was providing training sessions to develop clinical coding and AR-DRG proficiency and had introduced a compulsory accreditation process in Saudi hospitals affiliated to the private sector. However, the most recent research shows that these fundamental health insurance operational tools were not fully implemented. Bah et al. (2015) conducted a study at six private-sector healthcare centres in the Eastern Province of Saudi Arabia to assess the implementation status of AR-DRGs reimbursement coding. While one of the targeted centres had accreditation from the Joint Commission International and another from the Central Board for the Accreditation of Health

Institutions, the actual implementation of AR-DRGs in these centres was still uncompleted.

Poor health insurance infrastructure, together with weak or incomplete clinical documentation resulting in inefficient coding and incorrect AR-DRGs, hindered the implementation of the second and third phases in the public healthcare sector. The CCHI worked to address this issue in hospitals affiliated to the private sector, by promoting electronic communication to establish an information exchange between stakeholders. A later initiative was the Saudi Health Insurance Bus project, which aimed to standardise the health insurance claims process and enable stakeholders to engage in electronic data submission and payment (Khouja, 2013). These analysts reinforced the notion that progress in the Saudi health insurance project would have been dramatically improved, by addressing the existing challenges facing its implementation, which are discussed in greater detail in the following section. Figure 2-7 shows the layout of the common factors that have impacted on the Health Insurance Scheme implementation strategy in Saudi hospitals.

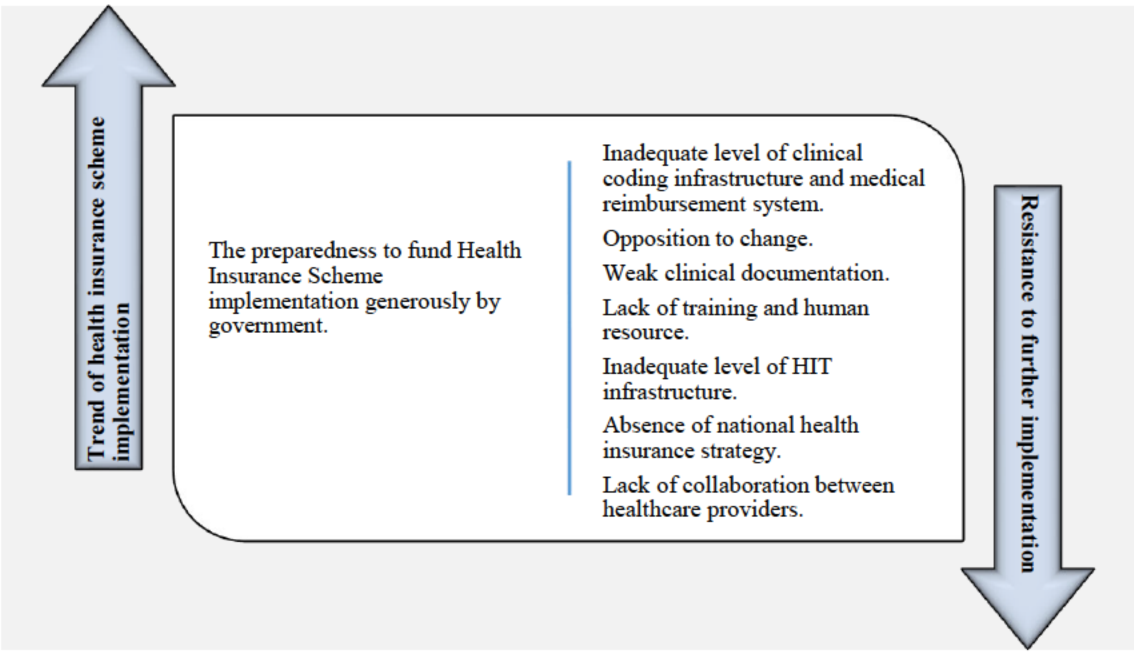



**Figure 2-7 Existing challenges hindering a successful health insurance scheme implementation**

## 2.6 Challenges facing healthcare providers

A major concern for large healthcare systems worldwide has been the elimination or limitation of persisting challenges. Understanding the underlying difficulties facing Saudi healthcare is essential to determine the reform needs and requisite resources.

### 2.6.1 Confronting high demand for healthcare

Increased demand on healthcare services, due to population growth, is recognised as a perennial challenge for healthcare providers worldwide (Nicholls, 2016). The sustained, above-average population growth rate in Saudi Arabia became a burden for healthcare providers. Healthcare service expansion necessitated increased healthcare funding, which forced the Saudi government to rethink its policy on financing public healthcare (Yusuf, 2014). A large body of evidence from more recent healthcare system studies has confirmed that although attempts at healthcare reforms were made, inherent barriers to reform remained. AbouEl-Seoud (2013) concurred that efforts to mitigate the administrative burden in Saudi public hospitals had limited success, due to policies which lacked specificity and defied implementation.

Studies by Almalki et al. (2011) and Ram (2014) showed that despite the intensive efforts of Saudi healthcare providers to keep pace with global developments, inherent defects inhibited the implementation of reforms. Increasing demands, escalating costs, a growing shortage of qualified professionals, and a dated HIT system persisted. In combination, these negative factors produced a compromised system and workforce, lacking the technology and skills required for a smooth transition to a more advanced, integrated system, comparable with systems refined over far longer periods in developed countries.

### 2.6.2 Regional disparities in healthcare development

Regional disparities in healthcare development, particularly the inferior provision of training programs in rural areas, constitute a barrier to the development of a unified national system and the rural population is disadvantaged by inferior professional skills. Al-Hashem (2016) confirmed that healthcare institutions in the cities of Jeddah, Dammam, and Riyadh received more health education programs than rural areas and a superior quality in healthcare service, although such differentiation is common in many nations, particularly those classed as developing countries.

### 2.6.3 Underlying Saudi healthcare challenges

Regional studies have assessed the common healthcare challenges facing the GCC countries. Achoui (2009) and Alshamsan, Leslie, Majeed, and Kruk (2017) identified rapid population growth and the resultant pressure on healthcare services, as the dominant regional issue. There was concern that inherent structural challenges would continue to impede proposed healthcare developments in the Gulf countries. Kumar (2016) noted that while GCC oil wealth makes healthcare funding relatively easier than in other developing countries, the acceleration of chronic disease in the Gulf population offsets the funding available for development. Saudi Arabia lags in state-of-the-art healthcare technology, yet it is universally accepted that technological innovation provides a means to a more integrated national healthcare system that offers better healthcare, potentially equal across geographical differences, which in turn produces a healthier nation (Altuwaijri, 2008).

Several researchers identified the fundamental factors restricting Saudi healthcare system developments. Almalki et al. (2011) listed the ongoing challenges as a shortage of native Saudi health professionals, a reluctance to provide financial support for world-class training, and the lack of development of national compatibility standards in healthcare technology, particularly in MOH facilities. Alkraiji, Osama, and Fawzi (2014) reported that substandard interoperability in HIT software, inadequate HIM training, a general shortage of Saudi health professionals, and ineffective policies and procedures, have imposed limitations on potential healthcare development for many years.

The rapid turnover of non-Saudi health professionals impacts adversely on the establishment of stable work relationships, teamwork, and interpersonal communication, as well as reducing productivity in the workplace (Almalki et al., 2011; Dawoud et al., 2016). Notwithstanding the increased demand, compromised manpower and inadequate infrastructure, Saudi healthcare services must cope with the severe impact of the annual *Hajj*. Customarily, the Saudi government offers free healthcare services to around five million pilgrims annually (Walston et al., 2008). Almalki (2012) suggested that the government should implement a seasonal *Hajj* health insurance to offset the financial burden.

The impact of oil wealth and rapid economic expansion has produced several negative social consequences. Saudi Arabia has the highest road accident rate in the world, mainly due to the lack of deterrent action against the many drivers who violate traffic rules.

Alshahrani (2017) noted that on average 20% of Saudi public hospitals beds are occupied by patients with injuries received in motor vehicle accidents, while 81% of all mortalities in Saudi public hospitals result from road accidents. Mansuri, Al-Zalabani, Zalat, and Qabshawi (2015) reported 86,000 mortalities and 611,000 injuries, 42,000 of which led to permanent disability, caused by road accidents in the preceding two decades in Saudi Arabia. Similarly, Ageli and Zaidan (2013) attributed 39,000 injuries and 7,153 deaths to road accidents, with nearly 80% of these cases requiring treatment in MOH hospitals during 2013. Annual road accident injury costs have averaged 7 billion Saudi Riyal (nearly US $1.9 billion) in recent years. Although the high incidence of motor accidents receives considerable attention, there has been no effective government intervention. Mansuri et al. (2015) found that 4.7% of Saudi Arabia's total mortalities are caused by motor accidents; in Australia and the US the road accident portion is around 1.7%.

While the rapid turnover of healthcare professionals and the burden of too many road accidents, mainly impact on human resources and healthcare costs, another longstanding challenge has been the poor HIT infrastructure. This has had a profound effect on functionality by reducing service quality and administrative efficiency, often preventing the application of more recent, more advanced technology. Uluc and Ferman (2016) asserted that inferior health technology infrastructure presents a fundamental barrier to improving healthcare in developing countries. Innovative technology and associated training are intended to reduce human resource levels. Dr. Abdullah Al-Rabeeah, former Saudi Minister of Health, confirmed that poor coordination between health organisations, due to weak planning, represents a substantial challenge (Al-Rabeeah, 2003). Mufti (2000, p. 5) remarked: 'There is unfortunately little coordination in planning, among health agencies.' Safi (2016a) found that although healthcare in Saudi Arabia had improved substantially, as demonstrated by the WHO ranking of 26th out of 190 countries, the shortage of qualified professionals and lack of coordination between health organisations results in the underuse of sophisticated equipment in some healthcare facilities. This is tantamount to misuse of resources.

## 2.7 Enacting Saudi public healthcare reform

### 2.7.1 The crucial need for clinical coding

Successful implementation of the Saudi health insurance scheme is totally dependent on efficient diagnosis and procedure coding, the implementation of which forms the focus of this study.

Attaining a global standard in healthcare reimbursement requires an HIM system running ICD-10, together with a DRG package, to convert diagnoses and procedures of patient healthcare episodes into standardised codes for submission to health insurance organisations (Kimura, Sato, Ikeda, Noda, & Nakayama, 2010; Timothy, 2011). Implementation of the ICD-10/DRG combination is fundamental to improving the commercial aspect of healthcare claims management (Polyzos, Karanikas, Thireos, Kastanioti, & Kontodimopoulos, 2013). There can be no argument, as has been demonstrated clearly in global healthcare literature, that efficient clinical coding using the appropriate software is a core component of the reimbursement process for healthcare services (Cascardo, 2014; Tran, Cennimo, Chen, & Altschuler, 2013). Collins, Allbon, and Bennett (2010) stated that the healthcare reforms enacted by the Council of Australian Governments included raising the quality of clinical coding. Carpentier (2012) contended that healthcare organisations, like any business, need to maintain profits to operate successfully. In modern healthcare, this cannot be achieved without meeting the required standards of clinical coding. The author also pointed out that healthcare service organisations carry the burden of the cost of clinical coding operations, in order to collect payments from healthcare insurance companies.

Clinical coding has been neglected in Saudi Arabia and is now a priority in further healthcare developments. Alternatively, Hazazi and Chandramohan (2017) suggested that the overall healthcare financial burden on the Saudi government has led to the ignoring of challenges which it perceives as secondary.

### 2.7.2 The national funding dilemma

Figure 2-3 above shows how the annual government funding of the public healthcare sector has grown consistently, increasing by 78% from 35,063,200 Saudi Riyal in 2010 to 67,758,793 in 2017. Khan (2016) and Thompson (2017) noted that the Saudi government has accepted the broad challenges facing the country and has prioritised healthcare over other essential sector reforms. Accordingly, the government unveiled a national strategy for a range of public reforms, described as a 'vision' for the future. The Saudi Vision 2030 focuses on the post-oil era and will introduce a series of national reforms, reducing the dependency on oil revenue and government financial support. The funding of public healthcare is regarded as a priority.

Though several researchers analysed the Saudi healthcare challenges, few successfully identified workable solutions and reform strategies to mitigate the cumulative effect facing the public healthcare sector and the need to provide for the annual escalating demand. Almalki (2012) proposed that a strategy of privatising Saudi public hospitals, completing the health insurance project, and improving HIM and HIT infrastructure will provide a platform for reform and ultimately reduce the financial burden.

Khaliq (2011) examined the legislation governing the proposed privatisation. Public hospitals would be sold to the private sector. While the MOH is likely to continue managing primary healthcare, there is a lack of clarity on the process and operational details. Recently, the MOH revealed in its response to the Consultative Council (national legislature) that government-owned companies will be established to assume ownership of hospitals and take over the employment of existing staff, a step aimed at raising the quality and efficiency, as well as rationalising costs (Hazzazi, 2018). Shifting public hospitals from government administration to government companies does not fall within the standard definition of privatisation. The MOH has not clarified the funding and operational details of this transformation proposal, nor defined the time frame.

Alkhamis (2017) conversely observed a lack of evidence supporting the argument that privatising Saudi public hospitals is an appropriate solution. He noted that the first phase of the compulsory health insurance implementation for expatriates in the private sector unexpectedly resulted in increased service demands. Alkhamis, Hassan, and Cosgrove (2014) produced statistics showing that in 2008 expatriates in Saudi Arabia (excluding their families) comprised 30% of the total population. Thus, in offering this group private-sector treatment under the health insurance scheme, the private-sector contribution to healthcare funding should roughly equal 30% of the total national health expenditure but amounted to only 22% that year.

Discussing the same issues, Mugapish and Hasan (2016) and Walston et al. (2008) both asserted that keeping pace with global healthcare developments would help improve the

Saudi Arabian public healthcare sector, in that substantial upgrading is prerequisite to overcoming existing challenges. Rising costs, increased demand, shortage of health professionals, the need for technological improvements, and the lack of reimbursement methods in healthcare organisations continue to impact on Saudi healthcare; privatising public hospitals represents a possible funding solution but does not eliminate the need to examine and find solutions for each of the highlighted problems. Khaliq (2011) stated that privatisation is the only solution to the continual increasing demand for healthcare services.

Irrespective of the funding of healthcare reforms, the funding of the existing healthcare services has become a major government concern (Yazbeck, Rabie, & Pande, 2017; Young, 2016). The costs of healthcare for expatriates, currently representing nearly 37% of the population based on the latest census, and an average of five million pilgrims annually clearly imposes limitations on the funding of reforms and development.

Almalki (2012) observed that with the government as sole funder, the option of privatising public hospitals had to be considered. There was a need for a Saudi health insurance strategy as an alternative funding source for public healthcare. Marušič and Prevolnik Rupel (2016) emphasised that healthcare systems globally are subject to perpetual change, as well as becoming progressively more complex. This demands reform, as indicated by the experiences of successful countries. ‘A reform implies sustained, purposeful, and fundamental changes’ (Marušič and Prevolnik Rupel (2016, p. 226). The successful implementation of health insurance in Vietnam is proof that it is an effective approach to addressing the funding dilemma, not only in developed nations (Wagstaff & Pradhan, 2005).

The weak existing health insurance infrastructure was inadequate for privatisation. The failure to maintain healthcare expansion in proportion to population growth necessitated a holistic approach, rather than a package of separate solutions (Almalki, 2012). Marušič and Prevolnik Rupel (2016) pointed out that the complexity of challenges facing healthcare and the inability or lack of resources to alter the root causes complicates reform. An efficient health information system, a sufficiency of skilled healthcare professionals, and committed, creative leadership are paramount to the reform process.

The self-assessment of the MOH claimed that progress has made in the areas of HIM, electronic health, health insurance, and in the creation of policies on which to reform

Saudi healthcare under the short-term National Transformation Program (NTP) 2020, which the Saudi cabinet had adopted to maintain momentum in achieving the long-term Saudi Vision 2030 goals (Saudi Vision, 2016). Whether the completed implementation of only the first phase of the national health insurance scheme constituted a level of progress or the non-implementation of the second and third phases implied failure, the funding problem remained unsolved.

Alharbi (2018) analysed the healthcare component of Vision 2030 from the change management perspective of whether the organisation had demonstrated readiness for change. The study concluded that the Saudi government had only paid attention to economic and technical aspects, ignoring the fundamental human component.

> Human interactions are the core element that constitute and make or break an organization. Therefore, ignoring these in planning, policy formulation, and decisions could be detrimental, as an organization’s readiness to change is valueless without the organizational members’ willingness to adapt and maintain consistency with the transformation required. Otherwise, resistance could destroy the entire exercise and efforts of NTP 2020. (p. 86)

A potential strategy for reforming Saudi public healthcare funding is to draw from successful cases of the use of health insurance. The Australian healthcare system is regarded as a proven example of the benefits of diversifying funding sources through comprehensive health insurance. The Saudi MOH has proposed the eventual implementation of mandatory healthcare insurance for all citizens and expatriates, as is the practice in Australia. However, employing direct taxation, the method used by Australia to debit ensured parties is unacceptable to the Saudi public. According to a study by Thompson (2017), the government should understand that Saudi Vision 2030 must not appear to impose a greater financial burden on citizens, many of whom have low incomes. Despite this reaction and the implications for the proposed privatisation of 274 Saudi Arabian public hospitals, a sharing of healthcare funding responsibilities between the government and other sectors, without the government relinquishing ownership of the public healthcare sector, appears to be a feasible step toward healthcare system reform. This is due to some complex challenges currently facing hospitals which need long-term solutions, as illustrated in Figure 2-8.

The basis of a reform proposal would potentially include diversifying funding sources to cover MOH institutions, together with universal health insurance covering citizens, expatriates, and pilgrims. Saudi healthcare reform policy framework should integrate proven solutions from developed and developing countries, adapted to the Saudi Arabian context.

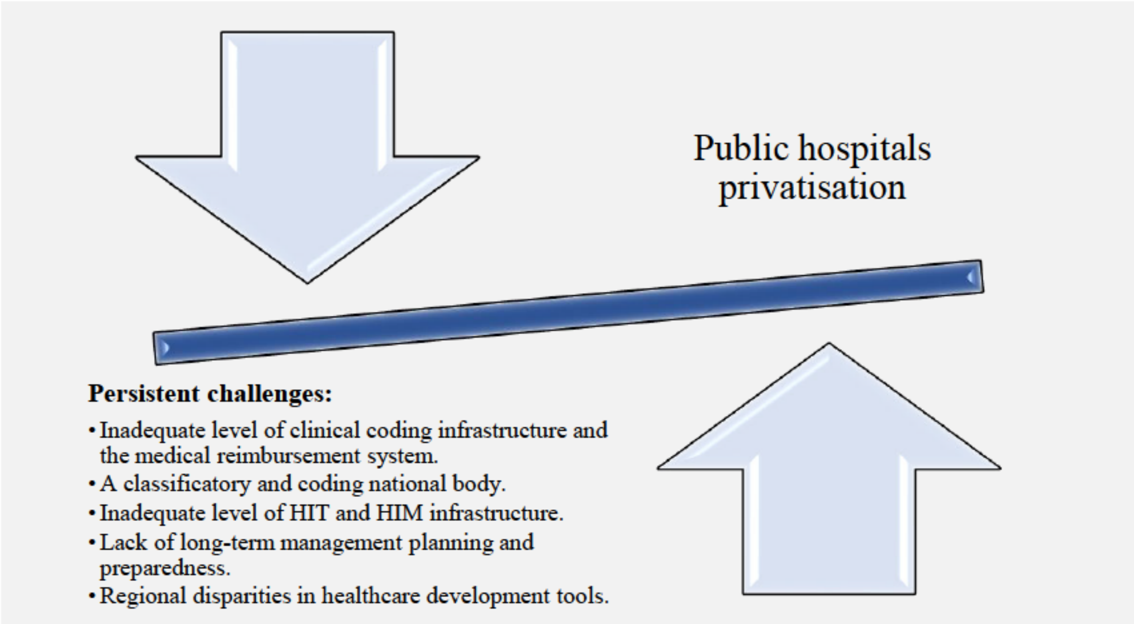



**Figure 2-8 Persistent challenges affecting privatisation of public hospitals**

## 2.8 An overview of the Australian healthcare system

The Australian healthcare system is rated as one of the best in the world (Mustofa, 2016; Willis, Reynolds, & Keleher, 2016), occupying fifth position behind Japan, Sweden, Canada, and France (Starfield, 2000). Historically, healthcare in Australia was administered by state and territory governments before the Federal Government expanded its role through policy and legislation covering pharmaceuticals, finance, coverage, and the benefits of health institutions. This restructuring was based on the experience of the United Kingdom (UK) at the end of World War II (Palmer & Short, 2000; Willis, Reynolds, & Keleher, 2009). The Australian system bears some resemblance to the UK National Health Service but was not implemented until 1972, due to the need for modifications in terms of authority and funding (Willis et al., 2009).

A landmark was established in 1984 with the introduction of Medicare, a comprehensive healthcare insurance project covering all Australian citizens, New Zealand citizens resident in Australia, citizens of other countries with bilateral Reciprocal Health Care Agreement with Australia, foreigners who qualify as permanent residents, as well as applicants for specially designated permanent visas; foreigners on parent visa application are excluded. The system is financed by the Medicare levy, an additional tax amounting to 1.5% of beneficiary annual income, or 2.5% per family. Those eligible for Medicare in higher income brackets without additional private health insurance to cover services excluded by Medicare, pay progressive taxation. The Medicare levy covers 16% of the Australian Government's total healthcare costs with the balance drawn from other forms of taxation revenue (Miles, Latham, & Biles, 2016; Willis et al., 2009).

The Medicare national health insurance scheme provides all eligible persons with comprehensive healthcare cover. As Australian healthcare includes public and private sector institutions, Medicare uses three rates of reimbursement: 1) 100% in public institutions; 2) 85% for general practitioner services in private clinics, based on the Medicare Benefits Schedule (MBS), with the balance covered by supplementary private health insurance, or the patient; 3) 75% in private hospitals based on the MBS, with the balance covered by supplementary private health insurance or the patient (Willis et al., 2009, 2016).

Medicare is complemented by the Pharmaceutical Benefits Scheme, which covers most of the costs of prescription medicines (Willis et al., 2009). International students and their families in Australia are covered under the MBS by the mandatory Overseas Student Health Cover (Ong, 2009). Casemix funding based on ICD coding and DRG categories replaced itemised billing, initially in Victoria in 1993 and thereafter was adopted by the remainder of the country. As the Australian healthcare model evolved, the need arose for a national standard of coding based on Australian healthcare practice and a national organisation responsible for creating national coding standards, now known as the NCCH (Roberts, Innes, & Walker, 1998). The Australian national healthcare system serves as a model for other national systems. Notwithstanding Australia's status as a developed nation, it should confirm to the Saudi Arabian government that diversifying public healthcare funding sources presents a clear solution to relying solely on State funding.

## 2.9 Conclusion

The discovery of oil in 1938 transformed Saudi Arabia from one of the world's poorest nations to a 2016 ranking of 15th, based on per capita GDP adjusted by purchasing power (Ventura, 2019). Notwithstanding its position as the world's leading exporter of oil in the 1970s and the development of a formidable healthcare system ranked 26th in the world by the WHO in 2000, the combination of escalating national healthcare costs due to rapid population growth, longer life-expectancy, chronic non-communicable illnesses, a 25% expatriate population, and a cultural obligation to provide free healthcare to roughly five million Hajj pilgrims annually, the Saudi government has been forced to find alternative sources of funding. Phase one of a national health insurance scheme was implemented in 1999. A shortcoming was the failure to implement a diagnosis and procedure classification and coding system, as exemplified by ICD-10-AM and ACHI, for standardising claims and reimbursements.

The uncompleted health insurance scheme is one of a series of unrealised MOH projects initiated to improve Saudi healthcare quality. The resumption of efforts to successfully conclude the process, which necessitates the implementation of ICD-10-AM and practice of clinical coding, also supports the funding of the Saudi Crown Prince's Vision 2030 national upliftment project. The change management analysis of Saudi MOH reform processes that never reached fruition pointed to the lack of transparency and neglect of consultative processes as factors preventing the achievement of an organisational state of readiness for innovation and change (Alharbi, 2018). Ironically, it appears to be the MOH that needs to modify its management style to see its plans successfully implemented.

# 3 Chapter Three: Literature Review Part One - Health Information Management and Technology

## 3.1 Preface to literature reviews

The literature applicable to the factors influencing the implementation of ICD-10-AM and clinical coding in Saudi public hospitals includes health information technology and management; healthcare financing and reform; hospital staffing, training, evaluation, and organisational factors; as well as clinical coding, medical classification, and ICD-10 and its modifications. The literature review has been spread over three chapters:

**Chapter 3** covers the potential impact of health information management and technology on the functioning of ICD-10 and clinical coding.

**Chapter 4** covers the historical development of the ICD series from a classification of causes of mortality up till ICD-10, the national modifications to serve the healthcare systems of individual countries, and the development of DRGs to provide a system of reimbursement.

**Chapter 5** presents the literature of ICD-10 implementations in a few developed and developing nations, the techniques used to evaluate sources, and their relevance to the study aims and objectives, as well as revealing the existing gaps.

## 3.2 Introduction

'HIM is the heart of a health organisation; with each beat, it supplies much-needed information to users such as physicians, staff nurses, allied health professionals, health administrators, insurance companies and government health departments' (Al Kiyumi et al., 2017, p. 1). Historically, HIM covered the manual organisation and protection of patient information in the medical records department and the availing of this for clinical or administrative purposes.

The rapid advances in the field of technology and emergence of HIT made a considerable impact on HIM and automated many routines of the medical records department, particularly the structuring of the storage and retrieval of patient files. The implication is that HIM professionals now require a far greater understanding of health information, information technology, and the management of Electronic Health Records (EHR) (Al Kiyumi et al., 2017).

The central theme of the chapter is the role of health information from the perspectives of technology and management, as crucial pillars for the implementation of clinical coding systems. Other HIT areas relevant to the information derived from clinical coding, such as health data standards and EHR, form a part of the coverage.

## 3.3 What is health information?

A half-century ago, the term ‘health information’ generally referred to personal details regarding allergies and other medical problems, an individual was obliged to enter on application forms, perhaps for a job, home loan, or an insurance policy. Today, well into the Information Age, health information includes all medical information from the details of the practitioner’s diagnosis and prescription to the statistics released annually by the WHO, on the global occurrence of specific diseases. Along the process between the creation of the data and its eventuality as a statistic, it may be captured into the EHR of the patient, used in the supplying of pharmaceuticals and radiological or pathological assessments, translated into clinical coding to be used for billing and reimbursement by the health insurer, accessed by the physician in reference to patients’ previous visits, and shared with participating organisations in Health Information Exchange (HIE).

Health researchers, Fiorito and Edens (2016) proposed that health information is the product of the interactivity of HIT and Health Informatics (HI), although the distinction between the two is not well-defined. HIT defines the integrated operating hardware and software applications of healthcare computerised systems, while HI involves the process of how health information is recorded and shared electronically, in order to serve the needs of healthcare organisations. The processing of HIT and HI, and the overall running of healthcare information systems, is dependent on a management function described as HIM, which forms an important category of current healthcare literature. From the variations in coverage of the many definitions of the term encountered, this study focuses on ‘HIM’ as the process of managing healthcare data, including medical records, storage of patient data, coding, classification of diseases and the billing process (Fiorito & Edens, 2016).

## 3.4 From technology to health information technology

As the concepts and practices of technology have expanded, so too has the definition of the term. Before the new millennium, Orlikowski (1992) defined technology as hardware equipment designed for productive activity in human developmental areas such as industry and informatics. Epp (2001) noted the inadequacy of such a definition and proposed that technology refers to hardware and software that can used by skilled people to achieve an objective. Progress saw a broadening of the term to include a range of tools, techniques, and processes and the associated human skills necessary to apply them, towards a defined objective in a specific field or community such as healthcare (Banta, 2009). Aksoy and DeNardis (2007) discussed the term ‘information technology’; ‘information’ refers to the interpretable data, used to explain a phenomenon, while technology refers to the software and hardware devices used to facilitate the utilisation of such interpretable data. Bowens, Frye, and Jones (2010) stated that the integration of technology into health information created the concept HIT, which includes an array of technologies and electronic systems, including applications, hardware, and software used for the purposes of the storage, analysis, and sharing of patient information in healthcare systems, such as the electronic health record. It is a distinct ‘information technology’, separate from ‘medical technology’, which describes medical devices from stethoscopes to MRI scanners, the outputs of which do produce a form of medical information.

A single, universal definition of HIT appears to be lacking in healthcare literature, indicating the existence of contentious views, or alternatively reflecting the rapid evolution of the technology of healthcare. Zeng, Reynolds, and Sharp (2009) noted, with regret, the lack of a uniform definition of HIT among government documentation and research literature. Asan and Carayon (2017) and Kasemsap (2017) argued that HIT is a broad concept, defining an array of the major technological categories, inclusive of hardware devices and dedicated health service software for the storage, retrieval, and exchange of medical data. Davis and LaCour (2014) and Thompson and Brailer (2004) defined HIT as the system requirements of healthcare information processing. Its implementation encompasses both the software and hardware in the fundamental healthcare purposes of storing, recapturing, and sharing data, as well as the secondary utilisation of the data for knowledge and decision-making purposes.

In the early 2000s, a new conceptual category in the health technology infrastructure emerged, known as health informatics. Perreault and Shortliffe (2001) asserted that HI was originally known among healthcare professionals as medical informatics and that HI came into usage when health leaders realised that medical informatics was not solely for the use of physicians. O'Carroll, Yasnoff, Ward, Ripp, and Martin (2003) defined HI as the process by which health institutions utilise technical applications to translate their aims from the theoretical sphere into the practical. Hence, the concept of HI covers the technical applications using the HIT infrastructure for the purpose of collecting, analysing, storing, and sharing medical information, in order to increase healthcare quality. Shortliffe and Blois (2006) discussed several additional HI applications used in health organisations, such as bioinformatics, imaging informatics, clinical informatics, and public HI.

Given the absence of a clear, universal definition of HIT, a working definition must include the fact that HIT may incorporate information technology that is not necessarily healthcare-specific such as Windows-based computers and servers. Such hardware is configured into a healthcare system using the requisite health data standards to run specific health applications such as an EHR system, designed for healthcare purposes.

## 3.5 Health data standards

It is crucial to efficient communication and sharing of information among healthcare and other organisations via HIT applications to meet the required health data standards. A proliferation of studies that emphasise the role of health data standards in promoting efficiency in healthcare systems (Alkraiji, 2012; McWay, 2013). Health data standards refers to the interoperability of core informatics elements and technological components to facilitate the smooth flow of information via the infrastructure, using mutually established technological standards known as data standards (Erickson, Wolcott, Corrigan, & Aspden, 2003). Uhomoibhi, Alkraiji, Jackson, and Murray (2011, p. 348) noted: ‘Applications must be adopted based on interoperable standards, for healthcare organisations to see the benefits introduced by these systems. Interoperability means that the communicated messages must be understandable by a computer at the receiving end of a communication.'

Aspden, Corrigan, Wolcott, and Erickson (2004) revealed that the absence, unavailability, or shortage of mainstream data standards has hampered sharing of information between healthcare facilities and commercial clinical laboratories, between chemists and hospitals regarding prescriptions, as well as between healthcare institutes and insurance companies regarding reimbursements. Spooner and Classen (2009) revealed the benefits of health data standards as increasing patient safety, reducing medical costs and medical errors, and increasing the efficiency of communication between different medical sectors to exchange medical data. Failure to adhere to these standards is an obstacle to healthcare development.

Compatibility implies a shared language of communication and level of standardisation, to exchange and process healthcare data efficiently and securely (Alkraiji et al., 2016; Hammond, 2005). Hammond (2005) defined this fundamental baseline requirement in the functioning of all information technology systems with the term 'interoperability'. When participating components, or groups of components, embrace common procedures, systems, and functions, 'functional interoperability' is achieved. When the communication language of the transmitting computer is understandable and accessible by the recipient computer, or alternatively when the binary structure and formatting of exported data can be accepted and interpreted by the receiving computer, functional interoperability exists. Thus, HIT demands a high level of standardisation and compatibility in the integration of discrete components of the system to exchange health data securely. Alternatively, the lack of compatibility of software programs across interacting HIT infrastructures will impact negatively. Interoperability is crucial for the adoption, implementation, and functionality of clinical coding.

Some researchers have concentrated on the individual HIT components in terms of compatible input and output standards. Alkraiji, Osama, et al. (2014) advanced the following description: HIT infrastructure comprises a group of medical devices, computers and networks interacting to share and exchange healthcare data, assisting health professionals to deal with this data for a variety of medical purposes.

The WHO lists the following international health data standards:

1) ICD-10 is a classified set of standardised terminology and associated codes for disease, injuries, and other health problems.
2) Logical Observation Identifiers Names and Codes (LOINC) provides a system of standardised codes for measurements arising from tests and observations that may be grouped into two categories; laboratory and clinical.
3) Health Level Seven (HL7) is a healthcare standard that provides a specific structure for messages carrying clinical data.
4) Systematized Nomenclature of Medicine (SNOMED) is a hierarchically structured terminology incorporated in EHRs to facilitate the storage and retrieval of clinical care records.
5) Statistical Data and Metadata eXchange (SDMX) provides the formats to be used in the exchange of health data and metadata. The WHO adaptation SDMX-HD (Health Domain) allows medical facilities to exchange indicators and metadata between one another (World Health Organisation, 2019a).

Other important health data standards are:

1) Digital Imaging and Communications in Medicine (DICOM) enables the sharing of medical imaging such as MRI scans and X-rays.
2) Current Procedural Terminology is a coded set used for the billing of procedures in the USA.
3) Fast Healthcare Interoperability Resources (FHIR) is an exchange standard.
4) Health Insurance Portability and Accountability Act (HIPAA) Privacy and HIPAA Security Rules protect against the unauthorised use of healthcare data (World Health Organisation, 2019a).

The Healthcare Information and Management Systems Society of the US (HIMSS) refers to four categories of health data standards; namely:

1) Content (HL7).
2) Terminology (LOINC, HL7, SNOMED, SDMX, ICD-10).
3) Transport (FHIR, DICOM).
4) Privacy and Security (HIPAA).

Health Data Standards are the foundation of interoperability. Research into the national level of hospital interoperability indicated that 29.7% of all hospitals in 2015 were operating in all four domains of interoperability; namely, finding, sending, receiving, and integrating electronic patient information from outside providers (Holmgren, Patel, & Adler-Milstein, 2017).

The Australian government has established a National Digital Health Strategy which aims for complete interoperability between all national health institutions by 2022. At a presentation of the Australian Digital Health Agency entitled 'Global standards and interoperability in Australian healthcare', it was pointed out the enormous benefits of digital health, in terms of the following negative statistics due to a lack of interoperability. On average, 13% of general practitioner consultations require a subsequent appointment due to missing information. 223,000 patients are admitted to hospital annually as a result of adverse drug events, which amounts to over 2% of all hospital admissions, at a cost of A$1.2 billion. 14% of pathology tests would be unnecessary had the physician access to patient information from an earlier test. Such statistics could be effectively reduced with full national interoperability (Trujillo, 2018). The overall National Digital Health Strategy goals constitute the highest level of care coordination; a reduction in preventable hospitalisations, improved self-care, minimisation of duplication and operating costs, and a superior patient and provider healthcare experience (Steven & John, 2019).

The National Digital Health Strategy aims to have a complete 'My Health' record for all Australians who fall under Medicare, excluding those who choose to opt out, by 2022. At the end of January 2019, the uptake was 89%. Personal uploads to 'My Health' include all clinical documentation, dispensary records, diagnostic imaging, and pathology results. In addition, information on choices such as organ donation are included. The national interoperability strategy will allow any clinician full access to a patient's personal medical history from any treatment point (Australian Digital Health Agency, 2019).

Notwithstanding advances in technology, more powerful and faster processors, and more skilfully tailored software, the compatibility of discrete components through data standards remains fundamental to interoperability. Kijsanayotin (2016) indicated that different systems of health information have led to a global challenge, particularly in developing nations, to establish integrated, functional, and effective procedures and systems of health information, as well as interoperability with those of other nations. The bottom line in informatics is that failure to establish stable data standards will result in communication failure (Systems Society of the United States, 2019).

## 3.6 Positive impact of technology on healthcare

HIT plays a fundamental role in supporting clinical information management through its infrastructure. This includes secure systems for exchanging healthcare information among healthcare professionals, account payments and reimbursements, and monitoring the statistical evidence that assesses performance levels of healthcare services (Fiorito & Edens, 2016). In the past two decades, many researchers have assessed and quantified the impact of HIT on healthcare. Researchers such as Morrissey (2002), Buntin, Burke, Hoaglin, and Blumenthal (2011), Colicchio et al. (2016), and Lyon and Lewis (2016) have all agreed that the use of technology in healthcare services produces many benefits that translate into cost savings. An abundance of healthcare-related research literature confirms the finding that HIT reduces healthcare costs in the long term. Bardhan and Thouin (2013) and Patil and Patil (2017) noted that using HIT in healthcare organisations improves the overall quality of healthcare delivery, as well as reducing the overall costs. Sharma, Chandrasekaran, Boyer, and McDermott (2016) confirmed the role of HIT in improving the quality and reducing the costs, as well as reducing medical errors from both the quality and cost-related perspectives.

Recent studies have paid attention to the accelerated development of HIT in many aspects of healthcare. De Raeve et al. (2016) and Ossebaard and Van Gemert-Pijnen (2016) dealt with the recent surge of interest in electronic health technology. The researchers noted that electronic health has become a major factor in the improvement of healthcare systems worldwide, in terms of increasing the safety of the storage and circulation of health information. Peeters, Krijgsman, Brabers, De Jong, and Friele (2016) observed that the past few years have seen increasingly rapid advances in the field of HIT, HIM, and communications technology and the role of these in supporting patient self-management of chronic diseases.

Thus, health technology has been constantly refined and information communication technology in healthcare has become one of the essential components of HI, contributing to greater efficiency (Coiera, 2015; Haux, Winter, Ammenwerth, & Brigl, 2013). Furthermore, many researchers reported that HIT plays an important factor in increasing workplace efficiency, reducing workloads, medical errors, and healthcare service costs (Chaudhry et al., 2006; Kimaro & Nhampossa, 2007; Shah & Peikari, 2016).

Slight and Bates (2016) discussed the assessment that HIT leads to a reduction in medical errors, thus increasing patient safety, based on the evidence that greater accuracy of transmitted data improves professional work-related communication. The study also confirmed that HIT ensures greater accuracy in calculating dosages of medications.

Overall, researchers agree that the role played by technology in healthcare leads to improvements throughout HIM functions. Alkadi (2016) confirmed that HIT unifies multidisciplinary treatment working structures, enhancing management and administration, as well as the diagnoses, treatments, payments, and reimbursement of patients. A wide range of standard hardware used in general computing applications interact efficiently with healthcare-specific software, linking many functions and improving the overall quality of healthcare services.

### 3.6.1 Health information exchange

HIT plays a fundamental role in supporting the electronic exchange of confidential, critical patient clinical information between multiple organisations; the advantage of providing healthcare professionals with the previously unavailable patient information is self-evident (Fiorito & Edens, 2016). HIE describes the transmission of healthcare-related data, both internally and between health facilities, organisations, and government agencies covering healthcare treatment and practice, medical aid and health insurance, research, education, training, policy formulation, and statistical computation and includes national, multinational and bilateral organisations (Almoaber & Amyot, 2017; Vest & Gamm, 2010). According to Shapiro et al. (2016, p. 217), the US Department of Health and Human Services subscribes to the following definition: '[HIE] is the electronic movement of health-related information among organisations, according to nationally recognized standards. The goal of HIE is to facilitate access to, and retrieval of, clinical data to provide safer, timelier, efficient, effective, and equitable patient-centred care.'

At the healthcare facility level, it accounts for the process of effectively sharing electronic health information at patient-level between various institutions; the prospective benefits of providing healthcare professionals with the patient-level information, which was formerly unavailable, are widespread (Vest & Gamm, 2010). Ultimately, healthcare facility level data may be included in regional, national, and global level statistical data, indicating the potential of HIE to unify all health data into one global system (Hersh et al., 2016; Kaelber & Bates, 2007). Ancker et al. (2015, p.2) referred to the current focus on data standards and interoperability: 'Potential [HIT] solutions have focused primarily on facilitating provider-to-provider information sharing, including interoperable EHR and [HIE] systems.' Many studies confirm the benefits of using HIE in healthcare systems.

A decade ago, Kaelber and Bates (2007) projected that in the US, given the availability and immediate accessibility of pertinent patient information, particularly in emergency care, nearly 70% of unfortunate drug events and 18% of patient safety violations could be eliminated. Frisse et al. (2012) and Rahurkar, Vest, and Menachemi (2015) assessed the reduction of health service costs in emergency situations, by accessing patient information in a fast and secure manner. Frisse et al. (2012) found that approximately US$800 million per annum in healthcare costs had been saved by eleven US hospitals, using HIE to access healthcare data histories of emergency department patients. A considerable amount of literature has been published on the role of HIE in enhancing the quality of healthcare systems. A study by Adler-Milstein, Bates, and Jha (2011) reported that in 2009, the US allocated $30 billion for the adoption of HIE systems by healthcare organisations, based on its valuable function in providing basic patient data to aid clinical decisions and the electronic prescribing process.

A further explanation given by Adler-Milstein et al. (2011) is that effective HIE involves all providers participating in an exchange meeting the core exchange criteria and selecting a subset from the menu criteria. The core criteria encompass the recording of patient data, critical decision support, electronic prescribing, and other primary HIE applications. The menu criteria involve elements aimed at bettering coordination between healthcare facilities and equipping patients with accurate clinical and educational information. Dr Adler-Milstein is an eminent US health information scientist and national HIT policy advisor, with a special interest in HIE and interoperability. She and other esteemed healthcare academics conducted a US national HIE survey. Adler-Milstein, Bates, and Jha (2013, p. 1486):

> We found that 30 percent of hospitals and 10 percent of ambulatory practices now participate in one of the 119 operational [HIE] efforts across the [US], substantial growth from prior surveys. However, we also found that 74 percent of [HIE] efforts report struggling to develop a sustainable business model.

Test results proved to be the most exchanged data, followed closely by patient summary care records, discharge summaries, and clinical summaries. The survey involved almost 3,500 hospitals participating in 119 HIE cooperatives. However, the survey also concluded that most US healthcare providers, and 90% of physician practices, do not exchange data. Other studies have emphasised the potential of HIE to improve the efficiency of healthcare services. Shapiro, Kannry, Kushniruk, Kuperman, and Subcommittee (2007), Rahurkar et al. (2015) and Almoaber and Amyot (2017) suggested that to increase the efficiency, quality, and safety of patients who visit health organisations, there is a need to promote HIE systems to ensure accurate and immediate access to patient data. In practice, however, as noted by the Adler-Milstein survey, the benefits of HIE come with a cost, which may have been underestimated in the planning stages. This delicate balance of greater efficiency and cost is likely to have great relevance to the main study topic.

### 3.6.2 Electronic health records

An 'electronic health record'(EHR) refers to a data record of a patient's health information in a format prepared for computer processing, storage, and disseminating securely and accessible to all authorised system users. EHRs are designed and structured to support quality integrated healthcare. Their earliest usage occurred as far back as 1992 with the emergence of Personal Computers (PCs) as workstations for physicians when an electronic format for submitting health insurance claims was developed in the US. Their subsequent development parallels that of the continuous advances in PCs and PC networking (Evans, 2016). EHRs contain past, present, as well as prospective information (Simmons, Singhal, & Lu, 2016). EHRs, in transporting healthcare data between facilities and agencies and promoting greater efficiency through rapid transfer speeds, increasing privacy and reducing labour and costs, may be described as the vehicle of healthcare data processing (Dinev, Albano, Xu, D'Atri, & Hart, 2016; Fiorito & Edens, 2016). In addition to offering performance improvements in healthcare data systems in terms of ease and speed of access, EHRs have increased accuracy and efficiency by reducing the potential for human error (Adler-Milstein, Everson, & Lee, 2015; Cesnik & Kidd, 2010).

Baumann and Karel (2013, p.41) presented a more practical, detailed definition: '[An EHR] is generated by one or more encounters in any healthcare delivery setting. The EHR includes information on patient demographics, progress notes, medications, vital signs, clinical history, immunizations, laboratory results, and reports of diagnostic procedures.' The transformation from manual documentation to EHR provides the key that unlocks the full potential of HIT and HIM in documenting patient healthcare with greater efficiency (Weaver & O'Brien, 2016). Dimick (2012, p. 1) projected an attainable healthcare scenario for the year 2025: ‘EHRs and accompanying technology like HIE, computer-assisted coding, voice recognition software, and patient portals—along with revamped government quality and EHR incentive programs—are modifying many aspects of HIM.’

In order to assess the impact of EHRs on the quality of clinical data administration, as well as the implications for HIM and HIT, existing literature and research was analysed. Since the new millennium, the massive transformation in healthcare from paper to paperless records and systems has drawn critical attention from researchers, more than one of whom has described EHRs as the heart of HIT (Grimson, Grimson, & Hasselbring, 2000; Perlin, 2016). Farhan et al. (2005) asserted that the most important part of the health information system is the medical record. A systematically and appropriately documented health record is critical to sound healthcare, as it acts as a primary communication channel between healthcare professionals at diverse levels. This statement holds whether the medical record is in hardcopy or electronic format. The handwriting of doctors has been the subject of a whole category of jokes and handwritten prescriptions often seem to be coded. There can be little doubt that an EHR offers greater accuracy, more secure storage, and reduces the potential for critical errors.

EHRs, as well as improving the storing, accessing, sharing, and securing of clinical data and supporting research, have made a great impact on the execution of clinical coding. Kortüm et al. (2016) emphasised that EHRs are fundamental to ICD-10 implementation. Before EHRs, clinical findings were written out by the attending physician and the diagnoses were then entered manually into the Hospital Information Systems (HIS) by administration departments. ‘Since the introduction of the EHR, the entry of a diagnosis in the diagnosis field is mandatory for the treating physician’ (Kortüm et al., 2016, p.4). This can be achieved either by using a drop-down menu of the 50 most frequent diagnoses or by means of a classificatory search engine (Kortüm et al., 2016).

Cowie et al. (2017, p. 1) confirmed that ‘EHRs provide opportunities to enhance patient care, to embed performance measures in clinical practice, and to improve the identification and recruitment of eligible patients and healthcare providers in clinical research.’ King, Patel, Jamoom, and Furukawa (2014) found that EHRs had increased the opportunities to support quality integrated healthcare in terms of accessing health information remotely. Bardhan and Thouin (2013) and Lavin, Harper, and Barr (2015) recently listed the benefits as: increased patient safety by yielding more accurate health data, greater quality of healthcare services through greater integration, as well as minimising medication errors. Hoover (2017) stated that comprehensive EHRs enhance the HIT infrastructure in healthcare institutions, allowing healthcare professionals access to detailed patient information at the time of service. The researcher stating that 'more than 60% of medication errors in hospitals were traced to poor handwriting. Additionally, some EHRs are designed to integrate with barcode scanning technology. If a nurse scans the wrong medication an alert pops up alerting to him/her a problem.' (P.21)

EHRs have been well assessed in terms of the cost versus benefit equation in the US and hospitals estimate savings of billions of dollars annually. According to Hillestad et al. (2005), the evaluation covered the health and safety benefits related to widespread implementation of EHRs and concluded that effective adoption, as well as networking of EHRs, would eventually save over $80 billion annually simply by enhancing efficiency and safety of healthcare. However, older studies that promoted the importance of EHRs often had an element of speculation and lacked the objectivity of more recent studies. Earlier researchers argued that the cost of shifting from traditional to electronic form would pose a major challenge. Several very recent studies such as Adler-Milstein et al. (2014), Beasley and Girard (2016), Meigs and Solomon (2016), Kruse, Kothman, Anerobi, and Abanaka (2016) have found that the total cost of EHRs implementation is considered a serious challenge for many healthcare organisations.

Among the most recent researchers, Hammid and Cline (2013), Wang and Biedermann (2012), Jamoom and Hing (2015), Gabriel, Jones, Samy, and King (2014), Vest, Yoon, and Bossak (2013), Abramson, Edwards, Silver, and Kaushai (2014), and Kruse, Mileski, Alaytsev, Carol, and Williams (2015) have all highlighted the important role of HIT infrastructure on the EHR implementation process. Abramson, McGinnis, Moore, and Kaushal (2014), Menon, Singh, Meyer, Belmont, and Sittig (2014), Sockolow, Bowles, Adelsberger, Chittams, and Liao (2014), Simpson Jr (2014), and Kruse et al. (2016) all contended that training staff is an important factor in implementing EHRs.

US EHR adoption has, however, accelerated. According to Zeng (2016, p. 112):

> Several factors have contributed to the adoption of EHRs: the meaningful user incentive program from the federal government; the advancement of computer and information technologies, including both hardware and software; and the shift from a volume-based system to one focused on quality and value of care. In the US, the adoption rate of basic EHR systems among non-federal acute care hospitals has increased from 9.4% in 2008 to 75.5% in 2014—an 8-fold increase

> in 6 years. In North Carolina, almost all major health care systems have implemented new EHR systems in the past 5 years. The basic EHR adoption rate in North Carolina has increased from 11% in 2008 to 78.4% in 2014. Very soon, most (if not all) of our health care data will exist only in digital formats in some healthcare organisations.

EHRs fall into the category of commercial, interactive application software. There is intense competition in the marketplace and winning a major government tender is a huge prize. The projections of massive long-term savings may be realistic, but there is sufficient evidence from more cautious and thorough researchers that costs will inevitably be a factor, particularly in the context of developing nations.

In the context of researching an implementation of ICD-10-AM and clinical coding, it is necessary to emphasise that clinical coding using ICD classification has been practiced for many years without EHRs. As recently as 2013, only 10% of Australian hospitals had implemented EHRs (Xu, Gao, Sorwar, & Croll, 2013). The essential principles of ICD classification and translation into coding is dependent on a knowledge of anatomy, pathology, and hospital interventions, as well as the logical steps of the coding process and DRG grouping. These are invariable; whether coding manually or into an electronic record. This equates with the futility of believing that a calculator can make up for a poor understanding of arithmetic operators.

## 3.7 The practice of health information management

Historically, HIM has been defined as the healthcare organisational function that involves the management of patient information contained in medical records. Originally this referred to paper documentation but now refers to the management of electronic systems forming a part of the HIT infrastructure (Hersh, 2009). Present-day HIM oversees the processing of data in healthcare information systems and its integrity, security, and accessibility. It further offers user support and involves strategic planning and policy establishment. Al Kiyumi et al. (2017) observed that HIM is a core requirement of healthcare organisations in its function of supplying vital health information to healthcare professionals, including insurance companies and other government departments. It is accepted that HIM requires trained healthcare professionals who combine clinical, technological, and management skills.

Sheridan, Watzlaf, and Fox (2016, p. 1) provided the following description of HIM qualities and needs: ‘HIM as a profession has historically been oriented toward producing

HIM professionals with technical and managerial skills and behaviours, rather than leadership skills and behaviours.' It is clear, however, that depending on the level of transformation from a paper to EHR-based records that current HIM practitioners may use paper records, EHR, or a hybrid combination of paper and EHRs (Abdelhak, Grostick, & Hanken, 2014). HIM specialists, through patient information data and the HIT infrastructure, link physicians, medical records, outpatient clinics, inpatient cases, health insurance companies, and billing management. To distinguish between HIT and HIM professionals, Hersh (2009, p. 5) proposed: '[Health Information Technologists] – those who install, maintain, and optimize the hardware and software, [HIM]– those who bring their knowledge and skills to bear on increasingly electronic medical records, especially in areas of documentation, coding, and legal and compliance issues.'

Clinical coding is considered an essential HIM practice. Houser, Morgan, Clements, and Hart-Hester (2013) conducted a survey of the transition to ICD-10 in Alabama, US hospitals and commented on key HIM roles:

> Training approaches [provided by HIM staff including coders] addressed in this study targeted a full range of facility personnel and included methods designed to enhance employee skills while limiting facility costs. HIM directors were associated with primary leadership roles for implementation, a significant responsibility that is in line with their professional knowledge and skill sets. (P.6)

Clinical coding requires coders trained in the current medical classification referred to by the physicians. The implementation of a coding system into a healthcare information system demands HIM professional leadership. Appropriately qualified human resources will certainly be a decisive implementation factor, in terms of the study question.

## 3.8 Health information technology in Saudi Arabia

Long-standing challenges faced by the Saudi Arabian government-funded healthcare institutions, arising from the nation's unique historical, economic, and social development were introduced in Chapter 2. Sudden wealth saw great improvements in national healthcare but also resulted in above-average population increases, a rise in chronic disease, an exceptionally high rate of road accident injuries, which together with an unusually large proportion of expatriate workers, the annual influx of visiting pilgrims, and a persistent shortage of healthcare professionals have severely comprised healthcare services.

Several Saudi Arabian studies conducted on the national status of HIT indicate that a complex web of circumstances has led to a low adoption rate. In general, a slow rate of HIT uptake permeates Saudi Arabia, despite extensive steps by hospitals in all healthcare sectors to upgrade their infrastructures. A failure to identify weaknesses and supply solutions has had an accumulative effect. A few researchers have analysed the factors hindering HIT infrastructure improvements, particularly in public hospitals. While the debate on strategies to improve Saudi healthcare has continued, much research over the past decade has pointed to the low usage of HIT and acknowledged that the poorly developed HIT infrastructure presents a challenge to all healthcare improvements (Alkraiji, 2012; Almuayqil, Atkins, & Sharp, 2015). There is unanimity that the insufficiently developed HIT infrastructure will hamper the implementation of clinical coding.

The underdeveloped HIT infrastructure has not only had a significant negative impact on past attempts to improve Saudi healthcare but has given rise to further challenges facing healthcare organisations. Alsadan et al. (2015) noted that although information technology has undergone continuous improvements in developed countries in all fields, there remains a significant lack of development in developing countries, especially in the Arab world. The evidence of this study shows that HIT made a very late appearance in Arab countries, compared with developed countries. Otero et al. (2016) emphasised that in most developing countries there is a lack of HIT development, such that regulations, policies, and standardisation have been largely ignored. Recent literature indicates that the implementation of electronic health has stalled in the preliminary stages in Saudi Arabia and confirms a lack of HIM specialists, HIT infrastructure, software-hardware compatibility, and dedicated funding, hindering attempts at HIT development (Alharbi, Atkins, & Stanier, 2015, 2016).

The absence of health data standards and a lack of awareness of the need for interoperability has escalated HIT problems. The most recent studies all agree that Saudi Arabia must deal with long-standing challenges, before successfully upgrading the HIT infrastructure. Electronic health practices in Saudi Arabia commenced in 2000 when the government established a committee to overview electronic healthcare implementation (Uluc & Ferman, 2016). This committee reported that inferior health data posed an initial challenge for health providers in the conversion to electronic health. In 2005, the government established the Saudi Association for Health Informatics tasked with increasing awareness among healthcare professionals of the benefits of using electronic health, by promoting scientific conferences in this field (Uluc & Ferman, 2016). However, a lack of awareness of potential technological solutions is increasingly recognised as a worldwide challenge. Union (2012, p. 5) noted that '[In the European Union] there is a lack of awareness of, and confidence in, eHealth solutions among patients, citizens and healthcare professionals.'

Saudi health services have displayed even less awareness of the need to improve HIT systems. Altuwaijri (2010) noted that health services in Saudi Arabia had recently made great progress with some health organisations receiving international recognition, although there remains a significant lack of understanding of HI practices and an absence of related training programs. Recently, King Saud bin Abdulaziz and other universities established educational programs in HI, following the recommendations of the International Medical Informatics Association. However, Alsulame, Khalifa, and Househ (2016) pointed not only to the low implementation rate of electronic health but emphasised the minimal research assessing this condition.

Studies conducted in MOH hospitals also noted a lack of HIT infrastructure, as well as a lack of interoperability for the exchange of health information. There has been insufficient application of standardised electronic health networks among MOH hospitals (Altuwaijri, 2008, 2010), which will certainly impact on the implementation of ICD-10-AM and clinical coding in MOH public hospitals.

The poor HIT infrastructure development is a consequence of the failure of Saudi healthcare providers to produce a unified strategy for purchasing crucial software. The results of the random purchasing of health technology software are evident, with individual hospitals from all providers in Saudi Arabia showing different strategies in what should be a shared process. Alomeer (2016) noted that most hospitals across the country, representing all health providers, use different vendors. Thus, the concepts of health data standardisation and interoperability that facilitate successful and secure HIE have not formed a part of policy and planning.

Some researchers paid attention to the current status of electronic health in non-MOH Saudi hospitals. Al-Harbi (2011) reported that a survey conducted at KAMC had evaluated the implementation of HI, in terms of obstacles, benefits, and motivations. The results indicated that most healthcare employees at KAMC knew how to use health information applications and perceived these as valuable and useful. Challenges included a shortage of computers and technical failures. The study found that hospital staff lacked training, as well as technical and management support. KAMC does not reflect the MOH status quo.

In a comparison of MOH and other government hospitals regarding HIT development, Almalki et al. (2011) noted that although electronic health systems were being used in non-MOH hospitals such as KFSH&RC, usage in MOH hospitals was minimal.

In researching solutions to improve the HIT infrastructure in all health providers, Alsulame, Khalifa, and Househ (2015) conducted a case study of the perceptions of nine HI department heads of Saudi hospitals. The outcome suggests that there is a need for a national supervisory organisation to monitor electronic health and develop a national plan to implement e-health initiatives. Similarly, Alkraiji, Jackson, et al. (2014) emphasised that the absence of a national reference organisation represents a challenge to improving e-health in developing countries. They noted that in Saudi Arabia the lack of health data standards and plan for health information management affected electronic health in general.

Several longitudinal studies on electronic health have attempted to explain the challenges facing Saudi Arabia. Almalki (2012) noted that the situation was more severe for hospitals with minimal HIT. This included MOH public hospitals where the hospital management was rendered ineffectual in managing the problem. The researcher proposed that the best option for improving healthcare systems in Saudi Arabia would be the privatisation of public hospitals and development of a healthcare HIT infrastructure.

Altuwaijri (2012) argued that the adoption of electronic health is important in Saudi Arabia for the following reasons: (1) the majority of health centres and hospitals still use paper for documenting patient information; (2) there has been a major increase in the volume of health-related information; however, incompatible systems, with minimal or no interoperability, are accumulating unlinked pools of information in different health sectors and hospitals; (3) the majority of information systems in current existence are purely administrative rather than being patient-focused. Saudi healthcare systems are organisation-based, rather than patient-oriented. The lack of HIT development has been a continuous thread in Saudi studies, indicating that inferior technology and interoperability will provide a considerable stumbling block for the implementation of ICD-10 and clinical coding.

In recent years, several researchers have assessed the challenges of adding specific HIT components to the HIS infrastructure, in Saudi Arabia. Khalifa (2014) revealed that despite some HIS usage in the Middle East, there were several challenges to using this technology successfully in healthcare systems in Saudi Arabia, including a high resistance by physicians, attributed mainly to their lack of knowledge regarding the usage of information systems. The study suggested introducing HIS awareness training for healthcare professionals and improving the underlying HIT infrastructure in hospitals.

Several studies revealed that Saudi hospitals failed to consider the latest technology training and awareness measures, in order to avoid confrontation with recalcitrant healthcare professionals whose attitude was founded on a lack of knowledge and training. Alkraiji et al. (2013), Khalifa (2013), Alkraiji et al. (2016) and Khudair (2008) all emphasised the resistance to innovation among healthcare professionals. Aziz (2016) noted that in Arab countries, including Saudi Arabia, there is always resistance to healthcare system innovations from healthcare professionals.

Hayajneh and Zaghloul (2012) used a survey to identify challenges facing health providers in selected Arab countries, including Saudi Arabia, in implementing HIT in their hospitals. The descriptive cross-sectional survey results indicated that financial resources, cost, poor management, bureaucracy, low staff IT competency, lack of qualified IT staff, and lack of awareness of HIT values constitute barriers. The researchers stated that 'lack of qualified Information Technology staff was perceived to be a barrier, mostly in Saudi Arabia.' (P.3)

Discussing IT strategic planning in Saudi Arabia more than a decade ago, McConnell (2003) suggested that it should constitute the initial five years of a total IT twenty-year general strategy. The researcher noted that the Computing Society of Saudi Arabia and the King Faisal Specialist Hospital had been working together with the MOH, in formulating and establishing a systematic and well-developed infrastructure for health information, as part of the National Informational Technology Plan (NITP). However, a rigid and integrated twenty-year plan seemed unrealistic, as NITP was only in the planning stages. The plan entailed eHealth, eLearning, and Telemedicine. This strategy intended to reduce the negative reception accorded HIT developments by healthcare professionals.

All studies reviewed emphasised the long-standing shortcomings preventing the advancement of electronic health in Saudi Arabia. Ultimately, the MOH must be made aware of the minimum level of HIT infrastructure required by health organisations, in order to implement clinical coding successfully. The fundamental areas of focus should be health data standards and interoperability, health information exchange, and HIM.

Alkraiji et al. (2016) mentioned the lack of health data standards adopted by hospitals in their study exploring factors influencing the implementation of health data standards in Saudi tertiary hospitals. Their findings indicated that poor IT infrastructure represented the greatest challenge to the adoption of these standards. In a more recent study with the same focus, Alkraiji et al. (2013) noted that the major barriers included the lack of a data exchange plan and the absence of an effective national regulator. Another obstacle was the lack of HIT policy relating to the national healthcare system. The study noted the increasing concern that a failure to address the health data standards at the national level would impact adversely on the implementation of ICD-10.

The healthcare literature coverage of the use of HIE within the HIT infrastructure in Saudi Arabia is too limited to have national relevance. Attallah et al. (2016) reviewed the literature for the period and found that although the MOH prioritised the adoption of HIE practices at all levels of healthcare, effective implementation had been jeopardised by uneven HIT infrastructure and variations in data formatting and semantic ontology standards. The researchers contended that the likelihood of implementation of HIE is strong, because the MOH considers this system a priority rather than implementing EHRs in its healthcare institutions. Once Saudi Arabia succeeds in implementing HIE, this will allow healthcare professionals to share patient medical information securely electronically. This contention seems optimistic and contrasts with the position of so many recent studies that Saudi Arabia faces several unresolved challenges to improving the HIT infrastructure, especially in MOH hospitals that have not yet upgraded to EHRs which are a vital component of effective HIE practice.

Overall, poor HIT infrastructure has exacerbated problems and retarded the adoption of electronic healthcare practices in public hospitals. There has been a reduction in technical project resources, primarily due to high costs, which has occurred not only in Saudi

Arabia, but also regionally and globally. Further, HIT practices in Saudi public hospitals have suffered a reduction of IT specialists, training, and awareness programs, as well as poor management. Thus, Saudi public hospitals face challenges during the implementation of ICD-10 from an overall lack of technological and human resources. It may be concluded that an adequate HIT infrastructure is fundamental to enhancements in healthcare organisations. Improvements to daily healthcare functions are subservient to improvements in health technical infrastructure. Examining the vast difference in the aims and prescribed guidelines of Saudi public hospitals, and their actual technical practices highlights a very limited understanding of HIT. The weak HIT infrastructure casts doubt on the value and potential for the successful implementation of advanced technical practices.

## 3.9 Electronic health records in Saudi Arabia

EHRs are used in clinical documentation, health insurance claims and reimbursement, HIE, and eHealth almost universally in developed countries, although their uptake in public hospitals lags behind their use in private healthcare. In the developing world, mainly due to cost factors, this is not yet the case. Several studies confirm that Saudi public hospitals are still in the preliminary stages of implementing EHRs. In assessing the early implementation of EHRs in Saudi hospitals, all researchers showed concern regarding the limited extent of implementation successes (Alqahtani, Crowder, & Wills, 2017; El Mahalli, 2015b). Although EHRs are being used in a few hospitals in Saudi Arabia, challenges still face these hospitals in the completion of the implementation process, mainly related to dedicated budgets, as well as technical and administrative barriers (Baus, 2004; Hasanain & Cooper, 2014). While technical issues pose a general challenge to Saudi healthcare innovation and reform, they present a specific threat to implementing EHRs, regardless of the cost factor, in terms of the limitations of the existing HIT infrastructure which restricts all healthcare advancement. Hasanain and Cooper (2014) revealed that HIT infrastructure and social challenges are considered the biggest barriers to the implementation of EHRs in Saudi Arabia. This study recommended that to overcome these barriers there was a need for further investigation and planning, particularly in improving knowledge among healthcare professionals on the value of EHRs in dealing with patient records.

A WHO report dealing specifically with EHR implementation in developing countries, listed high cost, lack of clinical terminology standards, and resistance from healthcare professionals based on their general technology illiteracy (World Health Organisation, 2006a). An EHR-focused Saudi study indicated that due to the widespread manual patient record systems still employed in Saudi public hospitals, intensive work would be required for the implementation of EHRs (Alanazy, 2006). Hence, the underdevelopment of EHRs in public hospitals is the outcome of a lack of thorough planning strategies and the historical neglect of upgrading technical standards. This study also indicated that hospitals in the governmental and private sectors faced several challenges to the successful implementation of EHRs, listing healthcare professional and management resistance to technological innovation and inadequate dedicated budgets as the primary obstacles. Khudair (2008) noted that this negativity demands convincing and training physicians at the outset.

Notable progress in EHR implementation has been reported from certain government hospitals outside the scope of this study. The National Guard Health Affairs hospital, KAMC, was one of the first hospitals to have implemented EHRs in the Eastern Mediterranean Region of the Middle East, as early as 2001 (Altuwaijri, Sughayr, Hassan, & Alazwari, 2012). Despite that isolated success, a decade later, Al-Harbi (2011) found that most Saudi health organisations were still totally dependent on traditional manual paper methods for recording keeping, or used non-integrated software tools, such as patient admissions software. The same year, Bah et al. (2011) revealed that of nineteen public hospitals in the Eastern Province of Saudi Arabia covered in their comparative study, only three representing 15.8% of the study locations had successfully implemented standardised EHRs. The study identified that the major implementation challenge faced by these hospitals was a lack of interaction between physicians and nurses.

More recently, Saudi healthcare researchers have assessed the challenges facing the implementation process in public hospitals. El Mahalli (2015a) discussed the challenges facing nurses using EHRs in three public hospitals in the Eastern Province, where the system had already been implemented. The study found that regular loss of access caused by computer or power failures was considered the most common difficulty. Additional challenges included the lack of continuous training and support for IT staff in hospitals. This indicates a lack of awareness among the management and administration sectors of the requirements of core staff. The study recommended the establishment of an EHR committee to highlight the difficulties experienced by staff members using EHRs.

The inferior HIT infrastructure in Saudi public hospitals, in comparison with the other government hospitals, has compromised the potential use of EHRs. Alsahafi (2012) observed that while several non-MOH government hospitals had successfully introduced EHRs, there was a significant delay in MOH hospitals. Factors contributing to the delay included an inadequate workforce, a non-integrated system, and the generally negative attitude of doctors and other healthcare professionals. Hasanain, Vallmuur, and Clark (2015) contended that ignorance about the benefits of EHRs is the cause of such professional opposition. To eliminate these stumbling blocks, a national strategy was introduced by the MOH in 2009, under the governance of the CHS.

Resistance to innovation among professional health decision-makers, hospital directors, and medical practitioners derives from an unwillingness to break from outmoded routines adopted in the initial stages of their professional careers. Inevitably, it arises in organisations where a leadership vacuum exists. This lack of leadership commitment to change may be considered the equivalent in human resources of inadequate technology infrastructure in its propensity to stall organisational progress.

## 3.10 Health information management in Saudi Arabia

That Saudi hospitals are still in the preliminary stages of understanding the role of HIM in the modern healthcare system is confirmed by the minimal national research in that area of healthcare. Foremost, a lack of HIM professionals has persisted for many years. However, the Saudi Health Information Management Association (SHIMA) was established under the supervision of the Central Board of Accreditation of Health Institutions (CBAHI). A further advance has been the inclusion of HIM as a professional employment category within the Saudi hospital staffing structures since 2012 (American Health Information Management Association, 2015). SHIMA prepares short, medium, and long-term HIM action plans, formulates programs and procedures for implementing HIM developments, as well as conducting, monitoring, and evaluating, policy and implementation processes. SHIMA also submits periodic reports to the relevant hospital departments to assist in fast-tracking HIM innovations at the national, provincial, district, and city levels.

It has been observed that SHIMA achieved considerable success after its formation, in facilitating an open discussion forum for members, in order to improve national HIM practices. During the last few years, however, the list of fundamental HIM challenges has not been heeded and dealt with. Khalifa (2013) noted that the lack of qualified HIM professionals, together with the lack awareness of the advantages of EHRs and other electronic health applications persist.

The role of this study in identifying factors influencing the implementation of clinical coding is crucial, in order to develop solutions that will work for all Saudi public hospitals involved in the process. There is a need to build a knowledgebase on clinical coding and ICD-10 to disseminate awareness of its irrefutable benefits and offset the resistance that stems from a leadership vacuum in certain categories of Saudi healthcare institutions. MOH leadership must ensure that technological imbalances between hospitals are addressed prior to making policy resolutions regarding the implementation. It is fundamental to ensure that the HIT infrastructure in public hospitals is compatible and interoperable with the new system. The required complement of professional HIM staff, including coders and trainers, must be assessed and provided, as well as the impact of the initial training and transition to functionality of the new system on ongoing workloads.

## 3.11 Conclusion

This initial literature review defined information and technology in terms of healthcare and examined the development of the HIT infrastructure and HI, health data standards and interoperability, the innovative applications of HIE and EHRs, and finally the expansion and new functions of HIM, the professional area responsible for the implementation of ICD-10-AM and clinical coding.

Clearly, inadequacies in Saudi public hospital technology and the level of opposition from medical professional undermine the implementation of healthcare reforms, presenting a Catch-22 situation. Previous unsuccessful attempts at healthcare reform have been shown to be the consequence of three interdependent, negative factors that persistent in hindering the development of Saudi Arabian healthcare; namely (1) an inadequate, partially dysfunctional HIT infrastructure; (2) a dire shortage of suitably-qualified HIM professionals; and (3) the failure to have established and implemented a set of national health data standards, in accordance with ISO specifications.

# 4 Chapter Four: Literature Review Part Two - Healthcare Classifications and Coding

## 4.1 Introduction

The Alma Ata declaration produced a greater awareness of the socioeconomic inequalities in health. Developed nations began taking responsibility for global health funding and assisting poorer developing nations. The human immunodeficiency virus and acquired immune deficiency syndrome (HIV/AIDS) pandemic created a significant burden for providers of healthcare worldwide (De Maeseneer et al., 2008). The Millennium Development Goals 4 and 5 targeted the pitiful state of maternal and child health in many poorer countries but simultaneously highlighted the benefits of intensified scale-ups based on the evidence of clinical statistics. The 2015 outcome showed that since 1990 the worldwide under-five mortality rate was reduced by more than 50%, maternal mortality by 47%, and HIV, malaria, and other diseases by 40%. In many regions, the reduction was achieved late in the given period as health information analytical methods were refined to reveal neglected areas that required intense scale-ups (Way, 2015).

The continuous development of health information power, skills, and statistical analysis and methodology reflects in the expanded coverage, detail, functionality, and potential uses of ICD-10 (Lozano et al., 2011). This expansion includes the practical usage of the classification in primary healthcare for the origination and storage of individual data as well as its transmission to pharmacies and health insurers to expedite prescribed medicines and payments and reimbursements. Using appropriate HIT configured by HIM systems and HI professionals, ICD-10 has been integrated into all levels of healthcare.

It has been mentioned that certain countries adapted the basic WHO ICD-10 diagnosis classification to create their own national modifications, adding or relocating diagnosis codes according to their national clinical practice and producing a separate classification and coding for medical procedures. Some two decades after the WHO release of ICD-10, with the basic or modified diagnosis classification and some form of procedure code implemented in all developed nations and many developing nations, Saudi Arabia has committed to implementing ICD-10-AM, having concluded a contractual arrangement with Australia. This chapter offers a historical overview of the evolution of ICD classifications and the emergence of national modifications, with reference to Australia, Canada, the US, and Thailand.

## 4.2 Saudi Arabia: Late starter in clinical coding

We all go to school and, hopefully, all eventually graduate. Consequently, there is nothing special about the first day at school, except for the magnitude of the experience for the individual child. The MOH public hospitals that form the study site of this thesis find themselves in the position of the child starting school. The major nations and many developing nations have done it all before, in terms of implementing new ICD versions. Saudi Arabia is a late starter which may lead to specific problems, as yet undocumented in ICD literature. Before commencing the review of the literature on ICD-10 implementations, an overview of the historical development of related classifications is presented, progressing from the ancient Greek models to more scientific nosology, the taxonomical model of Linnaeus, early classifications of the causes of death, the International List of Causes of Death (ILCD), and the emergence of the WHO ICD series of classifications culminating in ICD-10.

The history of the classification of diseases and causes of death is extremely well-documented and commonly serves as an introduction to commentaries on the innovations of the latest ICD version. The primary documents of the post-WWII stages of development, namely ICD-6 to ICD-10, are available on the WHO, Centers for Disease Control and Prevention (CDC), Australian Consortium for Classification Development, German Institute of Medical Documentation and Information and many other websites. Earlier developments have generally been derived from secondary sources. This historical literature has not been reviewed but forms a background to establish the magnitude of accumulated knowledge from over a century of development experienced by the developed nations that has eluded Saudi Arabia. The level of detail and specificity of ICD-10 far exceeds ICD-9 and all earlier versions and approaching it from scratch will undoubtedly impact on its implementation in Saudi public hospitals.

## 4.3 What is classification?

Classification entails the systematic arrangement of items into groups or classes according to certain criteria (Beldiman, 2008). F. C. Thompson (2003) contended that a basic form of classification is involved in the survival of all animals: ‘The ability to classify is common to all animals, for to survive animals must group other organisms into at least three classes: Those to be eaten, those to be avoided, and those to associate with, especially members of their own class’ (p.788). Scientific classification goes a step further, in that it includes the hierarchical arrangement of elements within each class according to governing criteria. Scientific classification reflects observed reality in a modelled structure based on the nomenclature or terminology of the system. In biology, the taxonomic ranks of species, genus, family, order, class, phylum, kingdom, and domain are universally agreed upon as the structural nomenclature of the classification.

## 4.4 A historical overview of classifying deaths and diseases

This section outlines the history of mortality/morbidity classification systems the medical science from ancient times through the emerging statistical approach to the rise of the field of public health in the 19th century. Thereafter, it traces the development of international from the first ILCD to the ICD-10, which has become the international ‘standard diagnostic tool for epidemiology, health management and clinical purposes’ (World Health Organisation, 2019c, para.1). The past few decades have seen a dramatic increase in the use of the ICD as a multi-functional healthcare information resource, paralleling developments in HIT that enabled online practices of information storage, retrieval, and sharing and the emergence of EHRs and HIE.

### 4.4.1 Mortality classification

#### 4.4.1.1 Foundations of nosology: from ancient Greece to the renaissance

In the golden age of Greece, Hippocrates and his pupil, Galen, produced a lasting classification of diseases, based on the effects of external forces on the equilibrium of the four bodily humours: blood, yellow bile, black bile, and phlegm. This ancient classification of diseases into four basic classes, which persisted until the Renaissance in

Europe, constitutes the foundation of nosology, the branch of medical science concerned with the classification of diseases (Kalachanis & Michailidis, 2015).

While humoralism persisted, the first recognised classification of diseases structured according to contemporary principles of scientific empiricism was the publication of *Universa Medicina* in 1554, the crowning work of French physician Jean Fernel acknowledged as the father of physiology, who classified diseases according to organ (Moriyama et al., 2011). Thomas Sydenham, the 'English Hippocrates', published *Opera Omnia* in 1676 (Moriyama et al., 2011; Pearn, 2011; Poynter, 1973), an early classification of interventions. Ancient procedures used to restore the balance of the humours, such as bleeding, cupping and leeching continued to form part of the practice of the so-called 'barber surgeons' until the end of the nineteenth century (Hart, 2001).

The Swede, Carolus Linnaeus, famed for his 18th century botanical taxonomy, attempted a classification of diseases, which drew the attention of the Frenchman, F. Boissier de la Croix Sauvages and initiated a correspondence and mutual admiration for one another's work (Moriyama et al., 2011; Pearn, 2011; Poynter, 1973). In his treatise, *Nosology Methodica*, Sauvage applied similar principles to Linnaeus' taxa, or units, applicable to all levels from kingdom to subspecies. He developed ten classes, systematically subdivided into some 300 orders, according to medical symptoms (Poppensiek & Budd, 1966). William Cullen's Synopsis *Nosologae Methodicae* was published in 1775, followed in 1817 by John Mason Good's A Physiological System of Nosology, which played an important role in the development of the nomenclature of diseases. These scholars implemented pragmatic changes giving rise to a morphological classification system supporting a pathology based on anatomical structure and facilitating an understanding of epidemic diseases (Moriyama et al., 2011). As noted by F. C. Thompson (2003), historically, nomenclature and classification reflect the scientifically observed model that has developed parallel to the discipline.

#### 4.4.1.2 19th century mortality statistics and the emergence of public health

A 17th century forerunner in the emergence of the statistical classification of mortality was John Graunt, who in the London Bills of Mortality established a 36% mortality rate for children surviving to age six. Graunt foreshadowed the 19th century focus of medical classification on the gathering of statistics on the causes of mortality that culminated in the ILCD (Coiera, 2003).

In 1839, William Farr, a physician employed as a British government statistician, compiled in his professional capacity a classification of mortalities forming part of the First Annual Report of the Registrar-General of Births, Deaths and Marriages. In Farr's eclectic threefold classification, communicable diseases formed the first class, based on their level of risk; sporadic diseases classified by organ comprised the second class; and the final class was composed of diseases of uncertain origin, which included tumours, unaccountable sudden death, and dementia. Farr strove continuously to reflect the broader social determinants of health in his classification (Farr, 1885; Hare, 1883). His 1837 mortality report included a comment on 63 deaths as a result of 'starvation': 'Hunger destroys a much higher proportion than is indicated by the registers in this and every country, but its effects, like the effects of excess, are generally manifested indirectly in the production of diseases of various kinds' (Whitehead, 2000, p. 87). Farr's socially dynamic mortality system led to the establishment of the branch of medicine known as Public Health (Atkinson, 1993; Franklin et al., 2008). Farr's statistical approach was a demonstration of how inferences drawn from health statistics may be used to improve healthcare.

The first authoritative reference work on the terminology of diseases was the culmination of twelve years of work in the *Nomenclature of Diseases*, published by the Royal College of Physicians in 1868 and revised frequently until its last edition in 1959. An editorial in the *Indian Medical Gazette* of 1877 described its universal recognition and stated that there could be no disputing the fact that the Royal College of Physicians of London deserved the gratitude of the noble profession of medicine and the world for publishing the invaluable reference work. The publication marked a turning point in the history of medicine, providing a reference point for medical professionals in various countries to compare and enhance their knowledge ('Nomenclature of Diseases', 1877).

The development of classification systems manifested very little development until Europe was well into the Renaissance; however, the subsequent progress achieved prior to the intervention of Farr, highlights the reciprocal bond between scientific practice, its nomenclature, and its classification. While classification is limited by the contemporary knowledge of medicine, it nonetheless dictates medical practice (Jutel, 2011).

#### 4.4.1.3 The impact on causes of death of the new industrial cities

The Great Exhibition of 1851 was held in the specially constructed Crystal Palace and promoted technology as a means for improving the quality of life. Behind the monumental façade of design and engineering genius, many doctors saw social deficiencies in the industrial cities. William Farr described Manchester in 1846: ‘In the midst of a population unmatched for its energy, industry, and manufacturing skill, 13 362 children perished in seven years, over and above the mortality natural to mankind’ (Rose, 1971, p. 23). The medical profession had grasped the value of a statistical approach to disease and the contrast of urban development and its increased death rate provided the impetus that led to the First International Statistical Congress (ISC) in Brussels in 1853. One of the areas advocated for international collaboration was the causes of death. Achille Guillard, recognised as the father of demography, proposed the standardisation of nomenclature in the fields addressed by the Congress; further, William Farr and the Swiss Marc D’Espine were tasked with the development of a uniform international classification of mortalities (Jetté et al., 2010). The two statisticians presented separate lists at the second congress, held in Paris two years later. D’Espine produced a list based on symptoms, while Farr persisted in his categories which he extended to five. The congress eventually accepted a compromise of the two approaches and produced a list that was continually revised for its biennial assemblies, but never received full international acceptance. Noteworthy, was a resolution passed by the ISC in 1855, requiring physicians reporting mortalities to use the official international nomenclature (Moriyama et al., 2011).

The ISC developed into the International Statistical Institute (ISI). At the first ISI conference, held in Vienna, French statistician and demographer Jacques Bertillon, Chief of Statistical Services of the City of Paris, was elected to chair a committee tasked with developing a classification of causes of death (Ferenc, 2013; Gersenovic, 1995). The Bertillon Classification of Causes of Death was based on the principle established by Farr of categorising general diseases separately from those relating to specific organs or anatomical sites and his main classes moved from general diseases, through diseases related to specific organs, to malformations, specific diseases of infancy and, finally, to diseases with external causes and those insufficiently defined (Moriyama et al., 2011). The classification was adopted by the ISI at its Chicago meeting in 1893, marking the inception of the ILCD, adopt by the American Public Health Association in 1898 for use in the US, Canada, and Mexico with the proviso that it should be revised every 10 years (Elkin, 2012).

The value of international collaboration was demonstrated by the statistical analysis and proof of the source of a series of cholera outbreaks in France that spread to neighbouring European countries and Britain around the time of the release of Bertillon's classification (Bowker, 1996). In the late nineteenth century, the cholera bacillus was the cause of a series of epidemics, spread by pilgrims returning from Mecca. Before that, travelling on foot or by sailing ship, pilgrims would succumb to the disease before returning to France; after the advent of faster travel such as rail and steamboat, they were able to return quicker and bring the infection with them. Increased international communication in the 1890s increased the awareness of this problem and, consequently, the need to monitor health on at the international level (Bowker, 1996). After the initial ILCD, five further versions were produced, with ILCD-5 released in 1938 (World Health Organisation, 1967). At the end of World War II, the United Nations (UN) was established, immediately followed by the constituting of its specialised agencies, including the WHO in 1948 (Moriyama et al., 2011).

### 4.4.2 The international classifications of diseases

The WHO was mandated to assume responsibility for international medical classifications and the ICLD was superseded by the International Statistical Classification of Diseases and Related Health Problems, conventionally known as the ICD, which included both a 'causes of mortality' and a morbidity classification. Thus, ICD-6, adopted in 1948, is the successor to ICLD-5 (World Health Organisation, 1967).

Each step of the progression from ILCD to ICD-10 was based on the decisions of an international revisionary conference. Prior to the fourth ILCD conference, the classifications for diseases and causes of death were regarded as separate entities. This separation was challenged at the fifth revision conference, where Canadian delegates presented the *Standard Morbidity Code*, published in 1936 by the Canadian Dominion Council of Health (Lancaster, 2012; World Health Organisation, 2004).

#### 4.4.2.1 The development from ICD-6 to ICD-10

The US Committee on Joint Causes of Death was established in 1945, with a mandate to establish guidelines of how to establish the main cause of death where several causes are listed on a death certificate. The committee ultimately proposed a combined classification for diseases and deaths. At the sixth revision conference, the ICD-6, becoming the first WHO revision and the first classification to combine diseases and injuries with causes of death. ICD-6 comprised three tabulated lists, classified aetiologically with three-character numeric categories and four-character subcategories that could be accessed through a separate alphabetical index (Moriyama et al., 2011).

In 1951, prior to the seventh revision conference, the first WHO Centre for Classification of Diseases was established in the General Register Office of England and Wales, London. The conference maintained the same structure and content for ICD-7, concentrating on eliminating initial errors and inaccuracies in ICD-6. The release of ICD-7 saw a broadening of its usage, particularly in the US where it began to be used for the diagnostic indexing for hospital patient clinical records. Israel and Sweden also developed national adaptations, while the Pan American Health Organisation developed a Spanish translation of the US ICD-7 adaptation, for use in Latin American hospitals (Moriyama et al., 2011; German Institute of Medical Documentation and Information, 2016).

While the basic structure and classificatory principles were maintained, ICD-8 was influenced by the national adaptations of ICD-7. Major adjustments were made to the categories of infective, parasitic, circulatory, and perinatal diseases, together with mental disorders, congenital malformations, and injuries resulting from accidents, poisoning, and violence. The index was mandated to the US National Centre for Health Statistics (Moriyama et al., 2011).

The ninth revision conference received two major recommendations. The first was from specialists expressing the need to retrieve medical records for clinical research. The second was from physicians involved in medical care programs, in which the emphasis was on the individual patient’s condition, rather than an aetiological perspective. As a solution, certain conditions in ICD-9, released in 1977, were classified twice and the dagger-and-asterisk system was introduced, facilitating the classification of diseases of specific organ systems, together with an underlying general disease; for example, tuberculous meningitis is classified under meningitis with a dagger-and-asterisk cross-reference to tuberculosis. A further addition to the WHO body of classifications was the trial publications of supplementary classifications of Impairments and Handicaps, and Procedures in Medicine (World Health Organisation, 1978b, para.7). The original WHO procedure classification was known as the International Classification of Procedures in Medicine (ICPM).

Specialist adaptations of the basic classification were considered for oncology, dentistry, and ophthalmology. The structure of the oncology adaptation (ICD-O), as an example of a medical specialisation requiring more detail than the general format, includes the topography, morphology, and behaviour of neoplasms described by a four-digit topography code, a four-digit histology code, and a single-digit code for behaviour (World Health Organisation, 1976).

The expert committee investigations into alternative classification structures that preceded the tenth revision conference confirmed that the traditional arrangement could not be improved on. Attention was focused on achieving the optimum balance of multiple purposes and on allowing for future expansion without structural disruption to the existing codes (World Health Organisation, 1986). The introduction to Volume 2 outlines the purpose of ICD-10: 'The purpose of the ICD is to permit the systematic recording, analysis, interpretation, and comparison of mortality and morbidity data collected in different countries of areas and at different times' (World Health Organisation, 2004, p.3). Thus, the ICD was intended for statistical purposes, whether at a district, national or global level. The paragraph continues: 'The ICD is neither intended nor suitable for indexing of distinct clinical entities. There are also some constraints on the use of the ICD for studies of financial aspects, such as billing or resource allocation' (World Health Organisation, 2004, p.3).

The WHO ICD-10 comprises three volumes: Volume 1 contains the tabulated lists of the three-character categories and four-character subcategories, as well as introductory texts. Volume 2 contains a general introduction to ICD-10, an overview of the history of the classification, and the rules of mortality and morbidity coding with numerous examples. Volume 3 comprises the alphabetical index, a wide collection of encoded diagnoses, the unwanted effects of drugs and chemical substances, as well as the causes of injuries and poisoning (Jiang, Pathak, & Chute, 2009). The WHO procedures classification, ICPM, was not regarded as a great success as most countries preferred their own national procedures codes. No procedures classification accompanied ICD-10 but in 2012 the WHO began work on the International Classification of Health Interventions, which as of 2019 remains in a beta version (World Health Organisation, 2019b).

The development from the ICD-9 format of 3 to 5-character codes to 3 to 7-character codes in ICD-10 means an exponential development in the number of potential codes (World Health Organisation, 2007). This expansion is due to the need for greater clinical specificity, which in lay terms implies that what was described previously as an arm muscle injury, is now explained as an injury to the right arm biceps. The revision conference also initiated a mechanism for continuous updating, which has been implemented annually since 1996 (Moriyama et al., 2011). The basic classification in the form of a single list of three alphanumeric character codes, structured by category from A00 to Z99 is used for reporting data to the WHO mortality database to facilitate international compatibility. ICD-10 consists of 21 chapters and the first alphabetical character of the code is a letter linked to a specific chapter (Coiera, 2015).

## 4.5 ICD adaptations and modifications

User reports from as early as ICD-6 indicated the need for national adjustments to the morbidity classification, mainly related to specific national clinical standards and practices, as well as translation of terminology (Moriyama et al., 2011). The ICDA-8 became the first adaptation for hospital diagnostic data, replaced in 1979 by ICD-9-CM, the first clinical modification of the WHO ICD classification. It was only officially replaced by ICD-10-CM as recently as October 2015 (Monestime, 2015; Centres for Disease Control and Prevention, 2016). Before the release of ICD-10-CM, Australia produced ICD-10-AM and Canada ICD-10-CA, while in Europe ICD-10-GM is a German-language modification and ICD-10-nL is a Dutch modification. In Asia, Korea uses ICD-10-KM, while Thailand developed ICD-10-TM, which extends the coverage of many regional diseases. Additionally, Thailand created a separate ICD-10-TTM which is based on Thai traditional medicine and therapies (Jetté et al., 2010; WHO, 2015).

## 4.6 The United States clinical modifications

In 1979, The International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM), based on the WHO ICD-9, officially replaced the ICDA-8 adaptations. The introduction of ICD-9-CM provides the following description of a clinical modification:

> The term "clinical" is used to emphasize the modification's intent: to serve as a useful tool in the area of classification of morbidity data for indexing of medical

> records, medical care review, and ambulatory and other medical care programs, as well as for basic health statistics. To describe the clinical picture of the patient, the codes must be more precise than those needed only for statistical groupings and trend analysis (Buck, 2015, p.1).

The introduction of ICD-9-CM emphasises its complete compatibility with the WHO ICD-9 for international statistical purposes stating: ‘A few fourth-digit codes were created in existing three-digit rubrics only when the necessary detail could not be accommodated by the use of a fifth-digit sub-classification.’ (Centers for Disease Control and Prevention, 2007, para. 1).

The WHO released the ICPM procedure classification simultaneously with ICD-9, as a series of supplementary documents, termed ‘fascicles’ and covering medical procedures, interventions, and therapy types including surgery, radiology, and pathology. The procedure classification of ICD-9-CM was derived from Fascicle V of the ICPM, the surgical classification. Australia and Canada also adopted the US ICD-9-CM.

Like ICD-9-CM, the US clinical modification ICD-10-CM, derived from the WHO ICD-10, is intended for the classification and coding of morbidity, based on the physician’s clinical diagnosis of the patient in any consultation or treatment setting. ICD-10-CM codes greatly outnumber those of ICD-9-CM and are considered ‘intelligent codes’ in that they provide meaning for users (Steindel, 2010).

Alongside the ICD-10-CM diagnosis classification, the US has produced a separate classification of procedures, the International Classification of Diseases 10th Revision Procedure Coding System (ICD-10-PCS) (Topaz, Shafran-Topaz, & Bowles, 2013). Developed by the Centers for Medicare and Medicaid Services, it is solely for use in US inpatient hospital settings. ICD-10-PCS uses seven alphanumeric characters, while ICD-9-CM procedure coding used three or four numeric digits (Centers for Medicare and Medicaid Services, 2015). The first character refers to the category of medical procedure, followed by numbers that indicate the body system, root operation, body part, approach and device used in the procedure (Averill, Mullin, Steinbeck, Goldfield, & Grant, 1998; Steindel, 2010). To avoid confusion with the digits 0 and 1, the letters O and I are omitted There are approximately 87,000 procedure codes, all of which are seven characters in length (Chute, Huff, Ferguson, Walker, & Halamka, 2012; Utter, Cox, Owens, & Romano, 2013). The ICD-10-PCS is used by US HIM professionals as the standard tool for classifying and coding inpatient operations and procedures (Manchikanti, Falco, &

Hirsch, 2011; Mullin, 1999). The schedule is divided into sixteen different procedure categories, among them nuclear medicine, radiation oncology, medical and surgical, physical rehabilitation, and diagnostic audiology (Utter et al., 2013).

## 4.7 Development of the Australian modification

Australia has developed its own national clinical modification based on the WHO version of ICD-10, known as ICD-10-AM/ACHI/ACS and used to assign codes for diagnoses and procedures (Shepheard, 2009). Groenewold (2016, p. 45) explained: 'ICD-10-AM is used to classify diagnoses for all inpatient episodes of care. The ACHI is used to classify procedures and interventions performed during inpatient episodes of care. Clinical coders use the ACS as a guide to assigning ICD-10-AM/ACHI codes.'

Medical classification in Australia commenced in 1907 when the Australian Bureau of Statistics first used the ILCD to classify causes of death. Over the past 50 years, constant advances have been made in the field in Australia. Paralleling the development of national healthcare in 1968, Australian health organisations expanded the content of ICD-8 to suit the national approach to healthcare diagnoses, procedures, guidelines, and medical research. On the release of the US clinical modification, ICD-9-CM, Australia switched to this version as its basic classificatory system (Roberts et al., 1998).

As a classificatory system, ICD-10-AM/ACHI/ACS comprehensively reflects the development of the national healthcare system but is adaptable for alternative systems. Accordingly, the Australian modification is being used by numerous other countries confirming its inherent quality, as well as its relative ease of implementation and product support offered for smaller nations, as opposed to the mammoth ICD-10-CM, which supports the diversity of competitive systems and privatised funding across the US. It was against this background of product flexibility, national needs design, and technical support that the Saudi MOH based its decision to implement ICD-10-AM (Jetté et al., 2010).

### 4.7.1 The ICD-10-AM package

Historically, ICD-10-AM replaced ICD-9-CM, in the Australian Capital Territory, New South Wales, Victoria and the Northern Territory in 1998, with other Australian states following shortly afterwards. At the same time, the AR-DRG classification system, which is based on the ICD-10-AM and ACHI codes, replaced the Australian National Diagnosis-related Groups (AN-DRG) which had been used since 1992 for health funding, as well as for purposes such as epidemiological data and research (Weber, 2004).

The ICD-10-AM is published by the NCCH housed at the University of Sydney, which is also responsible for updating the classification schedules (Doyle & Dimitropoulos, 2009). The second and third editions were published in 2000 and 2002 (Murphy, Wiley, Clifton, & McDonagh, 2004) and the ninth edition in 2015. While, in practice, the term is used to cover the full package; namely diagnosis codes, procedure codes, coding standards, and DRGs used in Australia and licensed to other countries, as in the case of Saudi Arabia, ICD-10-AM strictly refers to the diagnosis codes structured in two parts; a tabular list of diseases and an accompanying index (Australian Consortium for Classification Development, 2017).

Licensing of other nations to use the Australian modification package is done through individual country contract with the Independent Hospital Pricing Authority (IHPA), an independent Australian government agency established as part of the National Health Reform Agreement in 2011. The IHPA also uses hospital data to determine funding levels for national public hospital services, using the process termed Activity Based Funding. Current licensees are Bahrain, Bosnia and Herzegovina, Bulgaria, Ireland, Lithuania, Macedonia, Moldova, New Zealand, Montenegro, Qatar, Saudi Arabia, Serbia, Singapore, Slovenia, Turkey, and Ukraine, although many of these nations only use the AR-DRG component (Independent Hospital Pricing Authority, 2015).

### 4.7.2 Australian classification of health interventions

The NCCH used the Medicare Benefits Schedule - Extended, which had formerly been used by HIM professionals to classify and code inpatient procedures and interventions in the Australian ICD-9-CM era, to create the ACHI (Barnes & Krinsky, 1999). ACHI codes comprise seven digits of which digits 1 to 5 denote the MBS item numbers, while the remaining two digits represent specific interventions. The ACHI fulfils the same purpose in Australian healthcare as ICD-10-PCS does in the US. It consists of two parts: a tabular list of interventions and an accompanying alphabetic index (Australian Consortium for Classification Development, 2017).

### 4.7.3 Australian coding standards

The ACS was created to ensure a consistent national standard in the application of ICD-10-AM and ACHI in Australian public and private hospitals. The ACS includes guidelines for the use of the procedure and diagnosis codes by clinical coders and other users (Australian Consortium for Classification Development, 2017). The ACS also governs the use of AR-DRGs. Australia's integration of coding schedule methods has produced a comprehensive synthesised system that reflects the national development of standardised healthcare practices.

### 4.7.4 Casemix

Casemix refers to classification into homogeneous groups based on the use of resources and forms the central classificatory component of the AR-DRG. It provides not only a basis for reimbursement, but also a consistent classification of patient types and related treatments (Health Information Management Association of Australia, 2015). Söderlund (1994, p. 225) observed: 'Measuring actual changes in health status, or health-related quality of life, must remain the gold standard for hospital product quantification.' Casemix is essentially a quantification and costing of hospital care that provides a superior method and far greater time efficiency than itemised billing. While the US and Australia use the Diagnosis Related Group, the UK prefers the Health Resource Group. Alternative approaches used in specific contexts are Facility Mix and Service Mix. Casemix incorporates a classificatory system and schedule of payments. Without the payment component, it can be applied to quantify service delivery, quality, and other healthcare assessments (Webster, 1996).

### 4.7.5 Australian diagnosis-related groups

In 1992, Australia created a coded medical payment classification system based on casemix, the AN-DRG, derived from the US system for grouping and calculating specific health cost weights in health insurance systems (Duckett, 2000). The AN-DRG was replaced in 1998 by the AR-DRG. All diagnoses and procedures listed in the clinical documentation of hospital inpatient records are coded by specialist clinical coders using the ICD-10-AM/ACHI/ACS. This coded information, together with individual demographic data (age, gender, and length of stay), is used to allocate an AR-DRG class by the clinical coder, hospital or state health authority (National Casemix and

Classification Centre, 2016). The health cost weight is based on a combination of patient demographic data, such as age and employment, and a grouping of the diagnoses and related procedures. This process eliminates the old-fashioned itemised billing system in which the costs of individual items, such as prescribed medicines, dressings, special nursing requirements, and length of hospitalisation were tallied to produce the final billing. The groupings are based on the averaging of historical data. Saudi Arabia has recently begun the process of introducing this medical payment system across all healthcare providers (Lucyk et al., 2016).

### 4.7.6 The practice of clinical coding using ICD-10-AM

The WHO International Statistical Classification of Diseases and Related Health Problems series has become the international standard for documenting and coding patient diagnoses and procedures.

The assigning of codes is based on the clinical documentation of a single health episode of an admitted patient as written up in the patient's file or entered into an her, depending on the systems employed in the hospital. The clinical documentation commences with the admittance diagnosis of the examining physician, who may call for an X-ray or blood test before finalising the diagnosis and therefore the documentation in the patient file may include reports from radiology and pathology and may extend to ward nurse reports, surgical interventions, and a pharmacy report on the prescribed medicines. Hence, the decisions required during the coding process are based on the application of the coder's knowledge of anatomy, pathology, general medical practice, and interventions to assign codes from the appropriate diagnosis and procedure classifications.

The following is an example of the patient record of a young woman referred for gynaecological assessment who has been examined outside the hospital. The examining gynaecologist has queried the possibility of an ovarian cyst. The patient underwent a keyhole laparoscopy under general anaesthetic to confirm the existence of the cyst, which was then removed for histological laboratory assessment and classified as non-cancerous. In practice, as in this case, the diagnosis is often not possible before the procedure. In this example, the actual diagnosis has been the last step and could only be established after the procedures.

**Table 4-1 ICD-10-AM/ACHI coding example**

| **Australian healthcare and clinical coding in practice** | |
|---|---|
| ICD-10-AM/ACHI Diagnosis and Procedure Classification and Coding; Gynaecologist referred patient covered by Medicare for hospital admission | |
| **Referral Diagnosis** [Clinical documentation] | 24-year-old female presents with ultrasound evidence of an asymptomatic query; Right ovarian dermoid noted during screening for possible polycystic ovary |
| **Clinical coding** | |
| **Classification** | **Assigned code** |
| **Surgical** Gynaecological Procedures / Ovary/ Excision/ Other excision procedures on ovary/ Laparoscopic ovarian cystectomy, unilateral | **Main Procedure** Laparoscopy 35638-04 |
| **Anaesthetist** General anaesthesia, ASA 19 | **Anaesthetic** 92514-19 |
| **Histology** M = morphology of neoplasms/teratoma | **Pathology Laboratory Procedure** M9080/0 |
| **Discharge diagnosis** Benign neoplasm of the ovary | D-27 |

## 4.8 ICD-10-TM and Thai DRG development and relevance

While the US and Australia differ enormously in size, they both qualify as Western, English-speaking nations with developed economies that were settled relatively recently. In contrast, Saudi Arabia has an ancient Islamic cultural heritage that represents the heart of Islam, even though the nation has recently been transformed economically through becoming one of the world's leading producers of oil (Tripp & North, 2003). Similarly, Thailand has an ancient Buddhist heritage and was ruled as a monarchy until 1932. Since then, it has mainly been under military rule interspersed with short bursts of democracy. The Vietnam War saw an influx of US dollars into the economy, which led to urbanisation, a higher standard of living for some, and a proliferation of Western culture (Wyatt, 2003).

The Thai Medical Informatics Society was established in 1991 through the insights of a consortium of computer science academics and graduates from the twelve medical schools in the country. ICD-10 was adopted in 1994 and used throughout the private and state health sectors by 1997 (Wansa Paoin, n.d.). There was soon recognition—particularly in the tropical regions—that ICD-10 lacked codes for certain regional health issues, such as necrotising fasciitis, dengue shock syndrome, and cobra and green pit viper snake bite. Thus, a nationally representative ICD-10-TM project was launched in 2000, followed by a pilot study in 25 hospitals, after which the ICD-10-TM became the national healthcare classificatory system alongside the Thai DRG (Wansa Paoin, 2006). Thailand introduced a universal coverage scheme in 2001, providing healthcare to all citizens not covered by health insurance. This scheme was originally touted as ‘thirty Baht treats all diseases’ (less than US$1); however, co-payment was eliminated in 2006 (Evans et al., 2012; Hughes & Leethongdee, 2007).

### 4.8.1 Development of ICD-10 for Thai traditional medicine services

In recognition of its cultural heritage, which includes an ancient traditional medical system, Thailand constructed a corollary ICD-10-TTM classification consisting of 528 diagnosis and 60 procedure codes. Procedures include herbal drugs, Nuad Thai (Thai massage), herbal compression, herbal steam and sauna, warm compression, postpartum warm salt pot compression and other traditional Thai postpartum therapies (Visithanon, 2012). Thai medicine is based on the Buddhist holistic view of humans, which ICD-10-TTM incorporates into Thailand’s national healthcare system. The WHO has estimated that three-quarters of the world’s population relies on traditional medicine—mainly medicinal plants—for general treatments. With the renewed Western interest in traditional medicine as adjunct therapies to allopathic treatments, this short discussion on ICD-10 TTM was included because it may hold future relevance for Saudi Arabia, where a large section of the population still employs traditional Arabic and Islamic medicine for specific conditions (Azaizeh, Saad, Cooper, & Said, 2010).

Based on these statistics of the global use of traditional medicine, either exclusively or in conjunction with allopathic medicine, the WHO has consulted with stakeholders and leading practitioners in the fields of traditional, complementary, and alternative medicines, together with health information systems experts, to developed a collaborative project plan. to produce. The project aims to produce an international standard terminology and classification system for traditional medicine for use with EHRs that will also serve as a standard for scientific comparisons. This includes an International Classification of Traditional Medicine, an International Standard Terminologies of Traditional Medicine, and a web portal linking these to the WHO Family of International Classifications (WHO-FIC) (International Classification of Traditional Medicine, 2010; Morris, Gomes, & Allen, 2012).

## 4.9 Conclusion

The chapter provided an overview of the origin of medical classification systems in ancient times, through category-based statistical lists and the emergence of public health to the advent of international co-operation to procedure the ILCD series, which after the establishment of the WHO at the end of WWII became the WHO ICD series, culminating in ICD-10. The emergence of national modifications due to the need for healthcare industry-related diagnosis and procedure classifications that form the basis of individual patient reimbursement by health insurers and hospital funding by government followed. As Saudi Arabia has become a licensee of the Australian package, the individual components of ICD-10-AM were examined, as well as the US ICD-10-CM and Thailand's ICD-10-TM and classification of traditional medicine and associated procedures, ICD-10-TTM, particularly in the light of the continued use of Saudi Arabian traditional medicine. Should the reason ever arise that Saudi Arabia may need to develop its own classification and coding schedule, the Thai classifications may well provide models to be examined.

The content of the chapter outlined the cumulative stages of development that culminated in ICD-10 as the embodiment of an international effort harnessing the disciplines of medical science, statistics, the emerging field of public health, and in the WHO era the emergent health information management. The national health information literature reviewed in the last literature review chapter covers countries, namely Australia, the US, Canada, and Thailand, that have all incorporated clinical coding into healthcare, at least since 1990, and have all been involved in at least one transition from an existing version of the ICD series to the successive version.

Thus, Saudi Arabia and its Gulf neighbours, some of whom are currently also implementing ICD-10, as well as many other developing countries, lack the cumulative health information and practical clinical coding knowledge of countries with decades of involvement. It stands to reason that the Saudi MOH should be gathering all the information it can from countries that have had a longer exposure to the standard practices involved in HIM and clinical coding.

# 5 Chapter Five: Literature Review Part Three - Factors Influencing Implementation

## 5.1 Introduction

The final literature review provides the documentary research directly related to the study question; the factors facing hospitals administered by the Saudi MOH in introducing clinical coding through the implementation of ICD-10-AM, ACHI, and AR-DRGs. It has been emphasised that Saudi MOH hospitals will implement this complex classification/coding system from scratch, rather than as an upgrade as has been the case for the developed nations transitioning from ICD-9 to ICD-10, some of which have compiled cause-of-death statistics for over a century and classified medical diagnoses for nearly seven decades. Together with a number of developing nations, they have also utilised ICD clinical coding for at least three decades. Responsibility for the national implementation of the ICD-10-AM/AR-DRG package rests with the Saudi MOH and CHS. Before reviewing an appropriate selection of international ICD-10 literature and its illumination of factors that may impact on the impending implementation in Saudi public hospitals, the parameters of the coverage, as well as the limitations, need enumeration.

1) The trend towards country-specific modifications of the WHO generic ICD-10, as examined by Jetté et al. (2010), was a guide to the decision to initially assess the literature sources nationally.
2) The selection of national healthcare literature was governed by the Saudi choice of ICD-10-AM and as Australia and Canada both previously used the US clinical modification ICD-9-CM, they form a natural grouping with the US. Given the economic situation of Saudi Arabia in comparison to the latter nations, particularly in the light of its late national implementation of clinical coding, it was essential to include a comparison with a developing nation. Thailand also used ICD-9-CM before developing its own ICD-10-TM and as a wealthier developing nation has certain affinities with Saudi Arabia.
3) After the coverage of the selected literature, factors influencing implementation are tabulated in three categories, (1) health information, (2) organisation, and (3) national. Successful health information production is dependent on the activities and attitudes

of the organisation, which in turn, is founded on the policy and support at national level.

## 5.2 Search strategy

A traditional term search was performed online using the US National Library of Medicine. Based on the structured MesH terms available, the following expression was entered into PUBMED:

1) 'Hospitals' [Mesh] AND 'International Classification of Diseases' [Mesh] AND Implementation which produced 18 results of which 4 were valid. The use of the 'Similar Articles' link produced 111 results from one article alone.
2) The next search 'International Classification of Diseases' [Mesh] AND ICD-10-AM [All Fields], produced 49 results, again followed by a 'Similar Articles' link search, which was very successful in retrieving most of the Australian records used.
3) 'Documentation' [Mesh] AND 'International Classification of Diseases' [MeSH Terms] produced over 7000 results, restricted to below 3000 by adding the term 'clinical'.

Other sources referred to include the primary documentation on ICD of the WHO and national healthcare organisations, as well as webpage information from consultancies, vendors, and training organisations. The national HIM websites such as the American Health Information Management Association (AHIMA) and the Health Information Management Association of Australia (HIMAA) also offer databases that were useful, as well as the use of bibliographies of some of the articles.

## 5.3 ICD-10 implementation in developed nations

### 5.3.1 Australia and the ICD-10-AM

The study entitled 'Where in the World Is ICD-10' by Brouch (2000) briefly covered the early history of uptake of ICD-10. The Czech Republic, Denmark, Romania, and Slovakia implemented ICD-10 for mortality coding in 1994, while Thailand implemented the system for both mortality and morbidity that same year. Australia introduced the classification for both mortality and morbidity in 1998, while the US implemented it for mortality only in 1999. The major portion of the article highlights the similarity of

Australia and the US in their recent ICD progress with the latter being the first country authorised to effect their own modification (ICD-9-CM), which was later modified by Australia to suit its specific healthcare context. In the US, classification and coding standards are established and maintained by the National Center for Health Statistics which falls under the CDC, while the NCCH publishes the ACS, has responsibility for revising the classification system, and produces educational programs leading to coder certification. Without a national supervisory body establishing, maintaining and adapting standards, as well as a suitably trained sustainable workforce, health information could not progress.

Thus, the authority, standards, and workforce, together with the related professional body HIMAA were already in place when the development of ICD-10-AM commenced in 1995, notwithstanding the many years of experience under ICD-9-CM, and it was only a matter of months before the establishment of the ICD-10-AM clinical coder Education Working Party (Brouch, 2000).

The directors of the NCCH co-authored the cornerstone of dedicated ICD-10-AM implementation journal literature under the title ‘Introducing ICD-10-AM in Australian hospitals’, the publication of which coincided with the adoption of the new Australian modification (Roberts et al., 1998). The article stresses the major input of clinicians to the NCCH process, as well as the importance of the incorporation of the familiar MBS procedure codes. Whereas the public hospital sector had previously used the ICD-9-CM for procedures and the MBS was used by the private sector, Australia now had one common classification of procedures. One of the factors most relevant to the Saudi MOH implementation is a reference to the impact on clinical coders:

> Introduction of the new classification will have major implications for the clinical coder workforce. They will not only need to become familiar with ICD-10-AM coding, but will also need an understanding of anatomy and the surgical procedures required by the specificity of the MBS-E. (Roberts et al., 1998, p. 34).

A follow-up article by Innes, Peasley, and Roberts (2000) provided a detailed step-by-step account of the transition and concluded with the following paragraph: ‘However, Australia's relatively storm-free ‘change’ has been due in large part to the goodwill and enthusiasm of clinical coders to improve their tools of trade and participate in education programs, as well as their eagerness to absorb educational material.’ (P.7)

Between 1995 and 1999, the NCCH Education Working Party prepared educational material and ran 81 courses on 130 days for 2,423 participants in most of Australia's major cities and New Zealand. The performed workshops in that time was comprised ‘train the trainer’ sessions and face-to-face workshops with the participants including clinical coders, often taking place in conjunction with HIM conferences (Innes et al., 2000).

In 1997 an ICD-10-AM Implementation Kit targeting non-HIM healthcare workers was distributed to all public and private hospitals and day surgery centres, detailing the background to the classifications and the impending implementation. In 1997 a set of six educational booklets, Taste of Ten, covering areas such as common medical conditions, obstetrics, mental health, injuries, and procedures were distributed to clinical coders to introduce the broader anatomical and procedural knowledge necessary for ICD-10-AM coding. Implementation was followed by a series of thirteen Post-Implementation Workshops to clarify issues raised. The very successful outcome of the national transition is testimony to the value of the first step that was covered; ‘knowing the issues’ must precede the drawing up of a plan (Innes et al., 2000).

A further follow-up study by Roberts (2004) describes the broader national 'major education plan' that supported the implementation phase. This included undergraduate HIM programs and professional clinical coding courses. The author argues that the strength of the Australian Modification is confirmed by the fact that as of 2004, it had already been implemented by New Zealand, Germany, and Romania, with Ireland shortly to follow.

A complete issue of the Health Information Management Journal (volume 38, no 1) was devoted to Australian health information. In the editorial entitled 'Health Classification—A Complex World' by Shepheard (2009, p. 4), the author stated: ‘In many ways HIMs and clinical coders are themselves an extension of these classifications; they are the means by which classifications, or more specifically the information they represent, are made available to the other users of these classifications.’ The editorial introduced several relevant Australian articles covering aspects of classification and coding, five of which have been reviewed.

A study entitled ‘Australian hospital data: not just for funding’ by Michel and Jackson (2009) points to the responsibility of clinical coders to provide data that can enhance patient safety and healthcare quality, detect and monitor hospital-acquired complications, and contribute to the Charlson Index of Comorbidity, which predicts the risk of in-hospital mortalities. As the title indicates, the article explored the full parameters of health information and the extent of benefit gained by producing statistics of the greatest accuracy. The authors cited a study into the number of admissions to children's hospitals on a primary diagnosis of gastroenteritis and the enormous savings that would be made by the introduction and availability of the rotavirus vaccination.

Soo, Lam, Rust, and Madden (2009) in their study titled ‘Do we have enough information? How ICD-10-AM Activity codes measure up’, explored the ICD-10-AM activity codes relating to injuries suffered in external activities such as sports, recreation, on the beach, camping, dancing, etc, that have potential value to statistical analyses of human activities in terms of injury risk. A new edition of ICD-10-AM is released by the NCCH every two years. In line with an emerging international trend after the millennium to capture valuable data relating to the causes of injury hospitalisations, the third edition of ICD-10-AM released in 2004 expanded the initial 16 activity codes into 236 comprehensive codes, referred to as the 'Activity block', which were covered by the study.

The major categories covering codes U50-U73 (Sports) are team ball, team bat or stick, team water, boating, individual water, ice and snow, acrobatic, combative, equestrian, wheeled non-motor, multidisciplinary, other school-related recreational, other specified sport and exercise, and other activity. Thus, diagnoses that fall into 'other activities' provide the evidence of overlooked or emergent activities that may warrant a new category in the future (Soo et al., 2009).

It has already been established that Saudi Arabia is plagued by one of the world's highest rates of road accidents and as a result, excessive fatalities and hospitalisations. Collection of such accurately coded data would provide immediate savings in healthcare expenditure, highlighting the long-term investment value and socio-economic benefits of following the trends established by the developed nations described by Michel and Jackson (2009).

Cheng, Gilchrist, Robinson, and Paul (2009) conducted a retrospective internal audit of surgical inpatient discharges, which were all recoded to examine the consequences of miscoding in ‘The risk and consequences of clinical miscoding due to inadequate medical documentation: a case study of the impact on health services funding.’ Approximately 16% of the 752 cases examined led to DRG changes that amounted to lost revenue of AU$575,300. Further effects of miscoding are inaccurate statistics in terms of disease surveillance and epidemiology. Clinical documentation errors exceeded coding errors.

The fact that a greater proportion of errors stemmed from the physician's failure to present the diagnosis correctly, either through insufficient detail to code to the level prescribed by the ACS, or due to a misjudged diagnosis highlights one of the most fundamental challenges of the expanded classification and emphasises the need for the training of physicians in documentation, which will be dealt with in greater detail later in this review (Cheng et al., 2009).

Curtis, Bollard, and Dickson (2002) produced a study that cited Cheng et al. (2009) and showed that the validity of coding is based on the level comprehensibility of the documentation, which was dramatically improved by the inclusion of nursing case manager progress reports of day-to-day observations of patients. In addition, the greater potential for incorrect documentation and coding of additional diagnoses was also stressed in a study by Reid, Allen, and McIntosh (2005) that concluded that comorbidities were more likely to be under-coded rather than over-coded which results in under-reimbursement to hospitals.

While the current study concerns the implementation of clinical coding in Saudi public hospitals, it is worthwhile to make some mention of mortality coding. In 'Counting the dead and what they died from: an assessment of the global status of cause of death data' by Mathers, Ma Fat, Inoue, Rao, and Lopez (2005), the authors, most of whom had either worked in or currently held positions in Australian healthcare, surveyed the global usage of ICD for mortality data, in order to assess its quality and, thus, its validity for medical research purposes. In only 23 (included Australia, Canada, and the US) of the 106 countries surveyed, did the record completeness exceed 90% and the use of non-specific codes lower than 90%. The study was based on data from 1990 to 2003 and 75 countries were unable to return any data. Consequently, there is a lack of data from the global regions that would benefit most from cause-of-death research.

One of the early articles, Innes et al. (2000) heaped praises on the achievement of the national coding workforce and the vital role it played in the successful transition. In contrast, there is a shortage of coding professionals, a tendency for coders to move quickly from job to job and the profession is not particularly well-remunerated. Hence, Postle, Koeldnik, and Miocevich (2009, p. 47) noted:

> In addition, many clinical coders realize that there is a level of ignorance in the workplace, outside of the health information environment, concerning just what clinical coding is about. Generally, there is little understanding amongst medical,

> nursing, and allied health staff of the level of clinical knowledge and specialist skills that are required for accurate coding. When clinicians become involved in research and want to abstract information from medical records, however, the clinical coder's knowledge and ability to assist sometimes comes as a shock and pleasant surprise to them.

Dealing with the projected workforce shortage, the researchers argued that while an understaffed profession means greater job security and the ability to demand better salaries, a shortage of staff tends to overload existing staff, increasing the likelihood that some will seek alternative employment (Postle et al., 2009).

The status of clinical coders is dealt with more broadly in 'Clinical coding internationally: A comparison of the coding workforce in Australia, America, Canada, and England' by McKenzie, Walker, Dixon-Lee, Dear, and Moran-Fuke (2004), which compares the results of national surveys conducted among coders and coding managers in each of the four nations, examining qualifications, further education, salaries, and workloads. Generally, Australian coders were the best educated with either a HIM degree from a university or certification from the HIMAA, as part of a HI or health administration qualification. A pertinent finding was that 'In all four countries, documentation issues were the primary concern for coding quality' (McKenzie et al., 2004, p. 9).

The last article discussed the general updating of new editions and stressed the value of well-trained coders in that many changes and expansions originate from queries posed by coders, based on difficulties that can only be exposed through the actual practical application of the classification (Doyle & Dimitropoulos, 2009).

The most important principle identified by the Health Information Management Journal coverage, in terms of the study focus is that clinical coding is at the epicentre of health information and its future and that its impact is far-reaching, as is the impact of erroneous coding. Assigned codes not only convey a diagnosis, procedure, or reimbursement, but may play a part in many statistical applications regarding specific diseases, treatments, and quality of healthcare (Michel & Jackson, 2009). An incorrect code not only indicates poor documentation or bad coding but may reflect in a loss of revenue and inaccurate statistics (Cheng et al., 2009). ICD classifications and the associated clinical coding have a key role and responsibility in 21st Century healthcare. They reflect changes in the body of medical knowledge and human activity and behaviour (Soo et al., 2009). An inadequately staffed coding department puts coders under stress and encourages them to look elsewhere (Postle et al., 2009).

A later Health Information Management Journal article provides an analysis of the actual coding process. An original approach is evident in the article entitled ‘Professional practice and innovation: The coding masterpiece: a framework for the formal pathways and processes of health classification’ by Price and Robinson (2011) compares the process of breaking up the subject and then reassembling it to the method employed in the conception and execution of some of the most famous 20th Century paintings: (1) the episode of care is reduced to its constituent parts so that it matches exactly the subject (2) the extracted information is prepared as the basis of the coding process (3) the episode of care is reassembled in coding. Thus, the ‘masterpiece’ is the exact reflection in coding of the patient's hospital episode.

One of the seminal articles, cited 717 times as of December 2019, on the clinical documentation/coding process and the inevitable influence of natural language expression and communication, both in the physician-patient dialogue and clinical documentation record is ‘Measuring diagnoses: ICD code accuracy’ by O'Malley et al. (2005), which reports the findings of extensive research by a team of consultants and academics into the documentation/coding pathway in hospital practice.

The report describes the hospital 'patient trajectory' (admission, diagnosis, diagnostic tests, and procedures and/or treatment) as ordered by the medical staff. Eight points along the process were highlighted as potential sources of error. Throughout, communication is fundamental. If the patient describes symptoms incorrectly or withholds information, the accuracy of the diagnosis may be compromised. If the clinician does not ask the right questions or misunderstands the patient, this introduces another source of error. The clinician’s knowledge and experience about the best diagnostic tests and procedures, and the availability of these, may also be problematic. The knowledge, experience, and diligence of the coder can also affect the accuracy of coding and may lead to misspecification, miscoding, and resequencing errors (O'Malley et al., 2005).

Shepheard (2018) in her study entitled ‘What do we really want from Clinical Documentation Improvement (CDI) programs?’, discusses clinical documentation, the need for CDI, and the emerging role of CDI specialists. Shepheard (2018, p. 4) proposes that ‘CDI programs are about the convergence of the clinical care, documentation and coding processes and should be guided by a principle of clinical truth.’

A similar article by Combs (2016, p. 58) suggests that 'CDI supports diagnostic specificity.' However, without the physician's diagnosis and procedure documentation matching the potential specificity of the classification, the coder cannot achieve this in coding. While the rise of CDI in the US has been attributed to the need to reduce reimbursement claims rejections, it serves as a benefit for all healthcare data purposes and AHIMA offers a qualification as a Certified Documentation Improvement Practitioner.

In the last of the Health Information Management Journal five articles, entitled 'Organizational factors affecting the quality of hospital clinical coding', Santos, Murphy, Baxter, and Robinson (2008) used a mixed methods approach to examine organisational variables (hospital specialisation; geographical locality; structural characteristics of the coding unit; education, training and resource supports for coders; and quality control mechanisms) that impact on coding quality. At the time of designing the educational materials to support the implementation of ICD-10-AM, the NCCH considered the factors impacting upon coding quality to include: 'communication with clinicians; ongoing coder education; review of the coding and documentation process by peers or a superior; coder environment and workload; availability of reference materials to guide code allocation; ongoing coder education; and resource support from management' (Santos et al., 2008, p.26). While the quantitative analysis showed little variation in terms of hospital type and locality, all participants rated education including training, and level of support as the foremost influences, followed by quality control measures. Barriers listed included a lack of resources, illegible and incomplete clinical documentation, deadlines and pressure, lack of communication, and excessive workload (Santos et al., 2008).

The final Australian article reviewed gives a detailed account of the Australian-assisted implementation of ICD-10-AM in Singapore. This source has been dealt with in greater detail than any other source reviewed and constitutes the most valuable contribution to the thesis. A study entitled 'Singapore's migration to a new classification system', by Dimitropoulos, Cumerlato, Shamim, & Madden (2014) describes the nation's transition to ICD-10-AM from the MOH decision, through training and other preparations, supported over a six-month period by a team of coding experts. The Singapore MOH, together with MOHH (Ministry of Health Holdings), launched a tendering process to find an appropriate consultancy to support the upgrade and the University of Sydney was awarded the role of Singapore's migration partner in July 2011. In order to fit the

Singapore health system model, representatives from the University of Sydney Project Team and MOH/MOHH representatives visited relevant sites to discuss the clinical and Mediclaim Coding, submission, and health insurance claims process. A Coding Experts Panel (CEP) was immediately established and an introductory migration kit comprising a basic generic introduction with specialist sections for clinicians and clinical and Mediclaim coders, specialist nursing staff, and administrative and financial data users. The kit for clinical coders included work and answer books based on the new classifications. The introductory educational material targeted a series of pilot workshops run by the CEP for coders and clinicians, the results and feedback of which were used as the basis of a more practically intensive and job-specific series of workshops and training courses.

Between November 2011 and the implementation date of 1 January 2012, a series of stringent training workshops for physicians and coders took place. Other healthcare professionals such as nursing staff and allied healthcare professionals were also motivated to attend either the short clinician or other data workshop. Mentors were made available to the institutions during the first two months of the implementation and post-implementation consolidation training workshops took place in April. In order to provide an accurate measure of coding and compliance standards, the Singapore Hospital Education Audit was performed in July and August 2012, involving 18 hospitals drawn from both the private and public sectors, and 3000 random coding examples, just one year after the award of the tender to UOS. The purpose was to assess the national coding quality and compliance with ACS, the strengths and weaknesses of the systems of individual institutions, and the future educational needs of clinical coders in Singapore, as well as to establish CDI in the workplace for clinicians. A National Steering Committee was formed to take over the educational, mentoring, and auditing roles of the UOS project team. A national coding website, the Coding Query Database was established based on the FAQs of the pre-implementation workshops and the queries to the mentoring team that oversaw the actual implementation (Dimitropoulos et al., 2014).

In conclusion, the authors pointed to the single, most crucial, starting factor; the Singapore MOH saw the vital need for a team of experts to guide the project successfully. Enormous ground was covered in a single year. Experts with a record of past successes established a participatory structure to produce a plan of action, grounded in education, and reviewed after a period of a few months to provide feedback as to what was necessary for the successive period. The final educational thrust took place right on the eve of the implementation, referred to by the authors as ‘optimising the actualisation of the learning’. Mentoring accompanied the launch, followed by educational consolidation after a few months, and the nationwide work of a year was reviewed with a view to the future and the handing over of the Singapore project to its owners (Dimitropoulos et al., 2014).

### 5.3.1.1 Summary of factors derived from Australian sources

#### 5.3.1.1.1 Health information

The literature reviewed covered the development of the ICD-10-AM classification and coding system as a multi-level health information source for the collection, managing, transfer, analysis, and dissipation of health information (Michel & Jackson, 2009; Roberts, 2004; Roberts et al., 1998).

Proceeding from the systematic translation into code of the diagnosis of an individual health episode that might include a hospital stay and surgical or other procedures, it exists as a vehicle for the calculation of the appropriate reimbursement for treatment, assessment of the effectiveness of a procedure or hospital quality, as well as a statistic in computing the incidence of a disease at regional, national, or global level (Michel & Jackson, 2009; O'Malley et al., 2005; Price & Robinson, 2011). The guiding principle of the WHO expansion of ICD-10 is ‘greater specificity’ which demands greater detail in documentation as the basis for the coding of the health event, not only for reimbursement but for the secondary statistical and research purposes (Soo et al., 2009). Each of the processes the patient record serves, requires health data that reflects ‘clinical truth’ (Shepheard, 2018), which is dependent on coding accuracy. There are many factors that impact on this accuracy, which originates in the clinical documentation of the initial diagnosis and procedures (Cheng et al., 2009).

#### 5.3.1.1.2 National and organisational

The Australian national ICD-10-AM implementation preparations, particularly the design of materials for training and the train-the-trainer approach that redistributed the training from the national to organisational level, established an apparent spirit of mutual recognition that everyone was playing their part in a seamless healthcare hierarchical structure.

Virtually every Australian article discussed, points to the fact that ICD-10-AM demands more from the coder workforce, in terms of greater anatomical and pathological knowledge and the application of this to the expanded classification (Roberts et al., 1998). The need for preparatory coder training was emphasised, as well as a similar requirement for ongoing CDI to improve the clinical documentation of physicians (Combs, 2016; Shepheard, 2018). There were warnings of potential coder shortages and the detrimental impact this has on the reduced workforce, as well as the impossibility of coding accurately with inadequate clinical documentation (Postle et al., 2009).

An important message for the Saudi MOH was the observation that a major factor in the successful transition was the positive attitude exhibited by the coder workforce in their application to training (Innes et al., 2000), notwithstanding the confirmation from the HIMAA that just under two decades after the transition to ICD-10-AM, a health information workforce shortage threatens Australian healthcare (Health Information Management Association of Australia, 2016). Finally, the success of the ICD-10-AM transition in Singapore demonstrated the benefit of calling on experts with previous experience of a similar implementation (Dimitropoulos et al., 2014).

### 5.3.2 Canada and ICD-10-CA

While Canada slightly exceeds Australia in population and population density, Canadian healthcare literature on ICD-10-CA is minimal compared to Australian literature on ICD-10-AM, possibly because Canada has a ‘single-provider’ healthcare system, as opposed to the Australian and US hybrid systems that incorporate both national and private healthcare insurance funding.

A short Canadian government document describing the data that comprises the National Hospital Morbidity Database details the history of ICD usage and other diagnosis and procedure classifications used in Canada prior to ICD-10-CA. Historically, Canada developed as a bilingual country and certain provinces used alternative classification systems. The Canadian Institute for Health Information (CIHI) introduced the Canadian Adaptation (ICD-10-CA) in 2001, to be implemented by all provinces and territories during the period 2001-2005. During this staggered implementation period, a new procedure classification, the Canadian Classification of Interventions (CCI) was also introduced (Govt of Canada, 2001).

Between 1979 and the implementation of ICD-10-CA, different coding systems were used in different provinces; two diagnoses (ICD-9 and ICD-9-CM) and two procedure classifications (the Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures and the procedure section of ICD-9-CM). This presented major difficulties in compiling national statistics and provincial comparisons. ICD-10, together with the CCI, introduced national standardisation (Lalonde & Taylor, 1997).

Walker et al. (2012) assessed whether the transition to ICD-10-CA had a discernible impact on comorbidity coding and diagnosis in discharge data in Canadian hospitals. The study makes an important point regarding the use of data for statistical and research purposes:

> The widespread use of administrative hospital data has been facilitated by important advantages of the data, including their 1) readiness to be analyzed; 2) wide geographic coverage; 3) relatively complete capture of episodes of patient contact with the health system; and 4) relatively low cost to use. However, the use of these data for research purposes (i.e. purposes other than their primary use in funding and administration) is based on the assumption that they provide valid information about diagnoses, comorbidity and clinical services. (Walker et al., 2012, pp. 1-2).

The actual study concluded that there was minimal change in the number of diagnoses per unit of time and quality of the coded data, attributed to the level of preparatory coding at the hospital and provincial levels, as well as the workshops run by the CIHI for all coders nationally (Walker et al., 2012), echoing the crediting for the success of the Australian implementation to the coders (Innes et al., 2000).

The question, ‘Do coder characteristics influence validity of ICD-10 hospital discharge data?’ was investigated by Hennessy, Quan, Faris, and Beck (2010), based on over 400,000 records coded by 59 coders in the locality of Calgary and evaluated in terms of coder volume, employment status (full-time or part-time), and hospital type. Again, the purpose of the research was the assessment of coder quality with a view to statistical and research validity. The study concluded that the variables made no impact on coding quality (Hennessy et al., 2010). This confirms the findings of the Australian research into the impact of organisational factors on coding quality (Santos et al., 2008).

At the International Federation of Health Records Organisations and AHIMA joint conference in Washington DC in 2004, several papers were delivered on the implementation of ICD-10-CA and CCI. The two that follow deal with the organisational requirements discuss several practical factors that will inevitably make or break the Saudi public hospital implementations.

Moskal (2004) focused on the strategising and planning perspective of the Canadian implementation, presenting seven categories of guidelines. The author argued that a successful implementation is dependent on adherence to a comprehensive plan and timeframe, which is essential to coordinate and synchronise all aspects of an implementation, such that all technical, clinical, and administrative system components progress to a state of readiness. Leadership is crucial, as well as an organisational consciousness that sees every player as having a vital role. The final message: ‘build an implementation team!’

The second paper focused on a single hospital implementation at Humber River Regional Hospital, a multi-site general hospital with 605 beds in Toronto (Johnson, 2004). Coding leaders were sent on a national HIM professional training course and introduced to the materials they would use to educate the remainder of the staff. Testing of the vendor software (Meditech) followed and highlighted several problems that required modification to enable interoperability with ICD-10-CA. The solution required enhanced data quality and IT functionality, as well as Windows compatibility and needed additional funding and staffing which was not available. The stakeholders strategised and produced a list of crucial needs that an additional vendor would have to meet. All staff affected by the implementation attended an on-site demonstration by the vendor. After the installation of the new hardware and software, all staff underwent Windows and coding training. The information systems section found that viewing the new software was unsatisfactory on the existing 15- inch PC workstation monitors and these were upgraded to 17-inch models (Johnson, 2004).

The account highlights the issue of unforeseeable occurrences in project planning and the need to prepare for these by maintaining funding reserves. They lead to loss of time and productivity and cannot be eliminated by the most detailed planning (Johnson, 2004).

#### 5.3.2.1 Summary of factors derived from Canadian sources

The only Canadian article classified at the national level is the Lalonde and Taylor (1997) coverage of the historical differences of standards in different provinces, the difficulty this entails for national statistics, and the process of adopting a single standard in the transition to ICD-10-CA.

The literature classified as organisational discussed the need for preparation in terms of leadership strategies, planning, staff awareness, training, and potential loss of productivity necessitating an increase in staff. The two Canadian articles revealed essential preparations for a successful ICD-10 implementation: Moskal (2004) offered a blueprint for a comprehensive organisational plan, inclusive of all staff. Johnson (2004) dealt with a single hospital transition in detail and covered both health information and technical matters, including vendors.

At the health information level, two Canadian articles assessed the validity of ICD-10-CA coding (Hennessy et al., 2010; Walker et al., 2012) and established that due to the organisational strategising and training preparations, clinical coders were able to adapt to ICD-10-CA coding without loss of quality, as well as maintain similar outputs to what they have managed coding in ICD-9-CM.

### 5.3.3 The extended delay in the US transition to ICD-10

The US dominance of ICD literature is no surprise given its population; its leadership in global health activities in the developing world; the extent of tertiary academic institutions offering degrees in medical and information science; national healthcare organisations and professional medical, healthcare, and healthcare information management bodies; as well as the medical insurance industry and healthcare technology vendors. What increased the volume of literature exponentially was the number of delays in the US transition to ICD-10-CM, largely caused by opposition groups of physicians in private practice who exaggerated the negative impact it would have on their professional lives.

Whereas the US adopted the WHO ICD-10 for mortality reporting in 1999, a sequence of delays preceded the eventual national ICD-10-CM transition date of 1 October 2015 (Wing, 2016). It was the last developed country to do so by at least a decade (Kumar & Collins, 2017). ICD-10-AM was introduced in some Australian states in July 1998 and in the remainder in July 1999 (Innes et al., 2000). The Canadian Clinical Modification (ICD-10-CA) was officially launched in April 2001 (Johnson, 2004).

Coustasse and Paul III (2013) listed the economic downturn, political disputes and provider disagreements, coding inconsistencies, complicated healthcare regulations, and excessive costs as the main reasons for the delay in adopting ICD-10-CM, arguing that the transition that was being avoided was exactly what was needed to heal the division in US healthcare.

Groups of physicians constituted the predominant opponents of the transition from ICD-9-CM. Note the excessive use of metaphor in the title and the suggestion of vendor complicity and ulterior motives in the quotation from ‘The Tragedy of the Implementation of ICD-10-CM as ICD-10: Is the Cart Before the Horse or Is There a Tragic Paradox of Misinformation and Ignorance’(Manchikanti, Kaye, Singh, & Boswell, 2015).

> Further, the ICD-10-CM coalition includes 3M, which makes significant profits from the implementation of ICD-10 with consulting and software, as well as selling rather poorly designed Ambulatory Payment Classification (APC) software to Medicaid programs and others, and Blue Cross Blue Shield which has its own agenda. The decision by the Energy and Commerce Committee to not consider further postponement of ICD-10 was based on the testimony of 3M to avoid any postponement of ICD-10. However, physician groups are not members of the cooperating parties. (Manchikanti, Kaye, et al., 2015, pp. E486-487).

The same primary author was also a contributor to ‘Survival Strategies for Tsunami of ICD-10-CM for Interventionalists: Pursue or Perish!’, by Manchikanti, Marvel, Mark, Alan, and Joshua (2015), which criticised the ridiculous total of 144,000 codes that comprise ICD-10-CN and ICD-10-PCS. Appendix 1 shows the expansion of a spinal vertebrae fracture from 1 to 8 codes.

Richard Averill, an international authority on the development of classification, casemix, quality, and reimbursement technologies responded with ‘Misperceptions, Misinformation, and Misrepresentations: The ICD-10-CM/PCS Saga’ to dispel the myths about the apparent enormity of the increase in numbers of codes and the ignorance of how this occurred (Averill & Butler, 2013). Examining Appendix 1 from Manchikanti (2015, p. E 699), it is simple to see how the expansion from one single ICD-9 code for fractured vertebrae produces eight ICD-10 codes, by differentiation of osteoporosis or neoplastic disease, anatomical site and first or subsequent encounter. The article shows how adding left side or right side, doubles the number of codes. The argument that it should be abandoned due to its overcomplexity was rejected with the following statement: ‘Arguing that ICD-10 should be abandoned because a few ICD-10 codes are viewed as unnecessary detail is like arguing that English should be abandoned because it contains the unnecessary word “floccinaucinihilipilification” (which means “the habit of considering things worthless’ (Averill & Butler, 2013, p. 4).

The chapter of ICD-10 healthcare literature covering the polarisation of US healthcare became history when the official transition took place and has minimal relevance to the implementation of ICD-10-AM in Saudi MOH hospitals, other than that some resistance from physicians is likely. The delay period did, however, see the growth of a large body of constructive literature, particularly from the HIM sector that discussed transitional factors with definite validity.

In 2003, the US National Committee on Vital and Health Statistics commissioned the RAND Corporation to analyse the costs and benefits of switching to ICD-10-CM and ICD-10-PCS. The analysis of overall costs was divided into three major categories: training, lost productivity among coders, and systems changes. Potential training needs included areas such as claims processors, administrative staff, medical review staff, actuaries, auditors, fraud investigators, physicians, nurses, coders, laboratories, and employee benefit administrators (Libicki & Brahmakulam, 2004).

AHIMA distributed an organisational newsletter entitled ‘Research Highlights Five Studies That Navigate ICD-10-CM/PCS Transition’ in January 2012 (American Health Information Management Association, 2012). The first of the five studies examined whether current levels of physician clinical documentation were adequate to support correct coding with ICD-10-CM (Moczygemba & Fenton, 2012). A pilot study was conducted using two clinical coders and a quality assessor, all previously trained in ICD-10-CM by an AHIMA trainer, who coded 491 heart disease, pneumonia, and diabetes clinical records. The findings exposed that 178 of 207 (86%) records with heart disease as the principal or secondary diagnosis had been assigned an unspecified ICD-10-CM heart disease code. The results confirmed the need for enhanced clinical documentation from physicians to support ICD-10-CM coding (Moczygemba & Fenton, 2012). In a study entitled ‘Preparing for ICD-10 and Conforming Your Documentation’, the author warns physicians: ‘The level of specificity required in ICD-10-CM may wreak havoc on your practice, if practitioners are not documenting enough in the medical record’ (Buckholtz, 2013, p. 178). Similarly, the author of ‘Commonsense Approach to ICD-10 Implementation’ makes it very clear. ‘Weak documentation will not support ICD-10 diagnosis codes’ (Maguire, 2012, p. 148).

Another perspective on the crucial role of the physician and clinical documentation is provided in a superlative corporate white paper produced by the Kiran Consortium Group, consultants to a broad base of healthcare organisations with clients distributed across the

USA, as well as in Canada. The introduction to ‘Cracking the Code: Physician Clinical Documentation and ICD-10’ by Husty and Newell (2013) is emphatic:

> Most executives know the importance of clinical documentation relative to coding, billing, quality initiatives, risk management, utilization, medical necessity, and so on. However, it is the practitioners’ documentation, clinical documentation that is the sole source for all these functions. Practitioners’ documentation should also be supported by nursing and ancillary staff documentation. (p.2)

The article advocates CDI, as an ongoing support for physicians and a means for dealing with the element of resistance from the sector (Husty & Newell, 2013). Towers (2013) discussed the emerging role of the Clinical Documentation Specialist, an expert in guiding physicians towards raising their documentation to the levels of detail and specificity ICD-10 facilitates. The author, an Associate Professor of Medicine and Psychiatry at the University of Pittsburgh, offered valuable insights into how CDI programs, in turn, push physicians to a higher level of medical practice. Chapter 3 clearly documented the resistance that permeates many groups of physicians in Saudi Arabia. Here is a core factor that can be expected and must be dealt with. If physicians are not willing to be brought in at the preparatory stage, their lack of practice in the level of documentation demanded by ICD-10 will create a barrier to achieving quality coding.

Alternatively, there is no sign in the US literature of an emphasis on the need for training and improved medical knowledge for coders that permeates the Australian literature. A possible reason for this is the fact that many of the US articles were contributed by private practitioners who viewed the process on terms of their own need to document in greater detail. A study examining the impact of ICD-10-CM paediatric codes warned that a lack of proficiency with the introductions and changes had the potential to affect paediatrician reimbursement by eight percent and urged colleagues to become familiar with the new classification (Caskey et al., 2014).

One study that did mention coding as part of the organisational process discussed the results of a survey distributed to 116 HIM directors to test the implementation-readiness of Alabama Hospitals (Houser et al., 2013). Respondents were unanimous that a lack of collaboration between healthcare physicians and other providers prevented the completion of ICD-10-CM/PCS implementation of the US coding transition model (Houser et al., 2013). Grider (2012) highlighted the core clinical documentation/coding functions, while stressing that health organisations need to be proactive and understand that training for all players involved is crucial, noting that organisations that see the transition as an IT/HIM responsibility will have to bear the consequences. Thus, the key to success in the transition, and in the case of Saudi Arabia's MOH public hospital implementation, is preparation through training and education.

Immediately before and after the compliance date, the US literature manifested the addition of articles by specialists, who took the trouble to present the ICD-10 codes of their specialisation for the benefit of their professional colleagues. Rahmathulla et al. (2014) acknowledged that the expansion was overdue and offered advice to fellow neurosurgeons on documentation procedures, in order that coders meters of their coverage:

> The change to ICD-10-CM/PCS presents an opportunity for US providers, healthcare organizations, and payers not only to expand the ways in which medical procedures are documented for billing purposes, but also to enhance the specificity at which patient-level data may be utilized, to improve patient health outcomes, reduce medical errors, enhance quality data reporting, and increase the accuracy of claims payments. (p.2)

A post-compliance date literature review set out to examine the readiness of healthcare workforce for the transition regarding costs, training, and additional staffing (Paul III, David, Sacconi, Glover, & Marriot, 2017). The study concluded:

> Hospitals should expect to provide extra help to physicians in the first few months after implementation, as physician frustration could derail all preparations previous put in place. If that happens all the training of coders, and hiring of extra staff, will come to naught. (p. 95)

Appendix 2 shows the matrix of studies from developed nations, and Appendix 3 illustrates the summary appraisal of literature sources of the developed nations.

## 5.4 An ICD-10 implementation in a developing country

### 5.4.1 Thailand and the WHO-FIC Asia-Pacific Network

Thailand is rated one of the more recent global economic success stories and qualified as an upper-middle-income economy in 2011. However, due to disparities in income still to be addressed, Thailand is still officially classified as a developing country (World Bank, 2018). In Chapter Four, it was established that in less than two decades following the establishment of the Thai Medical Informatics Society, not only had Thailand produced its own modification of ICD-10 but an additional modification based on Thai traditional medicine, ICD-10 for TTM (Wansa Paoin, n.d).

Dr Wansa Paoin is the head of the Collaborating Centre for the WHO-FIC in Thailand. In 2007, at a WHO-FIC Asia Pacific Network (APN), he presented the ‘Road map for ICD-10 implementation in developing countries and pitfalls to avoid: the Thailand experience’ (Paoin, 2007). Tips for a successful implementation included; the Ministry should make ICD-10 coding mandatory, at least in all government hospitals; establish a central ICD office to support, assist, and collect hospital coding reports; and provide feedback on quantity and quality of ICD coded data from hospitals. In the preparatory phase, the Ministry, through the central office, should choose the method of coding (single or multiple coding); the level of specificity (3,4 or 5 digits); and the scope of coding (mortality, morbidity, in-patient, out-patient) (Paoin, 2007).

Practical suggestions included putting doctors through introductory coding training courses to facilitate their understanding of the correct diagnostic and procedure terms, as well as training small groups of doctors to become ICD trainers. Where ICD manuals and resources are scarce, and to assist novice coders, lists of common diagnoses and codes can be made up, with more difficult coding directed to more experienced individuals. The presentation was concluded as follows: ‘Developing countries should learn about ICD implementation by lessons provided by other country experiences’ (Paoin, 2007).

Pongpirul, Walker, Rahman, and Robinson (2011) conducted a survey of DRG coding practices in Thailand hospitals. DRGs involve both diagnosis and procedure coding, together with patient demographic factors, but are essentially about reimbursement. Unintentional coding errors may produce unfair reimbursements; alternatively, the practice of DRG creep, in which hospitals adjust DRG codes in order to receive greater payments, constitutes unfair practice and requires physician or coder collaboration. The survey involving nearly 1400 hospitals compared coding practices in audited and unaudited hospitals and highlighted three major factors impinging on reimbursement: (1) data quality; (2) coding practice; and (3) the hospital prioritisation of reimbursement at the expense of data and coding quality. The study found that, overall, eight healthcare professional disciplines (medical statisticians, nurses, physicians, public health staff, paramedics, medical records staff, IT staff, and finance/accounting staff) were involved at some time or other in hospital coding. The researchers noted that this constitutes an important difference between resource-rich developed and poorer developing settings where processes do not always match the recommended practice.

Ingun, Narkpaichit, and Boongerd (2015) evaluated the impact of universal health coverage on health information systems in Thailand and noted large-scale improvements in quantity and quality, but recommended the need to focus on improving interoperability, HIE, and meaningful use. Currently, hospital standards include ICD-10, HL7 messaging, LOINC a laboratory coding standard, and DICOM. They concluded: 'Integrating a national health information system is a gradual and iterative process that requires extensive time and resources, as well as political support and commitment from stakeholders' (Ingun et al., 2015, p. 146). The authors qualified this observation by stating that limited resources are not an excuse to continue with isolated, fragmented systems, although financial and technological sufficiency will not succeed without a unified national strategic plan.

Discussing the contribution of clinical coding to HIS improvements, the authors observed how the gradual stages of progress that followed the adoption of ICD-9-CM led to the establishment of the inpatient classification system for inpatient payments. DRGs replaced the traditional fee-for-service under the Traffic Accident Protection Act in 1993. From 1996 electronic inpatient records were used to create a national DRG Grouper which was then adopted by the MOH and eventually by all health insurance schemes (Ingun et al., 2015).

Sukanya (2017) audited nearly 120,000 medical records to assess the validity of principal diagnoses on discharge summaries and coding assessments. Classified into disease groups, the levels of error ranged from 13% to 34%. The major error source categories were inadequate written records, inferior clinical knowledge and depth of coder training and experience, and poor hospital quality control measures. The following description of the coding workforce in Thailand is revealing (Sukanya, 2017, p. 302):

> In Thailand, physicians are generally not trained in ICD-10 coding, except for physician auditors. There is a shortage of competent coders in hospitals. They come from diverse backgrounds: medical statisticians, nurses, physicians, public health staff, medical record staff, information technology staff, finance staff, accounting staff, as well as workers with only short-course coding training.

Discussing DRG errors, the author also mentioned 'DRG creep' (Sukanya, 2017).

Thailand is one of the drivers of the WHO-FIC APN and has shown initiative in providing an example to poorer member countries, such as Cambodia and Laos, in assisting with their ICD-10 implementations and ICD-10-based health statistics. Responses to implementation surveys provided the foundation of a regional implementation database identifying barriers and solutions, as well as online and paper-based training materials. The APN web page recommends regionalisation as a basis for individual national health system development (WHO-FIC APN, n.d.).

The report entitled ‘Activities of WHO-FIC Asia-Pacific Network’ by W. Paoin et al. (2017), delivered at the APN 2017 conference held in Mexico City, discussed the draft and translation into Lao PDR of ICD-10 simplified version, as well as the introduction of the Startup Mortality List (ICD-10-SMoL) V2.1 in preparation for its implementation in Laos. This list is recommended as an initial step towards standardised reporting of causes of death in countries lacking the capacity to code to ICD 3 or 4 digits (World Health Organisation, 2018a).

The power of APN regionalism is clearly illustrated in two other documents relating to the implementation of ICD-10 simplified version in Lao PDR. A Lao MOH presentation to the 2015 APN conference covers the achievements of the nation's first two phases of health sector reforms, including the building of the national DHIS2 (District Health Information Software 2) web-platform, capacity development to sub-national level, integration with existing information systems such as HIV, Tuberculosis, and Health Financing and the crucial strengthening of government ownership. A second report at a workshop covering the application of ICD-10 simplified version in DHIS2, mentions that participation covered all stakeholders, namely, related departments in the MOH, central, and provincial hospitals and healthcare centres, and the UHS. The report concluded with a tribute to the good practices and lessons learned from the APN (Founkham, 2016).

While the body of secondary English literature on ICD-10 in Thailand and the APN network is relatively small, necessitating the use of primary WHO documents to produce the picture, it reveals an enthusiastic, professional devotion to healthcare. Not only has Thailand its own ICD-10 modification but is a global leader in the move towards a classification that interpolates traditional and allopathic medicine. Further, the complexity and quality of the Thai studies covered in this review match the best.

Five novel factors have practical relevance to healthcare in developing nations and could be considered in the Saudi implementation:

1) Due to a shortage of certified coders, staff with alternative professional training code in some hospitals (Sukanya, 2017).
2) The references to ‘DRG creep’ raise the issue of the fundamental purpose of health classification and coding. Is the primary function of ICD-10 for reimbursement or is it to serve the purpose of an improved tool for the reporting of global healthcare data (Pongpirul et al., 2011; Sukanya, 2017)?
3) A successful ICD-10 implementation that enhances the national quality of healthcare and statistical data is a gradual process that works towards a long-term goal, in association with improved health data standards, interoperability, and data exchange (Ingun et al., 2015).
4) Many errors can be avoided from the start, through learning from the implementations of other developing countries (Paoin, 2007).
5) Regionalisation can be a positive, strengthening factor in terms of national implementations and healthcare in general (Founkham, 2016; Paoin et al., 2017; Phadouangdeth, 2015; WHO-FIC APN, n.d.).

Appendix 4 presents the matrix of factors from the Thai literature could provide an initial workable level during the implementation of ICD-10-AM in Saudi MOH hospitals. The matrix includes a regional category, which did not form a part of the matrix of factors from the developed nations.

#### 5.4.1.1 Summary of factors derived from Thai literature Sources

The position of Thailand as the most developed regional power, not only socioeconomically, but in terms of healthcare and health information in the APN, together with the perspective of the Thai medical profession that medical practice has no boundaries, facilitated a regionalism in healthcare. Consequently, some Thai researched qualifies for the factor category Regional which was not applicable to the literature of the independent developed nations.

Regional level: (1) ‘Developing countries should learn about ICD implementation by lessons provided by other country experiences.’ (Paoin, 2007), (2) In the Lao PDR implementation all stakeholders enjoyed active participation. The implementation focused on integration with existing healthcare systems (malaria, TB, HIV). The Lao MOH paid tribute to APN network (Founkham, 2016; Phadouangdeth, 2015), and (3) ICD-10 Simplified Version and SMoL (Startup Mortality List) were designed to get classification/coding going where simplification was warranted; additionally, Dr Paion recommended that where resources were limited, lists of common terms and codes should be drawn up (Paoin et al., 2017).

National level: (1) ‘Integrating a national health information system is a gradual and iterative process that requires extensive time and resources as well as high political support and commitment from stakeholders.’ (Ingun et al., 2015, p. 146) and (2) Commenting on health data standards, Ingun et al. (2015, p. 141) argues:

> A study of Dr. Wansa Paoin has provided the suggestion to have a responsible organization to organize and to maintain health data standards. Objectives of the study were to find an appropriate health data standard organization setting options for Thailand, by group discussion with experts and representatives from 33 related stakeholders both in public and private sectors, and by reviewing experiences from other countries, i.e., the [US], Australia and Canada.

Organisational level: A difference between resource-rich developed, and poorer developing settings is that processes do not always match the recommended practice [on the fact that nurses and other staff members were found to be coding discharge certificates in some hospitals] (Pongpirul et al., 2011).

Health information level: Commenting on the developing setting, Sukanya (2017, p. 302) observes:

> There is a shortage of competent coders in hospitals. They come from diverse backgrounds: medical statisticians, nurses, physicians, public health staff, medical record staff, information technology staff, finance staff, accounting staff, as well as workers with only short-course coding training. There are many steps in the coding process.

Is the primary function of ICD-10 for reimbursement or is it to serve the purpose of an improved tool for the reporting of global healthcare data (Pongpirul et al., 2011; Sukanya, 2017)?

### 5.4.2 Saudi literature relevant to the MOH ICD-10 implementation

The implementation of ICD-10-AM in Saudi Arabian hospitals, excluding a handful of academic and tertiary hospitals, will take place from scratch and not involve a transition from ICD-9.

One of the earliest Saudi references to the ICD is in a study entitled ‘Paediatric Inpatients at the King Khalid University Hospital (KKUH) Riyadh, Saudi Arabia,1985-1989’ by Bahakim, Bamgboye, Mahdi, Al-Mugeiren, and Familusi (1993) which states:

> Diagnostic coding of all admissions using the ninth revision of the ICD has been in operation at KKUH since its inception. The coded diagnoses and other relevant data for each patient are stored in the King Saud University mainframe computer through a terminal at KKUH. For the purpose of the present study, the stored data for the period April 1982 to August 1989 were retrieved from the computer storage system and analyzed. (p. 2)

The study looked only at the classes of diseases and the ages of the children admitted, having no interest in the quality of the coding, which was done by the doctor admitting the patient. The study is included in this review as evidence of the use of ICD-9 in some non-MOH hospitals as far back as the 1980s.

Farhan et al. (2005) produced the first Saudi Arabian study of ICD classification and coding. All five authors were employed as physicians at KFSH&RC, which is also not classified as a public hospital when they undertook 'Documentation and coding of medical records in a tertiary care centre: a pilot study' to assess the accuracy of ICD-9-CM coding in their workplace. The study analysed 300 randomly selected medical charts that produced 454 secondary diagnoses and 297 procedures. Only 61.78% of the audited medical records met the standard for good quality documentation and coding errors (30%) exceeded documentation errors (16.6%).

In the same year, Al-Ahmadi and Roland (2005) conducted a systematic literature review on primary healthcare quality in Saudi Arabia, covering 31 studies. While the review made no reference to clinical documentation or coding standards, it identified among the barriers to better quality; management and organisational factors, and professional and organisational culture. Technology infrastructure was often poor and professional development totally neglected, in terms of a lack of developmental literature and access to materials, as well as the impact of staff shortages causing extra working hours that eliminated any chance of establishing further training possibilities. Many of the reviewed studies referred to language difficulties in professional workplace communications, due to the large number of expatriate physicians.

Almalki et al. (2011) presented a general overview of the Saudi Arabian health system tracing its development and the challenges that it faces in its current phase of reform, listing these as: 'health workforce, financing and expenditure, changing patterns of diseases, accessibility to health care services, introducing the cooperative health insurance scheme, privatization of public hospitals, utilization of electronic health (e-

Health) strategies and the development of a national system for health information.' (p.789)

A pilot study of reimbursement practices in private healthcare centres in the Eastern Province, measured in terms of international best practices, offered insights into the latest MOH intentions. The use of multiple, unregulated reimbursement practices is further evidence of the lack of health data standards. Alternatively, the MOH is showing signs in its suggestion of privatising some hospitals that it is reducing its involvement in healthcare delivery, in favour of the continuous regulatory and accreditation of hospitals in Eastern Province and health insurance, as evidenced by the formation of the CBAHI, CCHI, and CHS (Bah et al., 2015).

After Farhan et al. (2005) there is an absence of Saudi healthcare literature devoted to ICD classification or its promised implementation in healthcare literature until 2012 and the publication of the PhD dissertation on health data standards and the implications of poor interoperability in Saudi Arabia, by one of the nation's most respected contributors to healthcare literature, Abdullah Alkraiji, Professor of Information and Communication Technology at King Fahd Security College in Riyadh. This PhD (Alkraiji, 2012) and a later study examining the lack of health data standards in the practical context of the multidisciplinary therapies offered chronic Saudi hospital diabetes (Alkadi, 2016), together qualify as the key Saudi healthcare research applicable to the MOH ICD-10-AM implementation in public hospitals.

Questions in the qualitative interview relating to the implementation of ICD-10-AM in other Saudi hospital sectors (Alkraiji, 2012) established the following commonly held views:

1) Saudi healthcare providers selected ICD-10-AM and enforced its implementation by Royal Decree without consulting and checking hospital capabilities, which is why only three of the study hospitals had switched to this version since 2005, one of these being a public hospital, namely KFMC.
2) In the hospitals that did adopt ICD-10-AM, it was not integrated it into the HIS system and could only serve as a standalone system for research, statistical, and reporting purposes.

3) This was due to the HIS systems in those hospitals still being ICD-9-CM compliant, as they were maintained by American vendors and based on the older classification which the US still used prior to 2015.
4) The application of ICD-10-AM did not meet the expectations of hospital experts, who foresaw a coding system integrated into the HIS system.

Participants attributed responsibility for the ineffectual situation to the authoritarian, non-participatory structure of Saudi Arabian healthcare and the lack of a HIM supervisory body and national professional organisations such as HIMAA and AHIMA. It was perceived that the Saudi healthcare authorities took a sudden decision to purchase the license to use ICD-10-AM without involving the stakeholders and healthcare providers or considering the technical capabilities. The shortage of coders had not been dealt with, as no training was available. One hospital had only three ICD-10-AM coders, all of whom were expatriates. It has been estimated that the country requires about 1500 coders; currently, Saudis comprise fewer than 5 percent of the workforce. Healthcare information systems in Saudi Arabia cost three times what they cost in North American and European countries, and Canada due to the lack of qualified specialists and technicians in Saudi Arabia (Alkraiji, 2012). The following two extracts sum up the organisational weaknesses.

> There are strained relationships between medical and non-medical staff, exacerbating the power struggle between the two groups in the hospitals. A greater balance in organisational structure between the two groups must be established in the public healthcare organisations. This is because the high degree of politics and bureaucracy in such organisations means there are numerous faults and conflict of orders in terms of drafting and proposing the specifications and requirements of a new system (Alkraiji, 2012, p. 189).

Alkraiji (2012, pp. 189-190), continued his commentary:

> In addition, healthcare organisations in Saudi Arabia are part of a multi-cultural environment. Having a non-standardised medical language in the hospitals requires a great many training programmes. This was considered by the majority of participants as one of the challenges and most costly aspects, facing the hospitals in Saudi Arabia.

Staff participation and training are the global cornerstones of organisational development.

Between the research of Alkraiji (2012) and Alkadi (2016) two studies researched the underutilisation of EHRs in the Eastern Province of Saudi Arabia, the first on nurse usage (El Mahalli, 2015a) and the second on use by physicians (El Mahalli, 2015b). The inability to retrieve patient records due to power failures, additional time to capture after power failures, length of reboot time, systems hanging, and the need for customisation of the EHR systems were found to be common barriers in both studies. Among nurses, the lack of computer literacy due to lack of training was regarded as a general problem. Physicians reported a negative impact on relationships with patients, as well as a low usage of ICD classification and coding (El Mahalli, 2015a, 2015b).

In ‘The healthcare system in Saudi Arabia and its challenges: the case of diabetes care pathway’, Alkadi (2016) evaluated the treatment of the diabetes pathway in Saudi Arabia in terms of the advent of Electronic Patient Records (EPRs) and the incomplete ICD-10-AM implementation. The examination of technical problems and the application of these to the chronic diabetes care pathway raised additional points of value poor health data standards and interoperability, extremely pertinent to the impending ICD-10-AM implementation. The author made several site visits to hospitals in Central and Eastern Saudi Arabia to conduct interviews.

Globally, Saudi Arabia has the third highest rate of type-1 diabetes, a disease that demands a multidisciplinary, multi-organisational regimen of treatment that may include physical, psychological, and acute illness care. The diagnosis of diabetes generally is made at a primary healthcare centre consultation where it is confirmed by a urine and two blood tests, initially random and then a second after fasting to compare glucose levels. The patient is than sent to a dietician who will attempt an intervention using dietary and lifestyle changes. A decision on the potential of these changes or whether the patient should be referred to secondary care involves a rescreening. At secondary care level, the patient will be screened for complications which will involve a combination of visits to urology, neurology, nephrology, a vascular specialist, and a health educator. The findings of one specialist may need to be discussed with another. Eventually when the condition is brought under control, the patient is likely to be referred back to the primary centre for maintenance visits and pharmacy repeats. Multiple HIT systems may be used by physicians, specialists, nurses, and other medical staff from different organisations to capture, retrieve and share data. In Saudi Arabia, the use of EPRs [the author refers to EPRs rather than EHRs] may be subject to the 'hybrid' approach in which some information may be captured electronically and some on paper. Thus, using the diabetes care pathway as a real example of complex healthcare in need of interoperability, the study challenges the lack of health data standards in the country. In concluding that the implementation of EPRs in Saudi Arabia had been unsuccessful to date, largely due to the failure to implement health data standards, the researcher points to its consequent impact on clinical documentation and coding. Until the Saudi MOH can establish national standards, through consultation with all healthcare players, cohesive national HIT systems are unattainable (Alkadi, 2016).

The Saudi academic journal literature reviewed, thus far, despite the excellence of all the individual studies reviewed and the revealing of factors that will influence the implementation of ICD-10-AM in the study hospitals offers few insights into the inner workings of the MOH and its part in the pre-implementation preparation, training, and build-up.

The name of Hussein Albishi, clinical coding advisor to the former Deputy Minister of Health, first appeared in the related literature in the International Federation of Health Information Management (IFHIMA) Global News of December 2011, in which he outlined the progress in building HIM in Saudi Arabia, the establishment of the SHIMA and numerous HIM symposiums and workshops that had taken place (Albishi, 2014a). The first noteworthy area of national development mentioned was the Saudi National Clinical Coding Portal, a website ‘ to promote the coding profession in Saudi Arabia and organise the application process for using the licensed ICD-10-AM & AR-DRGs around the country’ (Albishi, 2014a, pp. 4-8).

Next, the MOH launched a three-year strategic plan to restructuring of Medical Record department in all public hospitals in terms of manpower, location, equipment, and training in its hospitals including more than 2000 primary care centres. Albishi (2014a, p. 7) noted that ‘Records supervisor/manager performance programs were designed and focused on new HIM topics such as; accreditation readiness, evaluating the quality of HIMs, ICD-10-AM workshops, e-Health, and site visits to the country’s most advanced hospital HIMs departments.’ In the same section, reference is made to a longer-term plan:

> The MOH Information and Communication Technology (ICT) team, headed by Professor Mohammed Al-Yemeni, Advisor to the Minister of Health and General Supervisor of ICT, is working literally day and night on a ten-year e-Health strategic plan that will transform the healthcare system in Saudi Arabia (Albishi, 2014a, p. 7).

The report described this as ‘one of the largest e-Health projects in the world according to International HI and e-Health experts’ (Albishi, 2014a, p. 7). Albishi (2014a) briefly outlined the process of ICD-10 coding implementation in Saudi Arabia between 2007 and 2014, commencing in 2007 with the signing of a licensing agreement between the Saudi

Arabia and Australia, followed by the creation of a national committee to oversee the implementation. The author noted that the major challenges were a lack of training programs of clinical coding, poor levels of English literacy, a significant shortage of HIM specialists, and the perceived lack of professional career path for HIM specialists including clinical coders (Albishi, 2014a). The content of this article formed the basis of a presentation made by Albishi at the Middle Eastern Health Informatics (MEHI) Summit, 2014.

**Table 5-1 GAP analysis in the literature**

| GAPs | Where we want to be | Current Status |
|---|---|---|
| • Shortage of HIM & coding staff<br>• Poor English & Medical terminology<br>• Lack of awareness<br>• Poor HISs services<br>• Lack of space in MRDs.<br>• Ignored of profession.<br>• Lack of Strategic Planning. | • Standard HIM & coding staff (per beds)<br>• Improve English & Medical Terminology HIM & Coding training<br>• Share & Display Values<br>• Upgrade HISs & e-coding<br>• Expand MRDs<br>• HIM Department & Coding Centre<br>• Align MOH strategy & Organisations | • Shortage of coders & HIMs<br>• Poor English & Medical terminology.<br>• Lack of awareness.<br>• Poor HISs & un-updated classifications.<br>• Space shortage.<br>• Outdated APPs & Job descriptions<br>• Lack of strategic planning |

Source: (Albishi, 2014b, Slide 53)

The Gap Analysis presented to the MEHI Summit by the chief advisor (HIM) to the MOH (Albishi, 2014b) covered the shortage of HIM coding staff, their poor English and medical terminological skills, and their lack of awareness regarding ICD-10. It then moves on to the poor HIS services, lack of Ministry physical space, the ignored state of the HIM profession, and the lack of strategic planning. It makes no specific mention of the fundamental limiting factors; namely, data standards, technology infrastructure, and interoperability. Albishi (2014b) summarised the contents of the MOH Coding Road Map, which was launched in 2014 with the main focus on the implementation of the complete ICD-10-AM in ten of the top MOH hospitals, including reforming the payment system by the introduction of DRGs, by the year 2020.

There is no available evidence in the literature or web reports to confirm whether the Coding Road Map was followed. There are several coding training courses advertised, mainly from consultancies. Arizona Computer Services offered a two-day compact course on ICD-10-CM in May 2015 at a Dubai hotel. While Saudi Arabia and Qatar have chosen ICD-10-AM, albeit different versions to start with, the rest of the Gulf nations are using ICD-10-CM. Some Saudis attended the course, but no one from Qatar was present (Arizona Computer Services, 2015). Running two different modifications in neighbouring territories at a distance from skilled vendors is unnecessarily extravagant and contrasts with the regional sharing and assistance exemplified by the APN. There is no doubt that it means a duplication of software and vendors in the region, as well as virtually guaranteeing that regional health data standards and interoperability will suffer.

Audits after the Australian implementation of ICD-10-AM, the most notable being Cheng et al. (2009), indicated the need for improvements in clinical documentation and led to the rise of CDI. CDI specialist, Tammy Combs quoted an email from Dr Wil Lo, an international CDI consultant:

> In the Kingdom of Saudi Arabia, there is a movement toward privatization of health insurance and widespread use of AR-DRGs for inpatient reimbursement. With respect to health insurance, facilities will be required to demonstrate medical necessity of procedures by properly documenting the diagnoses. Insurance companies will utilize severity of illness, risk of mortality, intensity of service and length of stay as criteria to determine the level of reimbursement. Facilities will be more accountable, and CDI will help each facility meet the stringent standards set by the third-party payers. In the Kingdom of Saudi Arabia, and most likely in other countries throughout the world, CDI implementation is viewed as a priority (Combs, 2016, p. 59).

The researcher was intrigued by the reference to Saudi Arabia in an email exchange between two CDI specialists, one the author of the article and the other the source of the email who had visited Saudi Arabia as a CDI consultant. The rationale for the need to improve clinical documentation in the context of health insurance assessments of claims and reimbursements is particularly clearly expressed. However, there is no other reference to CDI in any of the Saudi healthcare literature and the phrase ‘CDI implementation is viewed as a priority’, expressed so enthusiastically, is ironic given that the persistent underlying challenges to healthcare reform have never been dealt with as priorities! It would seem that Dr Lo, the CDI consultant, is not referring to MOH hospitals.

Only Albishi as a MOH spokesperson reporting on the implementation plan in the IFHIMA monthly publication displayed any hope and enthusiasm (Albishi 2014a); alternatively his Gap Analysis (Albishi, 2014b), while overlooking the health data standards problems, did list challenges such as the lack of qualified coders, staff shortages, language barrier, professional resistance, inadequate physical space in medical records departments and the MOH, and a shortage of ICD-10 coding and educational materials.

#### 5.4.2.1 Summary of factors derived from the Saudi healthcare sources

The regional category which did not hold for the independent developed nations reflects the mutually supportive, and thereby cost reducing, healthcare information practices among the members of the APN. While political ambitions and competition may be a limiting factor, it does seem wasteful that in the Gulf region Qatar is implementing ICD-10-CM while Saudi Arabia has selected ICD-10-AM, eliminating the potential for sharing and cost-saving.

In terms of the health information category, Australia, Canada, and Thailand all implemented ICD-10 at least two decades ago, which has allowed a period for auditing clinical documentation and coding. Alternatively, Saudi Arabia has produced only one study which is exclusively a health information study.

##### 5.4.2.1.1 Health information

Farhan et al. (2005) assessed the quality of clinical documentation and coding retrospectively based on the hospital admissions of children, concluding that both areas were substandard although the coding was inferior.

Bah et al. (2015) confirmed the use of different ICD versions and AR-DGs in the hospitals researched. Hence, the study emphasises the dependency of clinical information on health data standardisation.

El Mahalli (2015b) covered the implementation of EHRs in Saudi Eastern Province hospitals from the physician perspective of clinical documentation, as well as the infrastructure impact (see organisational below).

##### 5.4.2.1.2 Organisational

Alternatively, the parallel study by El Mahalli (2015b) covered the implementation of EHRs in Eastern Province hospitals from the nurse perspective. This emphasised the impact at the organisational level through negative impacts and loss of work due to inadequate power supply, as well as the additional time consumption of inputting data for staff lack computer literacy.

Al-Ahmadi and Roland (2005) conducted a systematic review of into primary healthcare quality and listed poor technology infrastructure, lack of professional development and staff communications difficulties due to language barriers. While this study was conducted before the decision to implement ICD-10-AM, it is important in that the factors documented are those that persist.

#### 5.4.2.1.3 National

Alkraiji, 2012 produced the major contribution of the reviewed Saudi literature on the dearth of national health data standards that have not been dealt with, either prior to or since the thesis. The universally acknowledged requirement of a national technical supervisory and advisory body to implement and administer standardisation remains an unheeded factor.

Almalki et al. (2011) discussed the escalation of eHealth and its planned implementation in Saudi Arabia and concluded that the poor technological infrastructure and non-existent health data standards would have an adverse impact.

NOTE: Alkraiji published four journal articles but these emanate from the thesis and were adjudged superfluous. It should be noted that although the publication dates of the articles (2012-2016) are subsequent to the thesis (Alkraiji, 2012), all are based on the same qualitative interviews conducted in 2010. The contributions of Albishi constitute reports or announcements rather than published academic research.

## 5.5 Research insights gained from classifying the literature sources

While all Saudi studies, like those of the national healthcare literature sources reviewed, were allocated to one of three categories; namely, organisational, health information, or national. The researcher found that in the case of Saudi research this was not as unambiguous as had been the case with the sources from the other nations; namely, studies on hospital planning and preparations falling under organisational; those covering the unprecedented levels of specificity of ICD-10 under health information; and those on education and training, and full-scale interoperability under national.

The problem of categorising the Saudi literature is comprehensively illustrated in Alkadi (2016), which builds on the findings of Alkraiji (2012) that ‘exchanging medical data semantically among healthcare providers is impossible’ (p 185). Building on the thesis (Alkraiji, 2012), Alkad1 (2016) doubly stresses that the healthcare bureaucracy of Saudi Arabia continues to misunderstand the concept that healthcare reform must serve the cause of improving patient care. This was achieved by researching a practical medical example, namely the diabetes epidemic of diabetes and revealing how the continued disregard for national health data standards and interoperability reduces the potentially attainable quality of care for patients requiring the full multidisciplinary therapeutic interventions along the diabetes pathway (Alkadi, 2016).

With reference to the implication of the above statement that there was a degree of ambiguity in classifying the Saudi literature, Alkadi (2016) ties together three strands: (1) The failure to deal with the persisting lack of health data standards (national level) (2) impacts negatively on the quality of healthcare available for patients suffering a chronic disease (organisational), (3) while hampering the exchanging of patient information among the team of specialists who treat them, which will inevitably impact on the quality of clinical information and its value in healthcare research and statistics (health information). Appendix 5 displays the matrix of Saudi Arabian literature sources arranged according to the factor categories of health information, organisation, and national. Appendices 6, 7, and 8 combines the tables of literature sources from the five nations reviewed in this chapter, as per factor category.

## 5.6 Nationally established health data standards

The only non-Saudi source that dealt with data standards was a Canadian study published just before the country's transition to ICD-10-CA and celebrated the advent of unified data standards in Canadian healthcare, ending a tradition of different French and British provincial data standards; thus, enhancing the validity of national and regional statistics derived from hospital data (Lalonde & Taylor, 1997). Conversely, Australian and US studies paid no attention to data standards and technological compliancy because the required functional levels of interoperability were already in place and vendors who touted non-compliant new devices and software would be out of business. The most comprehensive Saudi study established that at the time of publication, Saudi Arabia had no national data standards. Different hospitals ran different ICD versions and modifications and essential healthcare communication standards such as HL-7 messaging and DICOM imaging (Alkraiji, 2012). The complementary diabetes care pathway study, discussed in the previous section, illustrated the impact of technological incompatibility, reducing the quality of patient care and preventing the team of medical specialists treating the same patient from exchanging information and communicating instantly via a single system (Alkadi, 2016). Nonetheless, Thailand, after transitioning to ICD-10, produced its own modification while rolling out universal healthcare and providing regular support to other APN nations implementing ICD-10. All this was managed with minimal data standards in place (Ingun et al., 2015).

## 5.7 Education and training under a national supervisory body

Clinical coding requires a minimum entry level of expertise which is gained by a university course under a healthcare administration degree or by training and testing through a professional body such as HIMAA. All HIM training is regulated in terms of standards and qualifications by the NCCH (Brouch, 2000). Thailand offers both a two-year diploma and four-year HIM degree (Paoin, n.d.; Yokobori et al., 2009), with further training support from the APN network and Thai Medical Informatics Association.

Training during the implementation in Singapore training was supported by the Australian expert panel and the execution by the local trainers was immaculate (Dimitropoulos et al., 2014).

It is paramount for Saudi Arabia to note is that despite the established training structures, Australia still faces a coder shortage (Postle et al., 2009) and in Thailand, hospitals do not have sufficient qualified coders and are forced to use all types of staff (Sukanya, 2017).

National Assistance and Implementation Costs: The transition in Singapore, using a team of coding experts from the University of Sydney, is the recommended way to go (Dimitropoulos et al., 2014). While there is no evidence in the literature on this matter, given the latest terms negotiated by NCCH and the Saudi MOH, this may well be the case in Saudi Arabia.

Alternatively, the reality of healthcare in developing nations necessitates adaptation to circumstances (Pongpirul et al., 2011), as demonstrated in the Lao PDR implementation, which received much assistance from other APN nations (Phadouangdeth, 2015). The Thai and APN literature makes frequent reference to reproducing basic classification lists when the complete books are unavailable (Paoin, 2006).

While there is no official release of costs, the international accounting consultants Rand Corporation gave the accepted breakdown as training, lost productivity, and systems changes (Libicki & Brahmakulam, 2004). In general, Saudi training costs are heightened by the number of expatriate staff members requiring training in different languages, while lost productivity must be included as an additional expense in the category of staff shortages. System costs, including vendors, have been reported at three times those in the US and EU (Alkraiji, 2012). Irrespective of actual costs, it is fair to say that the Saudi MOH will be forced to budget proportionately more heavily, than most other implementations (Founkham, 2016). Appendix 6 summarises the factors in the developed and developing nations in the national category.

## 5.8 Organisational implementation plan, training and materials

The organisational factors can be disaggregated into staff and technical matters. The complaints of the participants in the surveys carried out in Alkraiji (2012) and in Al-Ahmadi and Roland (2005) indicate that lack of consultation from the top down is a major negative factor experienced by Saudi healthcare professionals and other levels of staff, while other reported grievances included physician resistance, generally low staff morale, and the perpetual language barriers that exist with a high proportion of expatriate employees (El Mahalli, 2015a). If the comprehensive implementation plan matching those followed in the Developed Nations is to succeed, this paternalistic attitude of the MOH must give way to the participatory structure which introduces organisational awareness of the implementation, specific readiness training at the organisational level, the availability of training materials (Johnson, 2004; Santos et al., 2008), a staff support structure that facilitates the commencement of coding such as a committee that includes physicians, surgeons, theatre staff and ward staff (Wing, 2016), and given the added workload among already-compromised workers, due to staff shortages, some temporary staffing arrangements that exist for the implementation period (Paul III et al., 2017).

## 5.9 Technology

On the technology side, poor infrastructure, power outages (El Mahalli, 2015a) and the potential for system incompatibility (Alkraiji, 2012) will certainly pose a problem. Here again, it must be mentioned that it is unlikely that the ideal organisational structures conveyed by the authors from Developed Nations can possibly be met in Saudi Arabia, but an organisation of mutual support that implies overcoming of physician resistance, which is even warned against in Thai sources (Paoin, 2007), can achieve what has been achieved in Thailand. Appendix 7 summarises the factors in the developed and developing nations in the organisational category.

## 5.10 Multi-functional ICD-10 data, impact of errors and the need for CDI

The high standards discussed in the sources from developed nations refer to the need for complete documentation and accurate coding at both the reimbursement level and for the validity of clinical data for statistics and research (Michel & Jackson, 2009; O'Malley et al., 2005; Price & Robinson, 2011). Both Thailand and earlier Saudi research contain coding audits which show a relatively high level of error (El Mahalli, 2015b; Farhan et al., 2005; Sukanya, 2017).

The Australian audit referred to by Cheng et al (2009) attributed more errors to clinical documentation than coding. In general, even in the developed nations, the level of completeness and specificity of clinical documentation has been insufficient, which has seen the rise of CDI. No Thailand research mentioned CDI, but health information has been to train doctors in entry-level clinical coding, as well as training some to trainers. This willingness to do what seems most effective, in this case, would surely reduce physician resistance and improve hospital working relationships.

The contrast between the long-established sophisticated healthcare systems of the Organisation for Economic Co-operation and Development (OECD) nations and the imperfect system of a developing nation such as Thailand provides the major theme of the final discussion on the factors that will influence the implementation of ICD-10-AM in Saudi MOH hospitals. If Saudi HIM professionals and physicians are going to throw their hands in the air and say that the nation cannot make a start on ICD-10 implementation, due to the absence of national data standards, impetus and progress will be lost. Appendix 8 summarises the factors in the developed and developing nations in the health information category.

It can be concluded that the factors influencing the implementation of ICD-10 in Saudi MOH hospitals:

1) National Health Data Standards: while it is true that many data standards are missing, it is equally true as shown by the case of hospitals in Thailand that this will not impact directly on individual hospitals commencing ICD-10 coding.
2) National Supervisory Body: This is lacking together with a national education plan that will provide regulation of HIM and coding standards to support the future supply of HIM staff in Saudi hospitals.
3) National Implementation Costs: The costs of ICD-10 implementation are estimated to be three times the costs of the US and EU nations costs. Additionally, training costs have the added burden of training in languages dictated by the variety of expatriate staff.
4) Organisational Plan: The necessity of the individual organisational plan, inclusive of training needs, depends on the attitude of leadership towards participatory involvement by all members of staff, particularly the ability of management to motivate the physicians and to facilitate their involvement with HIM staff. Organisational training is unlikely to be successful in the face of staff shortages.
5) Organisational technology: Poor technology infrastructure, system failures due to power problems, and lack of compliance are factors which will cause staff to become demotivated, as well as the negative technical implications and the loss of recent work.
6) Clinical documentation and coding: The training of coders in ICD-10 and physicians in CDI is clearly ongoing at the national level. The reports of past Saudi coding quality levels indicate these were below OECD expectations but similar to coding levels in Thailand hospitals. What is essential is that a start is made because it is a long road and a long learning curve to match the coding quality in nations with a long history of morbidity coding. Whether clinical coders begin manually writing out codes or entering codes into software is immaterial.

## 5.11 Gaps in the literature

In the Saudi literature, it clear that while extensive research on HIM exists, no comprehensive study has examined the factors influencing the implementation of an ICD classification and the practice of clinical coding in Saudi public hospitals. To date, research has tended to focus on HIT or EHR areas, rather than on the emergence of clinical coding systems in Saudi hospitals. Agreement on factors influencing the commencement of such an implementation in Saudi public hospitals is lacking. Researchers in the field of HIM in Saudi hospitals, such as Alanazy (2006) Bah et al. (2011), Hasanain and Cooper (2014), Khalifa (2013), Hasanain et al. (2015) and Al Aswad (2015), have analysed the factors influencing the implementation of EHR. However, the Saudi literature does not reveal any research attempts to investigate factors influencing ICD-10 implementation in any healthcare providers hospitals.

Even though some Saudi hospitals had been using ICD-9-CM and had waived the option to move over to ICD-10-AM, little attention has been paid to clinical coding and most of studies have been carried out in developed countries. To the best of this researcher's knowledge, there has been no reliable analysis of the many factors that may influence the commencement of implementation of clinical coding in MOH hospitals in Saudi Arabia.

Hence, currently there is a direct need to clarify the status and factors impacting on the Saudi introduction of Saudi ICD-10-AM, particularly in MOH hospitals. Classification and coding are essential to the introduction of health insurance funding and the gathering of health statistics, in order to improve the quality of national healthcare. Weaknesses in the HIT and HIS areas exist, will soon reveal themselves. Referring back to the achievements of William Farr, still recognised today, and his attempts to derive social determinants from mortality statistics and, ironically a few decades later, the diagnosis of cholera brought to France by pilgrims returning from Saudi Arabia, it is clear that some value can be gained from health statistics without the modern technology systems. As Thailand healthcare has managed, the implementation of ICD-10-AM is the first necessary step that Saudi healthcare must now take.

The systematic, comparative evaluation of Australian, Canadian, and US literature on ICD-10 and associated modifications, as representative of the developed nations, with the literature of Thailand and Saudi Arabia, representing the developing nations has provided a basis for the inference of factors that will potentially influence the ongoing Saudi MOH hospital implementation of ICD-10-AM, as well as conclusively showing that no Saudi literature has yet undertaken a complete examination of these factors, thus, revealing the value that the current study has, in filling a void in Saudi healthcare literature.

## 5.12 Theoretical framework

Theory should ideally guide practice, and practice should be a source of theory, so that theory and practice inform each other (Creswell, 2009). It is possible that the implementation of ICD-10-AM is underpinned by Rogers' Theory of Diffusion of Innovations (Rogers, 2003). This theory seeks to explain how new ideas spread through organisations. It has been previously applied to health information systems and public health (Kaminski, 2011; Sahin, 2006). According to Rogers' theory, diffusion is a process whereby new ideas are introduced to individuals to better meet their needs. Rogers' theory includes six factors that may affect the diffusion of an innovation: (a) relative advantage, (b) compatibility, (c) complexity, (d) trialability, (e) reinvention and (f) observability. According to the theory, innovations that have a clear advantage are more likely to succeed, implying that health professionals in Saudi Arabia need to understand the advantages of clinical coding. E. M. Rogers (1995, p. 5) defines diffusion as 'the process by which innovation is communicated through certain channels over time among members of a social system' (p. 5). Rogers' theory suggests that there are five predominant steps leading to the acceptance or rejection of an innovation: (a) knowledge, (b) persuasion, (c) decision, (d) implementation and (e) confirmation (see Figure 5-1).

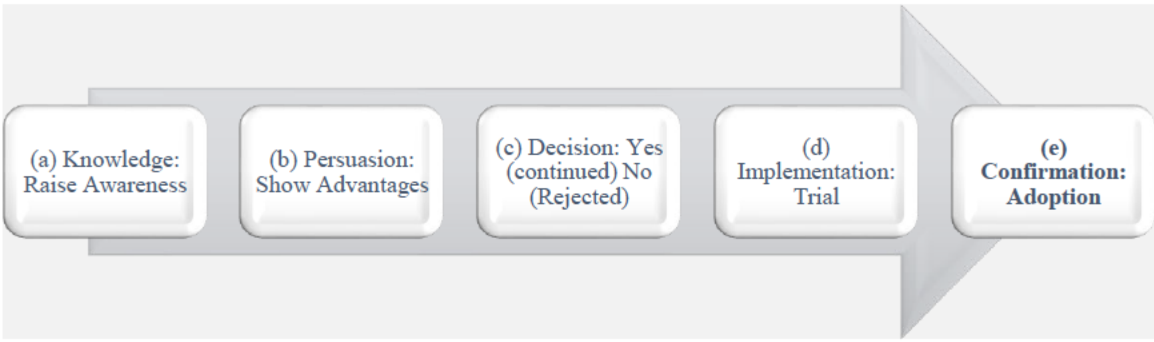



**Figure 5-1 Study conceptual model**
Source: (Rogers, 2003)

Innovations that are compatible with user needs are more likely to succeed, implying that healthcare professionals in Saudi public hospitals should be made aware through introductory training that ICD-10-AM will be able to meet their needs. Innovations that are perceived to be simple are also more likely to succeed and, thus, Saudi healthcare professionals need to understand that clinical coding, once the implementation process has been executed, will simplify their daily tasks. Innovations that permit users to test for themselves are more readily adopted, which implies that clinical coding is more likely to succeed if healthcare practitioners can review its potential and discover how it fulfils their needs. Innovations with visible benefits are more easily adopted, indicating that health professionals must be able to observe the advantages for themselves.

This approach begins by specifying the theoretical dimensions, deciding how to promote understanding and awareness and exploring the current status, in terms of factors influencing the commencement of the implementation. It involves creative thinking, producing practical ideas and executing them, thus, changing the reality of the status quo.

## 5.13 Conclusion

This chapter has covered, in detail, factors associated with the implementation of ICD-10. A systematic review was undertaken to retrieve studies that have assessed factors affecting the implementation process. After grouping and reviewing this literature in terms of developed and developing nations, relevant factors were compiled and compared with existing literature related to clinical coding in Saudi Arabia and the challenges facing ICD-10-AM implementation in MOH hospitals. Subsequently, the gaps in the Saudi literature were analysed and discussed. The chapter ended with an account of Rogers' Theory of Diffusion of Innovations and its suitability as the theoretical framework for this study, as a preparation for the presentation of the study methodology, to be discussed in the next chapter.

# 6 Chapter Six: Research Methodology

## 6.1 Introduction

Kothari (2004) defined research methodology as a systematic way to pursue the investigation and identify the impact of any research problems that may arise. Thus, the methodology provides a logical framework through which to proceed from the formulated research questions to the findings. This chapter outlines the theoretical phases of the research methodology, the methodological options that characterised each phase, and explains the rationale for each decision that contributed to the design of the methodological framework of this study.

The chapter commences with an examination of the methodological foundations of research design configurations, followed by detailing the rationale used in this research for the selection of an appropriate research design, method, and implementation strategy. Thereafter, the types of sampling techniques are explored, followed by a detailed examination of study populations, sample population composition and size in accord with the chosen mixed methods approach, and the sample requirements of the qualitative and quantitative approaches. Further sections expound the selection and development of the appropriate qualitative and quantitative study instruments for data collection, the ethical implications and requirements of the research process, pilot testing, and methods of assessing the validity and reliability of the instruments. The closing section details the researcher-participant interactive phase of the execution of the study, the data collection, and researcher’s data preparation for the purpose of analysis.

## 6.2 Practical methodological parameters

Selection of the most appropriate methodological model is essentially founded on the defined research problem and the desired outcome. In establishing the factors that will influence the implementation of ICD-10-AM in Saudi public hospitals, the study population constituted the healthcare employees of seven public hospitals, including physicians and medical specialists, nurses, health information managers, health informatics professionals, medical records staff, and healthcare administrators. As Saudi public hospitals have an exceptionally high level of expatriate staff members, particularly among physicians and nurses, there was a strong likelihood that some staff members would have had a level of exposure to ICD classification and an understanding of the functions of clinical coding. Similarly, it would be expected that degreed HIM and health informatics staff would at least have an academic background. Among the nursing and medical records staff, particularly those whose sole employer had been the Saudi MOH, it was inevitable that many would have had no previous exposure.

Thus, firstly, it was essential for the researcher to identify potential participants in the population with superior knowledge and experience to contribute more meaningfully, in terms of generating data for analysis. Such members of the population were most likely to be found in the professional areas of health information management and health informatics, although physicians with experience in a wide range of hospitals or in other countries might have an alternative perspective to offer. The reality that only one of the seven hospitals had reached a point of implementation where clinical coding had commenced added to the difficulty of identifying the most knowledgeable members of the population in the field of health information management and clinical coding. These constraints and the researcher's limitation of a one return journey from Australia to Saudi Arabia and a period of one-month in which to visit the study location, provided unalterable external factors that influenced the methodological design, choice of approach, and selection of the study instruments.

## 6.3 Research design

Variations to the generally accepted standard methodology and its sequence of executive may increase the quality of results, depending on the type of research and study topic. Good research design provides clear and accurate answers to research questions (Ghauri & Gronhaug, 2005).

Health research may be succinctly defined as the systematic steps to investigate solutions for any healthcare problem (Polgar & Thomas, 2008). The chairperson of the WHO Advisory Committee on Health Research described its purpose:

> The central role of health research in improving health and stimulating national economic growth is now well established. Health research supports health systems in the delivery of better, fairer, and more equitable health care to people. It does so by identifying challenges and providing best solutions, monitoring how health systems perform and producing new knowledge for better technologies and approaches to public health (Fathalla & Fathalla, 2004, p.8).

Saudi Arabia has provided a means to a solution; a costly one in the government's intention to obtain the best available coding system. But has it identified the challenges? The review of Saudi healthcare literature has identified many inadequacies in Saudi healthcare which have hampered the introductions of a series of healthcare innovations. These inadequacies persist. While clinical coding has been a standard hospital function in the developed and many developing nations for many decades, during which there have been a number of revised ICD versions released to which these nations have transitioned, the Saudi public hospitals are implementing ICD-10-AM completely from scratch. Clinical coding has not previously been included as a routine function of Saudi public hospitals. In examining the factors influencing the implementation of ICD-10-AM in Saudi MOH public hospitals, as a prerequisite to commencing clinical coding, which will be attempted from scratch against a background of unresolved persistent challenges, the parameters are extraordinary. As no other researchers have turned their attention to the unique circumstances, this study will provide a valuable addition to Saudi and international health information research, whether the implementation is successful or not.

Louise Barriball and While (1994), in discussing the development of research projects in general, stated that every research project proceeds through several stages, commencing with the selection of a working title and culminating in the dissemination of the study results. The steps or stages are described as systematic in that the process is logical and one step leads to the next. Polgar and Thomas (2008) outlined a general sequential research process from initial planning to dissemination of the findings: (1) planning, (2) hypotheses or aims, (3) research design, (4) data collection, (5) organisation and presentation of data, (6) data analysis, and (7) interpretation and conclusions.

Research methodology is divided into three types of approach; qualitative research, quantitative research, and a combination of these two approaches commonly referred to as mixed methods research (Johnson, Onwuegbuzie, & Turner, 2007). Historically, quantitative research preceded qualitative research, while the combined approach was first termed 'mixed methods research' in the early 1980s (Cameron, 2009; Creswell & Clark, 2007).

Mixed methods research generally employs a methodology that includes the collection, analysis, and integration of quantitative data, based on a survey or a pre-existing database, while the qualitative data is derived from interviews or focus group discussions (Bekhet

& Zauszniewski, 2012; Hennink, Hutter, & Bailey, 2010). The combination of a semi-structured interview and questionnaire has been widely used in mixed methods research (Harris & Brown, 2010). Tashakkori and Creswell (2007) defined mixed methods as the utilisation of both a qualitative and quantitative approach for gathering and analysing data, integrating the findings, and drawing inferences. Similarly, Johnson and Onwuegbuzie (2004) described mixed methods research as a combination of qualitative and quantitative methods, concepts, techniques, or approaches in the execution of a single study.

Execution of the mixed methods methodology may be concurrent or sequential, depending on the circumstances and purpose of the study and applies to both the quantitative and qualitative components (Collins, Onwuegbuzie, & Jiao, 2007). Creswell and Clark (2007) categorised sequential mixed methods design processes as either exploratory or explanatory. ‘Exploratory’ describes research in which the collection of qualitative data precedes the collection of quantitative data; ‘explanatory’ refers to the reverse in which the quantitative data collection precedes the qualitative. Babbie (2013a) and Creswell (2009) argued that if the results of either approach provide the basis for the planning of the other approach, as in sequential mixed methods research, both terms ‘exploratory’ and ‘explanatory’ are merited. A basic disadvantage of a sequential method is that the completion of both data collection processes generally extends the duration of the research in comparison with a concurrent method.

Concurrent mixed methods research design employs one of three data handling methods: concurrent triangulation, concurrent transformative, or concurrent nested. In both the transformative and nested designs, data is collected simultaneously but one is prioritised in reporting the outcomes. In concurrent triangulation design, the collection of data and reporting the outcomes of both sources are executed simultaneously, requiring no prioritisation. Thus, concurrent triangulation is often characterised by a balance between qualitative and quantitative processing, while in concurrent transformative and concurrent nested designs one of the processes takes precedence (Castro, Kellison, Boyd, & Kopak, 2010; Kroll & Neri, 2009). Similarly, Hanson, Creswell, Clark, Petska, and Creswell (2005, p. 229) noted:

> [In concurrent triangulation] priority is usually equal and given to both forms of data. Data analysis is usually separate, and integration usually occurs at the data interpretation stage. Interpretation typically involves discussing the extent to

> which the data triangulates or converges. These designs [concurrent designs] are useful for attempting to confirm, cross-validate, and corroborate study findings.

Olsen (2004) postulated that the term ‘methodological triangulation design’, which describes the process of using more than one investigative method in collecting study data from multiple sources, in order to enhance the credibility of the findings is valid for mixed methods research irrespective of whether the processing is concurrent or sequential. Creswell (2013) confirmed that concurrent triangulation reduces time expended on data collection in comparison with explanatory or exploratory sequential mixed methods design, because all data is collected in a single phase. A sequential approach strategy, entailing two visits to the study site to collect data was excluded on grounds of the extreme distance of Saudi Arabia from Australia. Hence, a concurrent or simultaneous design was selected for this study.

Several advantages of mixed methods research, as enumerated by Teddlie and Tashakkori (2009), apply to this study. Mixed methods research provides a basis for systematic management of a wide range of confirmatory and exploratory research questions, such as the nature of those comprising the questionnaire and semi-structured interview used in this study. The combination of quantitative and qualitative processes suits a combination of factual answers and considered opinions, strengthening the validity of the results. Liamputtong (2013) mentions that in certain cases, researchers may be forced to combine the qualitative and quantitative methods to provide the variety of data demanded by the research questions.

Describing the rationale for choosing a mixed methods approach, Liamputtong (2013, p. 326) postulated: ‘The simplest, and arguably most important, answer to this question is that the use of mixed methods affords researchers the means by which to tackle questions that would be difficult, or even impossible to tackle with a single-methods design.’ This statement provided a strong motivation for the choice of mixed methods in this study. Discussing the use of triangulation in a mixed methods research methodology, Olsen (2004) asserted that it may be considered an initial step towards the validation of the research findings.

Spratt, Walker, and Robinson (2004) argued that a mixed methods approach offers a more comprehensive image on which to produce more accurate answers to research questions, rather than using a quantitative or qualitative method alone. Similarly, using two data sources integrated within a single study increases the credibility of research findings

(Spratt et al., 2004). Regarding validity, Yeasmin and Rahman (2012, p. 156) discussing the use of triangulation methods stated: ‘Triangulation is a process of verification that increases validity by incorporating several viewpoints and methods.’ According to Sale, Lohfeld, and Brazil (2002), the interpretation of integrated quantitative and qualitative data provides a more comprehensive understanding of health issues than either approach could provide alone.

Although the quantitative analysis of the questionnaire responses was essentially a statistical comparison of the perceptions of mutually exclusive groups of participants, it did not explain the subtleties and nuances that differentiated individual perceptions. In contrast, the qualitative analysis of interview transcripts identified the many choices, attitudes, behaviours, and experiences of participants that could not have been forthcoming from a single questionnaire (Onwuegbuzie & Teddlie, 2003). Bowling (2014) noted that a quantitative method is an appropriate technique when the research questions can be completely answered by descriptive analysis. Risjord, Moloney, and Dunbar (2001) noted that a qualitative method is appropriate when a researcher investigates previously unexplored phenomena. The suitability of mixed methods research depends upon the complexity of the subject.

The studies that covered the Australian (Innes, 2000), Canadian (Moskal, 2004), and Singaporean (Dimitropolous, 2014) preparations for the transition to ICD-10 were unanimous that it was by no means a HIT/HIM concern. While the HIM/clinical coders were required to embark on a new level of knowledge of anatomy, pathology, and procedures as reflected in the expanded ICD-10 classification, the inputs to the patient file from the clinical documentation of the admitting physician, diagnostic tests, surgical and other procedures, and summaries from ward nurses would all require more specific documentation. Thus, it is universally accepted that awareness training across the board is essential, as well as specific training for particular functions.

A quantitative instrument was more suited to answer the research question from the broad organisational awareness level and a qualitative approach more appropriate to extract the perspectives from the experts associated with the HIM area. Hence, the diverse composition of medical professionals, health information professionals, and administrative workers forming the study population indicated the value of selecting a mixed methods approach. Bazeley (2002) observed that when research questions are complex, the answers have the potential for ambiguity reflecting the polarities of alternative points of view. For this reason, a concurrent triangulation design was selected as a means of analysing the rationale behind the variations in perceptions that characterised the responses to the questionnaire and semi-structured interview. It is a design suited to the integration of objective and subjective responses, in order to refine the range of findings on the central research question.

## 6.4 Research methods

The selected concurrent triangulation mixed methods design entails two parallel approaches. The data is collected simultaneously for the quantitative and qualitative instruments and then analysed and compared to determine the levels of convergence. In discussing the importance of convergence, Fielding (2012) noted that the final stages are integration and interpretation, whereby the researcher merges the datasets in order to: (a) ascertain the level of convergence (i.e., the extent to which the quantitative and qualitative data show agreement); (b) develop the analytical density or richness of the data by obtaining a wider and deeper picture based on different standpoints, and (c) draw evidence-based conclusions.

## 6.5 Sampling methods and sampling procedures

The selection of a study sample is a crucial stage in all research and aims to provide an accurate representation of the study population (Marshall, 1996). According to Kemper, Stringfield, and Teddlie (2003), the complexity of some research questions requires the inclusion of more than one sampling method in one study. Delice (2010) recommended that in order to choose an accurate sample representative of the study population, a researcher should follow the following steps: (1) Carefully define and describe the study population, (2) Determine the individuals or categories of the population, (3) Select the appropriate sampling technique, (4) Determine the appropriate sample size which represents the population and (5) Choose the sample.

The study population and its constituent healthcare and hospital staff categories have already been described. An overview of sampling techniques and the rationale for the choice of study sampling method follows. In social studies research, two common methods are used to determine the study sample; namely, probability and non-probability sampling (Abbas & Charles, 2003; Cavana, Delahaye, & Sekeran, 2001). Probability sampling techniques are widely used in quantitative research, while non-probability sampling techniques are more commonly associated with qualitative research (Teddlie & Yu, 2007). Burns and Grove (2010) asserted that both probability and non-probability techniques may be used to sample quantitative research. According to Minichiello (2004), a variety of techniques are used in health research for the purpose of drawing a random sample. They discussed four probability sampling techniques: simple random, systematic, stratified, and cluster sampling.

## 6.5.1 Probability sampling methods

### 6.5.1.1 Simple random sampling

The random sample method is used extensively to derive sample size in a quantitative approach and random sample number of tables can be found in most comprehensive introductory statistics texts. Simple random sampling is used in probability sampling, where each element in the population has an equal and independent opportunity to represent the population (Creswell, Plano Clark, Ivankova, Teddlie, & Tashakkori, 2016; Minichiello, 2004). The advantage in using random sampling is that all targeted participants have the same chance to represent the population and there is no bias towards a specific group. However, this kind of sampling needs a large sample to represent the population making the process of data collection more time-consuming. While the random sample is widely utilised in quantitative studies, it is not considered an appropriate technique for investigating new phenomena. Knowledge levels and opinion, based on previous HIM and coding exposure or even general interest, would certainly vary among any cross-section of staff in Saudi public hospitals, in terms of employee function, professional status, and even age. For example, a young HIM professional is far more likely to have had a greater exposure than an older doctor, as is a younger doctor though not to the same degree as an older HIM professional.

### 6.5.1.2 Systematic sampling

Systematic sampling is a practical method in which every $n^{th}$ subject in the target population is selected. It has the advantage of attaining a high degree of representation but is time-consuming and the researcher needs an understanding of the target population characteristics (Minichiello, 2004). Thus, it was dismissed due to the lack of knowledge of the characteristics of a target population to be drawn from seven separate hospitals.

#### 6.5.1.3 Stratified sampling

The stratified sampling method requires the researcher to divide the population into non-overlapping strata (e.g. specialists, doctors, nurses, administrators, etc) and choose a simple random sample from each stratum. Again, this technique of sampling requires considerable prior knowledge of the target population characteristics (Minichiello, 2004) and was therefore rejected.

#### 6.5.1.4 Cluster sampling

The use of cluster sampling, sometimes referred to as area sampling, is recommended when the target population is considerable, and the characteristics of this population are known or accessible. The researcher divides the population into clusters reflecting the composition of the population. In Saudi public hospitals, for example, clusters could be formed by directorate or by hospital size (large, medium, small), etc. The final sample would comprise samples from each cluster, reflecting the variation in professional status and function that characterises a hospital staff and administration. Cluster sampling is less expensive than random sampling but has a greater risk of errors, in comparison with simple or stratified random sampling when the sampling is large (Minichiello, 2004). Consequently, cluster sampling was also eliminated based on the need to analyse each of the seven hospital staffs separately, as well as the potential for inaccuracy.

### 6.5.2 Non-probability sampling methods

#### 6.5.2.1 Snowball sampling

Snowball sampling is useful where difficulties arise in determining the composition and characteristics of a study population. Data may be collected from one or more participants, who are then asked to nominate further participants (Babbie, 2013a). Snowball sampling is most suitable where the research method is dependent on the exploratory design (Baltar & Brunet, 2012) and was not an option for this research.

#### 6.5.2.2 Quota sampling

Quota sampling is comparable with the stratified sample technique of probability sampling, with the population divided into layers and presented as a matrix. Participants are selected according to characteristics that represent the matrix layer. This method demands a superior knowledge of the composition of the population (Minichiello, 2004), and again was not an option due to lack of knowledge.

#### 6.5.2.3 Convenience sampling

Convenience sampling may be used to select the most suitable participants from whom to obtain data, facilitating the researcher's complete data process and enhancing the generalisation of the study findings (Ferber, 1977; Tashakkori & Teddlie, 2003). The advantage in using convenience sampling is that it allows the researcher to recruit an acceptable sampling, with minimal time and costs expenditure (Ferber, 1977). The technique allows the researcher to recruit from participants who are accessible and available to participate, according to their knowledge (Hesse-Biber & Leavy, 2010). As the name of the technique implies, this approach to sampling provides relevant rich information easily, as opposed to obtaining a representative sample of a target population.

While convenience sampling has certain limitations, it is invaluable with a large population when randomisation is impossible to apply. In situations where the population is virtually infinite, convenience sampling is the only option available to recruit participants who are agreeable and available without undue effort (Etikan, Musa, & Alkassim, 2016). Abrams (2010, p. 542) noted: 'In studying hard-to-reach populations, a host of circumstances often force researchers to operate with samples of available subjects, resulting in strategies that may best be placed in the category of convenience sampling.' Given that levels of exposure to ICD classification, coding, and HIM, in general, would vary enormously among the various staff functions of Saudi public hospitals, the convenience sampling technique was selected as the most realistic method for collecting quantitative data from seven hospital locations, as planned in this study. These choices will be elaborated on later.

#### 6.5.2.4 Purposive sampling

Purposive or judgment sampling utilises the participants most capable of providing the necessary information (Cavana et al., 2001). Tongco (2007) noted that this is the most common method used to determine the sample when the researcher needs to find a specific answer to any research question, as it produces a sample that offers expert knowledge on the relevant issue. Cavana et al. (2001) noted that a purposive sample is limited to the individuals who can provide the information related to the topic of research, either due to the fact that they are the only ones who have that information or because they meet the researcher’s selection criteria. Minichiello (2004) stated that purposive sampling is suitable, as well as valuable, in situations where the investigator has enough population background knowledge and can handpick participants for the sample. Based on a similar rationale to the selection of the convenience technique for the collection of the quantitative data, the purposive sampling technique has been employed in this study to collect qualitative data from the targeted hospitals. These choices will be elaborated on later.

### 6.5.3 Sampling of hospitals

The study population comprised healthcare and administrative professionals representing six staff categories in each of seven public hospitals located in two large Saudi Arabian cities, Riyadh and Buraidah, in the major provinces of Riyadh and Qassim, respectively. The decision to use the Saudi category of MOH public hospital and the selection of the seven hospitals involved the following considerations:

a) Saudi public hospitals offer greater variation in physical size, staffing, range of employees, and levels of technology compared to the hospitals of the alternative healthcare sector service providers, such as the ‘other governmental’ and private sector hospitals, in terms of factors influencing the process of clinical coding implementation. Therefore, this study focuses on those hospitals affiliated to MOH.
b) The selection of the seven public hospitals hinged on the low rate of public hospital ICD-10-AM implementation reported by Alkraiji (2012), who indicated that at the date of finalisation of his thesis only one MOH public hospital, KFMC in Riyadh, had commenced clinical coding and only for inpatient coding. Hence, KFMC was purposively selected. The selection of the other six was based on their proximity to KFMC and their readiness or nearness to begin the clinical coding implementation process.

KFMC is one of the largest health institutions in the Middle East with a capacity of 1200 beds and is classified as a tertiary care provider (Altallal, 2013; Fagbo et al., 2016). The other six public hospitals, four in Riyadh and two in Buraidah, had recently taken an initial step towards implementation by introducing the clinical coding to their healthcare professionals. Of the seven hospitals, three are classified as tertiary healthcare providers and the remainder as secondary. Thus, the hospitals comprising the study population were selected on the criterion of level of implementation of ICD-10-AM and clinical coding. Table 6-1 below lists the study hospitals.

**Table 6-1 Study hospital locality and classification**

| Hospital Name | Location | Level | Beds |
|---|---|---|---|
| King Fahad Medical City (KFMC) | Riyadh | Tertiary | 1218 |
| King Salman Hospital (KSH) | Riyadh | Secondary | 244 |
| Imam Abdulrahman Al-Faisal Hospital (IAAH) | Riyadh | Secondary | 200 |
| Al-Iman Hospital (AIH) | Riyadh | Secondary | 207 |
| Al-Yamamah Hospital (AYH) | Riyadh | Tertiary | 300 |
| Buraidah Central Hospital (BCH) | Buraidah | Secondary | 300 |
| Maternity and Children Hospital in Buraidah (MCH) | Buraidah | Tertiary | 500 |

Source in accordance with the Ministry of Health (2017)

### 6.5.4 Sampling of quantitative participants

Most healthcare professionals in Saudi public hospitals have limited knowledge or experience of clinical coding. Hence, the sampling process included the identification of healthcare professionals with prior knowledge or experience of clinical coding, to represent the population of the study hospitals. Polit and Beck (2010, p. 75) noted: 'In a quantitative study, a sample's adequacy is assessed by the criterion of representativeness.' From this perspective, randomisation in sampling makes it unlikely to achieve a good representation in a quantitative approach, based on the lack of the elements that give an accurate representation of the study population. Burns and Grove (2010) noted that in descriptive research non-probability sampling may be used if selection is based on convenience.

Consequently, non-probability sampling which is often utilised to sample the quantitative data in nursing research, because it is very difficult to use a probability technique, was the appropriate category for the sampling technique of the quantitative group. A review of Saudi healthcare literature showed that convenience sampling has previously been employed to recruit participants for the quantitative approach in mixed methods studies in public hospitals, examples being as Altalhi (2017) and Altallal (2013). In the US, Sand and Elison-Bowers (2013) also used a convenience technique to determine the sample for a study which used a questionnaire to establish the relationship between a participant's ICD-10 knowledge and level of educational background and experience in ICD-9.

In the current study, a convenience sampling technique was used to recruit the quantitative sample of 483 participants representing physicians, nurses, HI, HIM and clinical coding staff, medical records staff, other health professionals, such as pharmacists and technicians. In addition, the questionnaire targeted non-health professionals who had enough exposure to or knowledge of clinical coding, such as administrators. A total of 327 questionnaires were returned from the seven study hospitals, giving a response rate of 68%. Forty-four surveys were disqualified for various reasons, leaving 283 eligible according to the survey criteria, reducing the response rate to 59%. The open-ended response rate was 20% (101 answers).

### 6.5.5 Sampling of qualitative participants

Typically, the sample size in qualitative studies is much smaller than in quantitative studies (Mason, 2010). Baker, Edwards, and Doidge (2012) noted that there is no formula for the sample size in qualitative studies and some studies have been based on only one participant. Padgett (2008) and Liamputtong (2013) asserted that the sample size in qualitative research is an essential step, dependent on sampling quality rather than quantity. Based on this viewpoint, the researcher used a purposive technique to increase the sampling quality by choosing employees with a superior grasp of clinical coding. HIM staff proved to be the best-qualified healthcare professional category from which to obtain more valid, first-hand information regarding the implementation of clinical coding in the targeted hospitals. This approach produced at least one participant from each hospital. Discussing the study instruments best suited to qualitative research, Drever (1995) noted that the semi-structured interview is considered a flexible method for small-scale research and can be used with very few participants.

In the comparative coverage of sampling methods, it was noted that some degree of bias exists in purposive sampling. To reduce this potential for bias in the qualitative data, the researcher gave all quantitative participants an opportunity to participate in the qualitative study by adding a ‘Yes/No’ option at the end of the survey, asking participants whether they would like to be interviewed. Participants who responded ‘Yes’ were asked to add an email address enabling the researcher to follow up and arrange an appointment. Eight participants engaged in the semi-structured interview. Seven were selected purposively from the group of HIM specialists while only one physician indicated a desire to be interviewed. The sample size, sampling methods, and number of hospitals and participants, in both the quantitative and qualitative approaches in this study, corresponded favourably with the equivalent parameters of a healthcare mixed methods study conducted by Altallal (2013).

## 6.6 Study instruments

Selecting the appropriate instruments for data collection is a crucial stage in the research design (Bastos, Duquia, González-Chica, Mesa, & Bonamigo, 2014). The choice of a survey questionnaire and semi-structured interview will be discussed later. The questionnaire and interview questions were developed by the researcher based on the literature review.

### 6.6.1 Quantitative instrument

The quantitative data was generated by a questionnaire survey administered to a convenience sample representing six staff categories of healthcare and administrative professionals from each of the seven study hospitals. According to Babbie (2013b), the survey is the most suitable and effective method available to a researcher gathering original data from a large population. Zikmund, Babin, Carr, and Griffin (2013) described the questionnaire as a study tool with which a researcher may collect data from a sample of participants in a short time at minimal cost, to obtain accurate information about the study population.

Several studies assessing the factors associated with ICD-10 implementation in developed countries also used the questionnaire survey. A survey conducted in Alabama, USA, used a questionnaire distributed to HIM directors of 116 hospitals (Houser et al., 2013). Sand and Elison-Bowers (2013) explored the relationship between participant ICD-10 knowledge and an educational background in ICD-9 using a convenience sample.

Two broad categories of questions, namely, closed-ended and open-ended are used in questionnaires. Closed-ended questions require participants to choose one of several options provided as answers to the questions, conventionally indicating the choice of answer with a tick. Open-ended questions require that participants compose their own response in a space provided for this purpose (Babbie, 1990; Geer, 1988). Although the open-ended question offers many advantages in broadening the perspective, a major practical drawback is the amount of time needed to convert each response into a suitable form for analysis (Bornman, 2009). This study questionnaire included only one open-ended question requesting participants to describe factors that would facilitate the implementation process. The questionnaire was arranged in three separate sections:

1) Individual participant demographic details, preceded by a covering letter of the study with an explanatory introduction and an ethical statement
2) Factors influencing the implementation of ICD-10-AM and clinical coding
3) Open-ended question

The demographics section gathered individual participant information essential for the analysis. It also included a guarantee of respect for privacy and a statement that all information would remain anonymous, in accordance with accepted ethical principles covering personal information offered for research purposes that will be discussed in greater detail later. The second section focused on the factors impacting on the implementation process in the study hospitals. This section was structured according to the three hierarchical factor categories established in the literature review to address the research question. The third section of the questionnaire was the single open-ended question, in which participants were requested to reveal the factors they envisaged as influential.

### 6.6.2 Qualitative instrument

Although the questionnaire responses from professionals in the six staff categories, who displayed great diversity in other demographic factors, produced significant information addressing the research question, it was essential to hear and record directly, the insights expert knowledge and greater exposure in the HIM field. The open-ended question did provide some opportunity for individual insights that may not have been covered in the questionnaire. However, the instrument does not allow the researcher to follow up important statements and guide the participant to qualify what has been expressed in greater detail. The researcher foresaw the need for a qualitative phase and conducted semi-structured interviews with participants selected purposively to hear the perspectives of professionals with a superior understanding of clinical coding. An interview has been defined by Kvale (1996) as an exchange of views or opinions between two individuals having a conversation about a subject of mutual interest. Green and Thorogood (2004) described the research interview process as a communication that is aimed directly or indirectly at the investigator’s need for research data.

King, Horrocks, and Joanna (2019) and Brinkmann (2014) noted that the interview is widely used as an instrument to collect data in qualitative research in the social sciences. King et al. (2019) defined the interview as an interaction in which the investigator (interviewer) and the sample unit (interviewee) produce research-related data. Face-to-face interviews fall into three categories: structured, semi-structured, and unstructured (Easterby-Smith, Thorpe, & Jackson, 2012). Harrell and Bradley (2009) and Longhurst (2003) noted that semi-structured interviews are most widely applied when there is a need to delve deeper and obtain richer information covering the diverse ranges of a study topic.

A semi-structured interview aims to provide qualitative, potentially richer data to complement the quantitative data derived from the questionnaire. The instrument adds research value in terms of the following attributes: (a) the response rate in semi-structured interviews is very high; (b) participants are not influenced by other parties, and (c) the researcher can clarify questions and stimulate responses where necessary (Bailey, 1987). According to the Cassell and Symon (2004), qualitative interview preparation involves the following sequential steps (a) determining the research questions; (b) generating the interview guide; (c) finding participants and; (d) conducting the interviews.

Specific questions were designed to add dimension to the information provided by the quantitative questionnaire, revealing aspects of the implementation process that could extend the findings of the research question. The following questions were used in the semi-structured interview sessions:

1) Why did your hospital implement clinical coding?
2) What is the current status of clinical coding in your hospital?
3) What were/are the factors influencing the commencement of the implementation of clinical coding in Saudi public hospitals?
4) What have been/will be the most positive aspects of implementing clinical coding in Saudi public hospitals?
5) Which healthcare professional categories require specific training to enable Saudi public hospitals to implement clinical coding more efficiently?
6) What can healthcare decision-makers in the Saudi MOH do to facilitate the implementation of clinical coding in Saudi public hospitals?

## 6.7 Ethical issues

Babbie (2013b) urged researchers to be attentive to ethical standards and conventions. A knowledge of the principles on practices that are permissible and prohibited is a prerequisite in the conduct of social science research. Hall and Sestak (2013) stressed that ethical approval is a prerequisite for the acceptance of research papers by all scientific journals and educational institutions. Additionally, researchers need to reveal any problems encountered while obtaining informed consent. Thomas and Ung (2000) noted that it is fundamental to obtain signed informed consent from every participant recruited into a research study. The researcher must disclose the complete information relating to the purpose of the study and any form of negative impact that he/she might potentially incur due to his/her involvement in the research process to every participant.

Thomas and Ung (2000) listed the criteria for evaluating applications for ethical approval to conduct research, which may vary according to country and institution. He noted the importance of a researcher reflecting on the ethical implications of answers given by respondents in interviews or surveys, before incorporating the data into a research study (Thomas & Ung, 2000).

The guidelines of the New England University Human Research Ethics Committee were strictly observed at every stage of this study and approval was granted by the Committee and the Saudi Arabian Ministry of Health, see Appendix 9 and 10. To obtain MOH approval, the researcher was required to undergo training and obtain a certificate of completion for the course ‘Protecting Human Research Participants’, which was successfully completed by online examination on 27 July 2015 (see Appendix 11).

Behi and Nolan (1995) asserted that the signing of a consent form by participants in social research is an essential step to maintaining privacy and making the data sources anonymous. The principle that personal information remains anonymous and private has been respected in this study. Thus, interview participants were required to sign a consent form (see Appendix 12 and 13) before interviews were conducted. The researcher had already explained to all participants that personal information offered in both approaches would remain confidential and that the interview was optional (see Appendix 14 and 15). DiCicco-Bloom and Crabtree (2006) noted that tape-recording of interviews is commonly used in social science research and participants must be informed if this will be the case.

Participants were informed by the researcher that audio recordings of the interviews would be made. Thomas and Ung (2000, p. 70) recommended that for low-risk research studies, such as the completion of a survey questionnaire, the issue of consent may be dealt with by the inclusion of a proviso to the effect: ‘By returning this survey questionnaire, I understand that I have given my informed agreement and acceptance to take part in this research study.’ In the covering letter of the quantitative questionnaire, participants were informed that returning the questionnaire indicated consent to participation, dispensing with the need to sign a separate consent form. As required, the researcher refrained from both testing and final data collection until the approvals had been confirmed.

## 6.8 Validity and reliability of study instruments

This section introduces the importance of testing the validity and reliability of data collection tools, which will be discussed in more detail in the following chapter. Meadows (2003) emphasised that the practical value of a questionnaire lies in the reliability and validity of data collected. Polit, Beck, and Hungler (2001) stressed that the validity and reliability of the study instruments must be tested, before collecting the data for the main study. What is clear is that the design and method are fundamental to the accuracy and validity of the findings, in terms of the study objectives. Chapter 7 presents this important process of developing and piloting study instruments in greater detail.

## 6.9 Data collection

After evaluating the testing of the internal consistency, reliability, and validity of the study instruments, the data was collected between 4 and 18 January 2016. The following section describes the data collection processes for both approaches.

### 6.9.1 Quantitative data collection

Bernard (2000) noted that a single researcher can recruit a large representative sample of a large population quickly and with less financial expenditure, using self-administered questionnaires. The researcher personally delivered printed copies of quantitative survey questionnaire by hand to participants at the study hospitals at the start of the morning shift, as prearranged with the management of each hospital potential participants and based on the ratio of employee distribution across the six structured employee groups of MOH hospitals.

The researcher arranged a meeting with the manager of each targeted department in each of the seven hospitals to explain the aims of the study. Williams (2003) suggested that to increase the response rate attractive coloured paper should be used for the covering letter of the questionnaire. Thus, the researcher provided clear instructions explaining the purpose and aims of the study in the cover letter, which was designed to encourage participation and included the researcher's contact details. Participants were requested to complete the surveys anonymously at a convenient place in their own time and to return them to a specified locked box, made available at each hospital for a period of two weeks. Thereafter, the researcher collected the surveys from each hospital and placed them in envelopes labelled with the name of the hospital, the number of participants, and the response rate.

### 6.9.2 Qualitative data collection

The researcher arranged personal appointments with the interview participants who were provided with an outline of the questions and a signed consent form beforehand. All participants indicated felt most comfortable using Arabic. The researcher commenced each interview by introducing himself and thanking the participant and then explained the purpose of the study. The whole interview was recorded using an audio recorder and proceeded according to the funnel technique with the researcher opening with a central question and then narrowing the objective to facilitate more in-depth information (Zikmund et al., 2013). On completion, the researcher again thanked participants for their involvement, as recommended by Harrell and Bradley (2009).

## 6.10 Data analysis

The Statistical Package for Social Scientists (SPSS) vs. 22 software was used to analyse the results of the quantitative survey questionnaire. An inductive method was used to analyse the content of the opened-ended question and the semi-structured interviews of the qualitative study. The questionnaire variables were coded, and the interview recordings transcribed into text before the analyses. The researcher applied the following coding to the questionnaire variables:

I. Part One (Demographics):

1) Name of hospital: (1) King Fahad Medical City, Riyadh, (2) Imam Alfaisal Hospital, Riyadh, (3) Al-Iman Hospital, Riyadh, (4) Al-Yamamah Hospital, Riyadh, (5) King Salman Hospital, Riyadh, (6) Buraidah Central Hospital, Buraidah, (7) Maternal and Children Hospital, Buraidah.
2) Gender: (1) Male, (2) Female.
3) Age: (1) Below 30, (2) 30 - 40, (3) 41 - 50, (4) 51 - 60, (5) Over 60.
4) Nationality: (1) Saudi, (2) Not Saudi.
5) Occupational category: (1) Health informatics professional, (2) Medical records professional, (3) Physician, (4) Nurse, (5) Other health professional (pharmacist, health technician), (6) Non-health professional (administrator).
6) Experience in the health sector: (1) Below 5 years, (2) 6 – 10 years, (3) 11 – 15 years, (4) Over 15 years.
7) Registered certificate in Clinical Coding: (1) Yes, (2) No.
8) Introductory training in ICD-10: (1) Yes, (2) No.
9) Highest level of education: (1) Doctoral degree, (2) Master’s degree, (3) Bachelor’s degree, (4) Diploma.
10) Percentage completion of ICD-10 implementation: (1) Partially implemented, (2) Fully implemented, (3) I don’t know.

II. Part Two: Factors impacting on the implementation of ICD-10: The researcher assigned five variables as follows: (1) Strongly agree, (2) Agree, (3) Neutral, (4) Disagree, (5) Strongly disagree.

As the interviews were conducted in Arabic, verbatim transcriptions were made in Arabic. The researcher contracted the same professional translation firm used in developing and piloting the qualitative instrument (see Chapter 7), to translate the transcripts from Arabic into English. The analysis followed.

### 6.10.1 Quantitative data analysis

Before conducting the analysis of the collected study data, it was checked for errors and missing values and incomplete questionnaires were discarded. The quantitative data was analysed using IBM SPSS, which is widely used to analyse survey data (Babbie, 2013b). The measurement levels of the responses were classified according to the SPSS data editor requirements. All responses were categorical and measured at the nominal level (qualitative categories) or at the ordinal level (ranked categories). The responses to each question were tabulated as frequency distributions reflecting the counts and percentages of participant responses to each category. The only methods of inferential statistical analysis that could be justified for this study are the non-parametric tests, appropriate for categorical variables (Agresti, 2007).

The SPSS vs. 22 software was used for the questionnaire data analysis. Scaled responses to questions on the survey instrument were analysed quantitatively and the results were presented by a combination of descriptive statistics, comprising frequency, percentage, mean, and standard deviation. Questionnaire items comprising the factor categories were quantified using data based on the number of participants (N), mean (M), and standard deviation (SD). The reliability of the survey data was calculated using Cronbach's alpha for the related items.

### 6.10.2 Qualitative data analysis

Most researchers use verbatim transcriptions of audio tapes to codify interviewee responses (Pope & Mays, 2006; Silverman, 2006). After the verbatim transcriptions were completed, the researcher used the information as raw data (Henn, Weinstein, & Foard, 2005).

#### 6.10.2.1 Open-ended question data analysis

Hsieh and Shannon (2005) noted that the content analysis method of interpreting is widely used for interpreting qualitative raw data, and this method was used to identify the common responses in the textual data derived from the interview transcriptions and open-ended survey question written responses (Leech & Onwuegbuzie, 2011). Textual data gathered were analysed with content analysis supported by NVivo 11.0 (Leech & Onwuegbuzie, 2011).

Thus, qualitative content analysis was used to identify themes revealed through responses and statements made by participants in the open-ended survey question. Common responses were used to generate the themes that represent the perceptions of the whole population. In addition to the frequency of occurrence of common responses, verbatim text examples from the interviews and open-ended survey responses were used to highlight the key concepts and themes revealed, as well as to support the clarity of these concepts. The researcher utilised NVivo 11® qualitative analysis software to the coding and the development of themes from the data, as well as the classification, sorting and arranging of information, and tracking frequency of occurrences.

#### 6.10.2.2 Semi-structured interview data analysis

The researcher initially used content analysis to evaluate the transcripts and gain a deeper understanding of original points arising, before categorizing these. Cavanagh (1997, p.5) noted: ‘Content analysis is much more than a naive technique that results in a simplistic description of data. It allows the researcher to test theoretical issues to enhance the understanding of the data.’ The content analysis was followed by a thematic analysis to identify the common responses. Braun and Clarke (2006, p. 78) asserted: ‘Thematic analysis should be seen as a foundational method for qualitative analysis.’ The thematic analysis involved several steps, commencing with a thorough reading of the transcripts, establishing the research codes and themes, and producing the report on the findings. The researcher used the thematic analysis steps suggested by Braun and Clarke (2006):

1) Reading and understanding the text
2) Assigning representative codes
3) Gathering the codes to identify themes
4) Naming and describing the themes and thematic content
5) Producing a report on the thematic analysis

## 6.11 Conclusion

This chapter covered the incorporation of the quantitative and qualitative instruments into a mixed methods methodology. In practice, the two approaches were executed simultaneously, and the data collected and analysed concurrently. This was followed by coverage on sampling and sampling techniques, and the relationships of sample and population sizes in quantitative and qualitative approaches. Thereafter, the question of appropriate study instruments was discussed and the rationale behind the choice of a survey questionnaire and semi-structured interview were explained. The final sections on the collection of data, methods of data analysis, and testing of the validity and reliability of the study instruments were preceded by a description of the importance of observing the ethical aspects of research; respect for privacy and the concept of informed consent.

# 7 Chapter Seven: Development and Validation of Research Instruments

## 7.1 Introduction

Chapter 7 describes the development of the research instruments administered to gather the study empirical data, commencing with an examination of the methods used to design and develop the questionnaire, followed by a section discussing the techniques used to evaluate the validity and reliability of the questionnaire. The subsequent section presents the results of a pilot study based on potential factors influencing the implementation and the analysis of the validity and internal consistency reliability. The last section discusses the evaluation of qualitative instrument performance to detect inherent weaknesses that could be corrected before the final data collection.

## 7.2 Designing and testing the questionnaire

A questionnaire is an instrument consisting of items that are designed to collect data from the study sample in order to address the stated research questions (Malhotra, 2006; Rattray & Jones, 2007). Thus, the questionnaire design must provide the means to produce information that will lead to interpretable findings. Jenn (2006, p. 32) warned: ‘A bad questionnaire renders the results uninterpretable, or worse, may lead to erroneous conclusions.’ Rattray and Jones (2007) outlined a sequential process to design and develop a questionnaire from the initial generation of items to the adoption of the final draft, covering the following stages:

1) Reviewing related literature
2) Ensuring the language quality
3) Consulting with experts on testing the content validity
4) Analysing the factorial validity and internal consistency reliability

### 7.2.1 Methods used to design and develop the questionnaire

The design and development of the questionnaire used in this study followed the steps outlined in Figure 7-1. The subsequent sections provide a detailed description of Steps 1 to 4 including a justification for the chosen methods, based on the literature.

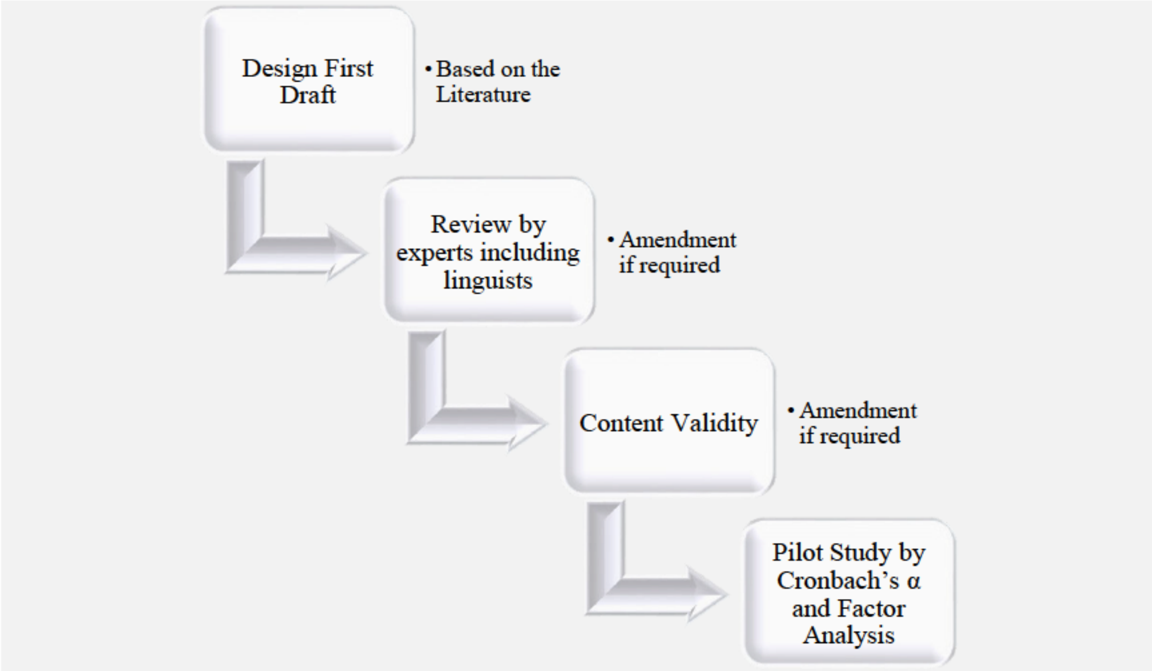



**Figure 7-1 Flowchart of questionnaire design and development**

### 7.2.2 Design of the first draft

The designing of the questionnaire followed the review of the healthcare literature covering ICD-10 implementation in several different countries. The review evaluated peer-reviewed articles, reports, and databases and was broadened by a citation search of certain articles to probe the topic more comprehensively. The first draft of the questionnaire was then drawn up with the content based on factors that might potentially influence the implementation of ICD-10-AM and clinical coding in Saudi public hospitals that emerged from the literature reviewed. The questionnaire was structured in three parts:

1) Respondent demographics (10 items);
2) Potential factors in terms of the research question, comprising 25 items categorized as health information, organisational, or national, and presented in the form of a five-point Likert scale (values: 1 = Strongly Agree, 2 = Agree, 3 = Neutral, 4 = Disagree, and 5 = Strongly Disagree);
3) Open-Ended Question (1 item).

### 7.2.3 Review by health information experts and linguists

Liamputtong (2013) proposed that after thorough revision, the first draft of a questionnaire should be reviewed and evaluated by experts in the specific research topic or in survey development. The researcher may then modify and/or reorder the questions according to the critical feedback provided by acknowledged experts. The researcher was fortunate to engage three health information experts to review the first draft of the English version of the questionnaire. The most significant comment voiced by two of the evaluators suggested removing all questions referring to the AR-DRG system, based on the rationale that the system had not yet been introduced in Saudi public hospitals and might be misunderstood by many respondents. After receiving the feedback from the health information experts, the researcher adhered to the following process recommended in Del Greco, Walop, and Eastridge (1987) for translating a questionnaire from the original language of the draft into an alternative language of presentation to suit the requirements of the study respondents.

1) The English (original) draft was reviewed by language experts in Saudi Arabia;
2) The questionnaire was translated into Arabic by sending it to a certified translation office in Saudi Arabia;
3) The Arabic version was translated back into English by sending it to a certified translation office in Australia;
4) The original English version and English version translated back from Arabic were compared.

#### 7.2.3.1 Amending the questionnaire

The researcher amended the questionnaire as suggested in the feedback obtained from the expert assessment and removed the item which referred to the AR-DRG system. The initial draft contained 26 statements in the second section, reduced to 25 by amendment.

#### 7.2.3.2 Analysis of content validity

Discussing content validity, Rubio, Berg-Weger, Tebb, Lee, and Rauch (2003, p. 94) drew a distinction between face validity and logical validity: ‘Face validity indicates that a measure appears to be valid based on a subjective evaluation. Logical validity indicates a more rigorous process, such as using a panel of experts to evaluate the content validity of a measure.’ Content validity is evaluated to ensure that all items in the questionnaire contribute to the purpose of the study. Content validity is established when all items in the study instrument measure the constructs they have been designed to measure (Babbie, 2013b). Haynes, Richard, and Kubany (1995) asserted that an essential step in the study instrument validation process is the estimation of a scale of content validity.

The content validity was initiated by sending the draft questionnaire to a panel of experts to indicate values for each item based on a scale of content validity created by the researcher (Polit & Beck, 2006). Scholars differ regarding the ideal number of experts for testing content validity. Yaghmaei (2003) recommended a minimum of five experts and maximum of ten as being acceptable, while Lynn (1986) suggested a minimum of three and a maximum of ten.

An additional three health information experts reviewed all items of the revised questionnaire and pronounced the content validity to be consistent with the objective of the study. For this assessment step, the Content Validity Index (CVI) created by the researcher was based on the following three-point scale: (1= Amendment, 2=Agree, 3=Not agree). Where 1 or 3 was chosen, the experts supplied explanatory comments or suggestions.

One item in the first draft of the questionnaire was found to be invalid in the CVI analysis, as it received a number 1 in CVI from two experts. The item had been worded: ‘MOH hospitals have sufficient health informatics and health information management specialists to implement ICD-10.’ This item was redrafted to make a distinction between the two groups of healthcare professionals:

- MOH hospitals have sufficient health information management specialists.
- MOH hospitals have sufficient health informatics specialists.

One expert with a superior understanding of the difficulties facing the healthcare profession in Saudi Arabia, particularly in HIM, suggested adding a question focusing on the absence of a HIM supervisory organisation. He pointed to the existence of a conflict of interests between the CCHI, which is responsible for monitoring the implementation of ICD-10 in the private sector, and the Saudi Health Council (SHC), which is responsible for monitoring the implementation across all Saudi Arabia’s health sectors. Another item received a CVI 3 from two experts and was, thus, rendered invalid. The item was worded: ‘Which of the following factors have caused a delay and/or lack of progress in ICD-10-AM planning and implementation in your hospital? Check all that apply.’ One of the experts explained that suggesting a delay or lack of progress was an assumption and therefore the item was deleted. Three further items from the first draft questionnaire were also deleted as they did not fall within the parameters of the purpose of the research and were given a CVI 3 by two experts. These items were: ‘There is resistance to implementing ICD-10 among some decision-makers in Saudi hospitals.', 'The Saudi Health Council offers clinical coding implementation support to all Saudi health sectors', and 'My hospital does not use the latest technologies in health information management.'

### 7.2.4 Internal consistency reliability and factorial validity

Internal consistency reliability refers to the degree of consistency of the measurement of concepts or factors extracted from clusters of items in a questionnaire or test instrument. It may be defined as 'How well the items measuring a concept hang together as a set' (Cavana et al., 2001, p. 320). Cronbach's α was applied to estimate the internal reliability of clusters of items that were assumed to measure the same factor. The unstandardised values of Cronbach's α were estimated for the reliability analysis because the numerical item scales (ranging from 1 to 5) were the same for each item. Cronbach's α was used because it is considered the best technique to test the internal consistency reliability of variables in the evaluation of questionnaires (Cronbach & Shavelson, 2004; Hogan, Benjamin, & Brezinski, 2000).

Cronbach's α values increase in relation to the number of correlations among a cluster of items, such that a high rate of alpha is created by a homogeneous cluster of items that have a similar magnitude of correlations. If the item responses consist only of random errors, and the correlations are missing between the items, then the variance is the same between the item scales and the individual items, such that alpha equals zero. In such a case, the responses are considered unreliable and an inconsistent measure of the construct. Values of Cronbach's α increase when the correlations between the item scores increase, such that when alpha = 1 a group of items is a perfectly reliable and consistent measure of a construct. However, alpha = 1 is rarely, if ever, encountered in reliability analysis, due to the influence of random error. Statisticians generally recommend that the threshold or cut-off value of Cronbach's alpha should be at least .6 before reliability can be considered as 'adequate' and at least .8 before reliability can be considered as 'good' (Allen & Yen, 2001). Fan and Lê (2011, p. 368) confirmed this issue by stating: 'All Cronbach's α coefficient values above 0.6 are considered acceptable.' The practical applications of Cronbach's α are limited and the use of this statistic is subject to the following assumptions:

1) The calculation of alpha assumes parallelity, which implies that the factor loadings for each item in a scale are constrained to be equal, all the error variances are constrained

to be equal, and the error variances are assumed to be uncorrelated. Failure to meet any of these assumptions frequently results in coefficient alpha underestimating the reliability of a scale (Peterson & Kim, 2013; Raykov, 2001).

2) The value of Cronbach's α is valid only when the item scales measuring several aspects of a single construct move in the same logical direction. The direction of the scales is a critical issue since Cronbach's α, unlike factor analysis, cannot be used to assess the reliability of clusters of items based on scales that move in both opposite directions. Negative values of alpha, which are invalid and cannot be easily interpreted, are extracted from such opposing scales (Field, 2009). For this reason, factor analysis is more useful to provide evidence of the internal consistency reliability of heterogeneous item scores than Cronbach's α.
3) The values of alpha are generally found to increase in direct proportion to the total number of items in the factor (Bonett, 2002). According to the relative values of alpha, a factor containing many variables will automatically be more reliably measured than one containing only a few items. The strong influence of sample size implies that the numerical comparison of individual levels of alpha between factors comprising different numbers of items is not appropriate.
4) If a factor is reported to be reliably measured using Cronbach's α in one study, this does not imply that the same factor will be reliably measured in another study using the same questionnaire. Estimates of reliability (and, by extension, validity) are study specific. If the study population (as well as the sample size, sample characteristics, context, and administration of the instrument) differs, then the estimates of scale reliability will axiomatically also be different (B. Thompson, 2003). For the above reasons, it is not surprising that in a review of reliability issues in psychological measurement, Sijtsma and Emons (2011, p. 565) concluded that 'as a reliability estimator, alpha should be replaced by better and readily available methods.'

In view of the limitations of Cronbach's α, a factor analysis was also performed to evaluate the validity and internal consistency reliability in terms of the structure, pattern, and consistency of the items that constituted each factor. Factor analysis condenses the matrix of classified item scores into 50 cases (in the rows) and 20 questionnaire item scores (in the columns) into a smaller number of hypothetical dimensions or constructs, conventionally called factors (Gorsuch, 1983). The factors are subsets of inter-correlated item scores that explain specified proportions of the variance in the correlation matrix.

There are two types of factor analysis commonly used by social scientists (Gorsuch, 1983). The first, Exploratory Factor Analysis, assumes no preconceptions of what the factors might be. The second, Confirmatory Factor Analysis (CFA), confirms the existence of preconceived factors. This study used CFA because the questionnaire contained three predetermined factors, each with a specified number of items, as manifested in the questionnaire.

Several statistical methods, examples being principal components and maximum likelihood, may be used to conduct CFA. After the initial extraction of factors, there are many types of rotations that can be done. Rotation is required because the unrotated solution is often indefinite and difficult to interpret (Gorsuch, 1983). In this study, the factors were extracted using principal components and Varimax rotation. Varimax is the most common rotation tool used to increase and decrease the loading on each variable (Gorsuch, 1983). The results of CFA are sensitive to the sample size. According to Hair, Anderson, Babin, Tatman, and Black (2010, p. 102): ‘A researcher would generally not factor analyse a sample with fewer than 50 observations.’ It had been the researcher’s intention to distribute the questionnaire to 500 participants. Following the recommendation that the sample size of a pilot study should be approximately 10% of the main study (Hertzog, 2008; Johanson & Brooks, 2010; Lackey & Wingate, 1998), the researcher planned a pilot study with 50 respondents, the recommended minimum for factor analysis.

The outputs of CFA are eigenvalues, communalities, and factor matrices which report the loadings of sequentially numbered factors onto specified clusters of variables. The interpretation of these statistics requires subjective judgments and, therefore, the conclusions of factor analysis are more tentative than when using other types of statistical tests (Gorsuch, 1983). The convention adopted in this study was that of extracted factors with eigenvalues greater than 1 and that the cumulative variance explained by the factors should be greater than 50% (Hair et al., 2010; Murtagh & Heck, 2012).

Communalities are the proportions of variance of each variable that explain the extracted factors. High communalities (between .5 and 1) indicate closely related variables, while communalities of less than .25 have little in common with one another (Hair et al., 2010). The convention used in this study was that factor loadings should be high ($\geq .5$) to contribute significantly to the reliability and validity of a factor, whilst variables with low loadings (< approx. .25) were considered to contribute little or nothing to a factor and could potentially be eliminated (Hair et al., 2010).

## 7.2.5 Pilot study

The pilot study was conducted after the content validity process using the Internal Consistency Reliability and Factorial Validity for the proposed factors, which is a methodological approach to evaluate the validity and reliability of a questionnaire before the questionnaire is administered in a further major study (De Vaus, 2013). Riazi (1999, p. 198) defined a pilot study as ‘a small-scale replica and a rehearsal of the main study.’ D. Polit et al. (2001) referred to the process of testing the validity and reliability of an instrument before collecting the data for the main study. Baker and Risley (1994) advised that social science studies should always include pre-testing of the research instruments and Christensen, Johnson, and Turner (2011) noted that a pilot study affords the researcher an opportunity to validate the research tools and test the feasibility of the study design. De Vaus (2013, p. 54) warned: ‘Do not take the risk. Pilot test first.’ Based on this unerring advice, the researcher conducted a pilot study to ensure that the questionnaire was valid and reliable for the data collection of the main study.

In establishing the pilot study sample size, the researcher took into account that CFA is not usually be applied to less than 50 observations (Hair et al., 2010) and the recommendation that a pilot study sample should approximate 10% of the main study sample (Hertzog, 2008). As the researcher aimed for 500 participants in the final study, a random sample of 50 healthcare professionals representing all six professional groups and seven study hospitals was recruited for the pilot study. The recruits answered all items in all three factor groups.

### 7.2.5.1 Findings related to organisational factors

The analysis of the eight items designed to measure the organisational factors could potentially influence the implementation indicated that one factor accounted for 38.64% of the variance. High communalities (.634 to .845) indicated that the items were related. The eight items had moderate loadings (.381 to .748) and, therefore, all contributed significantly to the reliability and validity of the questionnaire. Cronbach’s alpha (.763) reflected excellent internal consistency reliability. All organisational factors were, thus, established as valid and reliable.

#### 7.2.5.2 Findings related to health information factors

The analysis of the six items designed to measure the health information factors that could potentially influence the implementation indicated that one factor accounting for 37.33% of the variance. Moderate communalities (.363 to .864) indicated that the six items were related. The six items had strong loadings (.434 to .785) and, therefore, contributed significantly to the reliability and validity of the questionnaire. Cronbach's alpha (.651) reflected adequate internal consistency reliability for the six items. All health information factors were, thus, established as valid and reliable.

#### 7.2.5.3 Findings related to national factors

The analysis of the nine items designed to measure the national factors that could potentially influence the implementation indicated that one factor accounted for 26.35 % of the variance. High communalities (.451 to .891) indicated that the items were related. The nine items had moderate loadings (.242 to .682) and therefore measured as borderline in contributing to the consistency reliability and validity of the questionnaire. Cronbach's alpha (.604) reflected moderate internal consistency reliability. The national factors were, thus, established as on the borderline of being valid and reliable.

**Table 7-1 Factor analysis and Cronbach alpha table results**

| | | Mean | Standard Deviation | Communality | Loading | Eigenvalue | % of Variance | Cronbach's alpha |
|---|---|---|---|---|---|---|---|---|
| Organisational | 1 | 4.26 | 0.944 | 0.706 | 0.693 | 3.91 | 38.64 | 0.763 |
| | 2 | 4.28 | 0.858 | 0.721 | 0.674 | | | |
| | 3 | 4.56 | 0.675 | 0.620 | 0.748 | | | |
| | 4 | 4.54 | 0.579 | 0.845 | 0.637 | | | |
| | 5 | 4.36 | 0.563 | 0.643 | 0.381 | | | |
| | 6 | 4.44 | 0.541 | 0.634 | 0.644 | | | |
| | 7 | 4.26 | 0.853 | 0.517 | 0.626 | | | |
| | 8 | 4.48 | 0.544 | 0.723 | 0.490 | | | |
| Health information | 1 | 4.26 | 0.751 | 0.675 | 0.434 | 2.24 | 37.33 | 0.651 |
| | 2 | 4.22 | 0.840 | 0.419 | 0.423 | | | |
| | 3 | 4.14 | 0.833 | 0.864 | 0.785 | | | |
| | 4 | 4.02 | 0.845 | 0.801 | 0.745 | | | |
| | 5 | 4.02 | 0.979 | 0.363 | 0.553 | | | |
| | 6 | 4.08 | 0.877 | 0.430 | 0.629 | | | |
| National | 1 | 4.00 | 0.782 | 0.736 | 0.594 | 2.38 | 26.53 | 0.604 |
| | 2 | 4.06 | 1.077 | 0.501 | 0.288 | | | |
| | 3 | 4.04 | 0.699 | 0.775 | 0.242 | | | |
| | 4 | 4.48 | 0.544 | 0.891 | 0.304 | | | |
| | 5 | 4.26 | 0.853 | 0.752 | 0.516 | | | |
| | 6 | 4.40 | 0.535 | 0.538 | 0.636 | | | |
| | 7 | 4.12 | 0.746 | 0.649 | 0.682 | | | |
| | 8 | 4.04 | 0.880 | 0.451 | 0.626 | | | |
| | 9 | 4.14 | 0.857 | 0.760 | 0.522 | | | |

*Note*. National items 6 and 9 data include reverse-scored questions

### 7.2.6 Discussion

The content validity and internal consistency reliability of factors potentially influencing the implementation of ICD-10-AM and clinical coding in Saudi public hospitals covered in Section 2 of the quantitative instrument were measured by applying Cronbach's α and factor analysis to the results of a pilot study, confirming the high validation values adjudged by the experts for all items in the questionnaire. Cronbach's α ranged from $\alpha = 0.604$ to $\alpha = 0.763$ for all factors and the internal consistency reliability testing indicated that the rating of all items constituting the three factor categories, Health Information, Organisational, and National ranged between adequate and excellent.

The factor analysis produced a similar overall range between high and adequate for all items in each category, producing loadings ranging from 0. 242 to 0.785 and moderate communalities ranging from 0. 363 to 0.891. The factors returning the lowest internal consistency loadings and communalities were still within the moderate range, based on the empirical standards of the testing tools (Allen & Yen, 2001; Hair et al., 2010). This confirmed that the quantitative instrument designed to measure factors influencing the implementation of ICD-10-AM and clinical coding in Saudi public hospitals exhibited levels of content validity, internal consistency reliability, and factorial validity that far surpassed the minimum acceptable level.

## 7.3 Designing and testing the semi-structured interview questions

The semi-structured interviews constituted the qualitative instrument of the study. The interview questions were designed to address the questionnaire items of the quantitative instrument more comprehensively. Castillo-Montoya (2016) suggested that the interview questions should initially be drafted to align with the aim of the study in answering the research question; thereafter pretesting them in a pilot study and then improving the interview protocol based on the feedback of the pilot study participants.

As noted earlier, the term ‘pilot study’ refers to the application of methodological testing to refine the tools of the main study (Prescott & Soeken, 1989). Golafshani (2003) noted that reliability testing in a quantitative study assesses whether the instrument is valid and reliable, while the credibility testing in a qualitative study assesses the ability of the researcher to increase the credibility of findings. Chenail (2011) suggested that the researcher may be considered the research instrument in a qualitative study, as his/her ability in eliciting information from the participants is a variable of the quality of the data gathered. Kim (2011) noted that testing a qualitative instrument forms an important stage of the research, in detecting inherent problems that may be rectified before the final data collection and increase the credibility of the findings.

Acknowledging the impact that the researcher/interviewer's technique has on the quality of qualitative data, some scholars have argued that pilot testing a qualitative research instrument is superfluous. Holloway (1997) and Perry (2001) argued that separate methodological testing of qualitative instruments is unproductive, in that the final data gathering input may vary subjectively from that of a pilot study. Conversely, other qualitative research scholars have argued that testing the qualitative tool is important, as a trial, before committing to the final data collection process. Yin (2015) proposed that piloting the qualitative instrument ensures that the questions are clearly understandable and will shed light on potential participant difficulties. Majid, Othman, Mohamad, Lim, and Yusof (2017) advised that a pilot study should be conducted to allow for improvements in the interviews in the major study. The researchers also confirmed that, 'Piloting for interview is an integral aspect and useful in the process of conducting qualitative research as it highlights the improvisation to the major study' (p. 1073).

In this study, the researcher conducted pilot interviews by telephone in December 2015, to test the qualitative instrument. Two participants from the HIM departments of KFMC and IAAH, purposively selected, by the researcher were called and the proposed semi-structured interview questions were put to them. The calls were recorded, and written transcriptions were sent to each participant for comment and feedback. The researcher then received the participants' feedback, which did not include any comments or amendment suggestions.

## 7.4 Conclusion

The primary purpose of the chapter was to cover the process of verifying the content validity and internal consistency reliability of data collected by the study instruments in pilot tests, as a preparatory step to the final data collection processes. The chapter commenced by outlining and discussing the essential steps in the validation process and the application thereof to the study quantitative instrument; namely the testing by experts of the suitability of the arrangement and ordering of items and their clear and unambiguous expression through content validity analysis; and, thereafter the internal consistency reliability using Cronbach's α and factor analysis. Following elucidation of the requirements of pilot testing and the assembly of the sample to pilot the study questionnaire, the testing of qualitative instruments was discussed, leading up to the recorded telephonic piloting of the proposed questions for the study semi-structured interview. It was concluded that both study instruments were valid and reliable for the purpose of collecting the final research data.

# 8 Chapter Eight: Results

## 8.1 Introduction

The mixed methods data collection instruments of the thesis were designed to answer a single research question; ‘What are the factors influencing the implementation of ICD-10 and clinical coding in Saudi Public Hospitals?’ The quantitative survey questionnaire and qualitative open-ended question examined the general knowledge and awareness of ICD-10 classification and the practice of clinical coding in a random sample representing all professional categories in Saudi public hospitals. Alternatively, the semi-structured interview used a sample of purposively selected HIM specialists including clinical coders, as well as a doctor, to obtain the perspectives of experts involved in the implementation.

Chapter 1 presented the 2012 MOH decision to purchase the license to use the Australian modification of ICD-10 in all Saudi Arabian hospitals, a crucial component in the Saudi healthcare reform trend towards greater privatisation and funding by compulsory healthcare insurance, as a background to the research question. It was seen that despite generous funding from the Saudi government, many past attempts at implementing healthcare developments had petered out before completion. Saudi healthcare reviewers pointed to many systemic and organisational factors endemic to national healthcare, which served as motivational factors in the researcher’s decision to devote this thesis to the chosen research question and his hope that it would serve as a document for guiding healthcare organisations in the essential preparations for a successful implementation of ICD-10-AM and clinical coding.

The sudden development of the Saudi economy after the discovery of oil and the evolving structure of national healthcare was outlined in Chapter 2. Saudi Arabia is very late in adopting a system of classifying and coding diseases and interventions which has had a historical development over more than a century from a cause-of-death list into a unified morbidity and mortality classification. Since the post-World War II establishment of the WHO, mandated to develop of the ICD classifications beginning with ICD-6, new versions have paralleled the development of medical science and technology. ICD-10 presents a vast expansion of the previous version.

Literature on the global development of healthcare technology and emergence of eHealth, and its extent of incorporation and usage in Saudi healthcare were covered in Chapter 3.

The historical development of the ICD system was documented in Chapter 4, as a prelude to reviewing the main body of literature research on implementing ICD-10 in Chapter 5. In deriving the factors that may influence the introduction of ICD-10 in Saudi public hospitals, it was evident that these fell naturally into three categories; namely, organisational, health information, and national. The quantitative survey questionnaire and qualitative semi-structured interview, the methodological design, assessment of validity and reliability, and piloting of which were covered in Chapters 6 and 7, were both structured according to these categories.

## 8.2 Chapter structure

The chapter proper commences with an analysis of the demographic data, as completed by the quantitative sample respondents in the survey/questionnaire Part 1, with sub-sections on the number of respondents per hospital, gender, age, nationality, occupation, qualifications, and professional experience.

The survey was conducted at seven Saudi public hospitals which varied in size and functionality. The respondents from each hospital represented one of six professional healthcare or administrative categories. While it would have been ideal to select the sample from each hospital and professional category purposively, the time allocated for the researcher's site visit did not permit this. Accordingly, the composition of the sample from each study hospital varies in terms of representative sample size and proportionate representation of the occupational categories.

An additional demographic section assessed three aspects of an ICD-10 and clinical coding implementation; certification in clinical coding, participation in organisational awareness training in ICD-10 and clinical coding, and the respondent's perception of the status of implementation in his/her hospital.

The study quantitative input was based on the questionnaire that formed Part 2 of the survey. Twenty-three Likert scale items were grouped according to the categories, organisation, health information, and national factors derived from the literature reviewed. The overall survey and factor categories were assessed using SPSS, per individual demographic factor and questionnaire item and, thereafter, as combined Likert scale items. The analysis of the single open-ended question comprising Part 3 of the questionnaire and the semi-structured interview inputs were based on content analysis and response frequency rankings. The results are presented in the following order; (1) random sample demographics, (2) quantitative Likert scale survey questionnaire, (3) qualitative open-ended question, (4) qualitative semi-structured interview, and (5) interpolation of quantitative and qualitative results.

## 8.3 Survey Part 1: Respondent demographics

Table 8-1 presents an overview of all ten demographic categories, the values for each category, and the associated counts and percentages. Demographic items 1-6 & 9 are dealt with as a separate group to demographics items 7, 8 & 10.

**Table 8-1 Demographic categories, values, counts, and percentages**

| Respondent Hospital | Value | KFMC | KSH | IAAH | AIH | AYH | BCH | MCH |
|---|---|---|---|---|---|---|---|---|
| | Count | 47 | 28 | 50 | 51 | 50 | 34 | 23 |
| | Percent | 16.6% | 9.9% | 17.7% | 18.0% | 17.7% | 12.0% | 8.1% |
| Gender | Value | Male | Female | | | | | |
| | Count | 107 | 176 | | | | | |
| | Percent | 37.8% | 62.2% | | | | | |
| Age-bracket | Value | Under 30 | 30 to 40 | 41 to 50 | 51 to 60 | Over 60 | | |
| | Count | 95 | 114 | 52 | 18 | 4 | | |
| | Percent | 33.6% | 40.3% | 18.4% | 6.4% | 1.4% | | |
| Nationality | Value | Saudi | Expat | | | | | |
| | Count | 165 | 118 | | | | | |
| | Percent | 58.3% | 41.7% | | | | | |
| Category of employment | Value | Health Informatics | Medical Records | Medicine | Nursing | Other health | Non-health | |
| | Count | 28 | 44 | 47 | 116 | 28 | 20 | |
| | Percent | 9.9% | 15.5% | 16.6% | 41% | 9.9% | 7.1% | |
| Years of service in healthcare | Value | Under 5 | 6 to 10 | 11 to 15 | Over 15 | | | |
| | Count | 74 | 89 | 60 | 60 | | | |
| | Percent | 26.1% | 31.4% | 21.2% | 21.2% | | | |
| Certificated in clinical coding | Value | Yes | No | | | | | |
| | Count | 26 | 257 | | | | | |
| | Percent | 9.2% | 90.8% | | | | | |
| Participated in clinical coding course | Value | Yes | No | | | | | |
| | Count | 43 | 240 | | | | | |
| | Percent | 15.2% | 84.8% | | | | | |
| Level of education | Value | PhD | Master | Bachelor | Diploma | | | |
| | Count | 20 | 30 | 128 | 105 | | | |
| | Percent | 7.1% | 10.6% | 45.2% | 37.1% | | | |
| Status of implementation | Value | Partially | Fully | I do not | Sample total = 283 | | | |
| | Count | 128 | 14 | 141 | | | | |
| | Percent | 45.2% | 4.9% | 49.8% | | | | |

Table 8-1 analysed the demographics of the sample.

1) In the Saudi MOH implementation of ICD-10 in public hospitals, the dominant demographic factor was hospitals, as each unit was at a different stage of implementation.
2) Within the hospital, groups of staff performing different functions were expected to play different roles in the implementation and development of ICD-10 and clinical coding. Thus, within each hospital, occupation was a major factor that differentiated staff within the institution.
3) As the survey was completed by a random sample of the population of the seven study hospitals, there was a possibility that the sample would not reflect the true composition of the overall population or the representation from the individual hospitals.
4) As an example, an above-average number of first-year trainee nurses might respond differently to the survey items than a matron with a PhD, or a HIM (health informatics or medical records) staff member.

The Chi-square Test in SPSS estimates the difference between an expected level of a factor, as opposed to the observed level.

Running the non-parametric Chi-square test on the demographic factors highlights significant variability that may have an impact on the results. All the results fell within the 95% (0.05) standard significance level.

**Table 8-2 Non-parametric Chi-squared test on demographics 1-6 plus 9**

| Demographic categories | 1 | 2 | 3 | 4 | 5 | 6 | 9 |
|---|---|---|---|---|---|---|---|
| Chi-Square | 20.72 | 16.82 | 159.84 | 7.81 | 131.89 | 8.12 | 122.78 |
| df | 6 | 1 | 4 | 1 | 5 | 3 | 3 |
| Asymp. Sig. | 0.002 | 0 | 0 | 0.005 | 0 | 0.044 | 0 |

Demographics items 1-6 and 9 all fell well within the acceptable levels.

### 8.3.1 Respondent hospitals

All the study hospitals fell under the Saudi MOH and all were facing the same ICD-10-AM and clinical coding implementation process.

1) Five were in the national capital, Riyadh and the other two in Buraidah, approximately 330 kms away. KFMC, AYH and MCH are tertiary level and the other four are all secondary.

2) The hospitals exhibited variations in size, with KFMC more than double the size of the next largest, MCH, and six times as large as IAAH based on the number of beds, which has a direct relationship to personnel.
3) The three smallest hospitals produced the three largest contingents of respondents.

**Table 8-3 Hospital individual attributes and number of study respondents**

| Hospitals | Physical attributes | | | Study representation | |
|---|---|---|---|---|---|
| | Location | Healthcare level | Number of beds | Respondents | % of sample |
| KFMC | Riyadh | Tertiary | 1218 | 47 | 16.6% |
| KSH | Riyadh | Secondary | 244 | 28 | 9.9% |
| IAAH | Riyadh | Secondary | 200 | 50 | 17.7% |
| AIH | Riyadh | Secondary | 207 | 51 | 18.0% |
| AYH | Riyadh | Tertiary | 300 | 50 | 17.7% |
| BCH | Buraidah | Secondary | 300 | 34 | 12.0% |
| MCH | Buraidah | Tertiary | 500 | 23 | 8.1% |

The highlighted comparison bears out the fact that the greatest proportion of study respondents came from the second-smallest study hospital, based on the bed count.

### 8.3.2 Gender categories

The count indicated that 62.2% of the respondents were female, attributable to the fact that nurses comprised the largest occupational category and that the breakdown of 116 nurses was 99 females to 17 males. Disproportionate statistics included:

1) Greater male representation at KFMC and BCH.
2) Among the six occupation categories, four had greater male representation, while nursing and medical records indicated a female majority.

### 8.3.3 Age-bracket categories

Combining the appropriate brackets in Table 8-1 indicated that 209 respondents were in the 40-and-under group and that 74 respondents were over 40. Age may carry the implication of experience and acquired knowledge but may also imply resistance to innovation.

### 8.3.4 Nationality categories

The two Buraidah hospitals had the lowest Saudi/Expat ratios. Buraidah has a population of about 12% of that of Riyadh and the lower ratios were related to several possible employment, geographical, and cultural factors.

KFMC, the largest hospital though not in study sample representation, had a higher ratio of expats than Saudis, as did the occupations of medicine and nursing.

The health informatics and medical records categories comprised almost totally Saudis. There was only a single expatriate in each of these occupational categories.

### 8.3.5 Occupational category

All seven hospitals were represented by at least one survey respondent in each of the six occupational categories, other than AIH in the non-health professional category. Other-health specialists refer to medical practitioners working in specialised areas such as radiology and pathology; non-health professionals refer to the management functions of administration, finance, and systems. At times, health informatics and medical records were combined into a single unit referred to as CORE HIM. Table 8-4 examines the six occupational categories per study hospital.

**Table 8-4 Respondent occupations per hospital**

| Occupational category | Health Informatics | Medical Records | Medicine | Nursing | Other-health | Non-health | Total |
|---|---|---|---|---|---|---|---|
| KFMC | 4<br>8.51% | 1<br>2.13% | 8<br>17.02% | 23<br>48.94% | 6<br>12.77% | 5<br>10.64% | 47<br>100.00% |
| KSH | 2<br>7.14% | 5<br>17.86% | 5<br>17.86% | 11<br>39.29% | 3<br>10.71% | 2<br>7.14% | 28<br>100.00% |
| IAAH | 5<br>10.00% | 9<br>18.00% | 5<br>10.00% | 23<br>46.00% | 5<br>10.00% | 3<br>6.00% | 50<br>100.00% |
| AIH | 7<br>13.73% | 10<br>19.61% | 7<br>13.73% | 23<br>45.10% | 4<br>7.84% | 0<br>.00% | 51<br>100.00% |
| AYH | 2<br>4.00% | 6<br>12.00% | 9<br>18.00% | 23<br>46.00% | 6<br>12.00% | 4<br>8.00% | 50<br>100.00% |
| BCH | 6<br>17.65% | 12<br>35.29% | 5<br>14.71% | 6<br>17.65% | 3<br>8.82% | 2<br>5.88% | 34<br>100.00% |
| MCH | 2<br>8.70% | 1<br>4.35% | 8<br>34.78% | 7<br>30.43% | 1<br>4.35% | 4<br>17.39% | 23<br>100.00% |
| TOTAL | 28<br>9.89% | 44<br>15.55% | 47<br>16.61% | 116<br>40.99% | 28<br>9.89% | 20<br>7.07% | 283<br>100.00% |

1) At KFMC, IAAH, AIH, and AYH the nurse component was close to 50%.
2) At BCH, the CORE HIM group formed over 50% of respondents, while at MCH doctors were the largest component.

### 8.3.6 Years of service in healthcare sector

The peak for Saudi public health workers is close to 10 years of experience. Clearly, experience and age are closely related and the major factor that summarises these two demographic categories is that nearly 74% of the sample is 40 or under.

### 8.3.7 Level of education

Educational qualifications relate to specific professional functions and needs.

1) Approximately 45% of the sample had bachelors' degrees.
2) More doctors had PhDs or masters' degrees than bachelors.
3) All other occupational categories, other than medical records, showed the highest concentration of respondents in the bachelors' degree category.
4) Approximately 95% of medical records, the category expected to provide the clinical coders, had only diplomas.
5) In examining the distribution across hospitals, AIH, AYH, and BCH all indicated diploma as the largest qualification group.

### 8.3.8 Certificated in clinical coding and participation in an ICD-10 training course

Demographic items 7 & 8 offered additional quantitative data on factors that would affect the implementation of ICD-10-AM and clinical coding in Saudi Arabia and constituted possibly the most disappointing feedback from the survey. Table 8-5 indicates the number of respondents per hospital who were certificated in clinical coding (demographic 7), had received introductory training in ICD-10 and clinical coding (demographic 8), or both.

**Table 8-5 Certificated in clinical coding/ trained in ICD-10 & coding**

| Hospitals | Sample per hospital | Demographic 7 Certificated in Clinical Coding | | Demographic 8 Training in ICD-10 and Coding | | Demographics 7 & 8 Trained in Both | | Trained in one or both |
|---|---|---|---|---|---|---|---|---|
| | | No. (A) | % | No. (B) | % | NO. (C) | % | A+B-C |
| KFMC | 47 | 5 | 10.6% | 10 | 21.2% | 4 | 8.5% | 11 |
| KSH | 28 | 0 | 0% | 0 | 0% | 0 | 0% | 0 |
| IAAH | 50 | 3 | 6.0% | 8 | 16.0% | 3 | 6.0% | 8 |
| AIH | 51 | 9 | 17.6% | 9 | 17.6% | 8 | 15.7% | 10 |
| AYH | 50 | 4 | 8.0% | 5 | 10.0% | 3 | 6% | 6 |
| BCH | 34 | 3 | 8.8% | 9 | 26.5% | 3 | 8.8% | 9 |
| MCH | 23 | 2 | 8.7% | 2 | 8.7% | 1 | 4.4% | 3 |
| TOTAL | | 26 of 283 | 9.19% | 43 of 283 | 15.2% | 22 of 283 | 7.7% | 47 |

*Note:* The final column constitutes the number of individuals who had received training in either course or in both and was calculated by Column A + B – C.

1) 47/283 (17%) had undergone one or both training courses, though not necessarily in the MOH hospital where they were employed at the time of the survey.
2) KSH indicated no respondents with certification in clinical coding or training in ICD-10.
3) AIH had the highest percentage of certified clinical coders.
4) BCH had the highest percentage with introductory training in ICD-10 and clinical coding.

There exists a lack of training procedures, universally agreed as essential by all researchers reporting on ICD-10 implementation. Further, the unexpected neglect of these fundamental training necessities was a forewarning that a large portion of the sample was unlikely to be equipped with the knowledge and insights to respond authoritatively to the 23 survey items.

### 8.3.9 Status of implementation

The lack of agreement in any single hospital and indication that almost 50% of total respondents were 'Unsure' as to the progress of the implementation in their hospital suggested that the organisational awareness, information, and teamwork universally agreed throughout the literature to be essential was non-existent.

**Table 8-6 Status of implementation per hospital**

| Hospital | Fully implemented | Partially implemented | I do not know (uncertain) | Total |
|---|---|---|---|---|
| KFMC | 8<br>17.02% | 13<br>27.66% | 26<br>55.32% | 47<br>100.00% |
| KSH | 0<br>0% | 15<br>53.57% | 13<br>46.43% | 28<br>100.00% |
| IAAH | 0<br>0% | 30<br>60.00% | 20<br>40.00% | 50<br>100.00% |
| AIH | 2<br>3.92% | 17<br>33.33% | 32<br>62.75% | 51<br>100.00% |
| AYH | 1<br>2.00% | 28<br>56.00% | 21<br>42.00% | 50<br>100.00% |
| BCH | 1<br>2.94% | 17<br>50.00% | 16<br>47.06% | 34<br>100.00% |
| MCH | 2<br>8.70% | 8<br>34.78% | 13<br>56.52% | 23<br>100.00% |
| TOTAL | 14<br>4.9% | 128<br>45.3% | 141<br>49.8% | 283<br>100% |

1) No respondents from KSH or IAAH indicated a complete implementation, while a few from each of the other five hospitals did.
2) The most reasonable initial results were found to be IAAH and AYH, with the 'partial' responses outweighing the other two choices.

Examining demographic 10 by occupation showed that the CORE HIM staff (medical records and health informatics) produced a far more reasonable result.

**Table 8-7 Status of implementation core HIM staff responses**

| Hospital | Core staff (CORE HIM) | Complete | Partial | Unsure |
|---|---|---|---|---|
| KFMC | 5 | 2 | 1 | 2 |
| KSH | 7 | 0 | 7 | 0 |
| IAAH | 14 | 0 | 14 | 0 |
| AIH | 17 | 0 | 13 | 4 |
| AYH | 8 | 0 | 7 | 1 |
| BCH | 18 | 1 | 15 | 2 |
| MCH | 3 | 1 | 1 | 1 |
| TOTAL | 72 (25.4%) | 4 (5.5%) | 58 (80.5%) | 10 (14%) |

1) The hospital distribution of the 10 unsure respondents was 4 from AIH, 2 from KFMC and BCH, and 1 from AYH and MCH.
2) This would appear to indicate that the unsure respondents were 'uncertain whether the status was complete or partial' rather than that they had no idea at all.

## 8.3.10Implications of demographic 7, 8, & 10 for the study question

1) An extensive category of ICD-10 implementation literature recommended that the period of organisational training and preparations could take as long as two years.
2) Not only is relevant training necessary for all members of the six hospital staff categories but for all financial staff (accountants, auditors, financial IT systems),

researchers, data analysts, quality management, and more (Hazelwood, 2003; Bowman & Zeisset, 2012).

3) The fact that all survey participant had not yet attended an introductory ICD-10 awareness lecture implies that by global standards the implementation had barely started.
4) The unsure response of 50% of the sample on the status of implementation confirms that the implementation is not proceeding according to the accepted international HIM standards.

## 8.4 Survey Part 2: Questionnaire

Quantitative data on factors influencing the implementation of ICD-10-AM and clinical coding in Saudi public hospitals were gathered in Part 2 of the survey. Participants were asked to respond to 23 items reflecting factors drawn from the literature reviewed and structured into three categories; namely, organisation, health information, and national. The survey responses were indicated on a 5-point Likert scale of 1 (strongly agree) to 5 (strongly disagree). Thus, a response of 1 or 2 indicated a level of agreement; 3 neutral (uncertain or undecided); and 4 or 5 a level of disagreement.

### 8.4.1 The problems of Likert measures

Some debate exists on Likert scale evaluation. Likert levels of agreement or disagreement are defined as ordinal, referring to their purpose of ordering or arrangement (Sullivan & Artino, 2013). The use of the mean is frequently criticised by statisticians on the basis that if 30 respondents indicated 2 = agreement and 30 indicated 4 = disagreement, the mean would be 3 = neutral.

Nevertheless, accepting this limitation and treating the mean comparatively as an indication of variations in the sample, many Likert scale surveys in the social sciences do utilise the mean, standard deviation, range, minimum, maximum, and median to arrive at successful, meaningful conclusions (Sauro, 2016).

The 283 responses to each of the 23 Likert scale items that formed the quantitative instrument of the study produced the following mean values and associated standard deviations. Thus, a quick glance indicates that all 23 individual mean values hovered around the 4.00 = disagree level.

**Table 8-8 Sample mean and standard deviation for the 23 Likert items**

| | | Mean | Std Dev |
|---|---|---|---|
| **Organisational items** | | | |
| 1 | MOH hospital employees receive education and training to improve their performance and further their careers | 4.07 | 1.02 |
| 2 | MOH hospitals evaluate the effectiveness of staff training programs offered | 3.91 | 1.01 |
| 3 | MOH hospitals offer specific clinical coding training programs | 4.34 | .82 |
| 4 | MOH hospitals have sufficient health coders trained in the clinical coding | 4.14 | .93 |
| 5 | MOH hospitals have sufficient health information management specialists | 3.95 | 1.01 |
| 6 | MOH hospitals have sufficient health informatics specialists | 3.92 | 1.05 |
| 7 | My hospital uses clinical coding and is equipped with a networking connection to exchange of health information with health insurance and claims management companies | 4.16 | 0.89 |
| 8 | MOH hospitals are using well-qualified vendors to provide technology installations and upgrades to support the implementation of clinical coding | 4.07 | 0.87 |
| **Health information items** | | | |
| 1 | MOH hospital staff understand the usefulness of clinical coding in the storage and retrieval of medical data. | 4.16 | 0.86 |
| 2 | MOH hospital staff understand the usefulness of clinical coding in health information management and sharing. | 4.16 | 0.81 |
| 3 | MOH hospital staff understand the positive impact of clinical coding on healthcare quality, through its facilitation of statistics and research. | 4.13 | 0.86 |
| 4 | MOH hospital staff understand the usefulness of clinical coding in processing health insurance claims and hospital funding | 4.13 | 0.84 |
| 5 | In MOH hospitals, physicians and coders interact in order to decide on the correct clinical codes to match the patient diagnoses and procedures | 3.99 | 0.92 |
| 6 | In MOH hospitals, the level of clinical diagnosis by physicians as existing in current manual records is sufficient to enable coders to apply clinical coding | 4.04 | 0.88 |
| **National items** | | | |
| 1 | A Saudi health information management supervisory organisation monitors the implementation of ICD-10 in all health sectors | 4.10 | 0.89 |
| 2 | The MOH will fund the installation of a national network to link MOH hospitals to support ICD-10 and the management and sharing of health | 3.65 | 1.09 |
| 3 | My hospital is part of an integrated and compatible electronic network established for the purpose of exchanging health information with other | 4.20 | 0.93 |
| 4 | The MOH will fund the cost of maintaining and upgrading health information management software at hospitals to support ICD-10 | 3.66 | 1.06 |
| 5 | The MOH has sufficient ICD-10 course trainers | 4.03 | 1.05 |
| 6 | The MOH needs to provide hospitals with additional coders at the commencement of ICD-10 implementation* | 3.93*<br>2.07 | 1.01<br>1.01 |
| 7 | MOH hospitals are provided with funding specifically dedicated to the implementation of HIM and electronic health project development | 3.78 | 1.11 |
| 8 | The MOH funding of information technology infrastructure upgrades support the implementation of ICD-10 in hospitals | 3.73 | 1.11 |
| 9 | The application of standardised electronic health records (EHRs) in MOH hospitals will facilitate the implementation of ICD-10* | 4.08*<br>1.92 | 0.95<br>0.95 |

1) National 6 and 9 are marked with an asterisk. The actual means obtained are shown below the means of the rewritten items. Reversing items is regarded as a method of

overcoming response style bias but it can nullify any attempt to create an overall unified scale result from a set of items. Suárez-Alvarez et al. (2018) noted that the worded survey items with reversed forms were commonly used to reduce response bias. If, for example, half of the items were reversed and the sample indicated 'strongly disagree' to half and 'strongly agree' to the other half, the two halves cancel one another (Sonderen, Sanderman, & Coyne, 2013).

All items can be reversed, and it is regarded as fair statistical practice as if the item had been initially written in the reverse. For example, national 6, which was included on the basis that several researchers advised organisations to consider increasing staff over the implementation period can be rewritten: 'The MOH has sufficient coders to carry the additional workload that will occur at the commencement of ICD-10 implementation' and a similar result can be expected.

2) Given the unexpected outcome, with most results showing means between disagree = 4 and strongly disagree = 5 but having been informed by the qualitative interviewees that some sort of implementation was underway, it was logical that results tending more strongly toward agree would indicate some answers through a minority of respondents. Results below disagree = 4 are shaded to highlight where the minority was strengthened.
3) The highest mean was 4.34 for organisational 3, which also had the second-lowest standard deviation. This item will be discussed when the organisational items are evaluated as a category.

### 8.4.2 Creating Likert-scale results from Likert-type items

The SPSS transform/compute function was used to transform the complete 23-item survey, grouped into the three categories into a unified survey result. The results are displayed in Table 8-9.

**Table 8-9 Complete survey Likert-scale measurement**

| Sample | Mean | Std Dev | Min | Max | Median (50th percentile) |
|---|---|---|---|---|---|
| 283 | 4.01 | 0.53 | 2.39 | 5.00 | 4 |
| **Factor Categories** | | | | | |
| Organisation | 4.07 | .65 | 2.13 | 5.00 | 4.13 |
| Health Information | 4.10 | 0.63 | 1.83 | 5.00 | 4.00 |
| National | 3.91 | .61 | 2.00 | 5.00 | 3.89 |

### 8.4.3 Internal and external relationships between factor categories

The correlation matrix for the three factor categories computed using the SPSS transform function is shown in Table 8-10. The values above 0.4 imply strong correlations in both directions, as well as high significance.

**Table 8-10 Factor category correlation matrix**

| Correlations | | Organisational | Information | National |
|---|---|---|---|---|
| Organisational | Pearson Correlation | 1.00 | 0.59 | 0.53 |
| | Sig. (2-tailed) | | 0 | 0 |
| Information | Pearson Correlation | 0.59 | 1.00 | 0.52 |
| | Sig. (2-tailed) | 0 | | 0 |
| National | Pearson Correlation | 0.53 | 0.52 | 1.00 |
| | Sig. (2-tailed) | 0 | 0 | |
| | Respondents | 283 | 283 | 283 |

### 8.4.4 The significance of the impact of individual and group demographic factors on Likert responses

The most defining study demographic factors were demographic 1: hospital and demographic 5: occupation. Each respondent in the sample worked in one of the seven study hospitals, in one of the six occupation categories. Given the different rates of implementation, it can be assumed that a staff member of health informatics at KFMC may not have had the same perspective on the implementation, as a staff member of the same department at KSH, which according to demographic 10 was a long way behind in the implementation.

As the analysis progressed and exposed different viewpoints within the same department of the same hospital, it suggested that in practice there were 42 (7 hospitals x 6 occupations) operational categories; namely, health informatics, AIH; health informatics, KFMC; medical records, AYH, medical records, KSH, etc. In the end, this could be attributed to the fact that the implementation was proceeding without the majority of the population being informed.

Considering other demographic factors that might impact; for example, age, gender, and qualification can influence the cognitive process of response. Additionally, there is a unique Saudi healthcare factor that had the potential to impact strongly on the quantitative instrument; demographic 4 indicates that 42% of the study respondents were expatriates, which is a reasonable reflection of the expatriate proportion of Saudi medical and nursing services. Some expatriates may have had years of experience in an ICD-10 hospital environment.

Examples of demographic variables with associations to demographic 1 hospital and demographic 5 occupation that could impact on the survey outcome:

1) Age under 40 ratio per occupation: health informatics 26/28; medical records 34/44; medicine 16/47 (thus 31/47 doctors were over 40); nurses 99/116; other-health 22/28; non-health 11/20.
2) Degree qualifications per occupation (the balance all have a bachelor degree and the excess have diplomas): health informatics 19/28 (3 masters); medical records 2/44; medicine 47/47 (12 masters, 17 PhDs) ; nurses 75/116 (10 masters, 1 PhD); non-health 16/20 (1 masters, 1 PhD); other-health 19/28 (4 masters, 1 PhD).
3) Note that at MCH, doctors (medicine) formed the biggest occupation category in the smallest sample representation of 23.

**Table 8-11 Impact of demographic variables on SPSS-computed study unified mean values (Variable groups arranged from lowest mean)**

| Variable | Number | Mean | Standard deviation | Variance | Range | Min | Max | Median |
|---|---|---|---|---|---|---|---|---|
| Computed study scale | 283 | 4.01 | 0.53 | .28 | 2.61 | 2.39 | 5.00 | 4.00 |
| **Demographic 1: Hospital** | | | | | | | | |
| MCH | 23 | 3.85 | 0.75 | 0.57 | 2.61 | 2.39 | 5.00 | 4.09 |
| KFMC | 47 | 3.87 | 0.44 | 0.19 | 1.96 | 2.87 | 4.83 | 3.87 |
| BCH | 34 | 3.88 | 0.54 | 0.29 | 2.26 | 2.65 | 4.91 | 3.93 |
| AIH | 51 | 4.07 | 0.64 | 0.40 | 2.30 | 2.70 | 5.00 | 4.00 |
| KSH | 28 | 4.08 | 0.43 | 0.18 | 1.57 | 3.35 | 4.91 | 4.13 |
| AYH | 50 | 4.10 | 0.45 | 0.20 | 1.78 | 3.22 | 5.00 | 4.04 |
| IAAH | 50 | 4.13 | 0.43 | 0.19 | 1.61 | 3.39 | 5.00 | 4.04 |
| **Demographic 2: Gender** | | | | | | | | |
| Male | 107 | 3.96 | 0.54 | 0.29 | 2.61 | 2.39 | 5.00 | 3.91 |
| Female | 176 | 4.05 | 0.52 | 0.27 | 2.39 | 2.61 | 5.00 | 4.00 |
| **Demographic 3: Age bracket** | | | | | | | | |
| Over 60 | 4 | 3.32 | 0.44 | 0.19 | .91 | 3.04 | 3.96 | 3.13 |
| Under 30 | 95 | 3.99 | 0.51 | 0.26 | 2.39 | 2.61 | 5.00 | 3.96 |
| 41 to 50 | 52 | 4.02 | 0.54 | 0.29 | 2.61 | 2.39 | 5.00 | 4.02 |
| 30 to 40 | 114 | 4.05 | 0.53 | 0.28 | 2.22 | 2.78 | 5.00 | 4.09 |
| 51 to 60 | 18 | 4.06 | 0.58 | 0.34 | 1.74 | 3.26 | 5.00 | 4.00 |
| **Demographic 4: Expat/Saudi** | | | | | | | | |
| Expat | 118 | 3.95 | 0.53 | 0.28 | 2.61 | 2.39 | 5.00 | 3.93 |
| Saudi | 165 | 4.06 | 0.52 | 0.27 | 2.39 | 2.61 | 5.00 | 4.09 |
| **Demographic 5: Occupation** | | | | | | | | |
| Non-health | 20 | 3.84 | 0.53 | 0.28 | 2.13 | 2.87 | 5.00 | 3.78 |
| Medicine | 47 | 3.91 | 0.64 | 0.41 | 2.61 | 2.39 | 5.00 | 3.96 |
| Nursing | 116 | 4.01 | 0.45 | 0.21 | 2.30 | 2.70 | 5.00 | 4.00 |
| Health Info | 28 | 4.05 | 0.47 | 0.22 | 1.83 | 3.09 | 4.91 | 4.02 |
| Medical Recs | 44 | 4.11 | 0.54 | 0.29 | 2.09 | 2.91 | 5.00 | 4.17 |
| Other-health | 28 | 4.14 | 0.62 | 0.39 | 2.13 | 2.87 | 5.00 | 4.09 |
| **Demographic 9: Qualification** | | | | | | | | |
| PhD | 20 | 3.88 | 0.55 | 0.30 | 1.83 | 3.04 | 4.87 | 3.87 |
| Bachelor | 128 | 3.97 | 0.51 | 0.26 | 2.39 | 2.61 | 5.00 | 3.97 |
| Masters | 30 | 4.07 | 0.56 | 0.32 | 2.61 | 2.39 | 5.00 | 4.15 |
| Diploma | 105 | 4.08 | 0.53 | 0.28 | 2.09 | 2.91 | 5.00 | 4.09 |

**Grey shaded blocks**

1) Minimum values: the grey-shaded number 2.39 was the lowest value of the computed single mean value for any individual respondent. It represented the mean of an expatriate male doctor, aged 41-50, with a masters' degree working at MCH.
2) While it had no direct statistical relevance, the second-lowest mean for the whole study represented a Saudi female doctor, aged under 30 with a bachelors' degree, also working at MCH.
3) This meant that in the demographic variables of female, Saudi, age under 30, and bachelor's degrees, the 2.61 value was the lowest mean.

The study mean is a single value that represents the mean Likert response for 23 items for each of 283 respondents. The median is the mid-point frequency value of all respondent means. The mean and median are unaffected by group or sub-group size.

Demographic 1: the four hospitals in the later stages of implementation had the lowest mean values. MCH, the smallest hospital, indicated a median (4.09) 0.24 above the mean and the highest range (2.61). Half of the MCH respondents had computed means for the 23 items between 4.09 (median) and 5.00; hence the other half had means between 2.39 and 4.09, a far greater distance. The minimum values for KSH, AYH, and IAAH were well-above 3.00 = neutral.

Demographic 2: male and female were almost equidistant above and below the study mean. Nursing (84%) and medical records (60%) are the only female-majority occupations but five hospitals had significantly more females in the sample.

Demographic 3: the 4 over-60's comprised 3 expats and 1 Saudi, all doctors with PhDs. They produced the lowest mean and median (min 3.04; max 3.96). The next lowest was the under 30's. Thus, the oldest and youngest tended toward agree and the middle groups towards disagree.

Demographic 4: As a factor with only two groups, expat and Saudi, like gender, were equidistant above and below the study mean. Thus, the expat group overall showed a tendency toward levels of agree.

Demographic 5: nurses comprised 41% of the sample and the category's mean and median were the same as the full sample. Above nurses were the CORE HIM group and other-health specialists. Below, tending towards agree, were medicine and non-health, the two best qualified occupation categories.

Demographic 9: parallel with age-bracket where over 60’s and under 30’s were grouped below the study mean, in terms of qualification, PhD’s (20 in sample) were all over 40’s, other than one doctor under 30. PhDs were adjacent to bachelors, while masters and diplomas were above.

Thus, at MCH, BCH, and KFMC; among males; over 60s and under 30s; expats; doctors and non-health practitioners; and among PhDs and bachelors’ degree holders, there was a stronger tendency towards agree. Examining these in terms of the known Likert biases will explain some of the anomalies such as the grouping of youngest and oldest age-bracket groups.

### 8.4.5 Inherent Likert biases

#### 8.4.5.1 Response set and response style bias

Two major categories of Likert bias are ‘response set’ and ‘response style bias’. The former refers to responding according to what is considered desirable by a group. The latter refers to responding according to a pattern and generally not paying enough attention to individual item content (Suárez-Alvarez et al., 2018; Sonderen et al., 2013). Whichever the case, it imposes a negative impact on achieving a valid result.

There were 11 respondents who indicated 5.00 (strongly disagree) for all 23 items and a further 9 who responded 4.00 (disagree) to all 23. In both groups, individual respondents clearly did not pay attention to individual items.

#### 8.4.5.2 Central tendency bias

According to Central Tendency Bias theory, the two sequences of response (23 x 5.00 and 23 x 4.00) are roughly equal. Central Tendency Bias is one of the most common problematic features of Likert responses. It refers to a behavioural tendency in a part of a sample to avoid extreme choices; thus, manifested in the choice of disagree rather than strongly disagree. However, in a large sample, as well as one with a real distribution of occupational categories, ages, and qualifications, it can be accepted as a reflection of the variations of attitude and behaviour of the overall population (Sullivan & Artino, 2013).

Central Tendency Bias suggests that there is no meaningful difference between responding with a strongly disagree or a disagree to every single item?

A young Saudi female doctor from MCH responded with 23 neutrals; an expat nurse from AIH returned 16 neutrals and 7 disagrees, the first 12 items being all neutrals and the remainder being a mix of disagree and neutral. Nevertheless, from their individual perspective, these may not have been unreasonable responses.

Returning to Table 8-11, impact of demographic variables on study mean, there were two apparent anomalies in the grouping of variables. In demographic 3: Age brackets, the over 60's was closer aligned to the under 30's below the study mean and the brackets 31-40, 41-50, and 51-60 were grouped together above the mean. Similarly, in demographic 9: qualifications, PhD's were aligned with bachelor's below the study mean, while master's and diplomas were aligned above the mean.

There is a generally recognised social tendency that age brings conservatism, although greater education and life experience does produce a mediating effect (Cornelis, Van Hiel, Roets, & Kossowska, 2009). There were only 4 over 60s in the study and they were all doctors with PhDs; therefore, very likely to have a non-conservative point of view. The middle-age brackets and masters/diplomas aligned would possibly tend toward greater conservatism and, hence, the Central Tendency Bias.

#### 8.4.5.3 Examples of recurring patterns in the sample responses

Recurrent patterns and unexpected variations can also constitute part of the overall bias. Table 8-12 shows 6 examples of patterns among the 283 respondents

**Table 8-12 Likert response patterns extracted from the survey**

| | Individual cases | Organisational | | | | | | | | Health information | | | | | | National | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | Saudi, F, AIH, Med Recs Diploma, U 5 | SD | SD | SD | SD | SD | SD | SD | N | SD | SD | SD | SD | SD | SD | SD | SD | SD | SD | SD | SD | Ag | SD | SD |
| 2 | Saudi, F, AYH, Nurse, Diploma, 6-10 | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis | Dis |
| 3 | Saudi, M, AIH, Health Informatics, Masters, 11-15 | Dis | N | N | N | Dis | Dis | N | Dis | N | Dis | Dis | N | N | Dis | Dis | Dis | Dis | Dis | Dis | N | Dis | N | Dis |
| 4 | Expat, F, AYH, Nurse, Bach, 11-15 | SD | Dis | SD | SD | SD | Dis | SD | N | Dis | Dis | Dis | Dis | Dis | N | Dis | Dis | N | N | N | Dis | N | SD | SD |
| 5 | Saudi, F, AYH, Other health, Bach, U 5 | SA | N | Dis | N | Ag | Ag | N | N | SD | SD | SD | SD | Dis | Dis | SD | SD | SD | Dis | Dis | Dis | N | Dis | SD |
| 6 | Expat, F, KF, Other health, Bach, 6-10, | Ag | Ag | Ag | Ag | Ag | Ag | N | N | Ag | Ag | SD | Ag | N | SD | Ag | Ag | Ag | N | SD | SD | SD | Ag | SD |

*Note:* SA= Strongly Agree, Ag= Agree, N= Neutral, Dis= Disagree and SD= Strongly Disagree.

1) 21 x strongly disagree with 1 x neutral (organisational 8) and 1 x agree (national 7).
2) 23 x disagree. The big Likert question: why not all strongly disagree? Overall, the real difference between No 1 and 2 is that 2 was more consistent.
3) 13 x disagree (no strongly disagree) and when disagree was inappropriate, the respondent only moved to 10 x neutral. This pattern revealed a strong Central Tendency Bias.
4) A mixture of 7 x strongly disagree, 10 x disagree, and 6 x neutral.

Not one of the first four cases indicated an agree or strongly agree, right up to item 19 (national 5).

5) Respondent 5 was the first to use all five Likert ratings and by the ninth item (information 1) the respondent had used 1 x strongly agree, 2 x agree, 4 x neutral, 1 x disagree, and 1 x strongly disagree. The remaining fourteen items indicated 1 x strongly agree, 1 x neutral, 5 x disagree, and 7 x strongly disagree. The total indicated 2 x strongly agree, 2 x agree, 5 neutral, 6 x disagree, and 8 x strongly disagree.
6) 13 x agree, 4 x neutral, and 6 x strongly disagree. There were no strongly agree, no disagree, and two sudden swings between agree and strongly disagree.

### 8.4.6 The persistent minority

The concept of the persistent minority assumes that the respondents who persisted in responses opposed to the majority may have known something that most of the group did not (Allen & Seaman, 2007). There were 12 respondents (4.2%) whose 23 responses were computed to produce a mean below 3 = neutral.

1) These comprised MCH x 5, BCH x 3, AIH x 3, and KFMC x 1, the 4 hospitals with the lowest means in Table 8-11**.**
2) The occupational category breakdown of 4/47 doctors, 0/28 health informatics, 2/44 medical records, 3/116 nurses, 2/20 non-health, and 1/28 other-health professional, despite being small, does reflect that a higher representation in medicine and non-health, the two best qualified categories.

Measuring the ‘minority’, with a view to interpreting differences and extracting meaning is achieved through identifying the independent variables that reveal the differences. The important question remains, ‘Does the fact that 148 respondents produced a mean of 4.00

or higher (disagree to strongly disagree) render the minority opinions irrelevant?' That would only hold if all respondents in the sample had equal access to the necessary information.

### 8.4.7 The extreme in the majority

At the other end of the scale, the breakdown of the eleven participants who produced 23 x disagree responses included; AIH x 5 and other-health professionals x 6.

Such examples may be due to one or more of the response biases or may amount to what one of the Likert researchers called 'suspicious answers' (Sonderen, Sanderman, & Coyne, 2013).

The key question in evaluating statistics is whether an association is significant or random. It is hard, though, to give credulity to a whole group who rattled off a succession of 23 identical responses, some selecting disagree and others strongly disagree.

### 8.4.8 Analyses of the three categories of factors

The three categories varied according to individual items, groups of items, difficulties, and what needed to be revealed. For example, organisational was constructed with three groupings of associated factors, while health information had only two groups.

#### 8.4.8.1 Organisational category results

Organisational 1-3, covered the most fundamental aspect of preparation for implementing ICD-10 and clinical coding; staff training. Organisational 4-6 dealt with the adequacy of staffing in the HIM departments; organisational 7 & 8 examined technology issues. The Pearson two-tailed technique was used to estimate the correlations in each set of items.

**Table 8-13 Organisation group correlations**

| Training organisational items | | Item 1 | Item 2 | Item 3 |
|---|---|---|---|---|
| Item 1 | Pearson Correlation | 1.00 | .64 | .52 |
| | Sig. (2-tailed) | | 0 | 0 |
| Item 2 | Pearson Correlation | 0.64 | 1.00 | 0.37 |
| | Sig. (2-tailed) | 0 | | 0 |
| Organisational 3 | Pearson Correlation | 0.52 | 0.37 | 1.00 |
| | Sig. (2-tailed) | 0 | 0 | |
| Staffing organisational items | | Item 4 | Item 5 | Item 6 |
| Item 4 | Pearson Correlation | 1.00 | 0.58 | 0.58 |
| | Sig. (2-tailed) | | 0 | 0 |
| Item 5 | Pearson Correlation | 0.58 | 1.00 | 0.85 |
| | Sig. (2-tailed) | 0 | 0 | 0 |
| Item 6 | Pearson Correlation | 0.58 | 0.85 | 1.00 |
| | Sig. (2-tailed) | 0 | 0 | |
| Technology organisational items | | Item 7 | Item 8 | |
| Item 7 | Pearson Correlation | 1.00 | 0.56 | |
| | Sig. (2-tailed) | | 0 | |
| Item 8 | Pearson Correlation | 0.56 | 1.00 | |
| | Sig. (2-tailed) | 0 | 0 | |
| N | | 283 | 283 | 283 |

Correlations below 0.2 are weak; between 0.2 and 0.4 moderately strong; above 0.4 relatively strong. Thus, in training items, organisational 3 to organisational 2 and organisational 2 to organisational 1 indicated moderately strong associations. All other correlations were strong to very strong. Table 8-14 shows the totals of the Likert values for all items in the organisational category.

**Table 8-14 Likert degree of response per organisational item**

| Organisational items | Item 1 | | Item 2 | | Item 3 | | Item 4 | | Item 5 | | Item 6 | | Item 7 | | Item 8 | | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Strongly agree | 7 | 2.5% | 7 | 2.5% | 1 | 0.4% | 6 | 2.1% | 6 | 2.1% | 5 | 1.8% | 3 | 1.1% | 3 | 1.1% | |
| Agree | 24 | 8.5% | 23 | 8.1% | 12 | 4.2% | 10 | 3.5% | 24 | 8.5% | 30 | 10.6% | 9 | 3.2% | 9 | 3.2% | |
| Neutral | 24 | 8.5% | 48 | 17.0% | 21 | 7.4% | 39 | 13.8% | 43 | 15.2% | 47 | 16.6% | 47 | 16.6% | 52 | 18.4% | |
| Disagree | 116 | 41.0% | 116 | 41.0% | 106 | 37.5% | 111 | 39.2% | 116 | 41.0% | 103 | 36.4% | 106 | 37.5% | 119 | 42.0% | |
| Strongly disagree | 112 | 39.6% | 89 | 31.4% | 143 | 50.5% | 117 | 41.3% | 94 | 33.2% | 98 | 34.6% | 118 | 41.7% | 100 | 35.3% | |
| Mean values | | 4.07 | | 3.91 | | 4.34 | | 4.14 | | 3.95 | | 3.92 | | 4.16 | | 4.07 | 4.07 |
| Standard deviation | | 1.02 | | 1.01 | | 0.82 | | 0.93 | | 1.01 | | 1.05 | | 0.89 | | 0.87 | 0.95 |
| Median | | 4 | | 4 | | 5 | | 4 | | 4 | | 4 | | | | 4 | |

Organisational 3 'MOH hospitals offer clinical coding training programs' indicated the highest mean (4.34) and second lowest standard deviation (0.82) of all 23 items. Further, it is the only item that indicated a median of 5.00. Hence, half or more of the sample chose strongly disagree for the item.

Given the limitations in applying statistical techniques to ordinal data and the criticism of statisticians of the application of these techniques in social science analyses, establishing a logical link between two Likert items and manually examining the results provides a valid method to enhance Likert analysis.

In the training items (organisational 1-3), a logical association existed between organisational 3 (MOH hospitals offer specific clinical coding training programs) and organisational 1 (MOH hospital employees receive education and training to improve their performance and further their careers).

1) Logically, organisational 3 is a subset of organisational 1 which should be reflected in the responses. A level of agreement for organisational 3 implies a level of agreement for organisational 1. Inversely, a level of disagreement to organisational 1 implies a level of disagreement to organisational 3.
2) However, the reciprocal does not hold, meaning that a level of agreement for organisational 1 need not imply a level of agreement for organisational 3.
3) Alternatively, in the case of organisational 2 (MOH hospitals evaluate the effectiveness of staff training programs offered), while an association as a corollary to organisational 1 exists, there is no logical association that specifies a response.

Organisational 1 & 3 were relevant to every respondent in the sample, whereas there may have been some who had no idea whether the MOH evaluates training (organisational 2).

The progression from organisational 1 – 2 indicates a reduction in the mean from organisational 1 = 4.07 to organisational 2 = 3.91. Illustrating the Likert ordinal value changes that produce the .16 mean decrease.

1) strongly agree shows no change,
2) agree reduces by 1,
3) neutral doubles from 24 to 48,
4) disagree remains the same,
5) strongly disagree decreases by 23.

The ordinal changes are as follows:

23 x 5.00 (strongly disagree) to 23 x 3.00 (neutral) = 23 x -2 = -46

1 x 2.00 (agree) to 1 x 3.00 (neutral)

Hence, (-46 +1) ÷ 283 (sample size) i.e. -45 ÷ 283 = - 0.16 mean reduction

The increase in neutral for items that may have been beyond the knowledge of many staff members is reflected in the consistent rise of that measure from organisational 4 to 8.

In the organisational 4-6 staffing items, the highest levels of disagreement were for organisational 4 (sufficient clinical coders) with 16 levels of agreement. In organisational 5 (sufficient HIM) & organisational 6 (sufficient health informaticists), the levels of agreement doubled. Ironically, only one staff member from health informatics responded with a level of agreement and the occupation category returned a higher mean than the sample.

The technology items (organisational 7 & 8) saw the high neutral continue and levels of agreement at the minimum.

#### 8.4.8.1.1 The organisational category minority

To shed further light on the minority and reveal what this group might have known that differed from the remainder of the survey participants, those who responded agree (12) or strongly agree (1) to organisational 3 were examined as a group.

The thirteen respondents represented six of the seven study hospitals. MCH was not represented. The KFMC contingent included an expat male doctor, over 60 with a PhD, and an expat female other-health specialist, 31-40 with a bachelors, who seem to represent the core minority in their hospital. 10 respondents indicated a level of agreement for both organisational 3 & 1, while 3 indicated agree for organisational 3 and strongly disagree for organisational 1, which is an apparent illogical outcome.

In organisational 4, 5, 6 (staffing levels), the levels of agreement increased to as many as 35 respondents. However, as has been pointed out, the validity of this minority opinion is questionable considering that in organisational 6 (sufficient health informaticists) only one staff member of that category agreed.

### 8.4.8.2 Health information category results

What distinguished the organisational and health information categories, is that the former was concerned with the process taking place. Alternatively, health information was concerned with the actual knowledge required to enable the process to function. The health information group comprised two categories of association, namely: (1) health information category items 1-4, the benefits of ICD-10 and clinical coding, and (2) health information category items 5 & 6, the working relationship of physicians and coders, in terms of professional interactions and a satisfactory level of clinical diagnosis for ICD-10 coding. The Pearson two-tailed technique was used to estimate the correlations in each set of items.

**Table 8-15 Health information item group correlations**

| ICD/Coding benefit items | | Item 1 | Item 2 | Item 3 | Item 4 |
|---|---|---|---|---|---|
| Item 1 | Pearson Correlation | 1.00 | 0.70 | 0.63 | 0.59 |
| | Sig. (2-tailed) | 0 | 0 | 0 | 0 |
| Item 2 | Pearson Correlation | 0.70 | 1.00 | 0.75 | 0.73 |
| | Sig. (2-tailed) | 0 | 0 | 0 | 0 |
| Item 3 | Pearson Correlation | 0.63 | 0.75 | 1.00 | 0.73 |
| | Sig. (2-tailed) | 0 | 0 | 0 | 0 |
| Item 4 | Pearson Correlation | 0.59 | 0.73 | 0.73 | 1.00 |
| | Sig. (2-tailed) | 0 | 0 | 0 | 0 |
| **Physician/coder items** | | Item 5 | Item 6 | | |
| Item 5 | Pearson Correlation | 1.00 | 0.52 | | |
| | Sig. (2-tailed) | 0 | 0 | | |
| Item 6 | Pearson Correlation | 0.52 | 1.00 | | |
| | Sig. (2-tailed) | 0 | 0 | | |
| | N | 283 | 283 | 283 | 283 |

All correlations in the two groups were strong to very strong and highly significant. Health information category items 1-4 produced means between 4.13 and 4.16. Health information category items 5 & 6 showed lower means of 3.99 and 4.04 but both groups appear to indicate closely related items.

**Table 8-16 Breaks down the Likert levels per health information item**

| Health Information items | Item 1 | | Item 2 | | Item 3 | | Item 4 | | Item 5 | | Item 6 | | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Strongly agree | 3 | 1.1% | 2 | 0.7% | 3 | 1.1% | 2 | 0.7% | 4 | 1.4% | 2 | 0.7% | |
| Agree | 12 | 4.2% | 10 | 3.5% | 12 | 4.2% | 12 | 4.2% | 12 | 4.2% | 16 | 5.7% | |
| Neutral | 32 | 11.3% | 32 | 11.3% | 33 | 11.7% | 36 | 12.7% | 61 | 21.6% | 44 | 15.5% | |
| Disagree | 125 | 44.2% | 135 | 47.7% | 131 | 46.3% | 131 | 46.3% | 111 | 39.2% | 127 | 44.9% | |
| Strongly disagree | 111 | 39.2% | 104 | 36.7% | 104 | 36.7% | 102 | 36.0% | 95 | 33.6% | 94 | 33.2% | |
| MEAN VALUES | | 4.16 | | 4.16 | | 4.13 | | 4.13 | | 3.99 | | 4.04 | 4.10 |
| STANDARD DEVIATION | | 0.86 | | 0.81 | | 0.86 | | 0.84 | | 0.92 | | 0.88 | 0.86 |
| MEDIAN | | 4 | | 4 | | | | 4 | | 4 | | 4 | |

1) In addition to relatively equal mean values for the health information 1-4 group, the standard deviations were low and relatively equal, with all medians at 4.
2) The Likert response levels were similar for all items and in all four central tendency is evident with agree and disagree greater than strongly agree and strongly disagree.
3) The lowest sum of levels of disagree was 82%.
4) Between 12 and 15 respondents constituted the minority below neutral.
5) For health information 5 & 6, the slightly lower means of 3.99 and 4.04 appear closer than the drop of 17 for neutral and increase of 16 in disagree indicates.

#### 8.4.8.2.1 Health information category items 1-4 responses

The strong correlations of health information category items 1-4 constitute an ideal item set to investigate the consistency of responses. The items were similarly worded.

> Item 1. MOH hospital staff understand the usefulness of clinical coding in the storage and retrieval of medical data.
>
> Item 2. MOH hospital staff understand the usefulness of clinical coding in health information management and sharing.
>
> Item 3. MOH hospital staff understand the positive impact of clinical coding on healthcare quality, through its facilitation of statistics and research.
>
> Item 4. MOH hospital staff understand the usefulness of clinical coding in processing health insurance claims and hospital funding.

For those involved in healthcare and health information, these benefits can be grasped if not memorised in a single standard-length under-graduate level lecture by an enthusiastic trainer devoting ten minutes to each benefit. The terminology that is used to differentiate each item; namely, storage and retrieval, data, information management and sharing, healthcare quality, statistics and research, insurance claims and hospital funding, is not specifically healthcare terminology.

All 4 items returned levels of disagree of 82% or higher. Overall 10 respondents indicated a mix of levels of disagree and agree, while 10 opted for 4 neutrals.

**Table 8-17 Health information minority responses to health information category items 1-4 correlated items**

| | Demographics | | | | | | | | | | Health information | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 | 3 | 4 | Items 1-4 Median | VAR |
| 1 | KFMC | M | 51-60 | Non | Nurse | +15 | No | Yes | PhD | Uncertain | Ag | Ag | N | N | 2.50 | 0.33 |
| 2 | KFMC | M | + 60 | Non | Doctor | +15 | Yes | No | PhD | Fully | Ag | Ag | Ag | Ag | 2.00 | 0.00 |
| 3 | KFMC | F | 30-40 | Non | Other health | 6-10 | No | Yes | Bachelor | Fully | Ag | Ag | SD | Ag | 2.00 | 2.25 |
| 4 | IAAH | F | U30 | Saudi | Health Info | U5 | No | No | Bachelor | Partially | Ag | N | N | N | 3.00 | 0.25 |
| 5 | IAAH | F | 41-50 | Saudi | Med Recs | +15 | No | No | Diploma | Partially | Ag | Ag | Ag | Dis | 2.00 | 1.00 |
| 6 | IAAH | F | 30-40 | Saudi | Med Recs | 6-10 | No | No | Diploma | Partially | Ag | Ag | Ag | Ag | 2.00 | 0.00 |
| 7 | MCH | M | 41-50 | Non | Doctor | 6-10 | No | No | Master | Partially | Ag | SA | SA | Ag | 1.50 | 0.33 |
| 8 | BCH | F | U30 | Saudi | Non-health | U5 | No | No | Bachelor | Uncertain | SA | Dis | N | N | 3.00 | 1.58 |
| 9 | BCH | M | 30-40 | Saudi | Med Recs | U5 | No | Yes | Diploma | Uncertain | Ag | N | N | N | 3.00 | 0.25 |
| 10 | BCH | M | U30 | Saudi | Health Info | 6-10 | No | No | Diploma | Partially | Ag | Dis | N | Dis | 3.50 | 0.92 |
| 11 | BCH | M | 30-40 | Saudi | Med Recs | 11-15 | No | No | Diploma | Partially | Ag | Dis | N | SD | 3.50 | 1.67 |
| 12 | AIH | F | U30 | Saudi | Nurse | U5 | No | No | Bachelor | Uncertain | SA | SA | SA | SA | 1.00 | 0.00 |
| 13 | AIH | M | + 60 | Non | Doctor | + 15 | No | No | PhD | Fully | SA | SD | Dis | Dis | 4.00 | 3.00 |
| 14 | AIH | M | 51-60 | Non | Doctor | +15 | No | No | PhD | Fully | Ag | Ag | N | N | 2.50 | 0.33 |
| 15 | AIH | F | 30-40 | Non | Doctor | U5 | Yes | No | Bachelor | Uncertain | Ag | Ag | Ag | Ag | 2.00 | 0.00 |
| **Total agrees or strongly agrees** | | | | | | | | | | | 15 | 9 | 6 | 6 | | |

Table 8-17 is ordered by health information category item 1 and comprised the minority who responded strongly agree or agree to this item. The last column (variance) indicates individual variance across the four items.

#### 8.4.8.2.2 Examining the minority results (health information category items 1-4):

1) All 15 respondents in the minority table indicated strongly agree or agree for health information category item 1.
2) 9 respondents indicated strongly agree or agree for health information category items 1 & 2.
3) 6 respondents indicated strongly agree or agree for health information category items 1, 2 & 3.
4) Only 5 respondents were consistent and indicated strongly agree or agree for health information category items 1 - 4.
5) Additionally, two respondents managed 2 agrees and 2 neutrals, two managed 1 agree and 3 neutrals, and the rest interspersed agrees and disagrees etc.

#### 8.4.8.2.3 Composition of the minority (health information category items 1-4)

1) 15 respondents all indicated levels of agreement for health information category item 1. Among them were 5 doctors; 1 female, all expatriates. 3 of the doctors (AIH x 2, KFMC x 1) had PhDs, and had indicated ‘Fully completed’ for demographic 10. Additionally there was one nurse, 51-60 years of age, also with a PhD.
2) The 5 who indicated strongly agree or agree for all four items were 3 doctors (1 with a PhD), 1 nurse and 1 medical records staff member.

### 8.4.8.3 National category results

The nine national factor items covered a general understanding of the part played by the MOH in the provision of a national ICD-10 health information system, related software, and the funding of these in terms of maintenance, upgrades, and project development. Three additional items examined the importance of a national supervisory body, national health information exchange, and whether EHRs would assist the implementation.

The separate items were numbered national item 1 (supervisory body), national item 3 (national health information exchange), and national item 9 (EHRs would assist the implementation). National items 2 & 4 (national network, software, and the funding of these), national items 5 & 6 (sufficiency of national ICD-10 trainers and the potential need for additional coders), and national items 7 & 8 (funding of project development and upgrades) completed the category.

**Table 8-18 National group item correlations**

| Item 1 | National HIM supervisory body | | |
|---|---|---|---|
| Funding network/software items | | Item 2 | Item 4 |
| Item 2 | Pearson Correlation | 1.00 | 0.73 |
| | Sig. (2-tailed) | 0 | 0 |
| Item 4 | Pearson Correlation | 0.73 | 0 |
| | Sig. (2-tailed) | 0 | 0 |
| Item 3 | National network for exchanging health information | | |
| Trainers and coders items | | National 4 | National 5 |
| Item 4 | Pearson Correlation | 1.00 | 0.32 |
| | Sig. (2-tailed) | 0 | 0 |
| Item 5 | Pearson Correlation | 0.32 | 1.00 |
| | Sig. (2-tailed) | .000 | |
| Technology items | | Item 7 | Item 8 |
| Item 7 | Pearson Correlation | 1.00 | .63 |
| | Sig. (2-tailed) | 0 | 0 |
| Item 8 | Pearson Correlation | 0.63 | 1.00 |
| | Sig. (2-tailed) | 0 | 0 |
| Item 9 | EHRs will assist ICD-10 implementation | | |

The trainer/additional coder set showed a moderate correlation and the other two sets showed a high correlation. The following list highlights notable national items.

1) National item 1 (A Saudi health information management supervisory organisation monitors the implementation of ICD-10 in all health sectors). There is no national HIM supervisory organisation (SHIMA is the Saudi HIM professional body affiliated to IFHIMA). The item was inserted to test this knowledge. The sample mean was 4.10 indicating a reasonable level of general knowledge. The minority levels of agreement included several doctors and expatriates, though not the same composition that had featured previously.
2) National item 3 (an integrated, compatible network for exchanging health). The sample mean was 4.20; CORE HIM 4.33 indicating that the staff with more insight were even more unified in levels of disagreement.
3) National item 5 (MOH hospitals have sufficient ICD-10 course trainers). This was the most straightforward item in the group, producing a 4.03 mean with a minority of 25 that included some previous minority respondents.
4) National item 9 (reworded as 'the application of EHRs in MOH hospitals will have no bearing on the implementation of ICD-10'). This was also a tester in that the literature indicates many difficulties associated with setting up ICD-10 within an EHR

package. It is quite clear that at the time of the Australian, Canadian, and Thai transitions to ICD-10 EHRs were not being used in the context of hospitals and have no bearing on the knowledge and practices involved in clinical documentation and coding.

5) Examining the full survey totals and subtotals of response levels (Table 8-19) explains the lower means of some national items.

**Table 8-19 National category per item Likert values**

| National items | Item 1 | | Item 2 | | Item 3 | | Item 4 | | Item 5 | | Item 6 | | Item 7 | | Item 8 | | Item 9 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Strongly agree | 3 | 1.1% | 12 | 4.2% | 5 | 1.8% | 10 | 3.5% | 10 | 3.5% | 12 | 4.2% | 13 | 4.6% | 16 | 5.7% | 2 | 0.7% |
| Agree | 14 | 4.9% | 31 | 11.0% | 11 | 3.9% | 33 | 11.7% | 14 | 4.9% | 12 | 4.2% | 26 | 9.2% | 23 | 8.1% | 18 | 6.4% |
| Neutral | 39 | 13.8% | 69 | 24.4% | 36 | 12.7% | 65 | 23.0% | 49 | 17.3% | 47 | 16.6% | 57 | 20.1% | 57 | 20.1% | 50 | 17.7% |
| Disagree | 124 | 43.8% | 102 | 36.0% | 101 | 35.7% | 110 | 38.9% | 95 | 33.6% | 124 | 43.8% | 102 | 36.0% | 113 | 39.9% | 99 | 35.0% |
| Strongly disagree | 103 | 36.4% | 69 | 24.4% | 130 | 45.9% | 65 | 23.0% | 115 | 40.6% | 88 | 31.1% | 85 | 30.0% | 74 | 26.1% | 114 | 40.3% |
| Mean values | | 4.10 | | 3.65 | | 4.20 | | 3.66 | | 4.03 | | 3.97 | | 3.78 | | 3.73 | | 4.08 |
| Standard deviation | | 0.89 | | 1.09 | | 0.93 | | 1.06 | | 1.05 | | 1.01 | | 1.11 | | 1.11 | | 0.95 |
| Median | | 4 | | 4 | | 4 | | 4 | | 4 | | 4 | | 4 | | 4 | | 4 |

1) Nationals 2 & 4, which were correlated as the set of items on the installation and funding of a HIM network for exchanging health information, indicated levels of disagreement at approximately 60%, while neutral rose to almost 25% and levels of agreement to 15%. In contrast national 1 indicates levels of disagreement at 80% and levels of agreement at 6%.
2) Nationals 7 & 8, on the funding of technology and software upgrades were similarly correlated and produced similar results to nationals 2 & 4, with the means for the four items ranging from 3.66 to 3.78.
3) The high neutrals in these four items seem to indicate that these were the most difficult items for the sample to deal with.

#### 8.4.8.3.1 The national category minority

Despite the variation between single items in the category, producing ups and downs in the means and levels of neutral, 12 respondents produced individual means below 3.00 for the 9 national items. The group consisted of:

1) Hospitals: MCH x 5, AIH x 4, BCH x 2, and AYH x1.
2) Occupations: doctors x 5, nurses x 5, medical records x 1, and non-health x 1.
3) Nationalities: Saudis x 6 and expatriates x 6.
4) Most had already been included in a previous minority grouping.

### 8.4.9 Assessment of the questionnaire

The Likert values assigned to 23 items by 283 respondents were computed in SPSS into a single value for each respondent. Additionally, individual items regarded as more important or forming a part of important groups were examined separately.

1) The maximum of the individual computed mean was 5.00 representing those who responded with 23 x strongly disagree.
2) The fact that the minimum mean was neither 1.00 nor 2.00 indicates that nobody responded with the same level of agreement to all 23 items. The lowest two computed means were the two MCH doctors, the expatriate male with 2.39 and the Saudi female with 2.61.
3) The median of 4.00 indicates that this was the middle value of the 283 values, 141 values were greater or equal to 4.00 and less or equal to 5.00. Alternatively, the values 142 to 283 were spread over a range between 2.39 (minimum) and 4.00.

4) The analysis revealed biases that are common in Likert scale surveys.
5) While one group of respondents responded with a 5.00 (strongly disagree) for every item, another group produced a response of 4.00 (disagree) to each of 23 items, which in many ways amounts to a similar response in terms of relative consistency and evidence of the central tendency principle.
6) Other respondents showed certain patterns; for example, opting for neutrals rather than making a definite statement.

All in all, the sample left no doubt that the staff perspective of most respondents was that the implementation of ICD-10 and clinical coding in Saudi MOH hospitals leaves a lot to be desired. Most respondents had not been given any of the training considered essential and the whole implementation was lacking in organisational preparations. This was already evident from three of the demographic items.

It was clear to the researcher, based on responses to some items, that the introductory level of training expected had generally not taken place. However, it was also apparent, based on the contrasting responses of a minority, that certain individuals in the sample had been exposed to a level of training and that in at least one of the hospitals clinical coding had commenced.

### 8.4.10 Summary of the persistent minority

The primary reason for the detailed analysis of the minority was to highlight the contradictory opinion on staffing, training, and health information. The minority generally consisted of more highly qualified members of the sample who indicated that training was taking place and that additional trainers were unnecessary. At KFMC, AIH, and BCH, there was a minimum of one doctor, one nurse, and a CORE HIM member who perhaps had a designated leadership role among their occupational category. Several minority members indicated that the implementation was fully complete.

It would seem most unlikely that well-qualified, healthcare professionals would consistently indicate opposite responses if they did not have a basis for these responses. Although the minority was never entirely the same and indicated some illogical responses, the evidence suggests that the implementation has been initially entrusted to a small group of employees, which is diametrically opposed to the accepted practice in developed nations.

## 8.4.11 Survey part 3: Open-ended question

Part 3 of the survey requested participants to respond to an open-ended question: 'In your opinion, what are the factors that would facilitate implementing clinical coding?'

A total of 101 respondents provided additional data. Qualitative content analysis was used to identify common responses to the open-ended survey question and highlight themes. The responses fell into either the organisational or national factor categories with none touching on the concepts that were grouped in the survey under health information, which referred to understanding the purpose and benefits of ICD-10. The most common themes in order of frequency were:

1) The need for additional health information specialists and qualified ICD-10 trainers.
2) The need for training programs in clinical coding, ICD-10, medical terminology, English language usage, and CDI.
3) The need to upgrade the HIT infrastructure and implement EHRs.

### 8.4.11.1 Areas of priority

1) The need for health information specialists or experts and qualified ICD-10 trainers.

A37 'Recruitment of a higher number of qualified and experienced health information specialists works to facilitate the implementation process.'

A29: 'There is need to contract with qualified clinical coders to compensate [for] the shortage of current clinical coders.'

2) Training and education programs in clinical coding, ICD-10, medical terminology, English usage, and CDI.

A32: 'I am a Saudi lady. I am [a] certified clinical coder specialist. And no organisation or people [has given] me [a] chance to improve the coding process. There is no training centre in Saudi Arabia.'

A79: 'The MOH must do intensive training sessions for all staff who are using ICD-10 in all regions in Saudi Arabia.'

A68: 'Since [the] MOH announced the implementation of clinical coding, training programs in ICD-10, English language and medical terminology were totally ignored for the medical records staff, and consequently, this will create a major obstacle to implementation.'

3) Upgrading HIT infrastructure and adopting EHR.

A98: 'The hospitals need to implement the standardised EHR system and improving the [HIT] infrastructure to be able [to] implement ICD-10 successfully which relies mainly on accurate documented clinical information.'

A83: 'There is [a] need to improve the electronic health role in all MOH hospitals regarding health information by improving the methods of organising and storing this information accurately and properly. One of those important methods is EHRs.'

A78 'There is [a] need to improve the electronic health infrastructure and adopt the EHRs and the related ICD-10 software which can be [a] help [to] clinical coders to dispense of the traditional methods of searching and coding of the manual files.'

#### 8.4.11.2 Value of the Open-ended Question

Answers highlighted the areas of the implementation that concerned those who volunteered to complete the question. It was noteworthy that staff members rated the need for specialist staff, as well as additional staff members qualified in clinical coding, as higher priorities than the need for training.

## 8.5 Results of the semi-structured interview

The individual insights of MOH public hospital staff on the study question began to take shape in the qualitative responses to the single open-ended question that formed Part 3 of the survey. Many wrote with passionate expression, making an impact that cannot be derived from academic literature or the results of survey items.

The sample for the qualitative semi-structured interview was selected purposively and consisted of eight participants from the seven study hospitals. All, except one doctor (denoted as KF1) were HIM specialists, among them clinical coders. The interview data were analysed using the thematic analysis method, initially identifying the research variables, namely the factors influencing the implementation of clinical coding, and thereafter encoding the relevant statements contained in the interview transcriptions. The final generated themes, sub-themes, and the common themes revealed from the main transcripts were summarised and presented in Table 8-20, which is derived from the initial thematic map of the transcripts (see Appendix 18).

**Table 8-20 Thematic categories and sub-categories**

| Thematic Category | Thematic Sub-Category | Common Themes Revealed (codes) |
|---|---|---|
| Implementation Status | Ratios of Implementation | Status of implementation differs among hospitals due to differences in:<br>1) Numbers of specialist and specifically trained staff<br>2) Levels of training in workforces<br>3) Coding abilities and experience<br>4) General organisational awareness of the benefits of implementation (below) |
| | Benefits of Implementation | 1) Standard international ICD-10 classification and coding of diseases and procedures, as well as causes of mortalities.<br>2) Increased accuracy in the clinical documentation of diagnoses.<br>3) Standard international method of medical insurance claims submission and reimbursement.<br>4) Accurate coding of diagnoses and procedures for research.<br>5) Standardising the coding of drug therapies and surgical procedures to track results.<br>6) Researching verified statistics on the prevalence and distribution of diseases and procedures.<br>7) Quality assessment of hospitals through the monitoring and evaluating treatments and outcomes.<br>8) Improving healthcare efficiency and accuracy. |
| Factors which will negatively influence implementation | Organisational | 1) Absence of hospital implementation planning and preparation<br>2) Lack of training opportunities and the need for training<br>3) Lack of trained employees and specialised staff (clinical coders)<br>4) Poor organisation and execution of MOH courses |
| | Health Information | 1) Negative consequences for hospital reimbursement of incomplete or incorrect coding, as well as the impact on valid statistics and research data<br>2) Lack of doctor and nurse cooperation with medical records staff querying clinical documentation<br>3) Inadequate development of computer and information technological infrastructure |
| | National | 1) Absence of supervisory organisation for ICD-10-AM implementation<br>2) Traditional expatriate language difficulties and complications<br>3) Poor financial support for hospital implementations<br>4) Employee resistance due to lack of awareness; MOH must raise awareness at all levels of employees<br>5) Lack of interoperability and health data standards<br>6) Need for terminology standardisation through EHRs<br>7) Implementation strategy unclear; lack of structured departmental objectives |

### 8.5.1 Theme 1: Ratios of implementation

The implementation status of the study hospitals was addressed by the final demographic item of the questionnaire and returned a high level of uncertain responses, although far less uncertainty was indicated in the health informatics and medical records categories.

Overall, however, the interviewees agreed that the implementation process was incomplete. The question of an agreed definition for a completed implementation was raised. Did it refer merely to the in-hospital function of doctors submitting their clinical documentation to the clinical coders in medical records, or should it refer to the full organisational process of all departments (i.e. pharmacy, radiology, wards) inputting data to be coded for claims submissions?

#### 8.5.1.1 Variations in implementation status in public hospitals

All interviewees agreed that the status of implementation was either incomplete or had not yet commenced:

KF2: 'Currently, clinical coding implementation is considered to be incomplete, especially in MOH public hospitals and primary health centres, where the level of implementation varies according to the entity providing the medical services.'

The interviewee summarised the national implementation differences (1) Primary health-care centres: not yet commenced; public hospitals: application around 50%: referral hospitals: application 100%; (2) Private sector: application 100%; (3) Other governmental sectors; namely, military hospitals and King Faisal Special Hospital and Research Centre: application 100%.'

BM: 'MOH public hospitals lagging. The system exists in some larger referral hospitals, as well as private hospitals, but I think it is not applied in small public hospitals under the MOH, due to the lower capabilities and insufficiency of trained manpower and lack of infrastructure of health data management systems and information technology. The workforce needs training and that includes doctors, medical coding specialists, and those who review their inputs. Health information systems management is a rare specialisation and the number of specialists is low.'

KF1: 'Clinical coding presumably begins with the pathological case from the beginning, i.e. from the primary health care centres first before being converted to hospitals. So that at present, the medical coding is not applied in primary health care centres and there is no strategy to use it in the primary health care centres.'

#### 8.5.1.2 Reasons for incomplete status

It was ascertained that the six hospitals, other than KFMC, were either in the preliminary stages or had not embarked on the implementation process, as they had no qualified clinical coders. Other reasons for the incomplete organisational process included the lack of specialist staff, non-provision of training courses resulting in an inadequately trained workforce, and incorrect and incomplete coding, all of which varied from hospital to hospital.

IA: ‘There is a great shortage of specialist medical coding staff. The staff of medical records, consisting of four employees, is currently dealing with ICD-10-AM/ACHI in our hospital. In addition, there is no electronic medical coding in this hospital.’

#### 8.5.1.3 The benefits of ICD-10 implementation

The MOH decision to purchase a licence to use the ICD-10-AM package was driven by the need to achieve functionality of the national health insurance scheme. The wider benefits of implementing ICD-10 and clinical coding were referred to in the interview, initially as a means of general assessment of the knowledgeability of the interviewees. An organisational awareness of these benefits forms the basis of the general organisational training considered essential to ICD-10 implementation in the literature. It is vital that personnel who have any involvement with the recording of data, whether in documentary or coded format, understand its short and long-term purposes and that all inaccuracies have consequences on several levels.

IA: ‘The clinical coding system is considered one of the most important systems in the management of medical data and its storage and recovery, for later use in several areas including classification and coding of diseases and procedures, knowledge of causes of death, medical statistics, facilitating research, [and] finally, using the clinical coding system in medical insurance and financial claims.’ Very similar coverage was presented by other participants.

The participants confirmed that their understanding of the purposes of implementing clinical coding is, at least partly, due to their professional experience in HIM and that the MOH had failed in not providing the general organisational ICD-10 awareness training, irrespective of the essential clinical coding training for designated clinical coders.

### 8.5.2 Theme 2: Factors influencing the implementation

The factors influencing clinical coding and ICD-10 implementation in Saudi public hospitals were, again, classified into the three thematic categories; namely, organisational, health information, and national as established by analysis of the literature reviewed and illustrated above in Table 8-20.

The most voiced concern of the interviewees was the lack of training. This included clinical coding training essential for medical records staff, CDI for doctors, and general ICD-10 awareness training for all staff. Other recurring responses highlighted the lack of HIM specialists, the need for development of the information technology infrastructure, and the potential benefits of using EHRs in conjunction with ICD-10 and clinical coding. Several interviewees criticised the absence of a Saudi HIM supervisory organisation, the failure to follow a clear implementation strategy, and the language barrier. The need for the appointment of hospital management representatives to liaise with the MOH on individual hospital requirements and a general sense of MOH neglect among public hospital staff were also mentioned.

### 8.5.2.1 Organisational considerations

#### 8.5.2.1.1 Inadequate training

KF1: ‘In Saudi Arabia, there is no recognised training in medical coding, and it is difficult for some to travel overseas.’

YH: ‘There is a lack of training and education programs on the importance of clinical coding in general at MOH hospitals.’

KF2 ‘Train doctors, who are responsible for using ICD-10-AM (disease coding), on how to choose the correct disease codes. Currently, the doctors in our hospital select ICD-10-AM diagnosis codes necessitated by poor organisation of MOH training courses. The MOH must also attract qualified personnel in the field of health information systems and clinical coders.’

BM: ‘Training doctors who are responsible for medical coding on how to choose the correct medical codes in electronic medical systems, so that incorrect data is not being stored in the hospital records.’

The interview participants extended their description of training that is lacking to the general awareness training intended to produce a workforce that comprehends the benefits of clinical coding for both diseases and procedures.

YH: ‘The majority of people who are working in MOH organisations do not know what the ICD-10 means and the benefits of using ICD-10, so there is [a] need in the beginning of the implementation to increasing the awareness about this system by providing training and workshops for all staff.’

IA: ‘The MOH needs to develop a training process for all hospitals, by assigning personnel who are qualified and trained in specific electronic systems such as EHR to train staff in other hospitals.’

KS: 'There are several obstacles that prevent the application of clinical coding systems, the most prominent being the lack of medical records staff training.’

YH: ‘There is a shortage in specialised courses to introduce the system, as well as medical records staff and doctors training and also health informatics staff, so that the lack of this type of courses preclude the system application effectively. There is also a severe shortage in the number of specialised staffs in the coding system as we don't have trained and qualified employees. Despite of that, I'm a medical records manager here in the hospital and there is the absence of courses. Consequently, I think this will be the main challenge that will prevent the complete implementation of ICD-10 in all public hospitals.’

#### 8.5.2.1.2 Healthcare professionals requiring prioritised training:

Most interviewees responded that training was necessary for specific personnel in HIM and affirmed the need for the training doctors to use the coding system.

KF2: ‘All categories of doctors (consultant, fellowship, and resident), in addition to relevant personnel in [HIM]’.

KS: ‘Employees who need training in clinical coding are medical records department staff, [HIM] staff, and physicians.’

BM: ‘The MOH announced the implementation of clinical coding without providing training courses for healthcare professionals [in HIM] or doctors.’

IA: ‘The Ministry must arrange a series of training courses and workshops attracting qualified trainers to train the related healthcare professionals who are dealing with ICD-10.’

#### 8.5.2.1.3 Staff resistance to the implementation

Several participants emphasised the impact of staff resistance, resulting in poor case descriptions and inferior clinical documentation in manual records, as well as retarding the implementation process.

KS: ‘The absence of effective basic training for physicians and the medical records staff or coders has generated a lack of knowledge and hence a resistance to change.'

KF2: 'The lack of physician training in clinical coding can give rise to the resistance of implementation as was done with [the] EHR system. The MOH needs to draw up a unified strategy [for the] implementation process in public hospitals under the observation [of a] supervisory committee in [the] MOH which should be established for this purpose.'

#### 8.5.2.2 Health information considerations

##### 8.5.2.2.1 Incomplete and inaccurate coding

AY: 'The factors that will facilitate the accurate coding are as follows: (1) The employees who deal with ICD-10 must be fluent in English, (2) The employees who deal with ICD-10 must be known [sic] medical terminology, (3) The employees who deal with ICD-10 must be known pharmacology, for example if there is a diabetic patient, it very important to distinguish which kinds of Insulin [are to be] used (Drugs or Insulin needles) and put the appropriate code, (4) The employees who deal with ICD-10 must be known anatomy and physiology and (5) Clinical documentation must be accurate and clear. Thus, we can say that the key of ICD-10 implementation is good clinical documentations.'

KF2: 'Training doctors who are responsible for using the diagnostic coding system ICD-10-AM (in outpatient clinics) on how to choose the correct codes in electronic medical systems is essential.'

##### 8.5.2.2.2 Poor doctor/nurse – clinical coder relationships

IA: 'The lack of cooperation of doctors and nurses with medical records staff in clarifying diagnosis and medical procedures obtained by the patient in the manual medical file will be a barrier to use ICD-10.'

BC: 'The implementation strategy is supposed to ensure collaboration among clinical coders with clinical practitioners such as physicians and nurses to enhance the successful implementation, and its sustainability on the same level in all hospitals.'

AY: 'The absence of effective communication of some clinical professionals such as physicians with us [medical records staff-coders] is considered a barrier to the correct coding.'

### 8.5.2.3 National considerations

#### 8.5.2.3.1 Poor interoperability and health data standards

IA: ‘There is also a need to use standard health information systems, and develop and apply unified, integrated and compatible electronic systems in all hospitals to facilitate unified electronic systems. Perhaps, the costs of developing the IT infrastructure in all hospitals, as well as implementing EHRs, are obstacles facing the MOH before implementing the clinical coding system.’

KS: ‘There are several obstacles that prevent the application of clinical coding systems, the most prominent being the non-application of standardised EHRs to improve the side of clinical documentation and overcome the language barriers in manual files, as well as the computer infrastructure, including information systems networks, software and hardware that need to be developed in public hospitals. In addition, in many of MOH hospitals there is a lack of health information standards. This represents an obstacle to implementing clinical coding.’

#### 8.5.2.3.2 The need for a national supervisory organisation to monitor the implementation

KS: ‘Establishing a national supervisory committee to monitor the implementation [of] ICD-10 focused [on] the following goals: (1) Reviewing the current state of execution of national encoding (ICD-10) in all three health sectors (MOH, other governmental and private sectors). (2) Preparing a strategic plan to execute medical encoding (ICD-10). (3) Preparing a vision for integrating plans, such as training requirements (e.g. trainees, training centres, trainers, costs, etc.). (4) Preparing awareness and education programs for health workers about the importance of medical encoding. (5) Preparing a blueprint to ensure continuity in execution of the plans.’

BM: ‘The successful ICD-10 adoption in Saudi hospitals involves establishing a national of supervisory organisation to monitor the hospitals needs as there is an obvious of disparity from one hospital to another with regard to readiness of [the] implementation process.’

#### 8.5.2.3.3 The language barrier

BM: ‘Medical records staff often meet a problem to read the patients files as some of those problems are related to the lack of clear medical documentation and others related to the employee's language skills. Thus, by using EHRs, training the physicians and improving the clinical documentation can eliminate the problem of illegible [records] as well as improving the English language for medical records staff.'

#### 8.5.2.3.4 Ministry of health financial support for HIM and HIT upgrades

AY: 'Decision makers in Saudi government should provide adequate budget for development [of] the HIT infrastructure, recruitment specialists and increasing the specialised courses [in] training.

BC: 'Cost of providing clinical coding courses in all regions of the Kingdom and increasing the specialised staff also could be a significate [sic] barrier to implement ICD-10.'

BM: 'The MOH must clarify the strategy applied to clinical coding, as well as provide the required budgets for training and employing coding specialists in all MOH hospitals.'

## 8.6 Resultant themes from the qualitative analysis of factors impacting on the implementation

Combining the qualitative analyses of the open-ended survey question and the interview on factors perceived to be influencing the commencement of the implementation of clinical coding revealed a need for:

1) skills development training programs for staff directly involved with documentation inputs and coding practices to support correct coding and ICD-10 awareness education for other staff.
2) additional specialist trainers and coding and CDI experts.
3) the application of EHRs and ICD-10 classification/coding software to standardise clinical documentation and terminology and reduce language barriers.
4) an upgrade of the HIT infrastructure

Currently, the status of implementation is extremely low, with only one study hospital fully engaged in clinical coding. The qualitative participants confirmed that MOH public hospital implementation is far lower than that in the private and other government sectors.

The qualitative sample confirmed the survey results with greater intellectual authority, due to their professional capacities, experience, and general healthcare knowledge.

## 8.7 Interpolation of qualitative and quantitative results

Interpolating the results of the quantitative and qualitative study instruments, including the statistics derived from specific survey demographic items, indicated that the following factors have a negative impact on the implementation of ICD-10-AM and clinical coding in Saudi MOH public hospitals:

A. Organisational factors:

1) Only 9.2% of the sample were certified clinical coders, 15.2% had completed a training course in ICD-10, and 5.3% had undergone both types of training (only one in medical records).
2) Only 3 out of 44 medical records staff members representing the seven study hospitals were certificated in clinical coding. The remainder have had no training provided and the likelihood of having the required level of anatomy, pathology, and procedures knowledge is small. Doctors and nurses need CDI training, other specialists need training in procedure documentation, while all hospital staff in the occupational categories that constituted the study require an ICD-10 introductory course and training in medical terminology.
3) There exists a severe shortage of HIM specialists, experienced clinical coding trainers, and experts both for training and supervisory purposes.
4) The general shortage of staff prior to commencement of the implementation places an additional burden on implementing a new system.
5) Some participants perceived that inadequate HIT technology and an outdated HIM system to facilitate circulating, sharing, and exchanging data records for hospital and remuneration purposes create an additional burden.
6) The reference of one interviewee to 'poor organisation of MOH training courses' is fundamental. There is a noticeable gap between the MOH and Saudi government projections and the realisation of these. It seems that sound chronological planning and the implementation of successive phases of plans is not adhered to. Without the foundation of an organisational plan, the organisation will be lost.

B. Health information factors:

1) The reliance on doctors rather than clinical coders to do diagnosis coding places an added burden on their performance of their duties and will certainly cause dissatisfaction among medical records staff who were led to believe that they would be retrained as coders.

2) In general, there was a pessimistic attitude among the study population and a feeling of having been neglected by the MOH.

C. National factors:

1) There was an expectation that the traditional Saudi healthcare language barrier would be exacerbated by the exacting language requirements of standardised coder-friendly clinical documentation.
2) The failure of the MOH to constitute an effective national body to standardise and supervise the national ICD-10-AM implementation was criticised.
3) Uncertainty existed whether the MOH has the finance to fund the required training courses and technology upgrades.

D. Factors that would positively support the implementation:

1) The root cause of the weak ICD-10 implementation is that the MOH priority is to get Saudi health insurance scheme up and running. If the MOH was seriously concerned about implementing health classification and coding, they would have set about it in the way that it has been successfully implemented in other countries and allotted the time necessary for planning and training.
2) The MOH must develop skills training courses in coding, CDI, and an introduction to ICD-10 awareness course. Boosting individual hospital staff complements with experienced instructors and improving the current HIT system are the absolute minimum.
3) It goes without saying that all improvements to the areas of negative assessment applied would further support the implementation.
4) The bottom line is that there is no shortcut; introductory and incremental training cannot be avoided. Staff members appeared to be labouring under a myth that installing an EHR system incorporating ICD-10 coding software would provide implementation support. This is not a short-term solution and in no way circumvents the need for ICD-10 classification and coding training and the acquisition of an adequate level of anatomy, pathology, and hospital procedures knowledge, as well as medical terminology through training.

## 8.8 Validity of results

The relatively high means and low standard deviation levels for all 23 survey items confirmed the validity and conclusiveness of the quantitative instrument, although the detailed analysis indicated inconsistencies per study hospital and a minority perspective that differed from the vast majority.

The open-ended question responses, prompted by the survey items, provided an initial qualitative source of data, through which to understand the perceptions of the whole sample more objectively. The purposive selection of the semi-structured interview sample brought together participants with greater experience and insights into HIM as practiced in the Saudi public hospitals of the study. The role of the researcher in guiding the interviewees proved effective in covering all factors relevant to implementing ICD-10 and clinical coding as revealed in the extensive literature review, and obtaining the comparative data in the context of the Saudi public hospitals of the study.

# 9 Chapter Nine: Discussion and Conclusion

## 9.1 Introduction

The thesis covered the related healthcare background and implications of the Saudi government's decision to implement ICD-10-AM, the Australian modification of the basic WHO ICD-10 classification, throughout the country and examined a single research question 'What are the factors influencing the implementation of ICD-10-AM and clinical coding in Saudi public hospitals?' ICD classification and the clinical coding of hospital data is now viewed in the developed nations as the fundamental source of information on which to base improvements in the quality of healthcare.

This final discussion chapter commences by contextualising the researcher's decision to embark on the study and his inherent assumptions leading to the administration of the study instruments, in the light of the historic decision taken by the Saudi government and the MOH publicity that preceded the commencement of the ICD-10-AM implementation in public hospitals. This is followed by an interpretation of the findings of the study, and the application of these findings to the broader context of Saudi healthcare and the literature reviewed. The final sections cover the success and relevance of the study, its limitations, suggestions for future research, and closes with a conclusion of the study.

## 9.2 Context of the study

While some developed nations commenced morbidity coding in the post-World War II period, there remain nations which have not yet formally implemented clinical coding. Among these are Saudi Arabia and other GCC countries. A preliminary examination of international ICD-10 literature at the commencement of the study showed that the developed nations and several developing nations had either already transitioned or were about to transition from ICD-9 to ICD-10. The Saudi Arabia implementation of ICD-10 and clinical coding is extremely late in relation to many countries, but the national experience of implementing from scratch can still serve other nations in the future. Further, ICD-10 surpasses the previous version so significantly in extent and specificity that even for HIM departments well-versed in clinical coding, it requires lengthier and more comprehensive implementation preparations.

The historic impetus for the Saudi national implementation was the government's need to find alternative healthcare funding sources that led to the establishment of the CCHI and launch of a three-phase health insurance scheme in 1999, which never got past the first stage. Analysing and debating the failures of the Saudi MOH to follow through with reform plans has been a popular topic in Saudi healthcare research. As modern hospital billing for health insurance reimbursement is grouping-based rather than item-based, and in the case of Australia the underlying grouping factor is diagnosis-related and relies on the classification and coding of the complete diagnosis and interventions of an episode of in-patient hospitalisation, the decision was taken to purchase the Australian-modified ICD-10-AM package.

The signing of the agreement between the two governments was publicised on the MOH portal in January 2013, with the national implementation date for ICD-10-AM/ACHI/ACS and AR-DRG (2012 versions) set for 1 July 2013. The statement included: 'An extensive education program is being developed by the MOH which will prepare clinical coders, clinicians, and data users for the transition to ICD-10-AM' (Ministry of Health, 2013a. para.8). The portal mentions briefing sheets to:

1) increase awareness and knowledge of ICD-10-AM and its implementation;
2) assist an understanding of how ICD-10-AM will affect current practices;
3) inform creators and users of coded data of the implementation process;
4) enable hospitals and software suppliers to prepare for the implementation of ICD-10 -AM (Ministry of Health, 2013a, para 9).

## 9.3 Mixed methods research instruments

The researcher was aware of the limited time constraints of his single visit back home to Saudi Arabia from Australia and, thus, planned a mixed methods enquiry consisting of a quantitative survey completed by a random voluntary sample of staff members of the seven hospitals and six occupational categories, followed by a small purposively selected sample of HIM and an expert interacting in a qualitative semi-structured interview.

## 9.4 Administration of the research instruments

The three-part survey, comprising respondent demographics, quantitative questionnaire, and voluntary qualitative open-ended question was distributed, completed, and collected in January 2016, three years after the MOH portal announcement of the agreement and two-and-a-half years after the proposed national implementation date of 1 July 2013. Eight semi-structured interviews were conducted, by appointment, over the next few days.

When the researcher arrived back in Australia and came to terms with the results, there was little sign that the expected implementation preparations and publicised MOH promises had borne any fruition for the majority of staff members, who must surely have asked themselves: ‘What is in it for me, the forgotten medical records clerk, after all the publicity about restructuring our department as the centre of clinical coding in our hospital?’

The literature of the most experienced nations is emphatic that implementing an ICD-10-classification and the associated practice of clinical coding of inpatient hospital episodes require a minimum of an introductory awareness training for the whole organisation, as well as specialised training for HIM staff, doctors, and other professionals providing information that needs to be coded. Approximately 70.5% of the responses indicated levels of disagreement for the 23 items that queried aspects of preparatory training, basic knowledge of its value in healthcare, and its national implications through a shared network. Approximately 16% of all responses indicated neutral or ‘I don’t know’. That left around 13.5% of all responses indicating that throughout the 23 items, some members indicated an alternative experience and perspective of the implementation from the majority.

## 9.5 Expected planning and research assumptions

The December 2011 edition of IFHIMA Global News, was largely devoted to Mr. Hussein Albishi, HIM advisor to the former of deputy minister of health HIM & clinical coding specialist, who at the time of this research was IFHIMA regional director for the eastern Mediterranean zone (Albishi, 2011).

Albishi presented a detailed account of the status quo and planned developments of HIM in Saudi Arabia, including the background to the establishment of the SHIMA, to inform the international HIM community. He mentioned: ‘In December 2010, I was offered a contract for six months by the CHS to manage the implementation project of ICD-10-AM in Saudi Arabia’ (Albishi, 2011, p.6) and proceeded to describe the planned national restructuring of MOH hospital medical records departments in preparation for the advent of ICD-10-AM, which was in the pipeline although the contractual details were only concluded a year later. In 2014, Albishi's coverage of Saudi eHealth concluded: 'The Saudi National eHealth Strategy will leverage the ICD-10 implementation' (Albishi, 2014a, p. A10). The appearance of entrepreneurial clinical coding training companies such as Arizona in Saudi Arabia occurred the following year (Arizona Computer Services, 2015).

It was based on this show of confidence to the HIM world that the idea of a thesis on the implementation of ICD-10-AM in Saudi Arabia was conceived. While Saudi private hospitals had long been using the WHO ICD-9 or the US clinical modification ICD-10-CM (Bah et al., 2015), MOH public hospitals had not previously practiced clinical coding, and the literature showed no complete studies of an implementation from scratch. Thus, it seemed valid to fill a gap and research the factors influencing the implementation.

The early post-implementation Australian literature pointed to a four-year period of immaculate national preparations that commenced in the NCCC. It was made clear at the launch of ICD-10-AM between 1998 and 2000 that not only would the clinical coding workforce be required to produce coding of far greater specificity and detail than had been the ICD-9 standard, but that coders would also require additional knowledge of anatomy, pathology, and hospital procedures (Roberts et al., 1998). The subsequent literature attributed the success of the Australian implementation, as largely due to the immaculate preparations and the part played by the clinical coder national workforce in assimilating the information presented in the handouts, training courses, and workshops organised to prepare them (Innes et al., 2000).

The researcher, thus, assumed that in the three years that followed the signing of the ICD-10-AM contractual arrangement between Australia and Saudi Arabia, the advised implementation preparations and essential coder training and general organisational awareness, as specified on the MOH web portal, would have been put into practice. According to the literature and the Saudi publicity surrounding the acquisition of ICD-10-AM, medical records staff would be certified in clinical coding and the balance of the professional staff would have attended introductory training providing an understanding of the relevance of ICD-10 classification and clinical coding.

## 9.6 Demographic data of the quantitative respondents

The sample composition varied in each of the seven study hospitals and in each of the six occupational categories. While the full sample gender breakdown indicated that 62% of the respondents were female, KFMC and BCH had male majorities. In the occupations, only nursing and medicine had more females than males. It was clear that the overall sample female majority was attributable to the fact that nursing which comprised 41% of the sample had an 84% female representation.

Age was examined using five brackets; combining the two lower brackets and the three higher indicated that 74% of the sample was under 40 years of age. Expatriates constituted 41% of the sample; KFMC indicated 60% expatriates while BCH had only 15%. Four professions showed greater Saudi representation, while nursing and medicine again differed indicating 64% and 66% expatriates, respectively. These two occupations were also the most represented in the sample population. The breakdown of occupations showed nursing (41%), medicine (17%), followed by medical records (16%), Health informatics (10%), other health (10%), and non-health (7%). While the KFMC sample contingent had 23 (49%) nurses, the BCH contingent had only 6 (8%) nurses. Alternatively, KFMC had only 1 (2%) medical records staff member, while BCH had 12 (35%).

The sample indicated 63% of respondents had degrees and 37% diplomas. While all sample members in medicine had degrees, only 3 of 44 (5%) in medical records staff were degreed.

## 9.7 Unexpected quantitative data from the respondent demographics

Demographic items 7 and 8 requiring a Yes or No response investigated the clinical coding and classification-readiness of the potential workforce responsible for HIM and clinical coding in the study hospitals, as well as the overall organisational awareness levels. These two demographic attributes, the first representing proof of attainment of a specific level of competency (certification) in a clinical coding training course and the second, an introduction to the classification structure, level of specificity, terminology, and codes of ICD-10, represent occupational skills. Either a staff member has them or does not, although they may be taught in the workplace to existing employees who did not have them at the commencement of their employment. Alternatively, demographic 9, represented a general qualification, such as a degree or diploma in a professional field. The implementation of clinical coding in a hospital information system demands that all HIM staff have had some exposure to the systematic practice of clinical coding, and in the Saudi plan described by Albishi (2011), it was stated that the medical records staff of each hospital would be trained to the level of qualified clinical coders. No healthcare degree or diploma will cover this aspect unless that skill has been included in the course components.

The results of demographics items 7 and 8 fell way below the anticipated levels of training course provision. Only 47 out of 283 (17%) of the sample had at least one of either the clinical coding certificate or the introductory training in ICD-10 and coding (see Table 8-5). KFMC, AIH, and BCH Hospital indicated more staff having completed one or both of the training courses than other hospitals (see Table 8-5). Even more unexpected was the fact that for both types of training, doctors and nurses indicated the highest numbers of respondents having completed this training, as opposed to the expected health informatics and medical records. The failure to follow the advice common to all ICD-10 implementation literature, and the disregard for the voiced MOH plan, impacted negatively on the information gained from the questionnaire, as the researcher had assumed that the appropriate staff members would have been offered one or both forms of preparatory training.

The researcher had initially planned to include a second research question based on the status of implementation but decided against it, on the grounds that it held little long-term benefit for implementations of ICD-10 in other countries. The status of implementation was thereafter included as demographic item 10, which in conjunction with demographics items 7 and 8 provided a clearer measurement of the levels of staff pre-qualification and implementation than the quantitative instrument itself.

Demographic 10 queried the status or level of completion of the implementation, according to three categories, complete, partially complete, and uncertain (Table 8-6). Initially, examining the overall outcome of the question, the results indicated just under 50% uncertain, which was an ambiguous outcome in the sense that it failed to differentiate between ‘I do not know because I am not involved’ and ‘I’m unsure whether it is complete or still partially incomplete.’ However, examining the responses by the occupational category of the respondents (Table 8-7), showed clearly that the 'CORE HIM' group, did not exhibit this uncertainty, returning a combined 5.5% complete, 80.5% partially complete, and 14% uncertain. Examining this by hospital, indicated that KFMC, BCH, MCH, and AIH were the furthest along the implementation road.

It has been stressed throughout the study that the ICD-10-AM and clinical coding implementation will take place from scratch, rather than as a transition from ICD-9 to ICD-10, as has been occurring in many nations since the release of the WHO ICD-10 in 1994 and its national clinical modifications thereafter. An Australian Government document dedicated to strengthening the HIM workforce, the growth of which has not kept pace with the expansion of HIM responsibilities that followed the advent of ICD-10-AM states:

> The HIM profession has existed in Australia for more than 60 years. Over this time, the tertiary education programs for HIMs have included coding components, and new graduate HIMs have often taken on coding roles immediately after graduation as a pathway to transition into other areas of professional practice. Other HIMs choose to stay as specialist coders long term, some moving into more senior coding roles or becoming coding educators (Collins et al., 2010, p.4).

As Saudi Arabia sets out to introduce the practice of clinical coding, new HIM specialisations have emerged from the impact of HIT developments and the refining of hospital system processes. Nevertheless, the basic classification and coding of clinical documentation remain firmly as the foundation. The development of AR-DRGs as the basis of casemix and the extension of the method for the calculation of hospital funding and quality assessment, in addition to insurance reimbursements, has recently seen the emergence of an additional HIM function with a leaning toward finance. The HIM costing specialist no longer performs the primary classification and coding function but confirms and uses the assigned codes for the calculation of the total financial value of medical services.

The Saudi MOH, against the evidence of its own history, has undertaken to achieve what has never been achieved in HIM in any country. The outcomes of demographics items 7, 8, and 10 provide evidence that from the first announcement of the implementation on the MOH portal, it has not kept pace. In comparison with ICD-7, the first ICD classification version used in Australia, ICD-10-AM is colossal. Further, in implementing ICD-10-AM, Australia relied on many HIM staff with specialist university degrees and years of clinical coding experience or involvement to their name.

The responses to the three demographic factors directly linked to the implementation fell far outside what one might describe as a reasonable range of expectation. Based on the colossal body of international literature describing the preparatory planning stages of the implementation of a new classification, together with the introduction of a novel process, such as clinical coding in the Saudi context, an in-house developmental and training phase is essential.

There is no doubt that the dearth of trained clinical coders among the departments that will manage health information and the lack of a formal introduction to ICD-10 classification for the workforce are major predictors of the outcomes of this research and the lack of serious commitment to healthcare that has been displayed by MOH leadership. The broad lack of pre-exposure and awareness training offered to employees denies them an opportunity to expand their job descriptions and performance functions and to play a role in the implementation and execution of a new level of healthcare information. It is a universally accepted fact in modern management that it is demoralising and counter-productive for staff to be excluded from developmental processes. A recent study by a Saudi change-management expert that analysed whether Saudi healthcare is change-ready for the Vision 2030 target, concluded: ‘The Saudi government should address the human issues of a health-care organisation rather than paying attention only to its economic and technical dimensions. Human interactions are the core element that constitutes and makes or breaks an organisation’ (Alharbi, 2018, p.86).

## 9.8 Categories of factors impacting on the implementation

It is clear from the literature reviewed that preparatory organisational planning and training of healthcare staff is fundamental to a successful implementation and applies to the introduction of all new systems. In the case of ICD-10, success is also reliant on achieving a satisfactory standard of health information for which quality coding is essential, not only to produce the claims for reimbursement but to produce long-term health information for quality evaluation, and statistical and research purposes. National consistency requires a standardised national system establishing health data standards, interoperability, and a national HIM body that looks after the supply and training of staff.

In a national public hospital, the relationship of these categories is invariably hierarchical. In the context of clinical coding, the absence of a national HIM body standardising training, maintaining adequate national staffing levels, setting national coding standards, and reviewing and auditing hospital data is likely to see variations in training and staffing at different hospitals, from which will emerge variations in the accuracy and completeness of health information in terms of clinical documentation and coding. This is a fundamental and unresolved problem in Saudi health information and results in a low level of staff employment satisfaction in Saudi healthcare institutions (Alshmemri, 2014).

## 9.9 Quantitative questionnaire

The 23 items and their structuring into the three categories, organisational, health information, and national were grounded in the literature reviewed. This involved coverage of the Saudi literature and that of four nations, dominated by the literature on ICD-10-AM written by Australian healthcare information experts, several of whom had a guiding role in their national implementation. The Canadian and US literature supplemented the Australian, while the literature of Thailand offered a valid and enthusiastic alternative approach for healthcare hampered by the realities of developing nations in regard to funding, technology, and staff who have not had the same standard of professional training and general education as those in the developed nations.

Had the researcher more time available for his study site-visit, he would have been inclined to choose a completely purposive sample using participants with some educational or career background in HIM and acknowledged insight into the public hospital implementation. This was not to be, and a five-point Likert scale questionnaire was chosen and offered on a voluntary basis to all members of the study hospitals' population.

## 9.10 Likert evaluation

There has been an ongoing controversy about the relevance of mean and standard deviation analysis of Likert scale surveys as a reflection of a whole population based on a sample (Allen & Seaman, 2007). It is now generally accepted that where a large sample is concerned and several Likert-type items are grouped and validated such as in the categories of this survey, comparison of items on the basis of mean and standard deviation is valid (Boone, H., & Boone, D., 2012). The common Likert scale biases, namely central tendency, response style, and response set biases, as well as the manifestation of these in individual response patterns, were covered. In a large sample with a realistic distribution of occupational categories, ages, and qualifications, a proportion of these biases may be accepted as a reflection of the overall population (Sullivan & Artino, 2013).

The medical records staff as the least qualified group, and health informatics as the youngest, showed substantially higher responses in strongly disagree, while doctors as the oldest and most qualified showed less strong disagreement than the other occupations. This was reversed in disagree, where medicine showed the highest responses followed by nursing and non-health, while medical records showed the lowest. Non-health and medicine, the two oldest and best qualified occupational categories showed the highest neutral responses. These survey responses follow the general population pattern that greater age and better qualifications produce the tendency toward caution with less likelihood to respond in the ‘strongly’ extreme values. The case of nurses in the survey requires a mention. Nursing with 99 out of 116 respondents below the age of 40 was second in youth to health informatics with 26 out of 28. However, 75 of 116 nurses were degreed including 10 masters and 1 PhD. This impacted slightly but the large number of nurses opting for neutral in several items was most likely linked to their having less direct knowledge of the implementation details.

## 9.11 Overall survey results

The sample presented an overall mean of 4.01, fractionally above disagree = 4.00, and a median of 4.00. While in the overall sample, the median remained consistent at 4.00 for 22 of 23 items, irrespective of the mean, there was considerable variation when the sample was subdivided according to hospital or occupation. As was stated in Chapter 8, while there were 7 hospitals and 6 occupational categories, in practice this amounted to 42 different sectors in that no sample representation was similar per hospital or category and all hospitals were at different stages of implementation. These differences in the impact of demographic variables were explored in Table 8-11.

The individual hospital means indicated that four exceeded the overall survey mean and three, namely KFMC, BCH, and MCH a fair way below 4.01. These appeared to be the hospitals that were more advanced in implementation status. Here, the lower means are attributable to a sub-group in each hospital with responses tending toward levels of agree, presumably based on alternative knowledge they had regarding the implementation. From the minority indications it was expected that AIH would fall into this group but the hospital mean was 4.07. AIH had no non-health category representative and on surveying the individual responses, it was noted that all four other-health members indicated 5.00. Removing the other-health group produced a 3.91 mean, aligning the hospital with the other three further along the implementation road.

In the occupational categories, only medicine and non-health indicated means below the overall survey means. The lower means were attributable to increased levels of agreement or neutral responses corresponding with reductions in the levels of disagreement among the majority. The 20 lowest means for all 23 items from all 283 respondents were produced by staff members of KFMC, AIH, BCH, and MCH and included 7 doctors, 5 nurses, and 3 non-health staff members, representing the occupational categories with superior educational qualifications, and 3 medical records, 1 other-health, and 1 health informatics staff member representing the lesser qualified categories. Of these 20 respondents, 4 (20%) had indicated 'Fully implemented' for demographic 10, the overall response to which was 14 out of 283 (5%). The group gave rise to what was termed the minority, which varied considerably in composition from item to item. Overall, far fewer than 20 respondents could be described as a persistent minority.

### 9.11.1 Organisational category results

The organisational category dealt with staffing and training, topics that involved the daily working reality of all respondents. The category produced a higher mean at 4.07 than the overall survey, with a median as high as 4.13. The items in this category were those least affected by the need to have received introductory ICD-10 awareness training as they refer to the pre-implementation preparatory process, rather than the information that should have been gained through the process.

Organisational item 1 'MOH hospital employees receive education and training to improve their performance and further their careers' indicated approximately 81% levels of disagreement vs 11% (31) levels of agreement with 8% neutral. Alternatively, organisational item 2 'MOH hospitals evaluate the effectiveness of staff training programs offered' was an item more removed from the daily working and while levels of agreement remained the same, levels of disagreement dropped roughly 8%, and neutral doubled to 17% causing the mean to drop from 4.04 to 3.91. Throughout the 23 items, a drop in the mean below 4.00 was more associated with a surge in neutral due to a drop in the levels of disagree rather than a change in the levels of agreement. The surge in neutral responses generally seemed to occur with items on which a portion of the sample had no knowledge.

Organisational item 3 'MOH hospitals offer specific clinical coding training programs' produced the highest mean of the survey and was the only item to indicate a median other than 4.00, producing a 5.00. This can be confirmed by the Likert responses Table 8-14 showing that over 50% of the 283 respondents indicated strongly disagree. Altogether, 88% of the sample responded with levels of disagreement, the neutral response was the lowest of the whole survey, and only 13 responded with levels of agreement, the second lowest of the survey. Even in this strongest negative response to such a clear-cut item as organisational item 13 respondents differed from the majority viewpoint. Either MOH hospitals are offering clinical coding training or they are not. Why should there be any contradiction? An examination of the 13 respondents showed they represented all hospitals except MCH and included an expatriate doctor from KFMC in the over 60 age bracket and holder of a PhD, one of the three most senior members of the sample.

In terms of adequate staffing of clinical coders (organisational item 4), HIM specialists (organisational item 5), and health informaticists (organisational item 6), the levels of disagreement decreased in step across the item-group from 80% to 71% with a corresponding increase in levels of agreement from 16 to 35 and means reducing from 4.13 to 3.95 to 3.91 for organisational items 4, 5 & 6, respectively. On splitting the data by occupation, health informatics responded with means of 4.14, 4.00, and 4.00, while medical records indicated 4.32, 4.36, and 4.32 for organisational items 4, 5 & 6, respectively.

Organisational items 5 & 6 had a technology slant, querying the existence of a network connection for sharing information and the quality of vendors. Both results followed the trend of organisational item 2 with significantly higher neutral responses producing means of 3.95 and 3.92, respectively.

It is quite clear that an overwhelming majority of staff members are not being offered, and do not believe that the MOH provides training in the workplace or that there is any kind of in-house training in clinical coding.

### 9.11.2 Health information results

The health information category mainly concerned HIM staff (health informatics and medical records) and although the mean was slightly higher, the minimum value was lower and, consequently, the measures covered an extended range.

Information items 1-4 (see Table 8-16) set out to establish the overall understanding of the range of purposes and benefits of ICD-10 and clinical coding. The first two items indicated means of 4.16 and the other two 4,13. The levels of agreement and neutral were almost identical across the four items, with the only real fluctuations between strongly disagree and disagree.

The strong correlations of the items made this an ideal group to examine the minority more closely (see Table 8-17). Levels of agreement were 15 for information item 1 and 14 for information item 4. However, only 5 of the 15 levels of agreement for information item 1 were consistent across the group to information item 4. Whatever questions this raises about the validity and consistency of the minority, it indicates a certain level of shifting within the whole sample. Notwithstanding, most of the sample had no introductory knowledge of ICD-10 or clinical coding.

For an adult, with an interest in healthcare and for any intelligent person without any previous exposure, these benefits can be grasped if not memorised in a single standard-length under-graduate level lecture, when presented by an enthusiastic trainer who devotes ten minutes to each benefit. The concepts that coding overcomes potential differences in the use of terminology, transcends languages, creates an international standard for statistical groupings that facilitates storage and retrieval and research, as well as providing the data for feedback on the frequency of diseases and success rates of interventions, are not hard to grasp. This is the one item group that should have been answered consistently and whatever implementation process has taken place, clearly the majority has been excluded.

The last two health information items concerned the interrelationships of coders and physicians in the coding process. Given the lack of any basic introduction, it was even more unlikely that the majority would be able to deal meaningfully with the items. Both means were lower than information items 1-4. Information item 5 ('In MOH hospitals, physicians and coders interact in order to decide on the correct clinical codes to match the patient diagnoses and procedures') produced a 22% neutral response. Surprisingly, information item 6 (‘In MOH hospitals, the level of clinical diagnosis by physicians as existing in current manual records is sufficient to enable coders to apply clinical coding codes’), which is a far a more difficult matter to assess, saw the neutral response drop.

### 9.11.3 National category results

The national category included several items that, given the lack of ICD-10 awareness, could not be knowledgeably answered by many in the sample. However, a number did draw logical conclusions. The means and medians dropped mainly due to neutral responses as high as 24% and levels of agreement higher than normal in some items. As a category, there was a great tendency towards agreement and the mean and median for the category at 3.91 and 3.89, respectively, were lower than for organisational and health information.

The wording of national item 1 ‘A Saudi health information management supervisory organisation monitors the implementation of ICD-10 in all health sectors’ proved to be a catch; there is no such national body. The item indicated a mean of 4.10 and a moderate neutral response. There were 17 respondents, representing all hospitals, who indicated levels of agreement. They included 4 doctors, 1 PhD and 3 masters, 3 respondents who had indicated ‘Fully Implemented’ for status of implementation, and at least 8 who appeared consistently in the minority group. The only saving grace would be that 10 of the 17 were expatriates. The elderly PhD doctor from KFMC, mentioned previously, did not make the mistake, although the KFMC other-health specialist, whose responses were generally consistent with his, did make the error.

National items 2 & 4, on MOH funding of national public hospital network and upgrades to hardware and software returned the two lowest means (3.65 and 3.66) of the category; levels of disagreement decreased to approximately 60%, neutral rose to 24% and 23% and both items had levels of agreement from 43 respondents. The latter responses would appear to be based on logical speculation.

National items 5 & 6 (the wording was reversed as discussed in Chap 8) looked at the national HIM workforce, in terms of an adequate number of trainers and whether there was a need for additional coders at the commencement of the implementation. National item 5 indicated a mean of 4.03, while for national item 6 it was 3.93. The only difference was that in national item 5 strongly disagree exceeded disagree, while in national item 6, this was reversed. These two items were of specific interest to the CORE HIM group.

Splitting the data by occupation showed the health informatics mean for national item 5 was 4.11 and for national item 6 indicated 3.46. Medical records indicated 4.34 and 3.82 respectively. The differences imply that the CORE HIM group moved toward levels of agreement in terms of the need for additional coders. There were 24 levels of agreement for both items and this minority included the same 6 CORE HIM members and 5 doctors in both. Here the senior KFMC expatriate doctor with a PhD opted for 2 neutrals, while the other-health specialist indicated agree for both. Nationals items 7 & 8 looked at the issue of MOH funding of project development and technology. Both items had almost identical Likert response levels with a surge in neutral to 20% and a decrease in levels of disagreement to 66%.

National item 9, the last item of the survey, was a something of a tester. EHRs may be beneficial in the long-run but that does not avoid the reality that the coding, anatomy, pathology, and procedure knowledge is what is currently lacking, particularly with the high level of medical records staff with only a diploma. Levels of disagreement indicated that around 75% of the sample believe that it will facilitate the implementation. Calculators make arithmetic operations far quicker if the user has learned the basic rules of operators. There is very little reference to EHRs, in conjunction with ICD-10 implementation in the related literature, in that the same level of clinical coding skills and medical knowledge is essential, whether classification and coding is done manually or in an online package.

### 9.11.4 Consistency of the minority

Foremost, while there is a discernible minority who have been permitted insights into the implementation that have not been offered to the majority, its composition varied across categories, groups, and single items.

The first minority encountered was the group of 14 respondents who indicated ‘Fully implemented’ for demographic 10: status of implementation. The hospital breakdown was KFMC 8, AIH 2, MCH 2, BCH 1, and AYH 1. There were 10 expatriates and 4 Saudis in the group, which included 3 doctors (1 from KFMC and 2 from AIH) all with PhDs.

Examining the demographic 10 minority on responses to organisational item 3 ‘MOH offers specific clinical coding training programs’ indicated that only 2, the over-60 male doctor with a PhD and the female other-health specialist, both expatriates working at

KFMC, responded with a level of agreement. The other 12 who indicated ‘Fully implemented’ responded to organisational item 3 with levels of disagreement or neutral. For information items 1-4, the two were joined by an additional two from the demographic 10 ‘Fully implemented’ group; two doctors from AIH who responded with levels of agreement to some of the four items. Only the over-60 KFMC expatriate doctor with a PhD responded consistently with agree for all four items.

Examining the group of 26 respondents who returned a computed means below neutral = 3.00 (tending toward agree) for the whole sample or at least one of the study categories indicates a hospital distribution of AIH 7, MCH 6, BCH 5, KFMC 4, IAAH 2, and AYH (2). KSH had no representation. The distribution of occupations was nurses 9, doctors, 7, medical records 4, non-health 3, other-health 2, and health informatics 1. In the first four hospitals which are those with a more advanced implementation status, the minority respondents indicate a balanced composition as a group, each comprising at least one doctor, one CORE HIM worker, and a combination of nurses/other-health or non-health professionals, suggesting they might form an initial hospital implementation team. perhaps even being trained to be trainers.

## 9.12 Results from open-ended question

The 101 voluntary open-ended comments provided a means of ranking which factors the staff considered priorities. Those who took the opportunity to comment indicated the need for additional skilled HIM staff and specialists, across-the-board staff training in clinical coding and ICD-10 classification, and HIS technology upgrading. Two comments are most noteworthy:

A68: ‘Since [the] MOH announced the implementation of clinical coding, training programs in ICD-10, English language, and medical terminology were totally ignored for the medical records staff, and consequently, this will create a major obstacle to implementation.’

The promise of restructuring and training for medical records staff throughout the MOH hospitals goes back to Albishi’s 2011 report in the IFHIMA Global News (Albishi, 2011). The respondent’s comment bears out his/her own insight as to what is essential, which appears to have been once recognised but forgotten by the MOH. It also indicates the failure of the MOH to recognise the accepted human resources principle that an organisation's greatest resource is a staff qualified for their individual roles. Alharbi (2018) advanced that technical needs are far easier to deal with than human issues. In other words, acquisition of the ICD-10-AM system and the required technology is the easy part. He noted that organisational dialogue and monitoring are the only means of assessing the human component. That clearly is not ongoing. Having made this generalisation, there were repeated appearances of medical records staff in the minority, particularly in national items 5 & 6, both items on HIM staff sufficiency. Further, there is irrefutable confirmation of an ongoing implementation, which suggests that the MOH policy adheres to a form of 'divide and rule' together with a form of secrecy and control of information.

A32: 'I am a Saudi lady. I am [a] certified clinical coder specialist. And no organisation or people [has given] me [a] chance to improve the coding process. There is no training centre in Saudi Arabia.'

This comment embodies an emotional response to the staff member's realisation that the MOH has failed to offer her the opportunity for career development, personal professional growth, job satisfaction, and upward mobility. She has spoken on behalf of the average medical records staff member with a sense of ambition and the personal need for accomplishment. She appears to have had the motivation to complete an introductory coding course but has not been appointed to code. Her career and contribution are limited by the lack of supportive structure provided by the MOH.

## 9.13 Results from semi-structured interview

While a one-on-one interview with purposively selected participants allows a more in-depth investigation of specific topics, it has a limitation in terms of not providing any basis for discussion or alternative viewpoint. Additionally, without an opportunity to analyse the questionnaire, the researcher was guided only by instinct rather than the direct queries arising from the quantitative analysis.

The introductory item in the interviews was the status of implementation. One interviewee mentioned that in Saudi private hospitals and other governmental hospitals it was fully implemented. In the study public hospitals, as covered in demographic item 10, several analyses were applied to unravel the problem that close to 50% of the respondents had answered 'uncertain'. In the interview, at least one respondent claimed that in two hospitals the process had not even commenced, due to a lack of skilled staff.

Examining Table 8-6, the two hospitals in doubt were KSH and IAAH. However, moving to Table 8-7 which was derived from a breakdown of demographic item 10 responses from the CORE HIM, it was clear that the staff of these occupational categories at the two hospitals unanimously indicated 'Partial implementation'. Further, the interviewee representing IAAH stated:

'There is a great shortage of specialist medical coding staff. The staff of medical records, consisting of four employees, is currently dealing with ICD-10-AM/ACHI in our hospital. In addition, there is no electronic medical coding in this hospital.'

In every way, this seems a preferable reply and a sign of a normal process, even if it is small and slow, rather than setting out on the wrong foot and having doctors code, as will be discussed in the next section.

## 9.13.1 Health information factors

### 9.13.1.1 The practice of doctors coding

The most staggering interviewee information relating to the central research question was undoubtedly that at KFMC, the only hospital where clinical coding had commenced in practice, the diagnosis coding had been placed in the hands of the doctors. Given the information offered to the international HIM community in the IFHIMA Global News by Hussein Albishi, this ranks as a shock and does not bode well for the future unless it would appear to hinge on the fact, as reiterated constantly by commentary in the literature review, that ICD-10 requires greater medical knowledge from coders than ever before. While there has been evidence of doctors coding in severely compromised health systems, such as some African countries (Dyers, Evans, Ward, du Plooy, & Mahomed, 2016), this skill would have been included in their medical training if they were intended to code. It must be regarded as a self-defeating development, a limitation to the primary function of doctors, an added expense, and a symptom of a healthcare system in a compromised state.

The current view of HIM and ICD-10 classification experts is that the administrative data derived from the coding of the doctor's clinical documentation, which is used in health insurance claims, constitutes only a part of quality health data. A Canadian study on health data quality provides a list of additional sources that may be included in the coded data:

> Discharge summaries or ambulatory care records, triage sheets, transfer summaries, service transfers, progress notes (physician or nurses), nursing assessments, operative reports or perioperative reports, referral letters, consultations, doctor orders, pathology reports, laboratory test results, microbiology reports, diagnostic imaging reports, X-ray reports, radiology reports, haemodialysis records, transfusion records, special procedures, prescription orders, patient histories, patient physicals, admission histories (Lucyk, Tang & Quan, 2017, p.4).

The codes for the diagnosed disease and subsequent interventions constitute a very small part of the potential data for healthcare quality evaluation and regional and international statistics that could be derived from the patient episode. A WHO manual prepared for the guidance of developing countries implementing ICD-10 very clearly places clinical coding in the medical records department, as the responsibility of the medical records officer who needs to be a coder of high standing to approve the work of junior coders (World Health Organisation, 2006b).

A Saudi Arabian research project provides a practical example of what the MOH is failing to see. Saudi Arabia has the third-highest rate of type-1 diabetes in the world and one of the best Saudi studies examined in Chapter 5 described how the five healthcare professionals involved in the multi-therapies used to treat the diabetes pathway were unable to interact and transfer documentation to one another, due to shortcomings in interoperability and health data standards (Alkadi, 2016). A follow-up study on diabetes providing an overview of the development of the disease into a non-communicable disease epidemic in Saudi Arabia mentioned in the discussion on the research limitations that the available data was administrative but that soon, with the advent of ICD-10-AM and clinical coding, data availability in diabetic research would be improved:

> Second, since the data is administrative data, information on the specific reasons for the reported ED visits and the outcome of these visits were not available. Future research will use the ICD when the MOH implements the Australian 10th Revision of the Classification (ICD-10-AM ACHI/ACS) at all MOH hospitals in the very near future (Almalki et al., 2019, p.74).

Here is an authentic Saudi Arabian example of the relevance of ICD-10 classification and coding that far exceeds daily insurance claims submissions. Coding will broaden the database of empirical factors in diabetes research and lead to an improved quality of life for Saudi diabetics. Several of the researchers are professors of medicine at Abdulaziz

University and the research was funded by the Saudi Association for Scientific Research and published in the Annals of Saudi Medicine.

While it may well be that the MOH has determined that including doctors and nurses would be the quickest way to producing coding for insurance submissions, incorrect coding is the quickest way to have claims rejected. If this problem is not overcome, it will seriously hamper the submission of claims and their reimbursement by insurers. Referring back to the important points raised in the literature from Thailand, the message of Dr Paoin in his road map for developing countries implementing ICD-10 presented to the WHO APN in 2007 was: ‘Developing countries should learn about ICD implementation by lessons provided by other countries’ experiences’ (Paoin, 2007, Slide 51). This method is an obvious one but seems to have been shunned by the Saudi MOH. On the role of doctors, it was emphasised that they need coding training for the purpose of grasping the required levels of specificity and the necessary terminology, as well as for the training of coders.

In the Thailand literature, the question was asked: Is the primary function of ICD-10 for reimbursement or is it to serve the purpose of an improved tool for the reporting of global healthcare data (Pongpirul et al., 2011; Sukanya, 2017)? The answer was given: A successful ICD-10 implementation that enhances the national quality of patient healthcare and statistical data is a gradual process that works towards a long-term goal, in association with improved health data standards, interoperability, and data exchange (Ingun et al., 2015). A simplified ICD-10 was created based on the most common diseases and the associated classifications and lists of these were drawn up to give coders an introduction.

As far back as 2011, aspects of occupational category reallocation and training related to the implementation of ICD-10 and clinical coding, were announced in an IFHIMA newsletter by Albishi (2011).

1) Medical records staff would be retrained to provide the clinical coders necessary for the implementation. It would be necessary for the group to be trained in clinical coding and ICD-10 classification, as well the level of anatomy, pathology, and procedures considered essential for ICD-10 coding.
2) Health informatics staff would provide the other HIM functions.
3) Doctors would be trained in the more detailed and anatomically specific clinical documentation required for ICD-10.

4) Other-health professionals, such as pathologists and radiologists, and specialised nursing staff would be trained to document the procedures in their fields, according to ACHI.
5) Non-health staff, such as administrators and financial officers, would also require a knowledge of in-patient procedures.

In 2014, the HIM advisor to the MOH presented a GAP analysis and MOH coding road map to the MEHI conference, paying attention to the shortage of qualified coders, inferior English and resultant medical terminology, the lack of physical space in medical records departments, and the lack of strategic planning and alignment between the MOH and hospitals. The advisor informed the conference that full-scale classification and coding, as well as the use of DRGs would be implemented in the top ten MOH public hospitals by 2020 (Albishi, 2014b).

The NTP 2020, adopted in April 2016, included the following strategic objectives:

> ‘(4) increase training and development both locally and internationally; (5) increase the attractiveness of nursing and medical support staff as a preferred career path; and (10) improve governance in the health system in order to enhance accountability with regard to quality issues and patient safety’ (Al-Hanawi, Khan & Al-Borie, 2019, p.10).

For Nos 4 & 5, the objective is a doubling of the status quo. However, for No 10 for which the key performance indicators states: ‘Percentage of healthcare facilities reporting comprehensive performance and quality measures’ (Al-Hanawi, Khan & Al-Borie, 2019, p.7), the objective is to move from 10% to 100%. According to the interviewees, none of the proposals of strategic plans had materialised.

### 9.13.2 Organisational and national factors

The interviewees confirmed the lack of training and listed HIM staff and doctors as requiring priority in training, as well as pointing to the lack of skilled and specialist staff, and the persistent Saudi healthcare language difficulties and staff resistance as organisational issues.

At the national level, the need for a supervisory organisation, the creation of a national implementation plan, and MOH funding in HIM and HIT upgrades were discussed. Among the numerous comments on the benefits of EHRs to a successful implementation, one is of additional interest. One of the two interviewees from KFMC stated: ‘The lack of physician training in clinical coding can give rise to the resistance of implementation as was done with EHRs system.' KFMC is more than double the size of the next largest study hospital and is already using EHRs, which have shown no benefit to the doctors' diagnosis coding. That EHRs make clinical coding any easier, appears to have been an erroneous concept that exists among many MOH public hospital employees. There are plenty of warnings about 'ICD-10 unfriendly' EHR systems and the field is still being evaluated. Based on the literature, it safe to say that EHRs will provide no easy learning method for ICD-10 classification and clinical coding.

Inferior HIT and the associated element of lack of interoperability, as well as fundamental inputs such as power supplies, have long been a complaint of Saudi health researchers (El Mahalli, 2015a, 2015b). It appears that the issue of EHRs has misled staff, in all probability due to not having had a basic introduction to ICD-10. There is no doubt that in the long run, the EHR does offer HIM benefits in terms of standardisation of terminology, data security, and data storage (Bowman, 2005). While it does offer easier access to codes, it does not offer automated coding and is no help unless the coder has the appropriate classificatory, physiological, and pathological knowledge (McKenzie, Walker & Lewis, 2003).

It is noteworthy that very little ICD-10 implementation literature covers EHRs, as the system only offers an alternative format (i.e. electronic vs paper capture and online vs book searches for the codes). Alternatively, as pointed out by interviewees from MCH and KSH, the use of EHRs in clinical documentation (not coding) offers physicians a means to standardise terminology in clinical documentation which, in turn, provides the clinical coders with a reduction in terminological problems.

The reality of the implementation of EHRs and other HIT technology in the US, Canada, UK, Germany, Netherlands, Australia, and New Zealand was covered in a 2008 review, which placed the maximum usage in Australian hospitals at 10%, although GP usage in those countries was much higher. The overall cost factor in terms of the ratio of technology cost to healthcare benefit was seen as the major limiting factor (Jha, Doolan, Grandt, Scott, & Bates, 2008). A later review shows that the major interest in EHRs has moved to adoption at the national level that enables the immediate retrieval of accumulated individual patient data from any geographic location (Xu et al., 2013). While the Australian government examination of the EHR systems commenced in 2000, it finally culminated in the national 'My Health' PHR (personal health record) system adopted in 2018 (Australian Digital Health Agency, 2018).

Thus, while the questionnaire sample showed a grave lack of awareness of the benefits of clinical coding in the health information category items, the misconceptions in relation to EHRs further compounds the lack of knowledge. This confusion reflects the MOH's sudden rush to attempt to implement ICD-10-AM from scratch and simultaneously implement a national eHealth system as part of the Vision 2030 national drive.

Several studies on the need for CDI followed the Australian implementation of ICD-10-AM and preceded the US implementation in 2015, indicating that this concept had arisen in the Australian case through coding evaluations and audits (Buckholtz, 2013; Shepheard, 2018). Combs (2016) referred to the Saudi activities of Dr Wil Lo, a noted CDI specialist, and quoted from an email he had sent to her, which ended with the line: 'In the Kingdom of Saudi Arabia, and most likely in other countries throughout the world, CDI implementation is viewed as a priority' (Combs, 2016, p.2). This clearly does not refer to the MOH public hospitals that formed part of this study. Nonetheless, CDI is clearly essential but not for the purpose of physician coding.

## 9.14 Factors impacting on the implementation arising from the study

Returning to the ICD-10 literature of acknowledged excellence, implicit in the overall survey and interview responses are the apparent lack of a detailed, structured, time frame-based MOH preparatory plan to move forward to a point of concurrent implementation readiness in all departments. Innes et al. (2000) described the design of the implementation educational literature and the 'train the trainer' workshops, commencing three years before the Australian implementation. Roberts (2004) outlined the ongoing broader national plan, involving universities and training organisations to ensure a growing supply of coders. Outstanding Canadian papers on planning were selected to be presented in the US at the AHIMA 2004 conference. Moskal (2004) highlighted the necessity of synchronisation in the respective clinical, technological, and administrative plans, while Johnson (2004) discussed the plan of a single hospital implementation emphasizing the need for system hardware evaluation involving vendors and assessing whether all the essential health data standards were in place to cope with the specifications of the new system. In the case of the specific hospital, a problem was encountered with existing monitors that interrupted the process and led to additional costs. Thus, there is a need to include contingency planning and funding to support the risk factor that things can go wrong and if time and funds are not allocated for eventualities it spells potential doom.

All the planning and preparatory literature has an inherent fundamental human resource element, the team. Manpower needs to be transitionally reallocated and shifts need to be altered to accommodate the transitional working process and the changeover without disrupting the basic healthcare services of the institution which appeared to be totally lacking in the study public hospitals. The examination of the minority in the sample seemed to indicate that rather than enable the participation of all staff in the implementation, it is both policy and practice keeping staff in certain departments in the dark about the new responsibilities of other members of their departments. Not only did the researcher intuit that the majority had little clue about the activities of the minority, but equally, unless the comprehension of items such as information items 1-4 was so poor, the minority had little clue about the exclusion of the majority.

A summary list of neglected factors generated by the quantitative and qualitative instruments per category as viewed by the greater portion of the survey sample respondents and interviewees:

❖ Organisation**:**

1) No evidence of thorough organisational planning and preparation incorporating a time frame.
2) No policy of continuous education and training offered to staff members.
3) No specific pre-implementation training of clinical coders or introductory ICD-10 awareness education.
4) Existing shortages of specialist and general staff in the crucial health informatics and medical records departments, despite the added burden of a novel implementation.
5) Where doctors have now been instructed to code, this is an organisational abuse of manpower skills in that it detracts from the primary purpose of treating patients and is a manifestation of extremely compromised healthcare systems.
6) Lack of awareness and confirmation of the state of the hardware and network technology, potential interoperability of the new software, as well as the relationship with and quality of vendors.
7) The need for organisational management plans to cope with groups manifesting staff resistance to change.

8) The language factor, unique to Saudi healthcare will inevitably continue until more native Saudis are trained and employed to replace a portion of the expatriates in Saudi hospitals.

❖ Health information:

1) Minimal awareness in each institution of the potential functionality and benefits of ICD-10 and clinical coding due to a lack of organisational training.
2) Doubt regarding the crucial clinical coding relationship of coders and doctors.
3) Where implementation had been completed, ill-advised coding by doctors leading to the need for CDI, a form of documentation training that according to the literature has been accepted in other hospital sectors.

❖ National:

1) Absence of a national supervisory implementation, standards, and reviewing body, as well as a lack of awareness of the necessity of such a body.
2) Lack of awareness regarding the role of MOH as funder and provider of the network, its technological components, structure, and interoperability.
3) Uncertainty regarding system maintenance and developmental project funding, ownership, and management, as well as the potential for projects in health information per individual institution.
4) Lack of understanding about the relationship of EHRs and the acquisition of the essential classification and clinical coding skills, as well as limitations in knowledge of anatomy, pathology, and the usage of standard medical terminology.

## 9.15 Commentary on the derived factors

The factors enumerated are not new to Saudi Arabia. They have all been listed in previous assessments of the state of national healthcare and analyses of healthcare reform. While they are endemic to Saudi healthcare, they are not restricted to this country. However, had the MOH realised that there was much to be gained and saved by reviewing and putting into practice the lessons learned by other countries, many of the factors listed could have been eliminated or their impact reduced. Examining these specific underlying problems within the implementation of a completely novel system within local hospitals does facilitate a fresh analysis.

Health information emerged in parallel with the development of information technology in the developed world, reinforced by the experience of the Millennium Development

Goals, the emergence of the concept of Global Health, and the realisation of the responsibility of developed nations to support healthcare in poorer developing nations, based on the fact that disease does not heed political borders. In the nations covered in the study literature review, health information has emerged as an independent, self-regulated professional field, nonetheless, one in which medical professionals act as an advisory body with a strong input. The WHO ICD series has similarly progressed through new versions, driven by technological advances, the related development of healthcare, and advances in medical research.

The adoption of ICD-10 and clinical coding, albeit driven by the need to facilitate health insurance claims, is taking place within the existing healthcare structures; the nation has not yet developed a separation between medicine and healthcare information. In terms of the necessity of a separate health information supervisory regulatory body, there is every likelihood that the MOH believes they can do the job and a separate body is superfluous. The fact that the MOH is unable to see the underlying complexity in the uptake of new systems has to do with self-imposed isolation. As SHIMA grows, becomes viewed as a contributory source of information and not as a potentially divisive influence on the labour force, a change in attitude to the establishment of a regulatory body is inevitable.

Rogers' Diffusion of Innovations Theory was considered as a potential model to describe the ICD-10 clinical coding implementation. Time is a factor in the model, but the base factor is knowledge and that is being hampered by the lack of general awareness and training apparent among most of the staff. Rogers' model describes the potential for rejection, but this has been replaced by resistance as an operational implementation is imperative. The fact that the MOH has not shown any interest in the broad inclusion of staff in the process must also be put down to their lack of knowledge about the full benefits of clinical coding and the improved quality of healthcare that it guarantees, through the use of the collected data post-health insurance claims.

Thus, the lack of training and education and general staff inclusion in the implementation, as well as the persistent inadequacy of technology, stem from a long-term failure in the MOH to view staff as a fundamental resource and inadequate technology as a source of inadequate results.

In 2017, based on the overwhelming concrete evidence of the benefits of healthcare research, the WHO established the Global Observatory for healthcare research and development (Hanney, & González-Block, 2015). The benefit of research health information transcends national divisions and is of value to all nations, all of whom hopefully can offer local research in return. The observatory web page reports that the developed nations average forty times as many health researchers as lower-income nations (World Health Organization, 2018b). Pooling research and making it available to all is the observatory's role. Thus, much of the general background on the non-communicable diseases that have arisen among the Saudi population is available and the wheel does not have to be reinvented.

## 9.16 The role of the MOH in Saudi healthcare transformation

A corporate legal bulletin, the Law Update of Al Tamini and Company, has produced a series of discussion documents covering the drive to Vision 2030. A recent one targeting potential external investors in Saudi HIT opened: 'Way back in April 2016 in a blaze of publicity Vision 2030 was announced to the world' (Bassi, & Bugis, 2019, p.1). This sentence very aptly describes the public relations competency of the MOH presentations regarding the transformation to digital health and privatisation in Saudi healthcare that appears to exceed the practical implementation.

Around the time that the IFHIMA monthly bulletin carried the announcement by the MOH representative for clinical coding (Albishi, 2011), Ahmed Balkair, Director of the MOH National e-Health Strategy and Change Management Office, produced a PowerPoint which has been used in several presentations. The presentation outlines the structure of the MOH, mentioning its 20 directorates, 25,000 employees, and the noted French, Canadian, and US academics, who together with IBM act as advisory consultants. In line with Dr Balkair's current position, he describes the importance of change management, including the concepts of fairness and openness with staff, the involvement of staff in change programs, and the availing of the necessary resources for change (Balkair, 2010).

An earlier Law Update article provides a 'snapshot' of the ongoing healthcare reform, noting that there are many integral parts with varying degrees of interrelatedness. The author states: 'Embedding an insurance-driven health regime in the new health economy of the country will be challenging, especially as regards the cost-recovery mechanisms necessary for long-term Public Private Partnerships' (Patalong, 2017, p.3).

These corporate assessments, together with the academic approach of Alharbi (2018), appear to tactfully indicate areas of neglect in the unfolding of the NTP 2020 and Vision 2030 plans. The presentation of Balkair (2010) refers to the review of the transformation plan conducted by the MOH international consultants in 2010. Their criticisms were that the plan was overambitious, the scale of necessary clinical changes was unprecedented, the challenges would be plentiful, and that the MOH was attempting to implement eHealth in a very short space of time in comparison to several developed countries that had been working on health digitalisation for over twenty years. The consultants advised the MOH to work module by module and, where possible, to avoid tailoring modules and follow the proven methods of implementation. It further pointed to the neglect for change management and the fact that Canada Health Infoway allocates between 15 and 30% of all project budgets to change management. This advice seems not to have been adhered to in the implementation of ICD-10 and clinical coding in MOH public hospitals.

The review by international consultants in 2010 offered an expert and, no doubt, costly assessment of the state of MOH healthcare reform. Costly consultancy is one thing if their expert advice is followed; that it has apparently not been followed is inexcusable. Where the minimal implementation has taken place, the proven international standards have been ignored and the model has been tailored to place the burden of coding on doctors. The Saudi Arabian CCHI was constituted in 1999. Section 2.5 covered the reviews Alhusaini (2006), Almalki et al., (2011) and Bah et al., (2015) of the initial installation of health insurance, which did not get past Phase 1 of a three-phase plan. All reviewers agreed that the plan had failed due to the neglect of the structures of reimbursement, particularly clinical coding. There is evidence that the same cycle of failure is reoccurring.

## 9.17 Apparent MOH underestimation of the classification and coding module

While the Balkair roadmap focuses on eHealth, it does refer to the MOH 'Data Centre Strategy Framework' incorporating clinical coding from the private and public hospital centres (Balkair, 2010). The need for clinical coding was dealt with in the IFHIMA monthly bulletin and in a separate roadmap presentation (Albishi, 2014b). In 2012, the announcement of the contractual agreement with the Australian government and the license to implement ICD-10-AM followed. If ignorance led to the neglect of clinical coding at the commencement of national health insurance, at least there was an awareness and acceptance of its essential nature by 2011. Just as the international eHealth consultants cautioned the MOH that in comparison with the twenty-year drive to eHealth of other nations, Saudi Arabia was being extremely ambitious, the preparations for implementing clinical coding in public hospitals were well-outlined but at the implementation stage appear to have fallen short.

It can only be surmised that the KFMC decision to proceed with doctors doing the diagnosis coding stemmed from the lack of medical knowledge of the medical records staff. The demographic breakdown of 44 sample participants from this occupation category indicated 1 expatriate, 2 Bachelors' degrees and the rest Diplomas, 16 staff members with over 10 years of service, and 34 under the age of 40. While the lack of medical knowledge may have posed a problem, it is certain that many of these staff members, in working with paper documentation, must have accumulated some knowledge of medical terminology, particularly the standard common diseases that occur daily. Over the eight years that followed the Albishi IFHIMA statement, much could have been done to assist these staff members in building on that terminological knowledge. Further, the WHO offers a free ICD-10 Interactive Self Learning Tool on two levels, the first dealing with mortality coding and the second adding in morbidity codes. Although this tool deals only with the WHO ICD-10 codes, as opposed to ICD-10-AM, there are plenty of similar inexpensive online learning tools with certification as an outcome that could have been offered as incentives to selected younger medical records staff. The appearance of private training companies offering extremely short, condensed coding courses manifested in 2015, a long way into the two decades that have passed since the initial introduction of health insurance.

Whether the Australian NCCH offered Saudi Arabia the same implementation training support that it successfully rendered in Singapore is a further consideration? While the international consultants from developed nations wisely advised the MOH not to tailor but to implement modules as implemented in other countries, the Thailand literature offers an alternative approach that does not really contradict these experts but considers their additional advice which was to be realistic, rather than overambitious. In Thailand, physicians control the application of coding and the aid given to poorer neighbours in the implementation of ICD-10. Doctors voluntarily train the coding workforce rather than coding themselves. It is obvious that in clinical coding, there are standard medical conditions that occur daily and those that are less common. A hands-on approach that distributes the most common medical records to starter and junior coders and the more complex, advanced coding to senior coders with more experience may well be a model to serve MOH public hospitals. It is inevitable that in the long run, from a purely budget perspective, the MOH cannot continue to see doctors waste their time on coding for which they are not trained, thus, reducing the time they can allocate to patients (World Health Organisation, 2006).

An important concept in the Thai literature on coding relates to the question: 'Is the organisational coding priority for insurance reimbursement or for overall quality data?' (Ingun et al., 2015). Other Thai coding researchers cautioned on the potential for 'DRG creep', which refers to altering data to increase financial gain (Pongpirul et al., 2011). The earlier reference to the need for superior data in research on diabetes, one of the non-communicable diseases of epidemic status in Saudi Arabia, indicates the need for the quality rather than reimbursement priority if the healthcare contribution to Vision 2030 is to be of value.

## 9.18 Ministry of Health manpower

The quantitative instrument sample indirectly emphasised the underlying manpower issues confronting Saudi Arabia. While the native population of the Kingdom is roughly equivalent to Australia at 24 million, the country relies on another 7 million expatriate workers. The high level of expatriate staff was brought out clearly in the demographic analysis of the quantitative survey. Several articles have dealt with the need to train more Saudis and it forms an aspect of Vision 2030. The Law Update deals comprehensively with this factor and introduces the potential costs that need to be assumed, not only in training new staff for the digitalisation of healthcare but additionally the likelihood of costs in severance pay for older workers, for whom it may not be considered cost-effective to train (Patalong, 2017). There is enough evidence of the quality of Saudi healthcare research and the overall high quality of hospitals in the country. The MOH needs to take the findings of Saudi national researchers more seriously and rise to the level of the professionalism of the majority of its healthcare practitioners.

## 9.19 Assessment of the study

### 9.19.1 Timing of the administration of the instruments

It was a reasonable assumption on the researcher's part that all members of the sample would have had some ICD-10 and clinical coding introduction, given the fact that it was over three years after the MOH announcement: ‘The NCCC will develop the 2012 versions of ICD-10-AM/ACHI/ACS and AR-DRG, with a planned national implementation date of 1 July 2013 for both classification systems’ (Ministry of Health, 2013, para. 6). It was assumed that standard ICD-10 implementation practices such as training in clinical coding for a portion of medical records staff, general organisational ICD-10 awareness, and appropriate staffing including trainers would have been carried out. Thus, the 23 questionnaire items were designed to gather feedback based on some basic training.

### 9.19.2 The quantitative instrument

Had the researcher been aware of the lack of awareness in the sample, he might well have considered using purposive sampling for both the quantitative and qualitative instruments based on the health information items 1-4 (‘MOH staff understand the benefits of ICD-10 and clinical coding, etc’) responses. The responses to these four items were the most overwhelming statement of "we know virtually nothing" and, overall, by far the most consistently answered. Those four items plus a couple in the organisational and national categories, together with demographics items 7 & 8, tend to render the responses of many respondents weak or even invalid, in the sense that they did not have the insight to comment on the more complex issues regarding MOH funding and the deployment of a network.

Alternatively, had the researcher an idea of the limited awareness in the study hospitals, those four Health Information items, for example, would have been more useful if they had been worded ‘I understand the benefits of ICD-10 and clinical coding … etc.’ A further option could have been to draw up occupation-specific surveys.

It could be said that the questionnaire, as it stands, was administered prematurely for MOH public hospitals. It remains to be seen whether an alternative set of study hospitals in a different location might have resulted in a different outcome. However, it did clearly confirm that the MOH has still not really examined itself and its failings continue to fritter away finances. The fact that the doctors are coding proves that it is then prepared to take desperate measures to save its own face.

The Likert scale proved to be invaluable in its ability to reveal sub-groups that existed in the population, as opposed to a series of Yes/No questions. Further, the criticism of the use of the mean may hold validity in specific scientific cases but used relatively as an initial guideline of where to look more deeply, it clearly reveals the impact of demographic factors that either separate or group the respondents.

Despite the inherent potential biases, these are counteracted by a large sample with a proportionate representation of the population, in terms of the impact of demographic factors.

The decision to include qualitative instruments in the form of the open-ended question and semi-structured interview proved the broadening potential of a mixed methods approach.

Having been confronted with non-coding, random coding, and physician coding, the researcher felt that one of the most positive and uplifting remarks of the semi-structured interviews was from the IAAH interviewee who indicated that at his hospital the four members of an understaffed medical records department were doing the coding. Merely to hear that at least one of the hospitals was adhering to the accepted international proven method was heartening. As the Thailand researchers, Ingun et al., (2015, p.146) pointed out, ‘Integrating a national health information system is a gradual and iterative process’. The fact that those four medical records employees were doing the coding, albeit in an understaffed department, makes it a certainty that in the long run, they will master clinical coding!

### 9.19.3 Qualitative instruments

The inclusion of qualitative instruments acts as a redeeming factor when the conditions in the study population are not an exact match for the prepared quantitative instrument.

The open-ended question gave the volunteer respondents an opportunity to go beyond the potential of the quantitative instrument, in stating their own personal views on the study question and indicating their own difficulties as hospital employees.

The contrary nature of doctors doing diagnosis coding was totally unexpected in terms of the thorough literature review of ICD-10 implementations in both developed and developing nations. This fact could not have emerged without a qualitative instrument.

Similarly, it was only through the interview that the researcher was able to confirm that at IAAH, the small Medical Records Department was doing the coding. This must raise the question of exactly what guidelines have been drawn up by the MOH to be followed by the individual hospitals.

## 9.20 The literary achievement and positioning of the study

In the assessment of the international consultants to the MOH on the overall implementation of eHealth, of which ICD-10 and clinical coding form an essential component, the Saudi MOH has undertaken an extremely ambitious project.

The study of factors influencing the implementation of ICD-10 in MOH public hospitals examined, in detail, a small but vital part of the plan that appears to be currently underestimated from the MOH perspective, as only necessary to prepare for insurance funding. In covering the context of Saudi healthcare and the obstacles that hindered earlier attempts at healthcare reform, it was established that many challenges that should have been overcome when they first arose remain.

A major category of health information constitutes the coded data arising from hospital inpatient healthcare diagnoses and procedures that in the long term contributes to appraisals on the quality of decisions, regimens of treatment, and efficacy of pharmaceuticals. Thus, the translation of the clinical documentation of hospital doctors into clinical coding is close to the heart of healthcare progress. At the organisational level, the factors are common to all system implementations, requiring preparatory planning that brings the human and technological resources to a point of operational readiness. As was suggested in the section on the role of the MOH, it can be gleaned that they suffer from isolation and have a far from comprehensive grasp of clinical coding as more than enabling insurance reimbursement and, to date, have not offered the national support essential to implement a national health information system. According to the study data, the implementation, to date, has not been executed successfully at any of the three levels.

This study has little functional value in developed nations but holds value for the implementation of clinical coding in many developing nations. It holds direct value for the next decade in Saudi Arabia as national healthcare attempts to overcome the challenges outlined in the thesis and successfully implement the promised eHealth package, thus, unleashing greater quality in Saudi healthcare and facilitating the contribution of valuable hospital data to the global health community.

The study has accessed and drawn on the accumulated wealth of Saudi healthcare information literature, mostly in the form of journal articles. The only comparable thesis appears to be the work of Alkraiji on the lack of health data standards, which was frequently referred to in the HIT and literature sections of this study. However, this study exceeds the latter work in its extent of coverage and particularly its inherent value for Saudi healthcare in the decade that culminates in Vision 2030. The work marks the foundation stage of the institutionalisation of Saudi health information and an implementation that can be built on, once the necessary principles and practices are acknowledged.

## 9.21 Suggestions for further research

This thesis studied the various theoretical and empirical strands to examine the factors that will influence the implementation of clinical coding to provide a logical framework for the best answers of the research question upon which this study was based. Despite that, some interesting recommendations regarding future studies in this field became evident, and thus this study also provided valuable suggestions that could be considered in further research.

As this study was restricted to public hospitals, it is suggested that more research is needed on hospitals in other healthcare sectors to ascertain any differences between them and the public hospitals examined in this study regarding clinical coding implementation.

Further exploratory studies’ qualitative or exploratory sequential research design needs to account for the varying circumstances found in the different levels of public hospitals, i.e. the sizes or classification of those hospitals, and whether they are tertiary- or secondary-level healthcare providers.

Finally, in claiming full ownership of Saudi national healthcare and making a valid contribution to international health, the historical ascent of Saudi healthcare indicates its reliance on expatriate professionals and indirectly on the medical training institutions of other countries. Notwithstanding the unique cultural pillars of the country, it adheres to the principles of western medicine. To establish self-reliance in national healthcare comparable with other nations, Saudi Arabia now needs to promote the training of healthcare professionals in the next generation and build the necessary institutions in which to train them. As we approach Vision 2030 and complete eHealth, researchers should pay attention to the decade beyond 2030 and provide the theoretical background that will help to reduce the requirement for expatriate professionals and initiate the building of more training institutions and national healthcare research centres.

## 9.22 Study conclusion

Clinical coding is a primary key to health information management and is a standard activity within most developed healthcare systems. Nearly all modern healthcare organisations use clinical coding packages to translate the clinical terminology in patient files into standard statistical codes, whether in relation to diagnoses or medical interventions. It follows, then, that clinical coding is a key contributor to improved health information management through streamlining access to information such as cause of death reporting, eligibility selection, medical services reimbursement, clinical data storage, clinical service assessment, health policy, and resource allotment.

The global trend to implement clinical coding reached the Saudi public healthcare provider through the continuous efforts of the Saudi Ministry of Health to improve the efficiency of its healthcare systems, especially its affiliated hospitals. The Australian Modification of clinical coding for diseases and procedures, broadly referred to as ICD-10-AM/ACHI/ACS, was selected to be the unified clinical coding system of diagnoses and procedures in those hospitals under this study. This study provided an exciting opportunity to advance our knowledge of the clinical coding implementation process by identifying and investigating the factors facilitating and hindering the process, which is believed to be the first such study in Saudi Arabia.

As such, this research project is important as it analyses obstructions to the adoption of clinical coding in Saudi Arabia and presents appropriate solutions. The study method provided an opportunity to collect data through combining two studies in order to achieve an in-depth understanding of the research topic. In this regard, the research can be described as exploratory or descriptive, as it promotes further understanding of the research issue.

The research adopted different ethical aspects such as maintaining the researcher's neutrality and ensuring compliance with set procedures; however, some limitations were recorded in this study, such as the time allocated for the data collection process in only two weeks. The data collection and research design stage contributed to the findings made, and enhanced the ability to answer the research question and meet the set objectives. The data obtained in this study focused on identifying the challenges facing clinical coding implementation and providing a comprehensive assessment of clinical coding in Saudi public hospitals by analysing quantitative and qualitative source data, and indicating how these challenges impact the implementation process.

Data analysed in this study was drawn from seven public hospitals which were selected by using purposive and convenience sampling methods. A concurrent mixed method design was utilised, consisting of two parallel approaches. The theoretical framework of this thesis was based on Diffusion of Innovation Theory. The quantitative approach involved a questionnaire used to collect data from a sample drawn from a population consisting mostly of healthcare professional groups. The qualitative approach involved semi-structured interviews with participants including health information management staff. Data for the quantitative approach were collected using a convenience sample of 283 participants. Data for the qualitative approach were collected using a purposive sample of seven participants, while only one physician indicated a desire to be interviewed.

This study has demonstrated, for the first time, that the Saudi public hospitals have a low level of clinical coding adoption. In addition, the most staggering interviewee information relating to the research question was undoubtedly that at KFMC, the only hospital where clinical coding had commenced in practice, the diagnosis coding had been placed in the hands of the doctors without training them how to select the appropriate codes for each health condition to be stored in this system. This resulted in an inaccurate medical database. It is worth mentioning that this serious issue may also affect other Saudi public hospitals (not included in the scope of this study), as KFMC is classified as one of the modern teaching health organisations for public healthcare providers.

Moreover, this study confirmed that there are essential obstacles facing the implementation process. These impediments include challenges faced by the public hospitals that can be overcome by recruiting qualified employees in the fields of health informatics and health information management, hiring qualified clinical coders, and increasing awareness of the value and benefits of clinical coding among health professionals. Alongside the above obstacles, this study determined that different mechanisms should be considered to facilitate the implementation process through rebuilding health information technology infrastructure, adopting standardised electronic health record systems, upgrading health information management software and systems, and providing a dedicated budget for electronic health projects.

Further, this study found that the leading problems facing public hospitals in relation to clinical coding implementation were lack of training programs in general, lack of training programs in clinical coding, lack of evaluating the effectiveness of training programs, and lack of qualified trainers in clinical coding. From another angle, this study demonstrated the need to establish a supervisory organisation to monitor a unified plan for the implementation process in all public hospitals, as the current processes and strategies of clinical coding adoption are very much dependent upon individual efforts in each hospital. Moreover, one of the organisational obstacles facing the implementation process is the lack of interaction between clinical practitioners and clinical coders; improvement is necessary in this area to facilitate the implementation process. This study also demonstrated that lack of clear patient documentation in medical records has a negative impact on the implementation process.

# References

Abbas, T., & Charles, T. (2003). *Handbook of mixed methods in social & behavioral research*. London: Sage Publications, Thousand Oaks.

Abdelhak, M., Grostick, S., & Hanken, M. A. (2014). *Health information: management of a strategic resource*. Edinburgh: Elsevier Health Sciences.

AbouEl-Seoud, M. (2013). Measuring efficiency of reformed public hospitals in Saudi Arabia: an application of data envelopment analysis. *International Journal of Economics & Management Sciences, 2*(9), 44-53.

Aboul-Enein, F. H. (2002). Personal contemporary observations of nursing care in Saudi Arabia. *International journal of nursing practice, 8*(4), 228-230. https://doi.org/10.1046/j.1440-172X.2002.00370.x

Abrams, L. S. (2010). Sampling 'hard to reach'populations in qualitative research: The case of incarcerated youth. *Qualitative Social Work, 9*(4), 536-550. https://doi.org/10.1177/1473325010367821

Abramson, E. L., Edwards, A., Silver, M., & Kaushai, R. (2014). Trending health information technology adoption among New York nursing homes. *The American journal of managed care, 20*(11 Spec No. 17), eSP53- eSP59.

Abramson, E. L., McGinnis, S., Moore, J., & Kaushal, R. (2014). A statewide assessment of electronic health record adoption and health information exchange among nursing homes. *Health services research, 49*(1pt2), 361-372. https://doi.org/10.1111/1475-6773.12137

Achoui, M. M. (2009). Human resource development in Gulf countries: an analysis of the trends and challenges facing Saudi Arabia. *Human Resource Development International, 12*(1), 35-46. https://doi.org/10.1080/13678860802638826

Adeleke, I. T., Ajayi, O. O., Jimoh, A. B., Adebisi, A. A., Omokanye, S. A., & Jegede, M. K. (2015). Current clinical coding practices and implementation of ICD-10 in Africa: A survey of Nigerian hospitals. *American Journal of Health Research, 3*(1-1), 38-46. https://doi.org/10.11648/j.ajhr.s.2015030101.16

Adler-Milstein, J., Bates, D. W., & Jha, A. K. (2011). A survey of health information exchange organizations in the United States: implications for meaningful use. *Annals of internal medicine, 154*(10), 666-671. https://doi.org/10.7326/0003-4819-154-10-201105170-00006

Adler-Milstein, J., Bates, D. W., & Jha, A. K. (2013). Operational health information exchanges show substantial growth, but long-term funding remains a concern. *Health Affairs, 32*(8), 1486-1492. https://doi.org/10.1377/hlthaff.2013.0124

Adler-Milstein, J., DesRoches, C. M., Furukawa, M. F., Worzala, C., Charles, D., Kralovec, P., . . . Jha, A. K. (2014). More than half of US hospitals have at least a basic EHR, but stage 2 criteria remain challenging for most. *Health Affairs*, 9 (2014): 1664–1671. https://doi.org/10.1377/hlthaff.2014.0453

Adler-Milstein, J., Everson, J., & Lee, S. Y. D. (2015). EHR Adoption and Hospital Performance: Time-Related Effects. *Health services research, 50*(6), 1751-1771. https://doi.org/10.1111/1475-6773.12406

Ageli, M. M., & Zaidan, A. M. (2013). Road traffic accidents in saudi arabia: An ardl approach and multivariate granger causality. *International Journal of Economics and Finance, 5*(7), 26-31. https://doi.org/10.5539/ijef.v5n7p26

Agresti, A. (2007). *Categorical data analysis*. New York: Wiley-Interscience.

Aksoy, P., & DeNardis, L. (2007). *Information Technology in Theory*. Canada: Course Technology.

Al Aswad, A. M. (2015). *Issues Concerning the Adoption and Usage of Electronic Medical Records in Ministry of Health Hospitals in Saudi Arabia* (Doctoral dissertation, University of Sheffield).

Al Hamid, A., Aslanpour, Z., Aljadhey, H., & Ghaleb, M. (2016). Hospitalisation Resulting from Medicine-Related Problems in Adult Patients with Cardiovascular Diseases and Diabetes in the United Kingdom and Saudi Arabia. *International journal of environmental research and public health, 13*(5), 1-13. https://doi.org/10.3390/ijerph13050479

Al Kiyumi, R., Walker, S. M., Tariq, A., & FitzGerald, G. (2017). *Health information management professionals [Present circumstances and future expectations]*. Brisbane, Australia, Queensland University of Technology.

Al-Ahmadi, H., & Roland, M. (2005). Quality of primary health care in Saudi Arabia: a comprehensive review. *International Journal for Quality in Health Care, 17*(4), 331-346. https://doi.org/10.1093/intqhc/mzi046

Alanazy, S. (2006). *Factors associated with implementation of electronic health records* (Doctoral dissertation, University of Medicine and Dentistry of New Jersey).

Alaraki, M. (2018). Assessing the Organizational Characteristics Influencing Quality Improvement Implementation in Saudi Hospitals. *Quality management in health care, 27*(1), 8-16. https://doi.org/10.1097/QMH.0000000000000152

Albishi, H. (2011) Health Information Management in the Kingdom of Saudi Arabia. *International Federation of Health Information Management Associations.* Retrieved from https://ifhima.org/wp-content/uploads/2014/03/global_news_2011-issue_9-december_2011.pdf. (accessed 07 March 2015)

Albishi, H. (2014a). ICD-10 Implementation in Saudi Arabia: Challenges and Opportunities! E-Health is Transforming Medical Records to Health Information Management! Value in Health, 17(3), A10. https://doi.org/10.1016/j.jval.2014.03.066

Albishi, H. (2014b). ICD-10 Implementation in Saudi Arabia: Challenges and Opportunities! Enhancing the Health Information Management Profession! Presentation at. *Middle Eastern Health Informatics (MEHI) Summit, 26-28 October 2014*.

Aldossary, A., While, A., & Barriball, L. (2008). Health care and nursing in Saudi Arabia. *International nursing review, 55*(1), 125-128. https://doi.org/10.1111/j.1466-7657.2007.00596.x

Alghamdi, M. G., & Urden, L. D. (2016). Transforming the nursing profession in Saudi Arabia. *Journal of nursing management, 24*(1), E95-E100. https://doi.org/10.1111/jonm.12301

Al-Hanawi, M. K., Alsharqi, O., Almazrou, S., & Vaidya, K. (2018). Healthcare Finance in the Kingdom of Saudi Arabia: a qualitative study of householders' attitudes. *Applied health economics and health policy, 16*(1), 55-64. https://doi.org/10.1007/s40258-017-0353-7

Al-Hanawi, M. K., Khan, S. A., & Al-Borie, H. M. (2019). Healthcare human resource development in Saudi Arabia: emerging challenges and opportunities—a critical review. *Public Health Reviews*, 40(1), 1. https://doi.org/10.1186/s40985-019-0112-4

Al-Harbi, A. (2011). Healthcare Providers' Perceptions towards Health Information Applications at King Abdul-Aziz Medical City, Saudi Arabia. *International*

*Journal of Advanced Computer Science and Applications, 2*, 14-22. https://doi.org/10.14569/IJACSA.2011.021003

Alharbi, F., Atkins, A., & Stanier, C. (2015). Strategic framework for cloud computing decision-making in healthcare sector in Saudi Arabia. In *The seventh international conference on ehealth, telemedicine, and social medicine, 1*, 138-144.

Alharbi, F., Atkins, A., & Stanier, C. (2016). Understanding the determinants of Cloud Computing adoption in Saudi healthcare organisations. *Complex & Intelligent Systems*, *2*(3), 155-171. https://doi.org/10.1007/s40747-016-0021-9

Alharbi, M. (2018). An analysis of the Saudi health-care system's readiness to change in the context of the Saudi National Health-care Plan in Vision 2030. *International Journal of Health Sciences, 12*(3), 83-87.

Al-Harthi, F., Alenad, A., Baitalmal, H., & Alkhurashi, A. (1999). *Health over a century*. Riyadh, Saudi Arabia: Ministry of Health.

Al-Hashem, A. (2016). Health Education in Saudi Arabia: Historical overview. *Sultan Qaboos University Medical Journal*, *16*(3), e286-e292. https://doi.org/10.18295/squmj.2016.16.03.004

Alhelali, R. A., McNabb, S. J., & Memish, Z. A. (2016). Evaluation of home respiratory therapy delivered to patients in the Ministry of Health's Home Medical Program (HMP) and administered through the Madinah HMP Center, Kingdom of Saudi Arabia, 2013. *Journal of epidemiology and global health, 6*(1), 19-27. https://doi.org/10.1016/j.jegh.2015.07.006

Alhusaini, H. (2006). *Obstacles to the efficiency and performance of Saudi nurses at the Ministry of Health, Riyadh Region: analytical field study*. Riyadh, Saudi Arabia: Ministry of Health.

Alkadi, S. H. (2016). The Healthcare System in Saudi Arabia and its Challenges: The Case of Diabetes Care Pathway. *Journal of Health Informatics in Developing Countries*, *10*(1), 1-29.

Alkhamis, A. (2012). Health care system in Saudi Arabia: an overview. *Eastern Mediterranean Health Journal, 18*(10), 1078-1080. https://doi.org/10.26719/2012.18.10.1078

Alkhamis, A. A. (2017). Critical analysis and review of the literature on healthcare privatization and its association with access to medical care in Saudi Arabia. *Journal of infection and public health*, *10*(3), 258-268. https://doi.org/10.1016/j.jiph.2017.02.014

Alkhamis, A., Hassan, A., & Cosgrove, P. (2014). Financing healthcare in Gulf Cooperation Council countries: a focus on Saudi Arabia. *The International journal of health planning and management, 29*(1), e64-e82. https://doi.org/10.1002/hpm.2213

Alkraiji, A. (2012). *Issues of the adoption of HIT related standards at the decision-making stage of six tertiary healthcare organisations in Saudi Arabia* (Doctoral dissertation, Loughborough University).

Alkraiji, A., Jackson, T. W., & Murray, I. R. (2014). Steps towards the Development of National Health Data Standards in Developing Countries: An Exploratory Qualitative Study in Saudi Arabia. *World Academy of Science, Engineering and Technology, International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering, 8*(6), 1625-1631.

Alkraiji, A., Jackson, T., & Murray, I. (2011). Health data standards and adoption process: Preliminary findings of a qualitative study in Saudi Arabia. *Campus-Wide Information Systems, 28*(5), 345-359. https://doi.org/10.1108/10650741111181616

Alkraiji, A., Jackson, T., & Murray, I. (2012). The role of health data standards in developing countries. *Journal of Health Informatics in Developing Countries*, 6 (2), 454 – 466.

Alkraiji, A., Jackson, T., & Murray, I. (2013). Barriers to the widespread adoption of health data standards: an exploratory qualitative study in tertiary healthcare organizations in Saudi Arabia. *Journal of medical systems*, *37*(2), 1-13. https://doi.org/10.1007/s10916-012-9895-2

Alkraiji, A., Jackson, T., Murray, I., Irani, Z., & Irani, Z. (2016). Factors Impacting the Adoption Decision of Health Data Standards in Tertiary Healthcare Organisations in Saudi Arabia. *Journal of Enterprise Information Management, 29*(5), 650-676. https://doi.org/10.1108/JEIM-11-2014-0111

Alkraiji, A., Osama, E.-H., & Fawzi, A. (2014). Health Informatics Opportunities and Challenges: Preliminary Study in the Cooperation Council for the Arab States of the Gulf. *Journal of Health Informatics in Developing Countries, 8*(1), 36-45.

Allen, I. E., & Seaman, C. A. (2007). Likert scales and data analyses. *Quality progress, 40*(7), 64-65.

Allen, M.J., & Yen, W. M. (2001). *Introduction to Measurement Theory*. Long Grove, IL: Waveland Press.

Almalki, M., Fitzgerald, G., & Clark, M. (2011). Health care system in Saudi Arabia: an overview. *Eastern Mediterranean Health Journal, 17*(10), 784-793. https://doi.org/10.26719/2011.17.10.784

Almalki, Z. S., Albassam, A. A., Alnakhli, M. A., Alnusyan, M. F., Alanazi, F. N., & Alqurashi, M. S. (2019). National rates of emergency department visits associated with diabetes in Saudi Arabia, 2011-2015. *Annals of Saudi medicine*, 39(2), 71-76. https://doi.org/10.5144/0256-4947.2019.71

Almalki. M. (2012). *Quality of work life and turnover intention in primary healthcare organisations: A cross-sectional study of registered nurses in Saudi Arabia.* (Doctoral dissertation, Queensland University of Technology)

Almasabi, M. (2013). An Overview of Health System in Saudi Arabia. *Research Journal of Medical Sciences [P], 7*(3), 70-74. https://doi.org/10.3923/rjmsci.2013.70.74

Almoaber, B., & Amyot, D. (2017). Barriers to Successful Health Information Exchange Systems in Canada and the USA: A Systematic Review. *International Journal of Healthcare Information Systems and Informatics, 12*(1), 44-63. https://doi.org/10.4018/IJHISI.2017010104

Almuayqil, S., Atkins, A., & Sharp, B. (2015). Knowledge management framework for e-healthcare in Saudi Arabia. *Seventh International Conference on eHealth, Telemedicine, and Social Medicine*, 112-117.

Alnaif, M. S. (2006). Physicians perception of health insurance in Saudi Arabia. *Saudi medical journal, 27*(5), 693-699.

Alomeer, S. H. (2016). *Integration of clinical information systems in Saudi Arabian health care contexts: A grounded theory exploration* (Doctoral dissertation, Queensland University of Technology).

Alqahtani, A., Crowder, R., & Wills, G. (2017). Barriers to the Adoption of EHR Systems in the Kingdom of Saudi Arabia: An Exploratory Study Using a Systematic Literature Review. *Journal of Health Informatics in Developing Countries, 11*(2), 1-23.

Al-Rabeeah, A. (2003). The history of health care in the Kingdom of Saudi Arabia with emphasis on pediatric surgery. *Saudi medical journal, 24*(5), 9-10.

Alsadan, M., Elmetwally, A., Anna, A., Jamal, A., Khalifa, M., & Househ, M. (2015). Health Information Technology (HIT) in Arab Countries: A Systematic Review Study on HIT Progress. *Journal of Health Informatics in Developing Countries, 9*(2), 32-49.

Alsahafi, Y. A. (2012). *Studies of EHR implementation and operation in different countries with particular reference to Saudi Arabia: a thesis presented in partial fulfillment of the requirements of degree of Master in Information Science at Massey University, Albany campus, Auckland, New Zealand* (Doctoral dissertation, Massey University).

Alshahrani, M. S. (2017). Effect of private versus emergency medical systems transportation in motor vehicle accident victims: Trauma Center Experience in Saudi Arabia. *Journal of Family and Community Medicine, 24*(1), 30-31. https://doi.org/10.4103/2230-8229.197179

Alshamsan, R., Leslie, H., Majeed, A., & Kruk, M. (2017). Financial hardship on the path to universal health coverage in the Gulf states. *Health Policy*, 121(3), 315-320. https://doi.org/10.1016/j.healthpol.2016.12.012

Alsharif, A. I. (2008, July). Health system and insurance in Saudi Arabia. In *Board of Healthcare Funders Southern African Annual Conference, Durban*, 3-16.

Al-Sharqi, O. Z., & Abdullah, M. T. (2013). "Diagnosing" Saudi health reforms: is NHIS the right "prescription"? *The International journal of health planning and management*, *28*(4), 308-319. https://doi.org/10.1002/hpm.2148

Alshmemri, M. (2014). *Job satisfaction of Saudi nurses working in Saudi Arabian public hospitals*. (Doctoral dissertation, Royal Melbourne Institute of Technology University).

Alsulame, K., Khalifa, M., & Househ, M. (2015). eHealth in Saudi Arabia: Current Trends, Challenges and Recommendations. *Studies in health technology and informatics*, *213*, 233-236. https://doi.org/10.3233/978-1-61499-538-8-233

Alsulame, K., Khalifa, M., & Househ, M. (2016). E-Health status in Saudi Arabia: A review of current literature. *Health Policy and Technology, 5*(2), 204-210. https://doi.org/10.1016/j.hlpt.2016.02.005

Altalhi, N., A. (2017). *A comparative investigation into the culture of saftey in public hospitals in Saudi Arabia* (Doctoral dissertation, Monash University).

Altallal, S., A. (2013). *The effect of hospital organisational structure on patient and nurse outcomes* (Doctoral dissertation, Monash University).

Altuwaijri, M. M. (2010). Supporting the Saudi e-health initiative: the Master of Health Informatics programme at KSAU-HS. *EMHJ-Eastern Mediterranean Health Journal, 16 (1),* 119-124. https://doi.org/10.26719/2010.16.1.119

Altuwaijri, M., M. (2008). Electronic-health in Saudi Arabia. Just around the corner? *Saudi medical journal, 29*(2), 171-178.

Altuwaijri, M., M. (2012). Health Information Technology Strategic Planning Alignment in Saudi Hospitals: A Historical Perspective. *Journal of Health Informatics in Developing Countries, 5*(2), 338-355.

Altuwaijri, M., M., Sughayr, A. M., Hassan, M. A., & Alazwari, F. M. (2012). The effect of integrating short messaging servicesreminders with electronic medical records on non-attendance rates. *Saudi medical journal, 33*(2), 193-196.

American Health Information Management Association. (2012). Research Highlights Five Studies That Navigate ICD-10-CM/PCS Transition. Retrieved from https://www.ahimafoundation.org/downloads/pdfs/N120118-PHIM%20%20FINAL%201_20_12.pdf. (accessed 11 March 2014)

American Health Information Management Association. (2015). Saudi Health Information Management Association. Retrieved from http://www.ahima.org/Saudi/healthmanagement (accessed 05 February 2016)

Ancker, J. S., Witteman, H. O., Hafeez, B., Provencher, T., Van de Graaf, M., & Wei, E. (2015). The invisible work of personal health information management among people with multiple chronic conditions: qualitative interview study among patients and providers. *Journal of medical Internet research, 17*(6), 1-13. https://doi.org/10.2196/jmir.4381

Arizona Computer Services. (2015). ACS Medical Coding ICD-10-CM training workshop, 27-28 May 2015, Dubai. Retrieved from http://acsmb.com/training/past_training?cid=16. (accessed 24 May 2016)

Asan, O., & Carayon, P. (2017). Human Factors of Health Information Technology—Challenges and Opportunities. *International Journal of Human–Computer Interaction, 33(4),* 255-257. https://doi.org/10.1080/10447318.2017.1282755

Aspden, P., Corrigan, J. M., Wolcott, J., & Erickson, S. M. (2004). *Patient safety: achieving a new standard for care*. Washington: National Academies Press.

Atkinson, D. (1993). Improving cause-of-death statistics: the case of fetal deaths. *American journal of public health, 83*(8), 1084-1085. https://doi.org/10.2105/AJPH.83.8.1084

Attallah, N., Gashgari, H., Al Muallem, Y., Al Dogether, M., Al Moammary, E., Almeshari, M., & Househ, M. (2016). A Literature Review on Health Information Exchange (HIE). *Studies in health technology and informatics, 226*, 173-176.

Australian Consortium for Classification Development (ACCD). (2017). *The international statistical classification of diseases and related health problems, tenth revision, australian modification (ICD-10-AM/ACHI/ACS)* (Tenth ed.). Darlinghurst, NSW: Independent Hospital Pricing Authority. Retrieved from https://www.accd.net.au/Icd10.aspx. (accessed 13 June 2017)

Australian Digital Health Agency. (2018). Adoption of digital health records. Retrieved from https://www.digitalhealth.gov.au/get-started-with-digital-health/digital-health-evidence-review/adoption-of-digital-health-records (accessed 03 January 2020)

Australian Digital Health Agency. (2019). My Health Record statistics. Retrieved from https://www.myhealthrecord.gov.au/statistics (accessed 03 August 2019)

Averill, R. F., & Butler, R. (2013). Misperceptions, misinformation, and misrepresentations: The ICD-10-CM/PCS saga. *Journal of American Health Information Management Association*.

Averill, R. F., Mullin, R., Steinbeck, B., Goldfield, N., & Grant, T. (1998). Development of the ICD-10 Procedure Coding System (ICD-10-PCS). *Journal of American Health Information Management Association, 69(5)*, 65-72..

Azaizeh, H., Saad, B., Cooper, E., & Said, O. (2010). Traditional Arabic and Islamic medicine, a re-emerging health aid. *Evidence-Based Complementary and Alternative Medicine*, *7*(4), 419-424. https://doi.org/10.1093/ecam/nen039

Aziz, H. A. (2016). A review of the role of public health informatics in healthcare. *Journal of Taibah University Medical Sciences*, *12*(1), 78-81. https://doi.org/10.1016/j.jtumed.2016.08.011

Babbie, E. (1990). *Survey research methods*. 22938th ed. Australia: Cengage Learning.

Babbie, E. (2013a). *The basics of social research*. 6th ed. Australia: Cengage Learning.

Babbie, E. (2013b). *The practice of social research*. 13th ed. Canada: Nelson Education.

Bah, S., Alharthi, H., El Mahalli, A. A., Jabali, A., Al-Qahtani, M., & Al-kahtani, N. (2011). Annual survey on the level and extent of usage of electronic health records in government-related hospitals in Eastern Province, Saudi Arabia. *Perspectives in health information management/ American Health Information Management Association, 8*(Fall), 1-18.

Bah, S., Almutawa, H. H. A., Alassaf, N. F. M., Al Hareky, M. S., Hashishi, A. S. M., Alkhater, Z. J. H., & Ajaimi, J. A. M. (2015). Pilot Study of Reimbursement Practices in Private Healthcare Centers in the Eastern Province of Saudi Arabia: To What Extent Do They Meet International Best Practices? *Perspectives in Health Information Management, 12*(Spring), 1-7.

Bahakim, H., Bamgboye, E., Mahdi, A., Al-Mugeiren, M., & Familusi, J. (1993). Pediatric Inpatients at the King Khalid University Hospital Riyadh, Saudi Arabia, 1985. *Annals of Saudi medicine, 13*(1), 8-13.

Bailey, K. D. (1987). *Methods of social research*. New York: Free Press.

Baker, S. E. and R. Edwards (2012). How Many Qualitative Interviews are Enough? Expert voices and early career reflections on sampling and cases in qualitative research. *National Centre for Research Methods*. Retrieved from http://eprints.ncrm.ac.uk/2273/ (accessed 7 April 2016).

Baker, T. L. (1994). *Doing social research*. Boston, MA: McGraw-Hill College.

Balkair, A. (2010). National eHealth Program. Retrieved from https://www.itu.int/ITU-D/cyb/events/2012/e-health/Nat_eH_Dev/Session%204/KSA-MOH-Presentation-SaudiArabia%20FINAL.pdf

Balla, S., Ahmed, H., & Sebiany, A. (2002). Occupational health in Saudi Arabia. *Hanley & Belfus, Inc*, 17(3), 491-507.

Baltar, F., & Brunet, I. (2012). Social research 2.0: virtual snowball sampling method using Facebook. *internet Research*, *22*(1), 57-74. https://doi.org/10.1108/10662241211199960

Banta, D. (2009). What is technology assessment? *International journal of technology assessment in health care, 25*(S1), 7-9. https://doi.org/10.1017/S0266462309090333

Barakah, D. M., & Alsaleh, S. A. (2011). The cooperative insurance in Saudi Arabia: A nucleus to health reform policy. *In Proceedings of the International Conference on Information and Finance, Singapore (21)*, 6-10.

Bardhan, I. R., & Thouin, M. F. (2013). Health information technology and its impact on the quality and cost of healthcare delivery. *Decision Support Systems*, *55*(2), 438-449. https://doi.org/10.1016/j.dss.2012.10.003

Barnes, C., & Krinsky, T. (1999). Classifications systems, casemix and data quality: Implications for international management and research applications. *Casemix Quarterly, 1*(2), 1-13.

Bassi, J., & Bugis, S. (2019). A Warm Welcome for Foreign Investment in Healthcare in the Kingdom of Saudi Arabia. Retrieved from https://www.tamimi.com/law-update-articles/a-warm-welcome-for-foreign-investment-in-healthcare-in-the-kingdom-of-saudi-arabia/

Bastos, J. L., Duquia, R. P., González-Chica, D. A., Mesa, J. M., & Bonamigo, R. R. (2014). Field work I: selecting the instrument for data collection. *Anais brasileiros de dermatologia, 89*(6), 918-923. https://doi.org/10.1590/abd1806-4841.20143884

Baumann, L. C., & Karel, A. (2013). Electronic Health Record. *Encyclopedia of Behavioral Medicine*, 669-670. https://doi.org/10.1007/978-1-4419-1005-9

Baus, A. (2004). *Literature review: barriers to the successful implementation of healthcare information systems*. Office of Health Services Research: West Virginia University Department of Community Medicine.

Bazeley, P. (2002). Issues in mixing qualitative and quantitative approaches to research. *Applying qualitative methods to management research, 21*(2), 141-156.

Beasley, S., Girard, J. (2016). Office-based Physician EHR Adoption in Southern US States. *Nineteenth Annual Conference of the Southern Association for Information Systems (SAIS)*, St. Augustine, FL, 18 March 2016, 1-6.

Behi, R., & Nolan, M. (1995). Ethical issues in research. *British Journal of Nursing, 4*(12), 712-716. https://doi.org/10.12968/bjon.1995.4.12.712

Bekhet, A. K., & Zauszniewski, J. A. (2012). Methodological triangulation: an approach to understanding data. *Nurse researcher*, *20*(2), 40-43. https://doi.org/10.7748/nr2012.11.20.2.40.c9442

Beldiman, D. (2008). *Functionality, information works, and copyright*. Austria: Yorkhill Law Publ.

Bernard, H. R (2000). *Social research methods: Qualitative and quantitative approaches*. Thousand Oaks, California: Sage.

Bird, A., Brown, M., & Lusignan, B. (2005). *The History and Social Consequences of a Nationalized Oil Industry*. California: Stanford University.

Bonett, D. G. (2002). Sample size requirements for testing and estimating coefficient alpha. *Journal of educational and behavioral statistics, 27*(4), 335-340. https://doi.org/10.3102/10769986027004335

Boone, H. N., & Boone, D. A. (2012). Analyzing likert data. *Journal of extension,* 50(2), 1-5.

Bornman, E. (2009). *Questionnaire Surveys in Media Research*. In: Fourie, P.J. ed. Media Studies: Media Content and Media Audiences, vol 3. Cape Town, Juta & Co. Ltd.

Boulanouar, Z., Alqahtani, F., & Alqahtani, F. (2016). IPO underpricing in the insurance industry and the effect of Sharia compliance: Evidence from Saudi Arabian market. *International Journal of Islamic and Middle Eastern Finance and Management, 9*(3), 314-332. https://doi.org/10.1108/IMEFM-12-2014-0118

Bowen, W. H. (2014). *The history of Saudi Arabia*. Santa Barbara: Greenwood.

Bowens, F. M., Frye, P. A., & Jones, W. A. (2010). Health information technology: integration of clinical workflow into meaningful use of electronic health records. *Perspectives in health information management/,American Health Information Management Association, 7*(Fall), 1-18.

Bowker, G. C. (1996). The history of information infrastructures: The case of the international classification of diseases. *Information processing & management, 32*(1), 49-61. https://doi.org/10.1016/0306-4573(95)00049-M

Bowling, A. (2014). *Research methods in health: Investigating health and health services*. Maidenhead, Berkshire, England: Open University Press.

Bowman, S. E. (2005). Coordination of SNOMED-CT and ICD-10: getting the most out of electronic health record systems. Coordination of SNOMED-CT and ICD-10: Getting the Most out of Electronic Health Record Systems/AHIMA, *American Health Information Management Association.*

Bowman, S. E., & Zeisset, A. M. (2012). ICD-10-CM/PCS transition: Planning and preparation checklist. *ICD-10-CM/PCS Transition: Planning and Preparation Checklist/AHIMA, American Health Information Management Association*.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Brinkmann, S. (2014). *Interview*, *Encyclopedia of Critical Psychology*. Berlin: Springer. https://doi.org/10.1007/978-1-4614-5583-7_161

Brouch, K. L. (2000). Where in the world is ICD-10? Where in the World Is ICD-10, *American Health Information Management Association*. 8(2000), 52-57.

Buck, C. J. (2015). *2015 ICD-9-CM for Hospitals, Volumes 1, 2 and 3 Professional Edition - E-Book*. Saunders.

Buckholtz, R. (2013). Preparing for ICD-10 and Conforming Your Documentation. *The Journal of medical practice management: MPM, 29*(3), 178.

Buntin, M. B., Burke, M. F., Hoaglin, M. C., & Blumenthal, D. (2011). The benefits of health information technology: a review of the recent literature shows predominantly positive results. *Health Affairs, 30*(3), 464-471. https://doi.org/10.1377/hlthaff.2011.0178

Burns, N., & Grove, S. K. (2010). *Understanding Nursing Research - eBook: Building an Evidence-Based Practice*. St. Louis, MO: Saunders/Elsevier.

Cameron, R. (2009). A sequential mixed model research design: Design, analytical and display issues. *International Journal of Multiple Research Approaches*, *3*(2), 140-152. https://doi.org/10.5172/mra.3.2.140

Carolan, K., & Reitzel, D. (2011). Preparing your organization's training program for ICD-10: how to assess your organization's ICD-10 readiness, train staff, and predict the costs of converting to this new system. *Healthcare Financial Management, 65*(10), 110-115.

Carpentier, P. J. (2012). The Risk of Getting Paid: Why ICD-10-CM May Increase Physician Liability under the False Claims Act. *Quinnipiac Health LJ, 16*, 117.

Cascardo, D. (2014). Physician Challenges in 2015. *The Journal of medical practice management: MPM, 30*(6), 395-398.

Caskey, R., Zaman, J., Nam, H., Chae, S. R., Williams, L., Mathew, G., ... & Boyd, A. D. (2014). The transition to ICD-10-CM: challenges for pediatric practice. *Pediatrics*, *134*(1), 31-36. https://doi.org/10.1542/peds.2013-4147

Cassel, C., & Symon, G. (2004). *Essential guide to qualitative methods in organizational research*. Los Angeles: Sage

Castillo-Montoya, M. (2016). Preparing for interview research: The interview protocol refinement framework. *The Qualitative Report*, *21*(5), 811-831.

Castro, F. G., Kellison, J. G., Boyd, S. J., & Kopak, A. (2010). A methodology for conducting integrative mixed methods research and data analyses. *Journal of Mixed Methods Research, 4*(4), 342-360. https://doi.org/10.1177/1558689810382916

Cavana, R. Y., Delahaye, B. L., & Sekaran, U. (2001). *Applied business research: Qualitative and quantitative methods*. Milton, Qld: Wiley.

Cavanagh, S. (1997). Content analysis: concepts, methods and applications. *Nurse researcher, 4*(3), 5-16. https://doi.org/10.7748/nr1997.04.4.3.5.c5869

Centers for Disease Control and Prevention. (2007). The Disease Classification. Retrieved from https://theodora.com/diseases/classification.html.

Centers for Disease Control and Prevention. (2016). International Classification Of Diseases - 9 - CM, (1979). Scientific Data Documentation. Retrieved from https://wonder.cdc.gov/wonder/sci_data/codes/icd9/type_txt/icd9cm.asp (accessed 02 August 2017)

Centers for Medicare and Medicaid Services. (2015). ICD-10-CM/PCS The next generation of coding. Retrieved from https://www.thenationalcouncil.org/wp-content/uploads/2013/01/ICD-10TheNextGenerationofCoding.pdf (accessed 22 April 2016)

Central Department of Statistics and Information. (2016). Key indicators. Retrieved from https://www.stats.gov.sa/en (accessed 12 July 2016)

Cesnik, B., & Kidd, M. R. (2010). History of health informatics: a global perspective. *Stud Health Technol Inform, 151*, 3-8. https://doi.org/10.3233/978-1-60750-476-4-3

Chaudhry, B., Wang, J., Wu, S., Maglione, M., Mojica, W., Roth, E., . . . Shekelle, P. G. (2006). Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Annals of internal medicine*, *144*(10), 742-752. https://doi.org/10.7326/0003-4819-144-10-200605160-00125

Chenail, R. J. (2011). Interviewing the investigator: Strategies for addressing instrumentation and researcher bias concerns in qualitative research. *The qualitative report*, 16(1), 255-262.

Cheng, P., Gilchrist, A., Robinson, K. M., & Paul, L. (2009). The risk and consequences of clinical miscoding due to inadequate medical documentation: a case study of the impact on health services funding. *Health Information Management Journal, 38*(1), 35-46. https://doi.org/10.1177/183335830903800105

Christensen, L. B., Johnson, R. B., & Turner, L. A. (2011). *Research Methods, Design, and Analysis*. Boston, MA: Pearson.

Chute, C. G., Huff, S. M., Ferguson, J. A., Walker, J. M., & Halamka, J. D. (2012). There are important reasons for delaying implementation of the new ICD-10 coding system. *Health Affairs, 31*(4), 836-842. https://doi.org/10.1377/hlthaff.2011.1258

Coiera, E. (2003). Healthcare terminologies and classification systems. *Guide to Health Informatics, Hodder Arnold*, 201-216. https://doi.org/10.1201/b13618-23

Coiera, E. (2015). *Guide to health informatics*. Boca Raton: CRC Press, Taylor & Francis Group.

Colicchio, T. K., Facelli, J. C., Del Fiol, G., Scammon, D. L., Bowes, W. A., & Narus, S. P. (2016). Health information technology adoption: Understanding research protocols and outcome measurements for IT interventions in health care. *Journal of Biomedical Informatics, 63*, 33-44. https://doi.org/10.1016/j.jbi.2016.07.018

Collins, Allbon, P., & Bennett, V. (2010). The coding workforce shortfall. *Australian Institute of Health and Welfare*. Retrieved from https://www.aihw.gov.au/getmedia/68650421-97aa-46cd-811d-20c22ecd061b/11875.pdf.aspx?inline=true (accessed 3 June 2016).

Collins, Onwuegbuzie, A. J., & Jiao, Q. G. (2007). A mixed methods investigation of mixed methods sampling designs in social and health science research. *Journal of Mixed Methods Research, 1*(3), 267-294. https://doi.org/10.1177/1558689807299526

Combs, T. (2016). The Impact of Clinical Documentation Improvement on the International Stage. *Journal of American Health Information Management Association, 87*(7), 58-59.

Cornelis, I., Van Hiel, A., Roets, A., & Kossowska, M. (2009). Age differences in conservatism: Evidence on the mediating effects of personality and cognitive style. *Journal of personality*, 77(1), 51-88. https://doi.org/10.1111/j.1467-6494.2008.00538.x

Coustasse, A., & Paul III, D. P. (2013). Adoption of the ICD-10 standard in the United States: The time is now. *The health care manager, 32*(3), 260-267. https://doi.org/10.1097/HCM.0b013e31829d77bc

Cowie, M. R., Blomster, J. I., Curtis, L. H., Duclaux, S., Ford, I., Fritz, F., . . . Leenay, M. (2017). Electronic health records to facilitate clinical research. *Clinical Research in Cardiology, 106*(1), 1-9. https://doi.org/10.1007/s00392-016-1025-6

Cresswell, K., & Sheikh, A. (2013). Organizational issues in the implementation and adoption of health information technology innovations: an interpretative review. *International journal of medical informatics, 82*(5), e73-e86. https://doi.org/10.1016/j.ijmedinf.2012.10.007

Creswell, J. W. (*2009*). *Research design*: *Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA, US: Sage Publications.

Creswell, J. W. (2013). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Thousand Oaks, CA, US: Sage Publications.

Creswell, J. W., & Clark, V. L. P. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA, US: Sage Publications, Inc.

Cronbach, L. J., & Shavelson, R. J. (2004). My current thoughts on coefficient alpha and successor procedures. *Educational and Psychological Measurement, 64*(3), 391-418. https://doi.org/10.1177/0013164404266386

Curtis, K., Bollard, L., & Dickson, C. (2002). Coding errors and the trauma patient-is nursing case management the solution? *Australian Health Review, 25*(4), 73-80. https://doi.org/10.1071/AH020073

Davis, N. A., & LaCour, M. (2014). *Health information technology*. St. Louis, MO: Elsvier/Saunders.

Dawoud, S. O., Ahmad, A. M. K., Alsharqi, O. Z., & Al-Raddadi, R. M. (2016). Utilization of the Emergency Department and Predicting Factors Associated With Its Use at the Saudi Ministry of Health General Hospitals. *Global journal of health science, 8*(1), 90. https://doi.org/10.5539/gjhs.v8n1p90

Dawson, C. (2016). *100 activities for teaching research methods*. London: SAGE Publications.

De Coster, C., Li, B., & Quan, H. (2008). Comparison and validity of procedures coded With ICD-9-CM and ICD-10-CA/CCI. *Medical care, 46*(6), 627-634. https://doi.org/10.1097/MLR.0b013e3181649439

De Lusignan, S. (2005). The barriers to clinical coding in general practice: a literature review. *Medical informatics and the Internet in medicine, 30*(2), 89-97. https://doi.org/10.1080/14639230500298651

De Maeseneer, J., Van Weel, C., Egilman, D., Mfenyana, K., Kaufman, A., Sewankambo, N., & Flinkenflögel, M. (2008). Funding for primary health care in developing countries. In: British Medical Journal Publishing Group. https://doi.org/10.1136/bmj.39496.444271.80

De Raeve, P., Gomez, S., Hughes, P., Lyngholm, T., Sipilä, M., Kilanska, D., ... & ENS4Care project. (2016). Enhancing the provision of health and social care in Europe through eHealth. *International nursing review*, *64*(1), 33-41. https://doi.org/10.1111/inr.12266

De Vaus, D. (2013). *Surveys in social research*. London: Routledge.

De Wulf, M. (2016). *Population Pyramids of the World from 1950 to 2100*. Retrieved from https://www.populationpyramid.net/world/2065/ (accessed 3 May 2016).

DeAlmeida, D. R., Watzlaf, V. J., Anania-Firouzan, P., Salguero, O., Rubinstein, E., Abdelhak, M., & Parmanto, B. (2014). Evaluation of inpatient clinical documentation readiness for ICD-10-CM. *Perspectives in Health Information Management, 11*(Winter), 1-16.

Del Greco, L., Walop, W., & Eastridge, L. (1987). Questionnaire development: 3. Translation. *CMAJ: Canadian Medical Association Journal, 136*(8), 817-818.

Delice, A. (2010). The Sampling Issues in Quantitative Research. *Educational Sciences: Theory and Practice, 10*(4), 2001-2018.

Determann, M., & Al-Semmari, S. K. (2010). A History of the Arabian Peninsula. *Bulletin of the School of Oriental and African Studies. University of London, 73*(2), 318- 319. https://doi.org/10.1017/S0041977X10000169

DiCicco-Bloom, B., & Crabtree, B. F. (2006). The qualitative research interview. *Medical education, 40*(4), 314-321. https://doi.org/10.1111/j.1365-2929.2006.02418.x

Dimick, C. (2012). Health Information Management 2025: Current “Health IT Revolution” Drastically Changes HIM in The Near Future. *Journal of American Health Information Management Association, 83*(8), 24-31.

Dimitropoulos, V., Cumerlato, M., Shamim, C., & Madden, R. (2014). Singapore’s migration to a new classification system. HIM-interchange online, 4(1 ). Retrieved from http://himaa2.org.au/HIM-I/sites/default/files/HIMI%204-1%20Dimitropoulos%20et%20al.pdf. (accessed 03 November 2016)

Dinev, T., Albano, V., Xu, H., D’Atri, A., & Hart, P. (2016). Individuals’ Attitudes Towards Electronic Health Records: A Privacy Calculus Perspective. In *Advances* *in Healthcare Informatics and Analytics*, (Springer), 19-50. https://doi.org/10.1007/978-3-319-23294-2_2

Doyle, K., & Dimitropoulos, V. (2009). Keeping our classification up to date. *Health Information Management Journal, 38*(1), 50-52. https://doi.org/10.1177/183335830903800107

Drever, E. (1995). *Using semi-structured interviews in small-scale research: A teachers guide*. Glasgow: The SCRE centre

Duckett, S. (2000). The development of Australian refined diagnosis related groups: the Australian inpatient casemix classification. *Casemix Quarterly, 2*(4), 115-120.

Dyers, R. E., Evans, J., Ward, G. A., Du Plooy, S., & Mahomed, H. (2016). Are central hospitals ready for National Health Insurance? ICD coding quality from an electronic patient discharge record for clinicians. *SAMJ: South African Medical Journal, 106*(2), 181-185. https://doi.org/10.7196/SAMJ.2016.v106i2.10079

Easterby-Smith, M., Thorpe, R., & Jackson, P. R. (2012). *Management research*. London: SAGE.

El Mahalli, A. A. (2015a). Adoption and Barriers to Adoption of Electronic Health Records by Nurses in Three Governmental Hospitals in Eastern Province, Saudi Arabia. *Perspectives in Health Information Management, 12*(Fall), 1-8. https://doi.org/10.4103/2278-0521.151407

El Mahalli, A. A. (2015b). Electronic health records: Use and barriers among physicians in eastern province of Saudi Arabia. *Saudi Journal for Health Sciences*, *4*(1), 32, 32-41. https://doi.org/10.4103/2278-0521.151407

Elkin, P. L. (2012). *Terminology and terminological systems*. London: Springer.

Epp, C. (2001). *Internet based Technologies and Systems for the support of indirect procurement* (Master's thesis, German National Library).

Erickson, S. M., Wolcott, J., Corrigan, J. M., & Aspden, P. (2003). *Patient Safety:: Achieving a New Standard for Care*. Washington, D.C.. National Academies Press.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics, 5*(1), 1-4. https://doi.org/10.11648/j.ajtas.20160501.11

Evans, R. (2016). Electronic health records: then, now, and in the future. Yearbook of medical informatics, 25(S 01), S48-S61. https://doi.org/10.15265/IYS-2016-s006

Evans, T. G., Chowdhury, A., Evans, D., Fidler, A., Lindelow, M., Mills, A., . . . Team, T. R (2012). *Thailand's Universal Coverage Scheme Successes and Challenges – An Independent assessment of the first 10 years (2001-2011)*. Nonthaburi, Thailand: Health Insurance System Research Office.

Fagbo, S., Skakni, L., Chu, D., Garbati, M., Peiris, M., & Hakawi, A. (2016). Multiple introductions of MERS-CoV in a 2014 hospital outbreak in Riyadh, Saudi Arabia. *International Journal of Infectious Diseases, 45*, 21. https://doi.org/10.1016/j.ijid.2016.02.080

Fan, S., & Lê, Q. (2011). Developing a valid and reliable instrument to evaluate the Web-Based Learning Environment in an Australian University Context. *Journal of Online Learning and teaching, 7*(3), 366-379.

Farhan, J., Al-Jummaa, S., Alrajhi, A., Al-Rayes, H., & Al-Nasser, A. (2005). Documentation and coding of medical records in a tertiary care center: a pilot study. *Ann Saudi Med, 25*(1), 46-49. https://doi.org/10.5144/0256-4947.2005.46

Farr, W. (1885). *Vital statistics : a memorial volume of selections from the reports and writings of William Farr*. The Sanitary Institute, London.

Fathalla, M. F., & Fathalla, M. M. (2004). A practical guide for health researchers: World Health Organization. *Regional Office for the Eastern Mediterranean*.

Ferber, R. (1977). Research by convenience. *Journal of Consumer Research, 4(1),* 57-58. https://doi.org/10.1086/208679

Ferenc, D. P. (2013). *Understanding hospital billing and coding*. St. Louis, MO: Elsevier.

Field, A. (2009). *Discovering Statistics Using SPSS*. 3rd Edition, London : Sage Publications Ltd.

Fielding, N. G. (2012). Triangulation and mixed methods designs: Data integration with new research technologies. *Journal of Mixed Methods Research, 6*(2), 124-136. https://doi.org/10.1177/1558689812437101

Fiorito, M., & Edens, T. (2016). *Health Information Management (HIM) White Paper*. Houston: Marion Financial Group.

Founkham, R. (2016). Health Information System Development and ICD-10 implementation in Lao PDR. Introductory workshop: implementation ICD-10 simplified version in Laos PDR. Retrieved from http://thcc.or.th/apn8th/download/Lao/ICD%2010%20BKK.pdf. (accessed 23 November 2016)

Franklin, R. C., Jacobs, J. P., Krogmann, O. N., Béland, M. J., Aiello, V. D., Colan, S. D., . . . Maruszewski, B. (2008). Nomenclature for congenital and paediatric cardiac disease: historical perspectives and The International Pediatric and Congenital Cardiac Code. *Cardiology in the Young, 18*(S2), 70-80. https://doi.org/10.1017/S1047951108002795

Frisse, M. E., Johnson, K. B., Nian, H., Davison, C. L., Gadd, C. S., Unertl, K. M., . . . Chen, Q. (2012). The financial impact of health information exchange on emergency department care. *Journal of the American Medical Informatics Association, 19*(3), 328-333. https://doi.org/10.1136/amiajnl-2011-000394

Gabriel, M. H., Jones, E. B., Samy, L., & King, J. (2014). Progress and challenges: implementation and use of health information technology among critical-access hospitals. *Health Affairs, 33*(7), 1262-1270. https://doi.org/10.1377/hlthaff.2014.0279

Gallagher, E. B. (2002). Modernization and health reform in Saudi Arabia, Chapter 4. *Health care reform around the world. London, Auburn House*, 181-197.

Geer, J. G. (1988). What do open-ended questions measure? *Public Opinion Quarterly, 52*(3), 365-367. https://doi.org/10.1086/269113

German Institute of Medical Documentation and Information. (2016). From ILCD to ICD-10. Retrieved from https://www.dimdi.de/static/en/klassi/icd-10-who/historie/ilcd-icd10/index.htm. (accessed 08 November 2016)

Gersenovic, M. (1995). The lCD Family of Classifications. *Meth Inform Med, 34*, 178. https://doi.org/10.1055/s-0038-1634590

Ghauri, P., & Gronhaug, K. (2005). *Research methods in business studies: A practical guide*. Harlow: Financial Times Prentice Hall.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report*, *8*(4), 597-606.

Goldstein, J. (2015). Strategies for successful ICD-10 implementation. *Health management technology, 36*(9), 12-13.

Gorsuch, R. L. (1983). *Factor analysis*. Hillsdale, New Jersey: Lawrence Erlbaum.

Govt of Canada. (2001). History of Diagnosis and Procedure Classifications Hospital Morbidity Database. Retrieved from http://www23.statcan.gc.ca/imdb-bmdi/document/3203_D6_T9_V1-eng.pdf (accessed 06 May 2018)

Green, J., & Thorogood, N. (2004). *Qualitative methods for health research*. London: *Sage* Publications.

Grider, D. C. P. C. (2012). Keeping Up with ICD-10: Will the Extension Stick? *The Journal of Medical Practice Management : MPM, 28*(2), 123-124.

Griffin, P. M., Nembhard, H. B., DeFlitch, C. J., Bastian, N. D., Kang, H., & Muñoz, D. A. (2016). Complexity and Systems in Healthcare. *Healthcare Systems Engineering*, 25-52. https://doi.org/10.1002/9781119174639.ch2

Grimson, J., Grimson, W., & Hasselbring, W. (2000). The SI challenge in health care. *Communications of the ACM, 43*(6), 48-55. https://doi.org/10.1145/336460.336474

Groenewold, E. (2016). Measuring the effectiveness of feedback in clinical coding training. *Assessment Zone*, 45. In Siddiqui, Z., & Wijesinghe, R. (2016*). Assessment Zone issue 3. This is an excellent resource produced by my students and worth sharing it*.

Guffey, S., & Duchek, D. (2013). Preparing Your Practice for ICD-10. *The Journal of medical practice management: MPM, 28*(5), 303.

Hair, J. F., Anderson, R. E., Babin, B. J., Tatman, R. L., & Black, W. C. (2010). *Multivariate data analysis* (7th ed.). New Jersey: Prentice Hall.

Hall, G. (20013). *How to write a paper.* Oxford: Wiley-Blackwell.

Hammid, F., & Cline, T. (2013). Providers' acceptance factors and their perceived barriers to electronic health record (EHR) adoption. *Online Journal of Nursing Informatics, 17*(3).

Hammond, W. E. (2005). The making and adoption of health data standards. *Health Affairs, 24*(5), 1205-1213. https://doi.org/10.1377/hlthaff.24.5.1205

Hanney, S. R., & González-Block, M. A. (2015). Health research improves healthcare: now we have the evidence and the chance to help the WHO spread such benefits globally. https://doi.org/10.1186/s12961-015-0006-y

Hanson, W. E., Creswell, J. W., Clark, V. L. P., Petska, K. S., & Creswell, J. D. (2005). Mixed methods research designs in counseling psychology. *Journal of counseling psychology, 52*(2), 224-235. https://doi.org/10.1037/0022-0167.52.2.224

Hare, F. A. (1883). *William Farr*. London: 111, Finsbury Park.

Harrell, M. C., & Bradley, M. (2009). *Data collection methods: Semi-structured interviews and focus groups*. Santa Monica, CA: RAND.

Harris, L. R., & Brown, G. T. (2010). Mixing interview and questionnaire methods: Practical problems in aligning data. *Practical Assessment, Research & Evaluation, 1(15),* 1-19.

Hart, G. D. (2001). Descriptions of blood and blood disorders before the advent of laboratory studies. *British journal of haematology, 115*(4), 719-728. https://doi.org/10.1046/j.1365-2141.2001.03130.x

Hasanain , R. A., & Cooper, H. (2014). Solutions to Overcome Technical and Social Barriers to Electronic Health Records Implementation in Saudi Public and Private Hospitals. *Journal of Health Informatics in Developing Countries, 8*(1), 46-63.

Hasanain, R. A., Vallmuur, K., & Clark, M. (2015). Electronic Medical Record Systems in Saudi Arabia: Knowledge and Preferences of Healthcare Professionals. *Journal of Health Informatics in Developing Countries, 9*(1), 23-31.

Hassanien, A. A., Majeed, A., & Watt, H. (2014). Retrospective observational study examining indications for hospitalisation among haemodialysis patients at one of the Ministry of Health Hospitals in Makkah, Saudi Arabia. *Journal of the Royal Society of Medicine Open, 5*(10), 1-11. https://doi.org/10.1177/2054270414547146

Haux, R., Winter, A., Ammenwerth, E., & Brigl, B. (2013). *Strategic information management in hospitals: an introduction to hospital information systems*: Springer Science & Business Media.

Hayajneh, S., & Zaghloul, A. A. (2012). *Barriers to the Adoption of Health Information Technology in Arab Countries' Hospitals: Practitioners' Perspective.* Paper presented at the 24th International Conference of the European Federation for Medical Informatics Quality of Life through Quality of Information–MIE2012.

Haynes, S. N., Richard, D., & Kubany, E. S. (1995). Content validity in psychological assessment: A functional approach to concepts and methods. *Psychological assessment*, *7*(3), 238-247. https://doi.org/10.1037/1040-3590.7.3.238

Hazazi, A. M., & Chandramohan, S. (2017). Privatization of Saudi health-care system and its significant effect: A review. *International Journal of Medical Science Public Health, 6*(12), 1652-1655. https://doi.org/10.5455/ijmsph.2017.0927211102017

Hazelwood, A. C. (2003). ICD-9 CM to ICD-10 CM: implementation issues and challenges. *ICD-9 CM to ICD-10 CM: Implementation Issues and Challenges/AHIMA, American Health Information Management Association*.

Hazzazi, H. (2018). Hospital privatization making headway. Retrieved from http://saudigazette.com.sa/article/526392/SAUDI-ARABIA/Hospital-privatization-makingsa-headway (accessed 08 April 2018)

Health Information Management Association of Australia. (2015). FAQs - What is ICD-10-AM, ACHI and ACS? Retrieved from http://www.himaa2.org.au/education/index.php?q=node/81 (accessed 16 August 2015)

Health Information Management Association of Australia. (2016). Why Employers in the Health Industry Need Health Information Professionals. Retrieved from https://www.alia.org.au/sites/default/files/Why%20Employers%20in%20the%20Health%20Industry%20Need%20Health%20Information%20Professionals%207Oct2016_dv001.pdf (accessed 22 January 2017)

Henn, M., Foard, N., & Weinstein, M. (2005). *A short introduction to social research*. London: Sage Publ

Hennessy, D. A., Quan, H., Faris, P. D., & Beck, C. A. (2010). Do coder characteristics influence validity of ICD-10 hospital discharge data? *BMC health services research, 10*(1), 1-9. https://doi.org/10.1186/1472-6963-10-99

Hennink, M., Hutter, I., & Bailey, A. (2010). *Qualitative research methods*. London: SAGE Publications.

Hersh, W. (2009). A stimulus to define informatics and health information technology. *BMC Medical Informatics and Decision Making, 9*(1), 1-6. https://doi.org/10.1186/1472-6947-9-24

Hersh, W. B., Totten, A., Eden, K., Devine, B., Gorman, P., Kassakian, S. Z., . . . McDonagh, M. (2016). *Health Information Exchange: Navigating and Managing a Network of Health Information Systems* Chapter 14. In Health information exchange: navigating and managing a network of health information systems. Edited by Dixon, B. (Ed.). Cambridge: Academic Press

Hertzog, M. A. (2008). Considerations in determining sample size for pilot studies. *Research in nursing & health, 31*(2), 180-191. https://doi.org/10.1002/nur.20247

Hesse-Biber, S. N., & Leavy, P. (2010). *The practice of qualitative research*. Los Angeles: SAGE.

Heywood, N. A., Gill, M. D., Charlwood, N., Brindle, R., Kirwan, C. C., & Collaborative, N. R. (2016). Improving accuracy of clinical coding in surgery:

collaboration is key. *Journal of Surgical Research*, 2(204), 490-495. https://doi.org/10.1016/j.jss.2016.05.023

Hillestad, R., Bigelow, J., Bower, A., Girosi, F., Meili, R., Scoville, R., & Taylor, R. (2005). Can electronic medical record systems transform health care? Potential health benefits, savings, and costs. *Health Affairs, 24*(5), 1103-1117. https://doi.org/10.1377/hlthaff.24.5.1103

Hogan, T. P., Benjamin, A., & Brezinski, K. L. (2000). Reliability methods: A note on the frequency of use of various types. *Educational and Psychological Measurement, 60*(4), 523-531. https://doi.org/10.1177/00131640021970691

Holloway, I. (1997). *Basic concepts for qualitative research*. London: Blackwell Science.

Holmgren, A. J., Patel, V., & Adler-Milstein, J. (2017). Progress in interoperability: measuring US hospitals' engagement in sharing patient data. *Health Affairs, 36*(10), 1820-1827. https://doi.org/10.1377/hlthaff.2017.0546

Hoover, R. (2017). Benefits of using an electronic health record. *Nursing2017 Critical Care, 12*(1), 9-10. https://doi.org/10.1097/01.CCN.0000508631.93151.8d

Houser, S. H., Morgan, D., Clements, K., & Hart-Hester, S. (2013). Assessing the Planning and Implementation Strategies for the ICD-10-CM/PCS Coding Transition in Alabama Hospitals. *Perspectives in health information management/ American Health Information Management Association, American Health Information Management Association, 10*(Spring).

Hsieh, H.-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research, 15*(9), 1277-1288. https://doi.org/10.1177/1049732305276687

Hughes, D., & Leethongdee, S. (2007). Universal coverage in the land of smiles: lessons from Thailand's 30 Baht health reforms. *Health Affairs, 26*(4), 999-1008. https://doi.org/10.1377/hlthaff.26.4.999

Husty, T. M., & Newell, L. M. (2013). *Cracking the Code: Physician Clinical Documentation and ICD-10* (0735-0732). Retrieved from http://www.kiran-consortium.com/library/whitepapers/TKCG%20White%20Paper%20-%2001%202012%20The%20C-Scape%20Series%20Cracking%20the%20Code-Physician%20Clinical%20Documentation%20and%20ICD-10%20FINAL.pdf (accessed 16 May 2017)

Husty, T. M., & Newell, L. M. (2013). ICD-10: cracking the code. *Healthcare Financial Management, 67*(7), 32-36.

Independent Hospital Pricing Authority. (2015). AR-DRG classification system. Retrieved from https://www.ihpa.gov.au/what-we-do/products/AR-DRG-classification-system (accessed 19 September 2015)

Ingun, P., Narkpaichit, C., & Boongerd, P. (2015). Thailand health information system improvement through universal health coverage implementation. *Journal of the Thai Medical Informatics Association, 2*, 137-147.

Innes, K., Peasley, K., & Roberts, R. (2000). Ten down under: implementing ICD-10 in Australia. *American Health Information Management Association, American Health Information Management Association*, 1(2000), 52-56.

Institute for Health Metrics and Evaluation. (2017). Saudi Arabia. Retrieved from http://www.healthdata.org/saudi-arabia (accessed 02 January 2018)

International Classification of Traditional Medicine. (2010). ICTM. Retrieved from https://sites.google.com/site/whoictm/.

Jamoom, E., & Hing, E. (2015). *Progress with electronic health record adoption among emergency and outpatient departments: United States, 2006-2011*. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.

Jannadi, B., Alshammari, H., Khan, A., & Hussain, R. (2008). Current structure and future challenges for the healthcare system in Saudi Arabia. *Asia Pacific Journal of Health Management, 3*(1), 43-50.

Jenn, N. C. (2006). Designing a questionnaire. *Malaysian family physician: the official journal of the Academy of Family Physicians of Malaysia, 1*(1), 32-35.

Jetté, N., Quan, H., Hemmelgarn, B., Drosler, S., Maass, C., Moskal, L., . . . Jakob, R. (2010). The development, evolution, and modifications of ICD-10: challenges to the international comparability of morbidity data. *Medical care, 48*(12), 1105-1110. https://doi.org/10.1097/MLR.0b013e3181ef9d3e

Jha, A. K., Doolan, D., Grandt, D., Scott, T., & Bates, D. W. (2008). The use of health information technology in seven nations. *International journal of medical informatics*, 77(12), 848-854. https://doi.org/10.1016/j.ijmedinf.2008.06.007

Jiang, G., Pathak, J., & Chute, C. G. (2009). Formalizing ICD coding rules using formal concept analysis. *Journal of Biomedical Informatics, 42*(3), 504-517. https://doi.org/10.1016/j.jbi.2009.02.005

Johanson, G. A., & Brooks, G. P. (2010). Initial scale development: sample size for pilot studies. *Educational and Psychological Measurement, 70*(3), 394-400. https://doi.org/10.1177/0013164409355692

Johnson, K. (2004). Implementation of ICD-10: Experiences and lessons learned from a Canadian hospital. Journal of *American Health Information Management Association*. Retrieved from http://library.ahima.org/xpedio/groups/public/documents/ahima/bok3_005558.hcsp?dDocName=bok3_005558

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational researcher, 33*(7), 14-26. https://doi.org/10.3102/0013189X033007014

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research, 1*(2), 112-133. https://doi.org/10.1177/1558689806298224

Jutel, A. (2011). Classification, disease, and diagnosis. *Perspectives in biology and medicine*, *54*(2), 189-205. https://doi.org/10.1353/pbm.2011.0015

Kaelber, D. C., & Bates, D. W. (2007). Health information exchange and patient safety. *Journal of Biomedical Informatics, 40*(6), S40-S45. https://doi.org/10.1016/j.jbi.2007.08.011

Kalachanis, K., & Michailidis, I. E. (2015). The Hippocratic view on humors and human temperament. *Eur. J. Soc. Behav*, 2, 1-5.

Kaminski, J. (2011). Diffusion of Innovation Theory. *Canadian Journal of Nursing Informatics, 6*(2), 1-6.

Kasemsap, K. (2017). Analyzing the role of health information technology in global health care. *Handbook of research on healthcare administration and management*, 287-307. https://doi.org/10.4018/978-1-5225-0920-2.ch017

Kemper, E. A., Stringfield, S., & Teddlie, C. (2003). Mixed methods sampling strategies in social science research. *Handbook of mixed methods in social and behavioral research*, 273-296.

Khalifa, M. (2013). Barriers to health information systems and electronic medical records implementation. A field study of Saudi Arabian hospitals. *Procedia Computer Science, 21(2013),* 335-342. https://doi.org/10.1016/j.procs.2013.09.044

Khalifa, M. (2014). Technical and human challenges of implementing hospital information systems in Saudi Arabia. *Journal of Health Informatics in Developing Countries, 8*(1), 12-25.

Khaliq, A. A. (2011). The Saudi health care system: a view from the minaret. *World health & population, 13*(3), 52-64. https://doi.org/10.12927/whp.2012.22875

Khan, C. M.-U.-H. (2016). Saudi Arabia's Vision 2030. *Defence Journal, 19*(11), 36-42.

Khoja, T., Rawaf, S., Qidwai, W., Rawaf, D., Nanji, K., & Hamad, A. J. C. (2017). Health care in Gulf Cooperation Council countries: a review of challenges and opportunities. *9*(8), 1-11. https://doi.org/10.7759/cureus.1586

Khouja, T. (2013). *Reform of financing healthcare services in the GCC: focus on establishing health insurance system in KSA* (Doctoral dissertation, University of Pittsburgh).

Khudair, A. (2008). Electronic health records: Saudi physicians' perspective. *Paper presented at the Appropriate Healthcare Technologies for Developing Countries, 2008. AHT 2008. 5th IET Seminar on*. https://doi.org/10.1049/ic:20080575.

Kijsanayotin, B. (2016). *EHealth in Thailand: Interoperability and health information standards*. Nonthaburi: Thai Health Information Standards Development Center, Health System Research Institution.

Kim, Y. (2011). The pilot study in qualitative inquiry: Identifying issues and learning lessons for culturally competent research. *Qualitative Social Work, 10*(2), 190-206. https://doi.org/10.1177/1473325010362001

Kimaro, H., & Nhampossa, J. (2007). The challenges of sustainability of health information systems in developing countries: comparative case studies of Mozambique and Tanzania. *Journal of Health Informatics in Developing Countries, 1*(1), 1-10.

Kimura, S., Sato, T., Ikeda, S., Noda, M., & Nakayama, T. (2010). Development of a database of health insurance claims: standardization of disease classifications and anonymous record linkage. *Journal of epidemiology, 20*(5), 413-419. https://doi.org/10.2188/jea.JE20090066

King, N., Horrocks, C., & Brooks, J. (2019). *Interviews in qualitative research*. Los Angeles: Sage Publications.

King, Patel, V., Jamoom, E. W., & Furukawa, M. F. (2014). Clinical benefits of electronic health record use: national findings. *Health services research, 49*(1pt2), 392-404. https://doi.org/10.1111/1475-6773.12135

Kortüm, K., Hirneiß, C., Müller, M., Babenko, A., Kampik, A., & Kreutzer, T. C. (2016). The influence of a specific ophthalmological electronic health record on ICD-10 coding. *BMC Medical Informatics and Decision Making, 16*(1), 2-7. https://doi.org/10.1186/s12911-016-0340-1

Kostoulas, A. (2014) Likert scales: Four things you may not know. Retrieved from https://achilleaskostoulas.com/2013/09/09/four-things-you-probably-didnt-know-about-likert-scales/

Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Delhi: New Age International (P) Limited.

Kroll, T., & Neri, M. (2009). Designs for mixed methods research. *Mixed methods research for nursing and the health sciences,* 31-49. https://doi.org/10.1002/9781444316490.ch3

Kruse, C. S., Kothman, K., Anerobi, K., & Abanaka, L. (2016). Adoption Factors of the Electronic Health Record: A Systematic Review. *JMIR medical informatics, 4*(2), e19. https://doi.org/10.2196/medinform.5525

Kruse, C. S., Mileski, M., Alaytsev, V., Carol, E., & Williams, A. (2015). Adoption factors associated with electronic health record among long-term care facilities: a systematic review. *BMJ open, 5*(1), e006615, 1-9. https://doi.org/10.1136/bmjopen-2014-006615

Kumar, P. D. (2016). Politics and Universal Health Coverage. *New England Journal of Medicine, 374*(5), 494-494. https://doi.org/10.1056/NEJMc1513946

Kumar, S., Collins, T. (2017) Impact of ICD-10 Implementation on Medical Facilities. *JSM Health Educ Prim Health Care 2(3):1036*, 1-6.

Kvale, S. (1996). *Interviews: An introduction to qualitative research interviewing*. London:Thousand Oaks: Sage Publications.

Lackey, N. R., & Wingate, A. L. (1998). The pilot study: One key to research success. *Advanced design in nursing research*, 375-384. https://doi.org/10.4135/9781452204840.n15

Lalonde, A. N., & Taylor, E. (1997). Medical classification systems in Canada: moving toward the year 2000. *Canadian Medical Association Journal, 157*(11), 1561-1565.

Lancaster, H. O. (2012). *Expectations of life: A study in the demography, statistics, and history of world mortality*. New York: Springer Science Business Media, LLC.

Latimer, J. (2010). Meeting of the who collaborating centres for the family of international classifications. *Annual Report of the WHO Collaborating Center for the Family of International Classifications for North America, October 2009 – September 2010*.

Lavin, M., Harper, E., & Barr, N. (2015). Health information technology, patient safety, and professional nursing care documentation in acute care settings. *OJIN: The Online Journal of Issues in Nursing*, *20*(2). https://doi.org/10.3912/OJIN.Vol20No02PPT04

Leech, N. L., & Onwuegbuzie, A. J. (2011). Beyond constant comparison qualitative data analysis: Using NVivo. *School Psychology Quarterly*, *26*(1), 70-84. https://doi.org/10.1037/a0022711

Liamputtong, P. (2013). *Research methods in health: Foundations for evidence-based practice*. Oxford: Oxford University Press.

Libicki, M. C., & Brahmakulam, I. T. (2004). *The costs and benefits of moving to the ICD-10 code sets*. Santa Monica (CA): RAND Corporation.

Longhurst, R. (2003). Semi-structured Interviews and Focus Groups. In N. Clifford, & G. Valentine (Eds.), *Key Methods in Geography by N. Clifford and G. Valentine (Eds)*, 117-132. London: SAGE Publications.

Louise Barriball, K., & While, A. (1994). Collecting Data using a semi-structured interview: a discussion paper. *Journal of advanced nursing*, *19*(2), 328-335. https://doi.org/10.1111/j.1365-2648.1994.tb01088.x

Lozano, R., Wang, H., Foreman, K. J., Rajaratnam, J. K., Naghavi, M., Marcus, J. R., . . . Atkinson, C. (2011). Progress towards Millennium Development Goals 4 and 5 on maternal and child mortality: an updated systematic analysis. *The Lancet*, *378*(9797), 1139-1165. https://doi.org/10.1016/S0140-6736(11)61337-8

Lucyk, K., Lu, M., Sajobi, T., & Quan, H. (2016). Disease Groupings: What are They, How are They Used, and How Do They Compare Internationally? *Perspectives in Health Information Management*. 1-12.

Lucyk, K., Tang, K., & Quan, H. (2017). Barriers to data quality resulting from the process of coding health information to administrative data: a qualitative study. *BMC health services research*, 17(1), 766. https://doi.org/10.1186/s12913-017-2697-y

Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing Research, 35*(6), 382-386. https://doi.org/10.1097/00006199-198611000-00017

Lyon, A. R., & Lewis, C. C. (2016). Designing health information technologies for uptake: development and implementation of measurement feedback systems in mental health service delivery. *Administration and Policy in Mental Health and Mental Health Services Research, 43*(3), 344-349. https://doi.org/10.1007/s10488-015-0704-3

Maguire, N. (2012). Commonsense Approach to ICD-10 Implementation. *The Journal of Medical Practice Management : MPM, 28*(2), 148-149.

Majid, M. A. A., Othman, M., Mohamad, S. F., Lim, S. A. H., & Yusof, A. (2017). Piloting for interviews in qualitative research: Operationalization and lessons learnt. *International Journal of Academic Research in Business and Social Sciences*, 7(4), 1073-1080. https://doi.org/10.6007/IJARBSS/v7-i4/2916

Malhotra, N. (2006). Questionnaire design and scale development. In R. Grover & M. Vriens *The handbook of marketing research: Uses, misuses, and future advances* (pp. 84-94). Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781412973380.n5

Manchikanti, L. (2015). Survival strategies for tsunami of ICD-10-CM for interventionalists: pursue or perish! *Pain physician*, *18*, E685-E712.

Manchikanti, L., Falco, F. J., & Hirsch, J. A. (2011). Necessity and implications of ICD-10: Facts and fallacies. *Pain physician*, *14*(5), E405-E425.

Manchikanti, L., Hammer, M. J., Boswell, M. V., Kaye, A. D., & Hirsch, J. A. (2016). A Seamless Navigation to ICD-10-CM for Interventional Pain Physicians: Is a Rude Awakening Avoidable? *Pain physician, 19,* E1-E14.

Manchikanti, L., Kaye, A., Singh, V., & Boswell, M. (2015). The tragedy of the implementation of ICD-10-CM as ICD-10: Is the cart before the horse or is there a tragic paradox of misinformation and ignorance. *Pain physician*, *18*(4), E485-E495.

Manchikanti, L., Marvel, H., Mark, B., Alan, K., & Joshua, H. (2015). Survival strategies for tsunami of ICD-10-CM for interventionalists: pursue or perish! *Pain physician*, *18*, E685-E712.

Mansuri, F. A., Al-Zalabani, A. H., Zalat, M. M., & Qabshawi, R. I. (2015). Road safety and road traffic accidents in Saudi Arabia. A systematic review of existing evidence. *Saudi medical journal, 36*(4), 418-424. https://doi.org/10.15537/smj.2015.4.10003

Marshall, M. N. (1996). Sampling for qualitative research. *Family practice, 13*(6), 522-526. https://doi.org/10.1093/fampra/13.6.522

Marušič, D., & Prevolnik Rupel, V. (2016). Health care reforms. *Slovenian Journal of Public Health, 55*(3), 225-227. https://doi.org/10.1515/sjph-2016-0028

Mason, M. (2010). Sample size and saturation in PhD studies using qualitative interviews. In *Forum qualitative Sozialforschung/Forum: qualitative social research*, *11(3).*

Mathers, C. D., Ma Fat, D., Inoue, M., Rao, C., & Lopez, A. D. (2005). Counting the dead and what they died from: an assessment of the global status of cause of death data. *Bulletin of the world health organization, 83*, 171-177c.

McConnell, H. (2003). International efforts in implementing national health information infrastructure and electronic health records. *World hospitals and health services: the official journal of the International Hospital Federation, 40*(1), 33-37, 39-40, 50-32.

McHale, T. (1980). A prospect of Saudi Arabia. *International Affairs (Royal Institute of International Affairs 1944-), 56*(4), 622-647. https://doi.org/10.2307/2618170

McKenzie, K and Walker, S and Lewis, M (2003) Building the Bridge to E-Coding. *In Proceedings Health Information Management Association of Australia Conference 2003*, Sydney.

McKenzie, K., & Scott, D. A. (2011). Using routinely collected hospital data for child maltreatment surveillance: issues, methods and patterns. *BMC public health, 11*(1), 2-10. https://doi.org/10.1186/1471-2458-11-7

McKenzie, K., Enraght-Moony, E. L., Waller, G., Walker, S. M., Harrison, J. E., & McClure, R. J. (2009). Causes of injuries resulting in hospitalisation in Australia: assessing coder agreement on external causes. *Injury Prevention, 15*(3), 188-196. https://doi.org/10.1136/ip.2008.020479

McKenzie, K., Walker, S., Dixon-Lee, C., Dear, G., & Moran-Fuke, J. (2004) Clinical coding internationally: a comparison of the coding workforce in Autralia, America, Canada and England. *In Proceedings 14th International Federation of Health Records Congress*, Washington.

McWay, D. C. (2013). *Todays health information management: An integrated approach*. Clifton Park, NY: Delmar/Cengage Learning.

Meadows, K. A. (2003). So you want to do research? 5: Questionnaire design. *British journal of community nursing, 8(12)*, 562-570. https://doi.org/10.12968/bjcn.2003.8.12.11854

Meigs, S. L., & Solomon, M. (2016). Electronic health record use a bitter pill for many physicians. *Perspectives in Health Information Management, 13*(Winter), 1-17.

Menon, S., Singh, H., Meyer, A. N., Belmont, E., & Sittig, D. F. (2014). Electronic health record–related safety concerns: A cross-sectional survey. *Journal of Healthcare Risk Management, 34*(1), 14-26. https://doi.org/10.1002/jhrm.21146

Michel, J. L., & Jackson, T. J. (2009). Australian hospital data: not just for funding. *Health Information Management Journal, 38*(1), 53-58. https://doi.org/10.1177/183335830903800108

Miles, M., Latham, H., & Biles, J. (2016). The Australian and New Zealand health care systems. In *Chronic Care Nursing: A Framework for Practice* (pp. 64-74).[5] Cambridge University Press.

Minichiello, V. (2004). *Handbook of research methods for nursing and health science*. Frenchs Forest, NSW: Pearson Education Australia.

Ministry of Health. (2005). *Health Statistical Year Book*. Riyadh, Saudi Arabia: Ministry of Health, Department of Statistics.

Ministry of Health. (2010). *Health Statistical Year Book*. Riyadh, Saudi Arabia: Ministry of Health, Department of Statistics.

Ministry of Health. (2011). *Health Statistical Year Book*. Riyadh, Saudi Arabia: Ministry of Health, Department of Statistics.

Ministry of Health. (2012). *Health Statistical Year Book*. Riyadh, Saudi Arabia: Ministry of Health, Department of Statistics.

Ministry of Health. (2013a). ICD-10-AM: Introduction. Retrieved from https://www.moh.gov.sa/en/HICC/ICD10AM/Pages/Introduction.aspx (accessed 03 July 2014)

Ministry of Health. (2013b). *Health Statistical Year Book*. Riyadh, Saudi Arabia: Ministry of Health, Department of Statistics.

Ministry of Health. (2014). *Health Statistical Year Book*. Riyadh, Saudi Arabia: Ministry of Health, Department of Statistics.

Ministry of Health. (2015). *Health Statistical Year Book*. Riyadh, Saudi Arabia: Ministry of Health, Department of Statistics.

Ministry of Health. (2017). *Health Statistical Year Book*. Riyadh, Saudi Arabia: Ministry of Health, Department of Statistics.

Minsity of Health. (2012). Dr. Khoshaim Opens a Training Course on the Application of the International Statistical Classification of Diseases. Retrieved from https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/News-2012-07-04-001.aspx (accessed 18 July 2014)

Moczygemba, J., & Fenton, S. H. (2012). Lessons learned from an ICD-10-CM clinical documentation pilot study. *Perspectives in health information management*, *9*(Winter), 1c.

Moczygemba, J., & Fenton, S. H. (2012). Lessons learned from an ICD-10-CM clinical documentation pilot study. *Perspectives in health information management/ American Health Information Management Association, American Health Information Management Association*, *9*(Winter), 1-11.

Monestime, J. (2015). *ICD-10-CM Implementation Strategies: An Application of the Technology Acceptance Model* (Doctoral dissertation, Walden University).

Moriyama, I. M., Loy, R. M., Robb-Smith, A. H., Rosenberg, H. M., & Hoyert, D. L. (2011). *History of the statistical classification of diseases and causes of death*. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.

Morris, W, Gomes, S, Allen, M. (2012). International classification of traditional medicine. *Glob Adv Health Med*. 1(4), 38-41. https://doi.org/10.7453/gahmj.2012.1.4.005.

Morrissey, J. (2002). Doctor's orders. Computerized decision-support system directs Vanderbilt physicians to the latest treatment data, helping to eliminate unnecessary costs. *Modern healthcare, 32*(16), 32.

Moskal, L. (2004). Implementation of ICD-10-CA and CCI in Canada. *Implementation of ICD-10-CA and CCI in Canada/AHIMA, American Health Information Management Association*.

Mufti, M. H. (2000). *Healthcare Development Strategies in the Kingdom of Saudi Arabia*. Boston, MA: Springer US.

Mugapish , M., & Hasan , A. (2016). The Success of Health Insurance for Saudis Citizens: Hospital Privatization in Saudi Arabia. *European Journal of Business and Management. 8(18)*, 183-192.

Mulla, A. (2001). *Privatization of general hospitals and its applications in saudi arabia*. Riyadh: King Fahad National Library.

Mullin, R. L. (1999). Brief History of ICD-10-PCS. *American Health Information Management Association, 70(9),* 1-3.

Murphy, D., Wiley, M. M., Clifton, A., & McDonagh, D. (2004). *Updating clinical coding in Ireland: Options and opportunities*. Dublin: The Economic and Social Research Institute (ESRI).

Murtagh, F., & Heck, A. (2012). *Multivariate data analysis* (Vol. 131): Springer Science & Business Media.

Mustofa, A. (2016). Contesting Welfare State: Health Care System in Australia. *Jurnal Kajian Wilayah, 2*(1), 2-18.

Narayanan, S. V., & Rose, R. J. (2017). A Survey of Health Information Management (HIM). *ERES International Journal of Information Management, 1*(1), 5-7.

National Casemix and Classification Centre (NCCC). (2016). About Casemix. Retrieved from https://nccc.uow.edu.au/casemix/aboutcasemix/index.html (accessed 09 February 2016)

Niblock, T. (2004). *Saudi Arabia: Power, legitimacy and survival*. London: Routledge.

Nicholls, R. (2016). Capacity Management in Healthcare Services. *Medical Maestro Magazine,* 16, 2250-2253.

Nomenclature of Diseases. (1877). *The Indian medical gazette*, *12*(5), 130–131.

O'Carroll, P. W., Yasnoff, W. A., Ward, M. E., Ripp, L. H., & Martin, E. L. (2003). *Public health informatics and information systems*. New York: Springer.

Olsen, W. (2004). Triangulation in social research: qualitative and quantitative methods can really be mixed. *Developments in sociology, 20,* 103-118.

O'Malley, K. J., Cook, K. F., Price, M. D., Wildes, K. R., Hurdle, J. F., & Ashton, C. M. (2005). Measuring diagnoses: ICD code accuracy. *Health services research, 40*(5p2), 1620-1639. https://doi.org/10.1111/j.1475-6773.2005.00444.x

Ong, D. (2009). *The International Students' Handbook: Living and Studying in Australia*. Sydney: UNSW Press.

Onwuegbuzie, A., & Teddlie, C. (2003). A framework for analyzing data in mixed methods research. In A. Tashakkori & C. Teddlie (Eds.), Handbook of mixed methods in social and behavioral research (pp. 351-383). London, England: Sage.

Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organization science, 3*(3), 398-427. https://doi.org/10.1287/orsc.3.3.398

Ossebaard, H. C., & Van Gemert-Pijnen, L. (2016). eHealth and quality in health care: implementation time. *International journal for quality in health care, 28*(3), 415-419. https://doi.org/10.1093/intqhc/mzw032

Otero, C., Almerares, A., Luna, D., Marcelo, A., Househ, M., & Mandirola, H. (2016). Health informatics in developing countries: a review of unintended consequences of IT implementations, as they affect patient safety and recommendations on how to address them. *Yearbook of medical informatics*, *25*(01), 70-72. https://doi.org/10.1055/s-0038-1641611

Padgett, D. (2008). *Qualitative methods in social work research* (2nd Edition ed. Vol. 36). Los Angeles: SAGE.

Palmer, G. R., & Short, S. D. (2000). *Health care and public policy: An Australian analysis*. South Yarra, Australia: Palgrave Macmillan.

Paoin, W. (2006). Development of ICD-10 Thai Modification in Thailand. Retrieved from http://apps.who.int/classifications/apps/icd/meetings/2006meeting/WHOFIC2006%20-%20C406%20-%20Development%20of%20ICD-10%20Thai%20Modification%20in%20Thailand.pdf. (accessed 03 May 2019)

Paoin, W. (2007). Road map for ICD-10 implementation in developing; country and pitfalls to avoid, the Thailand experience Paper presented at the WHO-FIC Asia Pacific Network 2nd meeting, September 10 - 11, 2007, Kyoto, Japan. Conf retrieved from Retrieved from http://www.whoficapn.com/apn/pdf_files/09dis_thai.pdf (accessed 22 Augest 2018)

Paoin, W. (n.d.). Thai Medical Informatics Association and medical informatics activity in Thailand. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.545.5159&rep=rep1&type=pdf. (accessed 10 May 2019)

Paoin, W., Yuenyongsuwan, M., Yokobori, Y., Endo, H., & Kim, S. (2018). Development of the ICD-10 simplified version and field test. *Health Information Management Journal*, *47*(2), 77-84. https://doi.org/10.1177/1833358317701277.

Paoin, W., Yuenyongsuwan, M., Yokobori, Y., Kim, S., Endo, H., & Suenaga, H. (2017). *Activities of WHO-FIC Asia-Pacific Network*. Paper presented at the WHO-FIC Asia-Pacific Network Conference Mexico City. Retrieved from from http://www.who.int/classifications/network/2017_WHOFIC_Poster_Booklet.zip?ua=1. (accessed 17 May 2019)

Patalong, F. (2017). Joining up the dots… Saudi healthcare reform. Retrieved from https://www.tamimi.com/law-update-articles/joining-dots-saudi-healthcare-reform/.

Patil, R. A., & Patil, A. D. (2017). Use of information technology in healthcare sector for improving outcomes. *International Journal of Basic & Clinical Pharmacology, 3*(2), 269-271. https://doi.org/10.5455/2319-2003.ijbcp20140403

Paul III, D., David, P., Sacconi, P. A., Glover, P. A., & Marriot, R. (2017). ICD-10 implementation: Is the workforce ready?. *in Business & Health Administration Proceedings, Avinandan Mukherjee, Editor*, 88-97.

Pearn, J. (2011). Differentiating diseases: the centrum of differential diagnosis in the evolution of Oslerian Medicine. *Fetal and pediatric pathology, 30*(1), 1-15. https://doi.org/10.3109/15513815.2011.520252

Peeters, J. M., Krijgsman, J. W., Brabers, A. E., De Jong, J. D., & Friele, R. D. (2016). Use and Uptake of eHealth in General Practice: A Cross-Sectional Survey and Focus Group Study Among Health Care Users and General Practitioners. *JMIR medical informatics, 4*(2), 1-10. https://doi.org/10.2196/medinform.4515

Perlin, J. B. (2016). Health information technology interoperability and use for better care and evidence. *Jama, 316*(16), 1667-1668. https://doi.org/10.1001/jama.2016.12337

Perreault, L. E., & Shortliffe, E. H. (2001). *Medical informatics: Computer applications in health care*. New York: Springer.

Perry, S. E. (2001). Appropriate use of pilot studies. *Journal of Nursing Scholarship, 33*(2), 107.

Peterson, R. A., & Kim, Y. (2013). On the relationship between coefficient alpha and composite reliability. *Journal of Applied Psychology, 98*(1), 194. https://doi.org/10.1037/a0030767

Phadouangdeth, L. (2015). ICD 10 Related to Public Health in Lao PDR. *Paper presented at the 7th Meeting of Asia Pacific net work, Siem Reap,* Cambodia, 28-30 June 2015.

Phillips, E., Pugh, D. S., & Johnson, C. (2010). *How to get a PhD: A handbook for students and their supervisors*. Maidenhead: Open University Press.

Polgar, S., & Thomas, S. A. (2008). *Introduction to research in the health sciences* (5th ed.). Sydney, New South Wales: Churchill Livingstone Elsevier.

Polit, D. F., & Beck, C. T. (2006). The content validity index: are you sure you know what's being reported? Critique and recommendations. *Research in nursing & health, 29*(5), 489-497. https://doi.org/10.1002/nur.20147

Polit, D. F., Beck, C. T., & Hungler, B. P. (2001). *Essentials of nursing research: Methods, appraisal, and utilization*. Philadelphia: Lippincott.

Polit, D.F. and Beck, C.T. (2010) *Essentials of Nursing Research: Appraising Evidence for Nursing Practice*. 7th Edi-tion, Wolters Kluwer Health/Lippincott Williams & Wilkins, Philadelphia.

Polyzos, N., Karanikas, H., Thireos, E., Kastanioti, C., & Kontodimopoulos, N. (2013). Reforming reimbursement of public hospitals in Greece during the economic crisis: implementation of a DRG system. *Health Policy, 109*(1), 14-22. https://doi.org/10.1016/j.healthpol.2012.09.011

Pongpirul, K., Walker, D. G., Rahman, H., & Robinson, C. (2011). DRG coding practice: a nationwide hospital survey in Thailand. *BMC health services research, 11*(1), 1-10. https://doi.org/10.1186/1472-6963-11-290

Pope, C., & Mays, N. (2006). *Qualitative Methods in Health Research* Chapter 1. In Qualitative Research in Health Care. Edited by Pope C, Mays N. Massachusetts: Balckwell Publishing ltd.

Poppensiek, G., & Budd, D. (1966). *A historical survey of animal-disease morbidity and mortality reporting*. Washington: National Academy of Sciences-National Research Council.

Postle, B., Koeldnik, N., & Miocevich, T. (2009). The coding conundrum: a workplace perspective. *Health Information Management Journal, 38*(1), 47-49. https://doi.org/10.1177/183335830903800106

Poynter, F. N. (1973). Sydenham's influence abroad. *Medical history, 17*(3), 223. https://doi.org/10.1017/S0025727300018718

Prescott, P. A., & Soeken, K. L. (1989). The potential uses of pilot work. *Nursing Research, 38*(1), 60. https://doi.org/10.1097/00006199-198901000-00015

Price, E., & Robinson, K. (2011). Professional practice and innovation: The coding masterpiece: a framework for the formal pathways and processes of health classification. *Health Information Management Journal, 40*(1), 14-20. https://doi.org/10.1177/183335831104000103

Rahmathulla, G., Deen, H. G., Dokken, J. A., Pirris, S. M., Pichelmann, M. A., Nottmeier, E. W., . . . Wharen Jr, R. E. (2014). Implementation and impact of ICD-10 (Part II). *Surgical neurology international, 5*(Suppl 3), S192. https://doi.org/10.4103/2152-7806.137182

Rahurkar, S., Vest, J. R., & Menachemi, N. (2015). Despite the spread of health information exchange, there is little evidence of its impact on cost, use, and quality of care. *Health Affairs, 34*(3), 477-483. https://doi.org/10.1377/hlthaff.2014.0729

Ram, P. (2014). Management of Healthcare in the Gulf Cooperation Council (GCC) countries with special reference to Saudi Arabia. *International Journal of Academic Research in Business and Social Sciences, 4*(12), 24. https://doi.org/10.6007/IJARBSS/v4-i12/1326

Rattray, J., & Jones, M. C. (2007). Essential elements of questionnaire design and development. *Journal of clinical nursing, 16*(2), 234-243. https://doi.org/10.1111/j.1365-2702.2006.01573.x

Raykov, T. (2001). Bias of Coefficient afor Fixed Congeneric Measures with Correlated Errors. *Applied psychological measurement, 25*(1), 69-76. https://doi.org/10.1177/01466216010251005

Regional Health Systems Observatory. (2006). Health Systems Profile- Saudi Arabia. Retrieved from http://apps.who.int/medicinedocs/documents/s17308e/s17308e.pdf (accessed 12 February 2016)

Reid, B., Allen, C., & McIntosh, J. (2005). Investigation of leukaemia and lymphoma AR-DRGs at a Sydney teaching hospital. *Health Information Management, 34*(2), 34-39. https://doi.org/10.1177/183335830503400204

Riazi, A. M. (1999). *A dictionary of research methods: Quantitative and qualitative*. Tehran, Iran: Rahnama Publications.

Risjord, M., Moloney, M., & Dunbar, S. (2001). Methodological triangulation in nursing research. *Philosophy of the Social Sciences, 31*(1), 40-59. https://doi.org/10.1177/004839310103100103

Roberts, R. (2004). ICD-10: an Update on the Worldwide Implementation. The Australian Experience, *American Health Information Management Association*.

Roberts, R. F., Innes, K. C., & Walker, S. M. (1998). Introducing ICD-10-AM in Australian hospitals. *The Medical Journal of Australia, 169*, S32-35. https://doi.org/10.5694/j.1326-5377.1998.tb123473.x

Rogers, E. M. (1995). Diffusion of Innovations: modifications of a model for telecommunications. In *Die Diffusion von Innovationen in der Telekommunikation* (pp. 25-38): Springer, Berlin, Heidelberg.

Rogers, E. M. (2003). *Difussion of innovations*. 5th edition. New York: Free Press.

Rose, M. E. (1971). The doctor in the Industrial Revolution. *British journal of industrial medicine*, *28*(1), 22. https://doi.org/10.1136/oem.28.1.22

Rouse, W. B. (2008). Health care as a complex adaptive system: implications for design and management. *Bridge-Washington-National Academy of Engineering-*, *38*(1), 17.

Rubio, D. M., Berg-Weger, M., Tebb, S. S., Lee, E. S., & Rauch, S. (2003). Objectifying content validity: Conducting a content validity study in social work research. *Social work research, 27*(2), 94-104. https://doi.org/10.1093/swr/27.2.94

Saati, A. (2000). Principles of hospital management: applications in Saudi Arabia. *Riyadh: King Fahad National Library*.

Safi, O. (2016a). The Challenges For Saudi Arabia Health Care System. *Indian Journal of Applied Research*, *6*(5), 231-233.

Safi, O. (2016b). Indian And Saudi Arabian Health Care Systems: A Comparative Study. *Indian Journal of Applied Research*, *6*(5), 229-230.

Sahay, S. (2001). Special issue on “IT and health care in developing countries”. *The Electronic Journal of Information Systems in Developing Countries, 5(1)*, 1-6. https://doi.org/10.1002/j.1681-4835.2001.tb00029.x

Sahin, I. (2006). Detailed review of Rogers' diffusion of innovations theory and educational technology-related studies based on Rogers' theory. *TOJET: The Turkish Online Journal of Educational Technology, 5*(2), 14-23.

Sale, J. E., Lohfeld, L. H., & Brazil, K. (2002). Revisiting the quantitative-qualitative debate: Implications for mixed-methods research. *Quality and quantity, 36*(1), 43-53. https://doi.org/10.1023/A:1014301607592

Sand, J. N., & Elison-Bowers, P. (2013). ICD-10-CM/PCS: Transferring Knowledge from ICD-9-CM. *Perspectives in health information management/, American Health Information Management Association, 10*(Summer), 1-16.

Sanders, T. B., Bowens, F. M., Pierce, W., Stasher-Booker, B., Thompson, E. Q., & Jones, W. A. (2012). The road to ICD-10-CM/PCS implementation: forecasting the transition for providers, payers, and other healthcare organizations. *Perspectives in health information management/, American Health Information Management Association, 9*(Winter).

Santos, S., Murphy, G., Baxter, K., & Robinson, K. M. (2008). Organisational factors affecting the quality of hospital clinical coding. *Health Information Management Journal, 37*(1), 25-37. https://doi.org/10.1177/183335830803700103

Saudi Vision. (2016). *National Transformation Program 2020*. Riyadh, Saudi Arabia: Saudi government. Retrieved from http://vision2030.gov.sa/sites/default/files/NTP_En.pdf (accessed 23 September 2016)

Sauro, J. (2016). Can You Take the Mean of Ordinal Data? Retrieved from https://measuringu.com/mean-ordinal/

Shah, M. H., & Peikari, H. R. (2016). Electronic Prescribing Usability: Reduction of Mental Workload and Prescribing Errors Among Community Physicians. *Telemedicine and e-Health, 22*(1), 36-44. https://doi.org/10.1089/tmj.2014.0246

Shapiro, J. S., Crowley, D., Hoxhaj, S., Langabeer, J., Panik, B., Taylor, T. B., . . . Nielson, J. A. (2016). Health information exchange in emergency medicine. *Annals of emergency medicine*, *67*(2), 216-226. https://doi.org/10.1016/j.annemergmed.2015.06.018

Shapiro, J. S., Kannry, J., Kushniruk, A. W., Kuperman, G., & Subcommittee, N. Y. C. I. E. C. A. (2007). Emergency physicians' perceptions of health information exchange. *Journal of the American Medical Informatics Association, 14*(6), 700-705. https://doi.org/10.1197/jamia.M2507

Sharma, L., Chandrasekaran, A., Boyer, K. K., & McDermott, C. M. (2016). The impact of Health Information Technology bundles on Hospital performance: An econometric study. *Journal of Operations Management, 41*, 25-41. https://doi.org/10.1016/j.jom.2015.10.001

Shepheard, J. (2009). Health Classification-a Complex World. *Health Information Management Journal, 38*(1), 4. https://doi.org/10.1177/183335830903800101

Shepheard, J. (2018). What do we really want from clinical documentation improvement programs? *Health Information Management Journal, 47*(1), 3-5. https://doi.org/10.1177/1833358317712312

Sheridan, P. T., Watzlaf, V., & Fox, L. A. (2016). Health Information Management Leaders and the Practice of Leadership through the Lens of Bowen Theory. *Perspectives in Health Information Management, 13*(Spring).

Shfaq, M., Qadri, F. A., Abusaleem, K. S. M., & Al-Zyood, M. (2016). Measuring quality of service from consumers' perspectives: A case of healthcare insurance in Saudi Arabia. *Health Science Journal*, *10*(1), 1. 1-11.

Shortliffe E.H., Blois† M.S. (2006) The Computer Meets Medicine and Biology: Emergence of a Discipline. In: Shortliffe E.H., Cimino J.J. (eds) Biomedical Informatics. Health Informatics. Springer, New York, NY

Sijtsma, K., & Emons, W. H. (2011). Advice on total-score reliability issues in psychosomatic measurement. *Journal of psychosomatic research, 70*(6), 565-572. https://doi.org/10.1016/j.jpsychores.2010.11.002

Silverman, D. (2006). *Interpreting qualitative data: Methods for analyzing talk, text and interaction*. London: SAGE.

Simmons, M., Singhal, A., & Lu, Z. (2016). Text mining for precision medicine: bringing structure to EHRs and biomedical literature to understand genes and health. In *Translational Biomedical Informatics* (pp. 139-166). Springer, Singapore.

Simpson Jr, J. L. (2014). *Examining differences in electronic health record adoption and motivations between small and large physician practices* (Doctoral dissertation, Capella University).

Slight, S. P., & Bates, D. W. (2016). *The Role of Health Information Technology in Patient Safety* Chapter 5. In America's Healthcare Transformation: Strategies and Innovations. Edited by Dixon Robert A. Phillips. Rutgers University Press

Sockolow, P. S., Bowles, K. H., Adelsberger, M. C., Chittams, J. L., & Liao, C. (2014). Challenges and facilitators to adoption of a point-of-care electronic health record in home care. *Home health care services quarterly, 33*(1), 14-35. https://doi.org/10.1080/01621424.2013.870098

Söderlund, N. (1994). Product definition for healthcare contracting: an overview of approaches to measuring hospital output with reference to the UK internal market. *Journal of Epidemiology & Community Health, 48*(3), 224-231. https://doi.org/10.1136/jech.48.3.224

Soo, I. H.-Y., Lam, M. K., Rust, J., & Madden, R. (2009). Do we have enough information? How ICD-10-AM Activity codes measure up. *Health Information Management Journal, 38*(1), 22-34. https://doi.org/10.1177/183335830903800104

Southern, D. A., Hall, M., White, D. E., Romano, P. S., Sundararajan, V., Droesler, S. E., . . . Ghali, W. A. (2016). Opportunities and challenges for quality and safety applications in ICD-11: an international survey of users of coded health data. *International Journal for Quality in Health Care, 28*(1), 129-135. https://doi.org/10.1093/intqhc/mzv096

Spooner, S. A., & Classen, D. C. (2009). Data standards and improvement of quality and safety in child health care. *Pediatrics, 123*(Supplement 2), S74-S79. https://doi.org/10.1542/peds.2008-1755E

Spragens, L. (2013). What Are the Arguments That Show That Palliative Care Is Beneficial to Hospitals? In *Evidence-Based Practice in Palliative Medicine* (pp. 407-415): Elsevier.

Spratt, C., Walker, R., & Robinson, B. (2004) *Mixed Research Methods*. Commonwealth of Learning, Vancouver, BC.

Starfield, B. (2000). Is US health really the best in the world? *Jama, 284*(4), 483-485. https://doi.org/10.1001/jama.284.4.483

Steindel, S. J. (2010). International classification of diseases, clinical modification and procedure coding system: descriptive overview of the next generation HIPAA code sets. *Journal of the American Medical Informatics Association, 17*(3), 274-282. https://doi.org/10.1136/jamia.2009.001230

Stephens, J. H., Ledlow, G. R., & Fockler, T. V. (2016). Converting ICD-9 to ICD-10. *Hospital topics, 94*(1), 1-7. https://doi.org/10.1080/00185868.2015.1119549

Steven, H., & John, A. (2019). Australia's digital health journey. *Med J Aust, 6*(2), e28. https://doi.org/10.5694/mja2.50039

Suárez-Álvarez, J., Pedrosa, I., Lozano, L. M., García-Cueto, E., Cuesta, M., & Muñiz, J. (2018). Using reversed items in likert scales: A questionable practice. *Psicothema*, 30(2), 149-158. doi: 10.7334/psicothema2018.33

Subotin, M., & Davis, A. R. (2016). A method for modeling co-occurrence propensity of clinical codes with application to ICD-10-PCS auto-coding. *Journal of the American Medical Informatics Association*, *23*(5), 866-871. https://doi.org/10.1093/jamia/ocv201

Sukanya, C. (2017). Validity of principal diagnoses in discharge summaries and ICD-10 coding assessments based on national health data of Thailand. *Healthcare informatics research*, *23*(4), 293-303. https://doi.org/10.4258/hir.2017.23.4.293

Sullivan, G. M., & Artino Jr, A. R. (2013). Analyzing and interpreting data from Likert-type scales. *Journal of graduate medical education*, *5*(4), 541-542. https://doi.org/10.4300/JGME-5-4-18

Systems Society of the United States. (2019). Types of Standards. Retrieved from https://www.himss.org/library/interoperability-standards/types-standards (accessed 07 August 2019)

Tashakkori, A., & Creswell, J. W. (2007). Editorial: The new era of mixed methods. *Journal of Mixed Methods Research, 1*(1), 3-7. https://doi.org/10.1177/2345678906293042

Tashakkori, A., & Teddlie, C. (2003). The Past and the Future of Mixed Methods Research: From 'Methodological Triangulation'to 'Mixed Methods Designs'. In Tashakkori, A., and Teddlie, C. (eds.), Handbook of Mixed Methods in Social and Behavioral Research. (pp. 671-701): Thousand Oaks, CA: Sage Publications.

Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*. Thousand Oaks, CA: Sage Publications Inc.

Teddlie, C., & Yu, F. (2007). Mixed methods sampling: A typology with examples. *Journal of Mixed Methods Research, 1*(1), 77-100. https://doi.org/10.1177/1558689806292430

Thomas, S. A., & Ung, L. C. (2000). *How to write health sciences papers, dissertations and theses*. Edinburgh: Churchill Livingstone.

Thompson, B. (2003). *Score reliability: Contemporary thinking on reliability issues*. Thousand Oaks, CA: Sage Publications.

Thompson, F. C. (2003). Nomenclature and classification, principles. In: *Resh VH, Carde´ RT, editors. Encyclopedia of insects (*pp. 798–807). San Diego, CA: Academic Press.

Thompson, M. C. (2017). 'Saudi vision 2030': A viable response to youth aspirations and concerns?. *Asian Affairs, 48*(2), 205-221. https://doi.org/10.1080/03068374.2017.1313598

Thompson, T., & Brailer, D. (2004). *Health IT strategic framework*. DHHS, Washington, DC.

Timothy, M. (2011). *Revenue-cycle management and reimbursement: the impact of health law and health reform on providers*. Dallas: Southern Methodist University.

Tongco, M. D. C. (2007). Purposive sampling as a tool for informant selection. *Ethnobotany Research and applications*, *5*, 147-158. https://doi.org/10.17348/era.5.0.147-158

Topaz, M., Shafran-Topaz, L., & Bowles, K. H. (2013). ICD-9 to ICD-10: evolution, revolution, and current debates in the United States. *Perspectives in health information management/, American Health Information Management Association, 10*(Spring).

Towers, A. L. (2013). Clinical documentation Improvement—a physician perspective: Insider tips for getting physician participation in CDI programs. *Journal of American Health Information Management Association, 84*(7), 34-41.

Tran, J., Cennimo, D., Chen, S., & Altschuler, E. L. (2013). Teaching billing and coding to medical students: a pilot study. *Medical education online*, *18*(1), 1-2. https://doi.org/10.3402/meo.v18i0.21455

Tripp, H., & North, P. (2003). *Culture Shock!: Saudi Arabia*. Portland: Graphic Arts Center Publishing Company.

Trujillo, M. (2018). Global standards and interoperability in Australian healthcare. Retrieved from https://www.gs1.org/docs/events/2018/Bogota/day3_20180412_bogota_global_standards_and_interoperability.pdf (accessed 13 October 2017)

Uhomoibhi, J., Alkraiji, A., Jackson, T., & Murray, I. (2011). Health data standards and adoption process: Preliminary findings of a qualitative study in Saudi Arabia. *Campus-Wide Information Systems, 28*(5), 345-359. https://doi.org/10.1108/10650741111181616

Uluc, C. I., & Ferman, M. (2016). A comparative analysis of user insights for e-health development challenges in Turkey, Kingdom of Saudi Arabia, Egypt and United

Arab Emirates. *Journal of Management Marketing and Logistics, 3*(2), 176-189. https://doi.org/10.17261/Pressacademia.2016219945

Union, E. (2012). eHealth Action Plan 2012–2020. Innovative healthcare for the 21st century. *Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions. Brussels, 6.12.*

Utter, G. H., Cox, G. L., Owens, P. L., & Romano, P. S. (2013). Challenges and opportunities with ICD-10-CM/PCS: implications for surgical research involving administrative data. *Journal of the American College of Surgeons, 217*(3), 516-526. https://doi.org/10.1016/j.jamcollsurg.2013.04.029

Van Sonderen, E., Sanderman, R., & Coyne, J. C. (2013). Ineffectiveness of reverse wording of questionnaire items: Let’s learn from cows in the rain. *PloS one, 8*(7), e68967. https://doi.org/10.1371/journal.pone.0068967

Van Teijlingen, E., & Hundley, V. (2002). The importance of pilot studies. *Nursing standard, 16*(40), 33-36. https://doi.org/10.7748/ns.16.40.33.s1

Ventura, L. (2019). The World's Richest and Poorest Countries 2019. *Global finance magazine*. Retrieved from https://www.gfmag.com/global-data/economic-data/worlds-richest-and-poorest-countries (accessed 08 January 2019)

Vest, J. R., & Gamm, L. D. (2010). Health information exchange: persistent challenges and new strategies. *Journal of the American Medical Informatics Association, 17*(3), 288-294. https://doi.org/10.1136/jamia.2010.003673

Vest, J. R., Yoon, J., & Bossak, B. H. (2013). Changes to the electronic health records market in light of health information technology certification and meaningful use. *Journal of the American Medical Informatics Association, 20*(2), 227-232. https://doi.org/10.1136/amiajnl-2011-000769

Visithanon, K. (2012). Development of ICD-10 For Thai Traditional Medicine Services (ICD-10 for TTM). Retrieved from http://www.whofic-apn.com/pdf_files/2013thai/06_ICD-10%20for%20Thai%20Traditional%20Medicne%20Services.pdf (accessed 10 September 2016)

Wager, K. A., Lee, F. W., & Glaser, J. P. (2009). *Health care information systems: a practical approach for health care management*. 2 Edition sd. Hoboken, NJ: John Wiley & Sons.

Wagstaff, A., & Pradhan, M. (2005). *Health insurance impacts on health and nonmedical consumption in a developing country*. Washington, D.C.: World Bank, Development Research Group, Public Services.

Walker, R. L., Hennessy, D. A., Johansen, H., Sambell, C., Lix, L., & Quan, H. (2012). Implementation of ICD-10 in Canada: how has it impacted coded hospital discharge data? *BMC health services research, 12*(1), 149. https://doi.org/10.1186/1472-6963-12-149

Walston, S., Al-Harbi, Y., & Al-Omar, B. (2008). The changing face of healthcare in Saudi Arabia. *Annals of Saudi medicine, 28*(4), 243-250. https://doi.org/10.5144/0256-4947.2008.243

Wang, T., & Biedermann, S. (2012). Adoption and utilization of electronic health record systems by long-term care facilities in Texas. *Perspectives in Health Information Management, 9*(Spring).

Way, C. (2015). *The millennium development goals report 2015*: UN.

Weaver, C., & O'Brien, A. (2016). Transforming Clinical Documentation in EHRs for 2020: Recommendations from University of Minnesota's Big Data Conference Working Group. *Studies in health technology and informatics, 225*, 18-22.

Weber, R. G. (2004). Recognizing the ICD-10-GM, German Coding Guidelines, and German Coders. *Recognizing the ICD-10-GM, German Coding Guidelines, and German Coders/AHIMA, American Health Information Management Association.*

Webster, F. (1996). Development of a casemix classification system for inpatient rehabilitation services. *Australian Health Review, 19*(3), 81-92. https://doi.org/10.1071/AH960081a

Whitaker, P. (2007). Positioning Your Facility for Severity Adjusted Coding. *Journal of American Health Information Management Association, 78*(4), 82-84.

Whitehead, M. (2000). William Farr's legacy to the study of inequalities in health. *Bulletin of the world health organization, 78*(1), 86-87.

WHO-FIC APN. (n.d.). About WHO-FIC Asia-Pacific Network Meeting. Retrieved from http://www.whofic-apn.com/01about.html (accessed 02 January 2017)

Williams, A. (2003) How to … Write and analyse a questionnaire. *Journal of Orthodontics*, 30:3, 245-252. https://doi.org/10.1093/ortho/30.3.245

Willis, E., Reynolds, L. E., & Keleher, H. (2009). *Understanding the Australian health care system*. Chatswood, N.S.W.: Churchill Livingstone/Elsevier.

Willis, E., Reynolds, L., & Keleher, H. (2016). *Understanding the Australian health care system*. Amsterdam: Elsevier.

Wing, T. L. (2016). ICD-10 Medical Coding: The Role of Perioperative Services in Addressing Implementation Challenges. *AORN journal*, *103*(2), 177-188. https://doi.org/10.1016/j.aorn.2015.12.008

World Bank. (2018). The World Bank In Thailand. Retrieved from www.worldbank.org/en/country/thailand/overview (accessed 23 January 2017)

World Health Organisation. (1967). *World Health Organisation Manual of the international statistical classification of diseases, injuries and causes of death*. Geneva: WHO.

World Health Organisation. (1976). *International classification of diseases for oncology*, first edition. Geneva: World Health Organisation.

World Health Organisation. (1978a). Declaration of Alma Ata: International *Conference on Primary Health Care, Alma Ata, USSR, 6-12 September 1978*. Geneva: World Health Organisation.

World Health Organisation. (1978b). *International classification of procedures in medicine* (Vol. 1). Geneva: World Health Organisation.

World Health Organisation. (1986). Community prevention and control of cardiovascular diseases : report of a WHO expert committee [meeting held in Geneva from 10 to 17 December 1984]. Geneva: World Health Organisation.

World Health Organisation. (2000). *The world health report 2000: health systems: improving performance*: Geneva: WHO.

World Health Organisation. (2004). *ICD-10: International statistical classification of diseases and related health problems: Tenth revision*. Geneva: WHO.

World Health Organisation. (2006a). *Electronic health records: manual for developing countries*. Geneva: World Health Organisation.

World Health Organisation. (2006b). *Medical records manual: a guide for developing countries*. Manila: WHO Regional Office for the Western Pacific.

World Health Organisation. (2007). *Performance Assessment Tool for Quality Improvement in Hospitals (PATH)*. Copenhagen : WHO Regional Office for Europe.

World Health Organisation. (2015). *Case-based Payment Systems for Hospital Funding in Asia An Investigation of Current Status and Future Directions: An Investigation of Current Status and Future Directions*. Paris: OECD Publishing.

World Health Organisation. (2018a). WHO *Application of ICD-10 for low-resource settings initial cause of death collection: The Startup Mortality List (ICD-10-SMoL)*, V2.1. Geneva: World Health Organisation.

World Health Organisation. (2018b). One year on, Global Observatory on Health R&D identifies striking gaps and inequalities. Retrieved from https://www.who.int/features/2018/health-research-and-development/en/

World Health Organisation. (2019a). Health situation and trend assessment. Retrieved from http://www.searo.who.int/entity/health_situation_trends/topics/health_data_standrads/en/ (accessed 25 January 2019)

World Health Organisation. (2019b). International Classification of Health Interventions (ICHI). Retrieved from https://www.who.int/classifications/ichi/en/ (accessed 11 August 2019)

World Health Organisation. (2019c). Classifications. Retrieved from https://www.who.int/classifications/en/ (accessed 25 January 2019)

Wyatt, D. K. (2003). *Thailand: A short history*. New Haven, CT: Yale University Press.

Wynbrandt, J. (2010). *A brief history of Saudi Arabia*. New York, NY: Facts On File.

Xu, J., Gao, X., Sorwar, G., & Croll, P. (2013). Implementation of e-health record systems in Australia. *The International Technology Management Review*, 3(2), 92-104. https://doi.org/10.2991/itmr.2013.3.2.3

Yaghmaei, F. (2003). Content validity and its estimation. *Journal of Medical Education, 3(1)*, 25-27.

Yazbeck, A. S., Rabie, T. S., & Pande, A. (2017). Health Sector Reform in the Middle East and North Africa: Prospects and Experiences. *Health Systems & Reform, 3*(1), 1-6. https://doi.org/10.1080/23288604.2016.1272984

Yeasmin, S., & Rahman, K. F. (2012). Triangulation'research method as the tool of social science research. *Bup Journal, 1*(1), 154-163.

Yin, R. K. (2015). *Qualitative research from start to finish*. New York: Guilford Press.

Yokobori, Y., Oi, T., & Yamamoto, S. (2009). Current Status of Education on Health Information Management around the World. *Information Management, 21*(1).

Young, K. E. (2016). Can the Saudi Economy Be Reformed? *Current History, 115*(785), 355.

Yusuf, N. (2014). Private and public healthcare in Saudi Arabia: future challenges. *International Journal of Business and Economic Development (IJBED), 2*(1), 114-118.

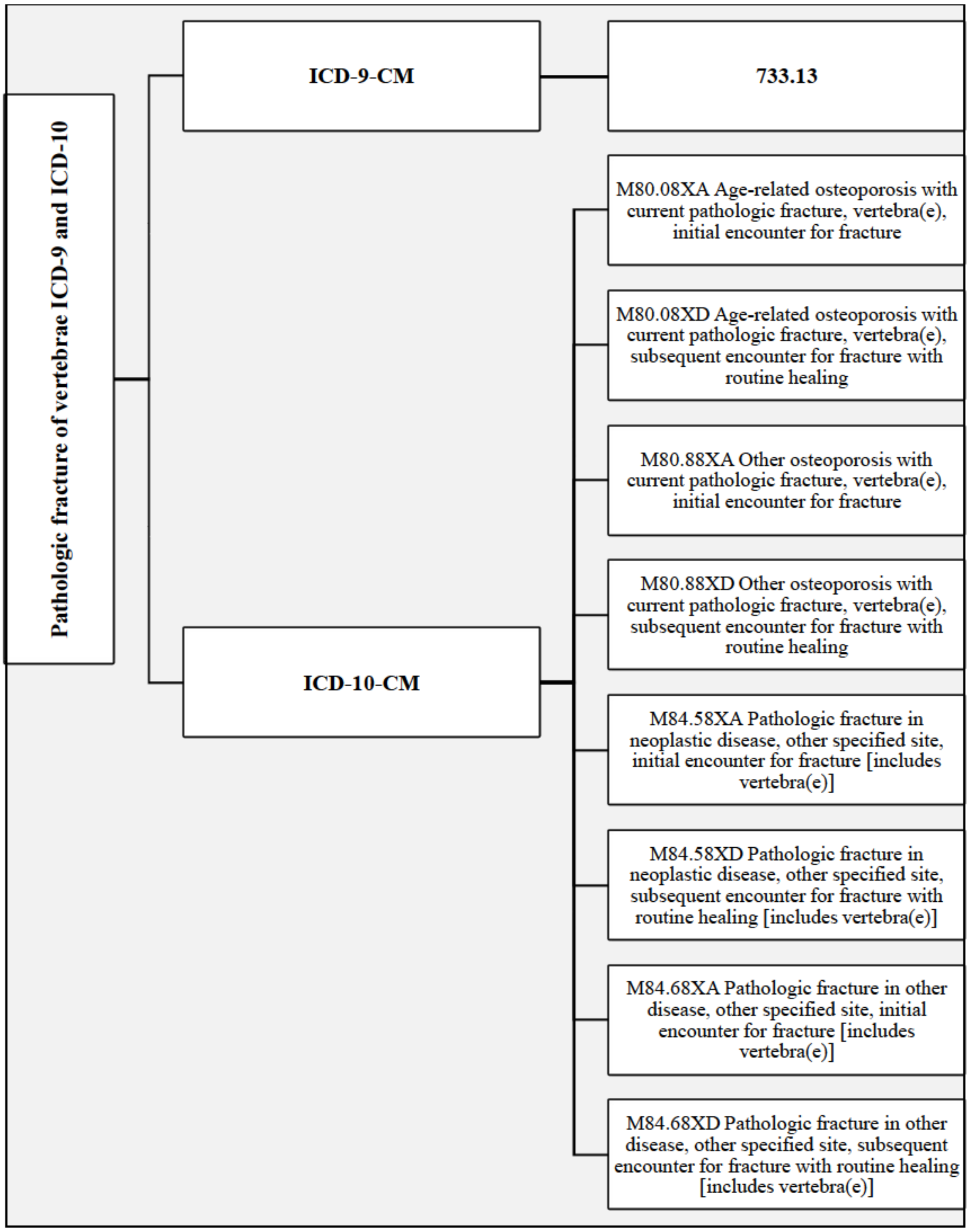
Zeng, X. (2016). The impacts of electronic health record implementation on the health care workforce. *North Carolina medical journal, 77*(2), 112-114. https://doi.org/10.18043/ncm.77.2.112

Zeng, X., Reynolds, R., & Sharp, M. (2009). Redefining the roles of health information management professionals in health information technology. *Perspectives in health information management/, American Health Information Management Association, 6*(Summer), 1-11.

Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2013). *Business Research Methods, Eight Edition*. Canada, South Western Cengage Learning.

# Appendices

## Appendix 1: Conversion of thoracic spinal codes from ICD-9 to ICD-10 (CM)




Source: (Manchikanti, Marvel, et al., 2015, p. E699)

# Appendix 2: The matrix of studies from developed nations, with publication type

| Author and Year | Country | Title and publication type | Health information |
|---|---|---|---|
| O'Malley (2005) | US | Measuring diagnoses: ICD code accuracy (Report) | Patient trajectory, major source of errors from miscommunication |
| Cheng (2009) | Australia | The risk and consequences of clinical miscoding due to inadequate documentation: a study of the impact on health services funding (Article) | reimbursement, impact of errors, clinical documentation errors exceeded coding |
| Michel (2009) | Australia | Australian hospital data: not just for funding (Article) | hospital data, basis of research stats |
| Price (2001) | Australia | Professional practice and innovation: The coding masterpiece: a framework for health classification (Article) | coding involves the analytical breakdown of the diagnosis and procedures and its reconstruction in code |
| Moczygemba (2012) | US | Lessons learned from an ICD-10-CM clinical documentation pilot study (Article) | greater specificity demands greater clinical documentation detail |
| Husty (2013) | US | Cracking the Code: Clinical Documentation and ICD-10 (Article) | Clinical documentation is the source of all medical information |
| Shepheard (2018) | Australia | What do we really want from [CDI] programs? (Article) | CDI benefits, data, patient, reimbursement |
| | | | **Organisation** |
| Johnson (2004) | Canada | Implementation of ICD-10: experiences and lessons learned from a Canadian Hospital (Article) | awareness, leadership support, strategic planning, education / training, technical compliancy, vendor readiness, the unforeseen |
| Santos (2008) | Australia | Organisational factors affecting the quality of hospital clinical coding (Article) | consistent training, supported by materials, is the basis of coding quality |

| | | | |
|---|---|---|---|
| Wing (2016) | US | ICD-10 coding: the role of perioperative services in implementation challenges (Article) | ancillary support for coders is essential (theatre staff/ward sisters etc) |
| Paul (2017) | US | ICD-10 implementation: Is the workforce ready? (Article) | a transitional settling period is vital, for physicians and coders which can alter staff needs and costs |
| | | | **National** |
| Lalonde (1997) | Canada | Medical classification systems in Canada: moving toward the year 2000 (Article) | multiple data standards weaken the value of health statistics |
| Roberts (1998) | Australia | Introducing ICD-10-AM in Australian hospitals (Article) | ICD-10-AM requires higher coder anatomy education |
| Innes (2000) | Australia | Ten down under: implementing ICD-10 in Australia (Article) | transition success through coder effort, national shortage, initial productivity loss |
| Brouch (2000) | US | Where in the world is ICD-10? (Article) | national supervisory body and education program fundamental |
| Libicki (2004) | US | The costs and benefits of moving to the ICD-10 code sets (Article) | 3 major categories of cost: training, lost productivity among physicians & coders, and systems changes |
| Postle (2009) | Australia | The coding conundrum: a workplace perspective (Article) | coder shortage, undervalued role |
| Dimitropoulos (2014) | Australia | Singapore's migration to a new classification system (Article) | implementation equals: national co-ordinating body, expert assistance, training and materials, periodic assessment of the training |

# Appendix 3: The summary appraisal of literature sources of the developed nations

### *A. National level factors from the developed nations: ideal implementation statements*

Lack of common data standards is a hindrance to using data to its full capacity.

Lack of data standards hampers the sharing of information and validity of statistics (Lalonde & Taylor, 1997).

A national supervisory body and the relevant educational program and qualifications is fundamental (Brouch, 2000).

ICD-10 demands a greater understanding of anatomy and surgical procedures from coders.
Preparing a national training plan starts with assessing the national implementation training needs.
The greater complexity of ICD-10 codes not only requires a knowledge of the classification itself, but a greater understanding of anatomy and the surgical procedures (Roberts et al., 1998, p. 34).
Planning can only take place after assessing needs. The success of the implementation is attributable to the careful preparation of the essential learning material and tools and the eagerness of the coders to absorb the educational material (Innes et al., 2000).

Using expert consultants with past experience is the most sensible way to approach implementation.

The dominant factor in the Singapore implementation was their MOH decision to be guided completely by the team of coding experts from the University of Sydney (Dimitropoulos et al., 2014).

Costs fall into three categories: training, lost productivity and systems changes.
The implementation costs can be divided into three major categories: training, lost productivity among physicians and coders, and systems changes (Libicki & Brahmakulam, 2004).

The HIM roles are unappreciated by many other health professionals and the general public.

Coding is an undervalued professional activity and needs to be promoted from ground level given the impending national shortage in Australia (Postle et al., 2009).

### *B. Organisational level factors from the developed nations: ideal implementation statements*

A comprehensive implementation plan includes organisational awareness and participation, leadership support, target assessment, strategic planning, education and training including periodic assessment and realignment, technical compliancy, and vendor readiness. Further, to provide for unforeseen events and costs and additional staff during the implementation.

A comprehensive implementation plan includes organisational awareness and participation, leadership support, target assessment, strategic planning, education and training including periodic assessment and realignment, technical compliancy, vendor readiness, and provision for unforeseen event and costs (Johnson, 2004).

Hospitals should plan to hire extra staff to support physicians and coders in the first few months after implementation and should budget accordingly (Paul et al., 2017, p. 95).

Training and adequate provision of materials within the organisation is the key to quality coding. Team assistance based on interactivity of medical, surgical, and qualified nursing staff with coders has a valid role in raising the standards of clinical documentation and coding.

Periodic training within the organisation, supported by materials is the basis of coding quality (Santos et al., 2008).

Team work, particularly the input of theatre staff and ward nurses, for physicians and coders will enhance procedure coding in particular (Wing, 2016).

### C. *Health information level factors from the developed nations: ideal implementation standards*

Poor clinical documentation is the major cause of coding errors. There are many factors along the patient trajectory on the quality of the clinical documentation, including basic communication skills of the medical staff and patient.

The accuracy, of a diagnosis aside from the knowledge and experience of the physician, depends upon the level of communication achieved by the physician and patient (O'Malley et al., 2005).

The most significant factor leading to coding errors and DRG change was poor quality or incomplete clinical documentation (Cheng et al., 2009).

Fully specified and complete hospital clinical documentation and coded data that accurately reflects the patient health episode, provides valid data for research, statistics, and a world-class health system.

Funding is only the immediate purpose of hospital data (Michel & Jackson, 2009).

Coding involves the analytical breakdown of the diagnosis and procedures and its reconstruction in code to perfectly reflect the health episode of the patient (Price & Robinson, 2011).

There is sufficient evidence that many physicians require training in how to document diagnosis and procedure to the full level of specification and completeness demanded by ICD-10.

‘Organisations should begin analysing their documentation now and preparing their clinicians regarding necessary changes in clinical documentation’ (Moczygemba & Fenton, 2012, p.5).

Clinical documentation is the source for all functions of hospital data (Husty & Newell, 2013, p. 2). Good clinical documentation is the foundation of a world-class health system (Shepheard, 2018).

# Appendix 4: The matrix of studies from a developing nation (Thailand), with publication type

| Author and Year | Country | Title and publication type | Health information |
|---|---|---|---|
| Sukanya (2017) | Thailand | Validity of Principal Diagnoses in Discharge Summaries and ICD-10 Coding Assessments (Article) | errors in hospital data; validity of principal diagnosis vs limitations of coders |
| | | | **Organisation** |
| Pongpirul (2011) | Thailand | DRG coding practice: a nationwide hospital survey in Thailand (Article) | coding for reimbursement, or based on principles of accuracy according to hospital attitude |
| | | | **National** |
| Paoin (n.d.) | Thailand | Thai Medical Informatics Association and medical informatics activity in Thailand (Web) | Thailand medical informatics history |
| Paoin (2007) | Thailand | Road map for ICD-10 implementation in developing; country and pitfalls to avoid, the Thailand experience (Conference) | ICD-10 implementation: learn from the experiences of other countries. Physicians need training in new level of clinical documentation regional support |
| Yokobori (2009) | Japan | Current status of education on [HIM] around the world (Conference) | HIM university and alternative HIM qualifications in Thailand |
| Ingun (2015) | Thailand | Thailand health information system improvement through universal health coverage implementation (Article) | UHC implementation plan, data standards |
| | | | **Regional** |
| Phadouangdeth (2015) | Laos | ICD 10 Related to Public Health in Lao PDR (Conference) | detailed phase implementation plan, integration with existing disease information systems |
| Founkham (2016) | Laos | Health Information System Development and ICD-10 implementation in Lao PDR (Conference) | importance of regional support, participation of all stakeholders |
| Paoin (2018) | Thailand | Development of the ICD-10 simplified version and field test | coding support, ICD-10 simplified |
| Paoin (2017) | Thailand | Activities of WHO-FIC Asia-Pacific Network (Conference) | Laos ICD-implementation; coding support, ICD-10 simplified, SMoL |

# Appendix 5: The Matrix of studies from a developing nation (Saudi Arabia), with publication type

| Author and Year | Title and publication type | Health information |
|---|---|---|
| Farhan (2005) | Documentation and coding of medical records in a tertiary care center: a pilot study (Article) | Low rate of quality documentation (61%); high rate of coding errors (30%) |
| El Mahalli (2015b) | [HER]: Use and barriers among physicians in eastern province of Saudi Arabia (Article) | inadequate clinical doc, inevitable coding errors |
| Bah (2015) | Pilot Study of Reimbursement Practices in Private Healthcare Centers in the Eastern Province: To What Extent Do They Meet Best Practices? (Article) | Multiple reimbursement systems (DRG) |
| Arizona Computer Services (2015) | Arizona Computer Services Medical Coding ICD-10-CM training workshop, 27-28 May 2015, Dubai (Web) | Joint Gulf State coding workshops attended by Saudi coders |
| Combs (2016) | The Impact of [CDI] on the International Stage (Article) | Quote from Dr W Lo on the strong uptake of CDI in Saudi Arabia |
| | | **Organisation** |
| Al-Ahmadi (2005) | Quality of primary health care in Saudi Arabia: a comprehensive review (Article) | Impediments to better quality healthcare: management, professional organisational culture; poor technology infrastructure; no professional development or health professional materials; staff shortages, language difficulties with high percentage expats |
| El Mahalli (2015a) | Adoption and barriers to adoption of [EHRs] by nurses in three governmental hospitals in Eastern Province, Saudi Arabia (Article) | Inadequate training, poor technology systems, computer illiteracy |
| | | **National** |
| Almalki (2011) | Health care system in Saudi Arabia: an overview (Article) | MOH challenges:<br>No national standards<br>Professional development ignored<br>Staff shortage, questions of funding, insurance |
| Albishi (2011) | [HIM] in the Kingdom of Saudi Arabia (Magazine) | National HIM organisation, SAHI, formed |

| | | |
|---|---|---|
| Alkraiji (2011) | Health data standards and adoption: preliminary findings of a qualitative study in Saudi Arabia (Article) | Data standards inadequate |
| Alkraiji (2012) | Issues of the adoption of HIT related standards at the decision-making stage of six tertiary healthcare organisations in Saudi Arabia (Thesis) | MOH authoritarian, no consultation<br>No national advisory body or health data standards<br>Lack of compliancy for ICD-10-AM with existing HIT & US vendors.<br>Poor staff morale, physician resistance |
| Alkraiji (2011) | Health data standards and adoption: preliminary findings of a qualitative study in Saudi Arabia (Article) | detailed phase implementation plan, integration with existing disease information systems |
| Alkraiji (2012) | The role of health data standards in developing countries (Article) | importance of regional support, participation of all stakeholders |
| Alkraiji (2013) | Barriers to health data standards: an exploratory qualitative study in tertiary health orgs in Saudi Arabia (Article) | coding support, ICD-10 simplified |
| Albishi (2014) | ICD-10 in S Arabia: Challenges, Opportunities! E-Health Transforming Med Records to HIM! (Article) | Planned implementation behind schedule<br>MOH Gap Analysis refers to national staff shortage, lack of training, awareness, poor HIS |
| Albishi (2014) | ICD-10 Implementation in Saudi Arabia: Challenges and Opportunities! Enhancing the HIM (Conference) | |
| Alkadi (2016) | The Healthcare System in Saudi Arabia and its Challenges: The Case of Diabetes Care Pathway (Article) | Neglected data standards restricts use of multidisciplinary pathway therapies |

# Appendix 6: Combining developed and developing nations sources: (1) national

| National/Regional | | |
|---|---|---|
| **Developed nations** | **SAUDI ARABIA** | **DEVELOPING NATIONS** |
| | **Health data standards and national supervisory bodies** | |
| Lack of common data standards is a hindrance to using data to its full capacity (Lalonde & Taylor, 1997)<br><br>A national supervisory body and approved national educational curriculum are essential (Brouch, 2000) | No national data standards reflecting in low interoperability (Alkadi, 2016; Alkraiji et al., 2011, 2012)<br><br>No national supervisory body other than the MOH serving that role (Alkraiji et al., 2012, 2013)<br><br>There is a recently formed hospital accreditation body<br><br>External authoritarian control by MOH. Poor technological infrastructure; currently lacking compliancy for ICD-10-AM (Alkraiji, 2012)<br><br>It unlikely that the prestigious NCCD would supply a package with no interoperability | While ultimately health data standards, HIE and interoperability are essential, Thailand, as of 2015, had achieved much without a national standards body and without single national data standards for each standard category (Ingun et al., 2015)<br><br>The Thai Medical Informatics Society serves as a national classificatory/coding body (Paoin, n.d.)<br><br>There is no quick fix to building a National Health System and gradual progress toward a long-term target is acceptable (Ingun et al., 2015) |
| | **National training and qualifications** | |
| ICD-10 demands a greater understanding of anatomy and surgical procedures from coders. (Roberts et al., 1998)<br><br>A national training plan starts with assessing the national implementation training needs. (Innes et al., 2000) | There are signs in the web material on the Saudi health initiative and the MECI Summit presentations that coding training has commenced (Arizona Computer Services, 2015) | Thailand offers a 2-year pre-Bachelor qualification and 4-year bachelor's degree in HIM and coding (Yokobori, Oi, & Yamamoto, 2009)<br><br>Regular APN short coder training courses (Paoin et al., 2017) |
| | **National assistance** | |
| Using expert consultants with past experience is the most sensible way to approach implementation (Dimitropoulos et al., 2014) | There are indications on the web of a certain level of Gulf co-operation in ICD-10 coder training. Most countries are, however, aligned to ICD-10-CM | Thailand and neighbouring countries use the APN as a mechanism for supporting new implementations, with more experienced nations supporting less experienced poorer nations (Founkham, 2016; Paoin et al., 2017) |
| | **National implementation costs** | |
| Implementation/transition costs fall into three categories: training, lost productivity and systems changes (Libicki & Brahmakulam, 2004) | Using the breakdown of Libicki & Brahmakulam (2004), Saudi training costs are heightened by the number of expats speaking different languages; lost productivity must be viewed against staff shortages; and system costs, including vendors, are rated at three times those in the USA and EU (Alkraiji, 2012) | While there are no references to costs, it is noted that in the APN region, more established countries assist poorer countries in ICD-10 training, preparations, and implementation, reducing the costs regionally (APN, n.d.) |

# Appendix 7: Combining developed and developing nations: (2) organisational

| Organisation | | |
|---|---|---|
| **Developed nations** | **Saudi Arabia** | **Developing nations** |
| **Implementation plan** | | |
| A comprehensive implementation plan includes organisational awareness and participation, leadership support, target assessment, strategic planning, education and training including periodic assessment and realignment, technical compliancy, vendor readiness, Further, provide for unforeseen events and costs and additional staff during the implementation (Johnson, 2004; Paul III et al., 2017) | Lack of MOH consultation with HIM professionals about individual institution systems and requirements<br><br>Physician resistance and general low staff morale (Al-Ahmadi & Roland, 2005)<br><br>Poor technology infrastructure and systems. Power outages. (El Mahalli, 2015a) | Thailand and APN countries operate on a level that ranks participation and consultation as fundamental (Founkham, 2016)<br><br>The Thais use innovation and intra-regional support as a means of overcoming lack of resources (Phadouangdeth, 2015) |
| **Organisational training and materials** | | |
| Training and adequate provision of materials within the organisation is the key to quality coding. Team assistance based on interactivity of medical, surgical, and qualified nursing staff with coders has a valid role in raising the standards of clinical documentation and coding (Santos et al., 2008; Wing, 2016) | Inadequate training.<br><br>Perpetual language barriers.<br><br>Computer illiteracy<br><br>(El Mahalli, 2015a) | Where there is a shortage of ICD-10 volumes, make up lists of the most common terms and codes. Use of training the trainer to minimise costs (Paoin, 2007) |

# Appendix 8: Combining developed and developing nations sources: (3) health information

| Health information | | |
|---|---|---|
| **Developed nations** | **Saudi Arabia** | **Developing nations** |
| **Multi-functioning ICD-10 classification and coding** | | |
| Fully specified and complete hospital clinical documentation and coded data that not only accurately reflects the patient health episode for precise remuneration, but also provides valid data for research, statistics and a world-class health system (Michel & Jackson, 2009; Price & Robinson, 2011) | Low rate of quality documentation (61%); high rate of coding errors (30%) (Farhan et al., 2005)<br><br>Inadequate clinical documentation, inevitable coding errors (El Mahalli, 2015b) | According to coding error studies, Thailand makes do with many poorly trained coders who do not attain a high level of accuracy. (Sukanya, 2017)<br><br>The reality of healthcare in developing nations necessitates adaptation to circumstances. (Pongpirul et al., 2011) |
| **Impact of poor documentation** | | |
| Poor clinical documentation is the major cause of coding errors. There are many factors along the patient trajectory that impact on the quality of the clinical documentation, including the basic communication skills of the medical staff and patient (Cheng et al., 2009; O'Malley et al., 2005) | Based on the patient trajectory, impact of communication barriers on diagnosis and documentation errors (O'Malley et al., 2005), Saudi language issues will have an impact (Alkraiji, 2012) | Thai coding audits show a low level of coding, which is often performed by a range of other healthcare professionals or administrative staff in hospitals which have no coders (Sukanya, 2017) |
| **The need for CDI training for physicians** | | |
| There is sufficient evidence that many physicians require training in how to document the diagnosis and procedure fully-specified and complete as demanded by ICD-10; hence the necessity of CDI (Husty & Newell, 2013; Moczygemba & Fenton, 2012; Shepheard, 2018) | It is clear from web material on the Saudi health initiative and the MECI Summit that coding training has commenced (Albishi, 2014b)<br><br>Email from Will Lo is proof of CDI training in Saudi (Combs, 2016)<br><br>Strong presence of CDI at AHIMA MECI SUMMIT 2017 | CDI is not yet mentioned in Thailand literature sources.<br><br>The Roadmap to ICD-10 by Dr Paoin refers to the need for training of physicians in good clinical documentation (Paoin, 2007) |

# Appendix 9: Ethical approval from the University of New England

une
University of New England

**Ethics Office**
**Research Development & Integrity**
**Research Division**
*Armidale NSW 2351*
*Australia*
**Phone** *02 6773 3449*
**Fax** *02 6773 3543*
jo-ann.sozou@une.edu.au
www.une.edu.au/research-services

**HUMAN RESEARCH ETHICS COMMITTEE**

**MEMORANDUM TO:** Dr Barry Tolchard, Dr Ahmed Bawa Kuyini-Abubakar & Mr Musaed Ali M Alharbi

**School of Health**

This is to advise you that the Human Research Ethics Committee has approved the following:

| | |
|---|---|
| **PROJECT TITLE:** | Factors influencing the implementation of ICD-10-AM in Saudi Arabia public hospitals |
| **APPROVAL No.:** | HE15-292 |
| **COMMENCEMENT DATE:** | 08 December, 2015 |
| **APPROVAL VALID TO:** | 08 December, 2016 |
| **COMMENTS:** | Nil. Conditions met in full |

The Human Research Ethics Committee may grant approval for up to a maximum of three years. For approval periods greater than 12 months, researchers are required to submit an application for renewal at each twelve-month period. All researchers are required to submit a Final Report at the completion of their project. The Progress/Final Report Form is available at the following web address: http://www.une.edu.au/research/research-services/rdi/ethics/hre/hrec-forms

The NHMRC National Statement on Ethical Conduct in Research Involving Humans requires that researchers must report immediately to the Human Research Ethics Committee anything that might affect ethical acceptance of the protocol. This includes adverse reactions of participants, proposed changes in the protocol, and any other unforeseen events that might affect the continued ethical acceptability of the project.

In issuing this approval number, it is required that all data and consent forms are stored in a secure location for a minimum period of five years. These documents may be required for compliance audit processes during that time. If the location at which data and documentation are retained is changed within that five year period, the Research Ethics Officer should be advised of the new location.

[redacted]

Jo-Ann Sozou
Secretary/Research Ethics Officer

08/12/2015 A15/25

# Appendix 10: Ethical approval from the Ministry of Health

Kingdom of Saudi Arabia
Ministry of Health
King Fahad Medical City
(162)

مدينة الملك فهد الطبية
King Fahad Medical City

المملكة العربية السعودية
وزارة الصحة
مدينة الملك فهد الطبية
(١٦٢)

| | |
|---|---|
| IRB Registration Number with KACST, KSA: | H-01-R-012 |
| IRB Registration Number with OHRP/NIH, USA: | IRB00008644 |
| Approval Number Federal Wide Assurance NIH, USA: | FWA00018774 |

October 19, 2015
**IRB Log Number: 15-354E**
Category of Approval: EXEMPT

Engr. Ahmad Barradah
Executive Director
Health Informatics and Information Technology

Dear Engr. Ahmad Barradah,

The Internal Review Board (IRB) has reviewed and approved the submission of Musaed Alharbi relating to the research protocol titled **'Factors influencing the implementation of ICD-10-AM in Saudi Arabia public hospitals'**. The IRB approval is from the research ethics point of view only. The authorization to undertake research in KFMC lies in your hands. The research proposal is being sent for your review and decision on the feasibility of carrying out the research in your section and your readiness to provide the necessary assistance. You can inform the researcher of your decision with a copy to us.

Sincerely yours,

[redacted]

***Prof. Omar H. Kasule***
Chairman Institutional Review Board--IRB.
King Fahad Medical City, Riyadh, KSA.
Tel: + 966 1 288 9999 Ext. 26913
E-mail: okasule@kfmc.med.sa

K F M C Approved 19 OCT 2015 I R B

# Appendix 11: Protecting human research participants certificate

## Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Musaed Alharbi** successfully completed the NIH Web-based training course “Protecting Human Research Participants”.

Date of completion: 07/27/2015

Certification Number: 1804602

# Appendix 12: Participant consent form (English version)

**Consent Form**

**for Participants**

**Research Project:** Factors Influencing the Implementation of ICD-10-AM and Clinical Coding in Saudi Public Hospitals

The term 'clinical coding' refers to the Australian Modification of ICD-10, comprising the diagnosis coding classification (ICD-10-AM), the procedure or intervention classification (ACHI), and the Australian coding standards manual (ACS), which has been adopted for use in Saudi Arabia by the MOH

| | | |
|---|---|---|
| I, ………… have read the information contained in the Information Sheet for Participants and any questions I have asked have been answered to my satisfaction. | ☐Yes | ☐No |
| I agree to participate in this activity, realising that I may withdraw at any time. | ☐Yes | ☐No |
| I agree that research data gathered for the study may be quoted and published using a pseudonym. | ☐Yes | ☐No |
| I agree to be identified in this research. | ☐Yes | ☐No |
| I agree to the interview being audio recorded and transcribed. | ☐Yes | ☐No |
| I would like to receive a copy of the transcription of the interview. | ☐Yes | ☐No |
| I am older than18 years of age. | ☐Yes | ☐No |

| | |
|---|---|
| **Participant** | **Date** |
| **Researcher** | **Date** |

# Appendix 13: Participant consent form (Arabic version)

## إقرار المشاركة

**عنوان البحث: العوامل المؤثرة فى تنفيذ نظام الترميز الطبى فى المستشفيات العامة السعودية**

يُشير مصطلح الترميز الطبى إلى النسخة الأسترالية العاشرة من التصنيف الإحصائى الدولى للأمراض لمنظمة الصحة العالمية، تشمل النسخة الأسترالية على ترميز الأمراض والإجراءات الصحية

| | |
|---|---|
| • (الاسم) ______________________ أقر بأننى قرأت نموذج المعلومات، وقد تمت الإجابة على جميع التساؤلات | ☐ نعم ☐ لا |
| • أوافق على أن أشارك فى هذا البحث بطوعية و أعلم أن بإمكانى التوقف عن المشاركة في أي وقت | ☐ نعم ☐ لا |
| • أوافق على أن البيانات التى سوف تجمع فى هذا البحث قد يتم إقتباسها و نشرها من دون الإفصاح عن هويتي | ☐ نعم ☐ لا |
| • أوافق على تحديد هويتي في هذا البحث | ☐ نعم ☐ لا |
| • أوافق على تسجيل المقابلة صوتياً | ☐ نعم ☐ لا |
| • أرغب في الحصول على نسخة مكتوبة من المقابلة | ☐ نعم ☐ لا |
| • عمري أكبر من ١٨ عام | ☐ نعم ☐ لا |

**المشارك** **التاريخ**

**الباحث** **التاريخ**

# Appendix 14: Information sheet (English version)

School Contact Details
School of Health
University of New England
Armidale NSW 2351
Australia
Phone 02 6773 3644
Fax 02 6773 3666
cchant@une.edu.au
www.une.edu.au/health/

## Information Sheet for Participants

I am a research student who is conducting PhD research in the School of Health at the University of New England in Armidale, New South Wales, Australia. I wish to invite you to participate in my research project described below

| | |
|---|---|
| **Research Project** | The title of the project: Factors Influencing the Implementation of ICD-10-AM and Clinical Coding in Saudi Public Hospitals<br><br>The term 'clinical coding' refers to the Australian Modification of ICD-10, comprising the diagnosis coding classification (ICD-10-AM), the procedure or intervention classification (ACHI), and the Australian coding standards manual (ACS), which has been adopted for use in Saudi Arabia by the MOH. |
| **Aim of the research** | The aim of this study is to increase knowledge and understanding of the factors that are associated with the implementation of the ICD-10-AM/ACHI/ACS in Saudi public hospitals, as understanding those factors are very important to facilitate implementation of ICD-10-AM/ACHI/ACS in Saudi hospitals. |
| **Survey Tool** | You are invited to participate in this study because you have valuable information to share on strategic planning. The survey tool will take approximately 10-15 minutes to complete. |
| **Confidentiality** | Your participation is very important in the conduct of this research. All information in this research documents will be kept confidential. |
| **Participation is Voluntary** | Your participation in the study is voluntary. You have the right to withdraw from the study at any time, If, after starting the questionnaire you decide to withdraw from the study and not complete the questionnaire, you are free to do this without consequence. If you agree to participate, you may take a questionnaire to complete. |
| **Survey questions** | The survey questions are not of a sensitive nature; they are unlikely to cause any discomfort. They are general, and aim to enable the researcher to identify the factors influencing the implementation of ICD-10-AM/ACHI/ACS in Saudi public hospitals. |
| **Interview questions** | If you have nominated to be interviewed, you will be asked to answer a number of questions about the factors influencing the implementation of ICD-10-AM/ACHI/ACS in Saudi public hospitals. Interviews will be conducted by the researcher. It is expected that the interviews will take about 20 minutes. Interviews will be taped audio only as a means to record what you say as much as possible |
| **Use of information** | Information from the survey will form part of my PhD thesis, which I expect to complete in June 2017. Information from this study may be used in scientific journal articles and conference presentations before and after this date. |
| **Storage of information** | I will keep hardcopy recordings and notes of this research in a locked cabinet at the researcher's office at the University of New England's School of Health. All electronic data will be kept on a password-protected computer in the same School. Only the named researchers will have access to the data. |

| | |
|---|---|
| **Disposal of information** | All the data collected in this research will be kept for a minimum of five years after successful submission of my thesis; the paper-based questionnaires will be shredded and relevant computer files deleted. |
| **Approval** | This project has been approved by the Human Research Ethics Committee of the University of New England. (Approval No: A15/25 on 8/12/2015). |
| **Implied consent** | If the questionnaire is returned, this will be considered as implied consent. |
| **Contact details** | Do not hesitate to contact us if you have any question about this study: |


| **Resercher** | **Principal supervisor** | **Co-supervisors** |
|---|---|---|
| Musaed Ali Alharbi | Dr Barry Tolchard | Dr Ahmed Bawa |
| University of New England<br>malharb2@myune.edu.au<br>+61267733569 | University of New England<br>btolchar@une.edu.au<br>+61267733643 | University of New England<br>kuyinia@une.edu.au<br>+61267733676 |


**Complaints**

Should you have any complaints concerning the manner in which this research is conducted, please contact the local contacts or the Research Ethics Officer:


| **The local contact** | **The Research Ethics Officer** |
|---|---|
| Dr Saud Aldalah,<br>Deputy of the Director General<br>General Directorate of Health Affairs in Riyadh Region<br>Riyadh , Alrbwh, P.O.Box 12822<br>Tel: 0114507255 Fax:0114505089<br>Email: sauddd30@hotmail.com | Research Services, University of New England<br>Armidale, NSW 2351, Australia<br>Tel: 0267733449 Fax: 0266733543<br>Email: ethics@une.edu.au |


Thank you for considering participating in this study

**Best regards,**

Musaed Ali Alharbi

# Appendix 15: Information sheet (Arabic version)

وسائل الاتصال بالكلية
كلية الصحة
جامعة نيو انجلاند
الهاتف: ٠٢٦٧٧٣٣٦٤٤
فاكس: ٠٢٦٧٧٣٣٦٦٦
cchant@une.edu.au
www.une.edu/health/

**نموذج المعلومات**

أفيدكم إنني باحث من جامعه نيو إنجلاند فى أستراليا و يسرنى دعوتكم للمشاركة فى البحث الموضح تفاصيله أدناه

| | |
|---|---|
| **عنوان البحث** | **العوامل المؤثرة فى تنفيذ نظام الترميز الطبى فى المستشفيات العامة السعودية**<br>يُشِير مصطلح الترميز الطبى إلى النسخة الأسترالية العاشرة من التصنيف الإحصائى الدولى للأمراض لمنظمة الصحة العالمية، تشمل النسخة الأسترالية على ترميز الأمراض والإجراءات الصحية |
| **أهداف البحث** | الهدف من هذه البحث هو معرفة الوضع الحالي والعوامل التي تؤثر على تنفيذ نظام الترميز الطبي في مستشفيات وزارة الصحة حيث أن تحديد هذه العوامل ستؤدي في نهاية المطاف للمساهمة في تسهيل تطبيق هذا النظام |
| **أداة المسح** | أنت مدعو(ة) للمشاركة فى هذا المسح نظراً للمعلومات القيمة المتوفرة لديكم ويستغرق من الوقت ١٠ إلى ١٥ دقيقة |
| **الخصوصية** | مشاركتكم مهمة فى إجراء هذا البحث و جميع المعلومات الواردة فى هذه الوثائق البحثية سرية |
| **المشاركة** | مشاركتكم فى هذا البحث طوعية و لك الحق فى التوقف عن المشاركة فى أي وقت |
| **أسئِلة المسح** | أسئِلة المسح عامة وتهدف إلى تمكين الباحث من تحديد العوامل التى تؤثر على تنفيذ نظام الترميز الطبى فى المستشفيات العامة السعودية |
| **أسئِلة المقابلة الشخصية** | إذا تم ترشيحك او تطوعك فى إجراء مقابلة، سوف يطلبُ منك الإجابة على عدد من الأسئلة حول العوامل التى تؤثر على تنفيذ تطبيق نظام الترميز الطبى فى مستشفيات وزارة الصحة وسوف تستغرق المقابلة المسجلة صوتياً حوالى عشرون دقيقة |
| **استخدام المعلومات** | أن معلومات هذا البحث تُعتبر جزء من بحثى لدرجة الدكتوراه , والذي أتوقع أن أنتهي منه فى يونيو 2017 , كما أن هذه المعلومات قد تستخدم فى مقالات أو مؤتمرات علمية قبل وبعد هذا التاريخ |
| **حفظ المعلومات** | سوف تحفظ الوثائق المطبوعة من هذه البيانات فى خزانة مقفلة فى مكتبى فى جامعة نيو إنجلاند فى أستراليا كما أن البيانات الإلكترونية سيتم الاحتفاظ بها على كمبيوتر محمى فى كلمة سر, ولن يسمح لأحد الوصول إلى هذه البيانات |
| **التخلص من البيانات** | سيتم الاحتفاظ فى كافة البيانات التى تم جمعها فى هذا البحث لمدة لا تقل عن خمس سنوات بعد الحصول على الدرجة العلمية ؛ حيث سيتم تمزيق الوثائق ومسح جميع الملفات من على أدوات التخزين |

| | |
|---|---|
| **الموافقة من الجامعة** | تمت الموافقة على هذا البحث من قبل لجنة أخلاقيات البحث العلمى فى جامعه نيو إنجلاند (تاريخ ٢٠١٥/١٢/٨ - رقم الموافقة A15/25) |
| **الموافقة الضمنية** | تعبئة المسح سوف يُعتبر موافقة على المشاركه فى هذا البحث |
| **تفاصيل التواصل** | لا تتردد فى التواصل مع فريق البحث إذا كان لديك أي استفسار |

| **الباحث** | **المشرف الرئيسى** | **المشرف المشارك** |
|---|---|---|
| مساعد على الحربى<br>جامعة نيو إنجلاند<br>malharb2@myune.edu.au<br>+966550558522<br>+61401400579 | الدكتور باري تولتشارد<br>جامعة نيو إنجلاند<br>btolchar@une.edu.au<br>+61267733643 | الدكتور أحمد باوا<br>جامعة نيو إنجلاند<br>kuyinia@une.edu.au<br>+61267733676 |

| | |
|---|---|
| **الشكاوي** | أي شكاوى بشأن الطريقة التى يتم بها إجراء هذا البحث، يمكن الاتصال محلياً أو مع مسؤول لجنة أخلاقيات البحث العلمى |

| **الاتصال المحلى** | **الاتصال بمكتب لجنة أخلاقيات البحث العلمى** |
|---|---|
| الدكتور سعود الدالة<br>مساعد مديرعام الشوؤن الصحية فى منطقة الرياض<br>تلفون :٠١١٤٥٠٧٢٥٥<br>فاكس: ٠١١٤٥٠٥٠٨٩<br>جوال: ٠٥٠٤٤٣٨٦٠٥<br>صندوق بريد: ١٢٨٢٢<br>sauddd30@hotmail.com | الهاتف: 0267733449<br>فاكس: 0266733543<br>ethics@une.edu.au<br>جامعة نيو إنجلاند<br>ارميدال, نيو ساث ويلز 2351 |

أشكركم على المشاركة فى هذا البحث

***مع أطيب التحيات***

مساعد على الحربى

# Appendix 16: Study questionnaire (English version)

**Dear survey participant,**

I take pleasure in this opportunity to introduce myself as Musaed Alharbi, a Saudi Arabian currently conducting PhD research at the University of New England in Australia on a topic of national importance regarding the development of healthcare in our country: **Factors Influencing the Implementation of ICD-10-AM and Clinical Coding in Saudi Public Hospitals**.

The purpose of this survey is to estimate the current status of ICD-10 in your public hospital and your perception of the factors that have impacted on, or will impact on the implementation process. Your estimation of the status and perception of factors will contribute, together with those of other survey respondents, to provide answers to the research questions that are fundamental to this study.

This research project has been approved by the University of New England Human Research Ethics Committee (Approval No: A15/25, on 08/12/2015) and the Chairman of the Institutional Review Board of the Ministry of Health in Saudi Arabia (Approval No. 162 on 08/10/2015). The completion of the survey questionnaire should take roughly 20 minutes of your time.

Please note that throughout this survey, the term 'clinical coding' refers to the Australian Modification of ICD-10, comprising the diagnosis coding classification (ICD-10-AM), the procedure or intervention classification (ACHI), and the Australian coding standards manual (ACS), which has been adopted for use in Saudi Arabia by the MOH.

I am extremely grateful for your participation. Please do not hesitate to contact to me with any question you may have related to the survey.

**Yours sincerely,**

Musaed Ali Alharbi

malharb2@myune.edu.au

## *Part one. Demographics*

**Please specify name of your hospital:**

- ☐ King Fahad Medical City
- ☐ Imam Abdulrahman Al-Faisal Hospital
- ☐ Al-Iman Hospital
- ☐ Al-Yamamah Hospital
- ☐ King Salman Hospital
- ☐ Buraidah Central Hospital
- ☐ Maternity and Children Hospital

**Gender**

☐ Female ☐ Male

**Age**

☐ Less than 30 years ☐ Between 30 to 40
☐ Between 41 to 50 ☐ Between 51 to 60
☐ More than 60 years

**Nationality**

☐ Saudi ☐ Other

**Occupational category**

- ☐ Health informatics professional
- ☐ HIM or Medical records professional
- ☐ Physician
- ☐ Nurse
- ☐ Other health professional (pharmacist, health technician)
- ☐ Non-health professional (administrator)

**How many years of professional experience in the health sector do you have?**

☐ Less than 5 years ☐ 6-10 years
☐ 11-15 years ☐ More than 15 years

**Do you have a registered certificate from any recognised organisation in the clinical coding system?**

☐ Yes ☐ No

**Have you participated in any clinical coding training courses?**

☐ Yes ☐ No

**Highest level of education achieved?**

☐ Doctoral degree ☐ Master
☐ Bachelor ☐ Diploma

**What is the percentage completion of the implementation of the clinical coding in your hospital?**

- ☐ Partially implemented
- ☐ Fully implemented
- ☐ I don't know

## *Part Two. Factors Impacting at the National, Organisational and Health Information-level*

This part contains three sections comprising statements that describe factors that may impact on the quality of implementation of clinical coding, according to health literature sources from Developed and Developing nations, including Saudi Arabia. For each statement below, please circle the response that best characterizes how you feel about the statement, according to the following criteria: 1 = Strongly Agree, 2 = Agree, 3 = Neutral or undecided, 4 = Disagree, and 5 = Strongly Disagree.

| **Organisational Factors** | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| MOH hospital employees receive education and training to improve their performance and further their careers | 1 | 2 | 3 | 4 | 5 |
| MOH hospitals evaluate the effectiveness of staff training programs offered | 1 | 2 | 3 | 4 | 5 |
| MOH hospitals offer specific clinical coding training programs | 1 | 2 | 3 | 4 | 5 |
| MOH hospitals have sufficient health coders trained in the clinical coding | 1 | 2 | 3 | 4 | 5 |
| MOH hospitals have sufficient health information management specialists | 1 | 2 | 3 | 4 | 5 |
| MOH hospitals have sufficient health informatics specialists | 1 | 2 | 3 | 4 | 5 |
| My hospital uses clinical coding and is equipped with a networking connection to exchange of health information with health insurance and claims management companies | 1 | 2 | 3 | 4 | 5 |
| MOH hospitals are using well-qualified vendors to provide technology installations and upgrades to support the implementation of clinical coding | 1 | 2 | 3 | 4 | 5 |
| **Health Information Factors** | | | | | |
| MOH hospital staff understand the usefulness of clinical coding in the storage and retrieval of medical data. | 1 | 2 | 3 | 4 | 5 |
| MOH hospital staff understand the usefulness of clinical coding in health information management and sharing. | 1 | 2 | 3 | 4 | 5 |
| MOH hospital staff understand the positive impact of clinical coding on healthcare quality, through its facilitation of statistics and research. | 1 | 2 | 3 | 4 | 5 |
| MOH hospital staff understand the usefulness of clinical coding in processing health insurance claims and hospital funding | 1 | 2 | 3 | 4 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| In MOH hospitals, physicians and coders interact in order to decide on the correct clinical codes to match the patient diagnoses and procedures | 1 | 2 | 3 | 4 | 5 |
| In MOH hospitals, the level of clinical diagnosis by physicians as existing in current manual records is sufficient to enable coders to apply clinical coding codes | 1 | 2 | 3 | 4 | 5 |
| **National Factors** | | | | | |
| A Saudi health information management supervisory organisation monitors the implementation of ICD-10 in all health sectors | 1 | 2 | 3 | 4 | 5 |
| The MOH will fund the installation of a national network to link MOH hospitals to support ICD-10 and the management and sharing of health information | 1 | 2 | 3 | 4 | 5 |
| My hospital is part of an integrated and compatible electronic network established for the purpose of exchanging health information with other hospitals | 1 | 2 | 3 | 4 | 5 |
| The MOH will fund the cost of maintaining and upgrading health information management software at hospitals to support ICD-10 | 1 | 2 | 3 | 4 | 5 |
| The MOH has sufficient ICD-10 course trainers | 1 | 2 | 3 | 4 | 5 |
| The MOH needs to provide hospitals with additional coders at the commencement of ICD-10 implementation | 1 | 2 | 3 | 4 | 5 |
| MOH hospitals are provided with funding specifically dedicated to the implementation of HIM and electronic health project development | 1 | 2 | 3 | 4 | 5 |
| The MOH funding of information technology infrastructure upgrades support the implementation of ICD-10 in hospitals | 1 | 2 | 3 | 4 | 5 |
| The application of standardised electronic health records (EHRs) in MOH hospitals will facilitate the implementation of ICD-10 | 1 | 2 | 3 | 4 | 5 |

## *Part Three. Open-Ended Question*

In your opinion, what are the factors that would facilitate implementing the clinical coding?

Do you wish to conduct an interview with the researcher by answering a few short questions? ☐ Yes ☐ No thanks
If yes, please print your email here:

***Thank you so much for your collaboration***

# Appendix 17: Study questionnaire (Arabic version)

## عزيزي المشارك / عزيزتي المشاركة

السلام عليكم ورحمة الله وبركاته

تحية طيبة وبعد،،،

أفيدكم أنني أحد منسوبي وزارة الصحة ومبتعث إلى جامعة نيو إنجلاند في أستراليا لإجراء بحث دكتوراه تحت عنوان: **العوامل المؤثرة في تنفيذ نظام الترميز الطبي في المستشفيات العامة السعودية** ولكونكم أفضل من يُعْطِي معلومات مفيدة لهذا البحث يضع الباحث بين يديكم هذه الإستبانة. الهدف من هذه البحث هو معرفة الوضع الحالي والعوامل التي تؤثر على تنفيذ نظام الترميز الطبي في المستشفيات العامة السعودية حيث أن الفهم الجيد والمعرفة الدقيقة لهذه العوامل ستؤدي في نهاية المطاف للمساهمة في تسهيل تطبيق هذا النظام.

تمت الموافقة على إجراء البحث من قبل لجنة أخلاقيات البحوث في جامعة نيو إنجلاند رقم A15/25 وتاريخ 8/12/2015 وكذلك لجنة البحوث الصحية في وزارة الصحة رقم 162 و تاريخ 8/10/2015. مشاركتكم هامة للغاية لإجراء هذا البحث وجميع المعلومات في وثائق البحث سوف يتم الإحتفاظ بها بشكل خاص وسري ولن يتم الإشارة إلى هوية المشاركين.

يُتوقع أن يستغرق استكمال تعبئة هذه الإستبانة أقل من عشرون دقيقة من وقتكم لذا آمل منكم التكرم في المشاركة.

يُرجى ملاحظة أن مصطلح الترميز الطبي يُشير إلى التعديل الأسترالي للنسخة العاشرة من التصنيف الإحصائي الدولي للأمراض، والذي يشتمل على ترميز الامراض (ICD-10-AM) ، وترميز التدخلات والاجراءات (ACHI) .

لا تتردد في التواصل مع الباحث في حال وجود أي استفسار أو ملاحظة.

شاكر ومقدر لكم سلفاً حسن تعاونكم و تفضلوا بقبول فائق التحية والإحترام،،،

**الباحث**

مساعد على الحربي

malharb2@myune.edu.au

## *الجزء الاول: معلومات عامة*

**الرجاء تحديد اسم المستشفى الذي تنتمي إليه**

- ☐ مدينة الملك فهد الطبية
- ☐ مستشفى الامام عبدالرحمن الفيصل
- ☐ مستشفى الإيمان
- ☐ مستشفى اليمامة
- ☐ مستشفى الملك سلمان
- ☐ مستشفى بريدة المركزي

**الجنس**

- ☐ أنثى
- ☐ ذكر

**العمر**

- ☐ أقل من ٣٠ عام
- ☐ ٣٠ - ٤٠ عام
- ☐ ٤١ - ٥٠ عام
- ☐ ٥١-٦٠ عام
- ☐ أكثر من ٦٠ عام

**الجنسية**

- ☐ سعودي
- ☐ جنسية أخرى

**المجال العام للتخصص**

- ☐ المعلوماتية الصحية
- ☐ إدارة المعلومات الصحية / السجلات الطبية
- ☐ الطب
- ☐ التمريض
- ☐ تخصصات صحية أخرى (صيدله / مساعد صحي)
- ☐ تخصصات غير صحية (إدارية)

**كم عدد سنوات الخبره لديك في القطاع الصحي؟**

- ☐ أقل من خمس سنوات
- ☐ ٦-١٠ سنوات
- ☐ ١١ - ١٥ عام
- ☐ أكثر من ١٥ عام

**هل لديك شهادة مسجلة من أي منظمة معترف بها في نظام الترميز الطبي ؟**

- ☐ نعم
- ☐ لا

**هل سبق أن شاركت في أي دورة في نظام الترميز الطبي؟**

- ☐ نعم
- ☐ لا

**المؤهل العلمي**

- ☐ دكتوراه
- ☐ ماجستير
- ☐ بكالوريوس
- ☐ دبلوم

**ماهي نسبة اكتمال تنفيذ نظام الترميز الطبي في المستشفى ؟**

- ☐ منفذ بشكل جُزئى
- ☐ منفذ بشكل كامل
- ☐ لا أعلم

## الجزء الثانى : العوامل التى قد تؤثر على تنفيذ الترميز الطبى على المستوى التنظيمى والمعلومات الصحية و الوطنى

هذا الجزء يحتوي على ثلاثة أقسام تصنف العوائق التى قد تؤثر على تنفيذ الترميز الطبى، وفقًا إلى مصادر الأدب من الدول المتقدمة والدول النامية ، بما فى ذلك المملكة العربية السعودية. الرجاء التكرم بوضع دائرة على الاجابة التي ترى أنها مناسبة وفقا للمعايير التالية: ١ = موافق بشده ، ٢ = موافق، ٣ = محايد، ٤ = غير موافق، و ٥ = غير موافق بشده

| العوامل التنظيمية | موافق بشده | موافق | محايد | غير موافق | غير موافق بشده |
|---|---|---|---|---|---|
| في مستشفيات وزارة الصحة يتلقى الموظفين التعليم و الدورات التدريبية لتطوير أدائهم وتعزيز حياتهم المهنية | ١ | ٢ | ٣ | ٤ | ٥ |
| في مستشفيات وزارة الصحة يتم تقييم مدى فاعلية البرامج التدريبية المقدمة للموظفين | ١ | ٢ | ٣ | ٤ | ٥ |
| تقدم مستشفيات وزارة الصحة برامج تدريبية في الترميز الطبي | ١ | ٢ | ٣ | ٤ | ٥ |
| تمتلك مستشفيات وزارة الصحة عدد كافي من المرمزين المدربين على نظام الترميز الطبي | ١ | ٢ | ٣ | ٤ | ٥ |
| تمتلك مستشفيات وزارة الصحة عدد كافي من المتخصصين في إدارة المعلومات الصحية | ١ | ٢ | ٣ | ٤ | ٥ |
| تمتلك مستشفيات وزارة الصحة عدد كافي من المتخصصين في المعلوماتية الصحية | ١ | ٢ | ٣ | ٤ | ٥ |
| يستخدم هذا المستشفى نظام الترميز الطبي وهو مُجهز في إتصال شبكى مع شركات التأمين الصحي وشركات إدارة المطالبات المالية لتبادل المعلومات الصحية | ١ | ٢ | ٣ | ٤ | ٥ |
| تعتمد مستشفيات وزارة الصحة على موردين مؤهلين لتوفير وتطوير الإنظمة التكنولوجية لدعم تنفيذ الترميز الطبي | ١ | ٢ | ٣ | ٤ | ٥ |
| **عوامل المعلومات الصحية** | | | | | |
| في مستشفيات وزارة الصحة يُدرك الموظفين فائدة الترميز الطبي في تخزين و إسترجاع المعلومات الصحية | ١ | ٢ | ٣ | ٤ | ٥ |
| في مستشفيات وزارة الصحة يُدرك الموظفين فائدة الترميز الطبي في إدارة المعلومات الصحية ومشاركتها. | ١ | ٢ | ٣ | ٤ | ٥ |
| في مستشفيات وزارة الصحة يُدرك الموظفين فائدة الترميز الطبي على جودة النظام الصحي من خلال تسهيل الأبحاث والإحصاءات | ١ | ٢ | ٣ | ٤ | ٥ |

| | | | | | |
|---|---|---|---|---|---|
| فى مستشفيات وزارة الصحة يُدرك الموظفين فائدة الترميز الطبى فى معالجة مطالبات التأمين الصحي و تحصيل الإيرادات المالية للمستشفى | ١ | ٢ | ٣ | ٤ | ٥ |
| فى مستشفيات وزارة الصحة هناك تفاعل بين الأطباء والمرمزين فى نظام الترميز الطبى من أجل تحديد الرموز الصحيحة لكلاً من التشخيصات والإجراءات الطبية | ١ | ٢ | ٣ | ٤ | ٥ |
| في مستشفيات وزارة الصحة يكون مستوى التوثيق الطبي للأطباء في الملفات اليدوية كافياً لتمكين المرمزين من تطبيق الترميز الطبى | ١ | ٢ | ٣ | ٤ | ٥ |
| **العوامل الوطنية** | | | | | |
| تقوم هيئة الإشراف على إدارة المعلومات الصحية السعودية فى مراقبة عملية تنفيذ الترميز الطبى فى جميع القطاعات الصحية | ١ | ٢ | ٣ | ٤ | ٥ |
| سوف تقوم وزارة الصحة فى تمويل تكلفة تركيب شبكة وطنية موحدة لربط مستشفياتها لدعم الترميز الطبي و إدارة وتقاسم المعلومات الصحية | ١ | ٢ | ٣ | ٤ | ٥ |
| في هذا المستشفى يوجد شبكة إلكترونية متكاملة ومتوافقة أُنشئت لتبادل المعلومات الصحية مع مستشفيات أخرى | ١ | ٢ | ٣ | ٤ | ٥ |
| سوف تقوم وزارة الصحة في تمويل تكلفة صيانة وتحديث برامج إدارة المعلومات الصحية لدعم الترميز الطبي | ١ | ٢ | ٣ | ٤ | ٥ |
| تمتلك مستشفيات وزارة الصحة عدد كافي من المدربين على نظام الترميز الطبي | ١ | ٢ | ٣ | ٤ | ٥ |
| تحتاج وزارة الصحة الى تزويد مستشفياتها في مرمزين إضافيين عند بدء تنفيذ الترميز الطبي | ١ | ٢ | ٣ | ٤ | ٥ |
| يتم تزويد مستشفيات وزارة الصحة بتمويل مخصص لمشاريعها في إداراة المعلومات الصحية و الصحة الإلكترونية | ١ | ٢ | ٣ | ٤ | ٥ |
| الميزانية المخصصة لتطوير البنية التحتية لتكنولوجيا المعلومات في وزارة الصحة تدعم عملية تنفيذ الترميز الطبي | ١ | ٢ | ٣ | ٤ | ٥ |
| سوف يسهل تطبيق السجلات الصحية الإلكترونية الموحدة في مستشفيات وزارة الصحة عملية تنفيذ الترميز الطبي | ١ | ٢ | ٣ | ٤ | ٥ |

## الجزء الثالث: سؤال مفتوح

**في رأيك، ما هي العوامل التي تساعد على تسهيل تنفيذ الترميز الطبي ؟**

هل ترغب في إجراء مقابلة مع الباحث للإجابة على بعض الأسئلة القصيرة؟

☐ نعم ☐ لا

اذا كان الجواب نعم، الرجاء كتابة البريد الإلكترونى الخاص بكم:

***أشكركم على المشاركة في هذا البحث***

# Appendix 18: The initial thematic map