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Health information literature across the cultural evolutionary divide

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Abstract: This paper details the process involved in developing the theoretical framework of factors for a major study entitled "Factors influencing the implementation of ICD-10 in Saudi public hospitals". An original systematic review strategy, together with specific features of Endnote bibliographic manager software, were used to classify the global literature, separating it into the categories of developed nations and developing nations and, again, nationally according to the national modifications of ICD-10. Finally, the separated literature was examined under three categories, namely Health information, Organization, and National, in order to cast light on how such a process could be implemented in Saudi public hospitals. The issue has not been previously discussed in the Saudi literature. Saudi Arabia is attempting to implement ICD-10 from scratch without the background of a history of earlier ICD version usage. The results of the systematic review indicate a combination of barriers facing healthcare organizations in implementing ICD-10, including a lack of training, specialists, awareness, technology, resources, and some administration barriers. However, in terms of the reality of developing nations, more applicable practical advice was found in the healthcare literature of Thailand, rather than in that of the OECD nations. As ICD-10 is a new phenomenon in Saudi public hospitals and, based on the findings of this paper, it is possible that implementation may best be underpinned by Rogers' Theory of Diffusion of Innovations, although

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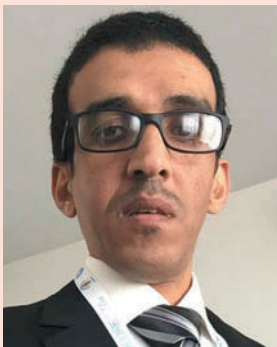
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PUBLIC INTEREST STATEMENT

A half-century ago, "health information" referred to personal details regarding allergies and other medical problems, an individual was obliged to fill in on application forms, perhaps for a job, home loan or an insurance policy. Today, well into the Information Age that has explosively changed our lives, "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. In between are the electronic health records of patients, covering the translation of the practitioner's clinical diagnoses and procedures into codes used for billing and reimbursement by the health insurer, the accessing of the records of previous visits, the sharing of participating organisations in health information exchanges, hospital orders of pharmaceuticals, and regional and national health statistics.

certain factors that are essential for its success illustrate that an organizational application Maslow's Triangle applies in dealing with these factors first.

Subjects: Development Studies; Information Science; Health and Social Care

Keywords: Theoretical framework; systematic review; Rogers' theory; Maslow; clinical coding

1. Terminology and study background

Clinical coders translate clinical documentation from the physician on the diagnosis and prescribed interventions of a patient health episode into code, as well as any reports such as radiology and pathology (Heywood et al., 2016). The coding schedule, in general usage worldwide, is the current version of the World Health Organization (WHO) International Classification of Diseases, Tenth Revision (ICD-10) (Manchikanti, Falco, & Hirsch, 2013). As WHO publishes only the diagnosis codes, several countries have added separate classifications for procedures and interventions, according to their national healthcare needs. These modifications include the Australian ICD-10-AM, United States ICD-10-CM, Canadian ICD-10-CA, German ICD-10-GM, Thai ICD-10-TM and Korean ICD-10-KM (Jetté et al., 2010; Lee, 2014).

ICD clinical coding has become a cornerstone of Health Information Management (HIM), facilitating the storage and retrieval of healthcare data for research and statistical purposes on a global scale, transcending the problem of national language differences. It has also enhanced the efficiency of health insurance claims processing and measuring of healthcare quality, as well as being the standard international means of classifying and reporting mortalities (Moriyama, Loy, Robb-Smith, Rosenberg, & Hoyert, 2011). The practice of clinical coding in Saudi Arabia has, generally, been minimal and is almost non-existent in public hospitals (Alkraiji, 2012).

In 2012, the Saudi Arabia government signed an agreement with the relevant Australian authority, to use ICD-10-AM (9th edition) nationwide. However, the record shows that the well-intentioned funding by the Saudi government frequently ends in aborted processes (Alharbi, 2018). An awareness of these failures, together with the fact that, to date, no Saudi study on clinical coding exists, forms the primary motivation for a mixed methods study entitled "Factors influencing the implementation of ICD-10-AM/ACHI clinical coding in Saudi public hospitals", from which the content of this paper has been synthesized.

The first author is a Saudi national with ten years of experience as a statistician and planning specialist in the Saudi Ministry of Health (MOH). The study was completed at an Australian university, under personal circumstances that could only support a single two-week fieldwork visit to Saudi Arabia. The study locations comprised five Saudi public hospitals of varying capacities in Riyadh and two in Buraidah, one of which is a maternity hospital. In total, 283 respondents completed the quantitative questionnaire, as well as a single qualitative open-ended question. Additional qualitative input was obtained from a semi-structured one-on-one interview of seven health information management specialists and one physician, chosen purposively.

2. The cultural and economic context, and healthcare system of Saudi Arabia

In 1900, the Ottoman Empire still controlled most of the Arabian Peninsula, but a thirty-year struggle under King Abdulaziz led to the incorporation of many small territories into the Kingdom of Saudi Arabia, officially constituted in 1932 (Bowen, 2014). The nation, at that stage, was agrarian and one of the poorest in the world, but paramount was the fact that the Saudis had regained control of the Islamic Holy Cities of Mecca, birthplace of the Holy Prophet Mohammed, and Medina, his place of burial. Thus, Saudi Arabia became the focal nation of the Hajj, the annual visit of millions of Islamic pilgrims to the holy cities (McHale, 1980).

The discovery of the first Saudi territorial oil well, in 1938, was followed by many more and the signing of a mutual support treaty with the United States of America (US) at the end of World War II (McHale, 1980). By 1970, the national picture of Saudi Arabia had changed forever. The country maintained nearly 25% of the world's oil reserves and was ranked as the world's largest oil exporter (Jannadi, Alshammari, Khan, & Hussain, 2008).

In healthcare, based on a 2000 report by the WHO, Saudi Arabia achieved an international a ranking of 26th out of 190 countries for efficiency of performance in terms of available resources, as well as ranking 61th in overall standard (World Health Organization, 2000).

Healthcare provision 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 to citizens, as well as expatriates working in the government sector, as well as the approximately 5 million visitors participating in the annual Hajj (Alharbi, 2018).

The nation experienced extraordinary population growth such that it increased ten-fold between 1954 and 2016, when it reached nearly 32 million, while the US population doubled from 163 million to 325 million, between the same two years (Alharbi, 2018). Additionally, Saudi Arabia has the highest level of road accidents in the world and 4.7% of Saudi Arabia's total mortalities are caused by motor accidents; in Australia and the US, the rate is around 1.7%. In effect, roads accident victim victims occupy, on average, 20% of Saudi hospital beds (Mansuri, Al-Zalabani, Zalat, & Qabshawi, 2015).

The high population growth and high accident rate, as well as the expectations of many elderly annual pilgrims, who arrive with serious medical conditions, has left the Saudi Government with soaring healthcare costs against a backdrop of a slight decline in oil revenue. Alternative funding methods such as privatization and health insurance have become essential (Marušič & Prevolnik Rupel, 2016). As ICD-10 coding has become the internationally-accepted means of submitted health insurance claims, this is an important motivating factor in the Saudi MOH decision to purchase ICD-10-AM and implement clinical coding nationwide.

3. Systematic technique used to identify factors influencing ICD-10 implementation in the literature

Smith, Devane, Begley, and Clarke (2011) noted that the systematic review is a technique to uncover the most relevant information from an enormous pool of potential articles and provide accurate information for decision makers in a short time and single place. Hence, the use of the systematic review technique, with logically identified keywords, is a reliable means to validate and summarise information from a considerable number of studies to provide an outline for the theoretical framework of the major study introduced above.

3.1. Scoping review

The initial search was performed in PUBMED using the following complex Boolean statement:

➢ (ICD-10[Title] OR Clinical Coding [Title] OR Medical coding [Title]) AND Implementation [All Fields] AND (Challenges [All Fields] OR Barriers [All Fields] OR obstacles [All Fields])

This statement proved to be far too specific and returned only 23 articles. After testing a number of other combinations, it was found that a reasonable coverage of the field, resulting in 1515 records was achieved using the following Boolean term and no date filter:

➢ (ICD-10[Title] OR clinical coding [Title] OR medical coding [Title])

These records were downloaded into an EndNote library in a single file in MEDLINE format, which includes the bibliographic data that is necessary for the reference list and the abstract, where available. The use of EndNote features in the selection or exclusion of records is invaluable:

(1) By simply sorting the data alphabetically in particular fields one can begin to establish what is valid or not. For example, sorting the Journal Title field, one can immediately eliminate non-English articles.

(2) Using the same field, articles from specialist medical journals, not covering the implementation were eliminated.

(3) Ordering the abstract field, articles without an abstract were examined. Here, it was established that all articles from J AHIMA (Journal of the American Health Information Management Association), one of the most prolific contributors to ICD-10 literature in the US, do not display an abstract in PUBMED, which necessitated an alternative source.

(4) The records also indicated no clear distinction between the terms "transition" and "implementation" which has a distinct bearing on the Saudi implementation. Hence, the 'transition from ICD-9 to ICD-10' is frequently described as an "implementation".

(5) It was also established that contributions to Australian journals may refer to ICD-10, but assume ICD-10-AM. This was found to apply equally to articles from the US and Canada.

Additional publications were retrieved via the ProQuest and Embase databases, supported by Google Scholar which gave access to all the J AHIMA journals. The EndNote "Find Duplicates" and "Full Text" functions were employed.

4. Literature selection and classification process
In the second phase, articles were selected based on the principal eligibility criteria and arranged in EndNote groups according to ICD-10 national modifications.

4.1. Primary classification into national modifications
The country-specific modifications of the WHO generic ICD-10, as examined by Jetté et al. (2010), guided the decision to assess the literature sources nationally. The decision was governed by the Saudi choice of ICD-10-AM and as Australia and Canada previously used ICD-9-CM (old US modification), they form a natural grouping with the US. Given the developing status of Saudi Arabia, in comparison to the latter nations, it was essential to examine other developing nations.

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. Some African nations, including South Africa, were examined but the literature produced nothing of real relevance. For example, in South Africa, the private healthcare of the wealthy classes uses ICD-10, but the poorly-funded public hospitals have not progressed to its general usage (Dyers, Evans, Ward, Du Plooy, & Mahomed, 2016).

4.2. Secondary classification into human and technological factors
The translation of the clinical documentation of a patient health episode into coding forms the basic data of a health information technology system. For sharing and storing, the system hardware and software components require a level of interoperability, termed health data standards. While ICD-10 requires medical practitioners trained to document the patient healthcare episode to the required level, professional coders to assign codes that reflect the episode in its entirety, and health insurer administrative staff to process the coding, the overall system requires professional health information managers.

The literature reviewed in researching "Factors influencing the implementation of ICD-10-AM and clinical coding in Saudi public hospitals", therefore, covers a number of research categories, namely health information technology and management, healthcare financing, staffing, training, evaluation, and reform. ICD-10 implementation necessitates the meeting of minimum standards

in each of these healthcare categories and a sub-minimum standard in any will impede a successful implementation.

4.3. Additional searches and search terms

Having established the classificatory basis of literature, further PUBMED searches were conducted using the terms ICD-10-AM [Title] for Australia and similar terms for the US, Canada and Thailand. Australia returned a further 20 articles, Canada 2 and Thailand 1. The U, however, produced 155 additional articles, which introduces a vital aspect of ICD-10 literature. Additionally, the applicable healthcare literature of Saudi Arabia was examined in full.

Given the population of the US, its leadership in Global Health activities in the developing world, the number of tertiary academic institutions teaching medical or information science and the extent of its professional organizations, the dominance is no surprise. What increased the volume exponentially was the number of delays in the US transition, largely caused by opposition from physician groups who exaggerated the negative impact it would have. In late 2015 when this researcher was beginning his investigation of the topic, the US had just implemented ICD-10-CM, whereas the related modifications had been implemented in Australia in 1998, in Canada over the period 2001–2005, and Thailand in 1999.

4.4. Final arrangement of factors into health information, organization and national

The factors were grouped into three categories, namely Health information, Organizational, and National. Health information refers to the competencies required to produce coded data valid for health insurance claims, research and statistics. Organizational concerns the factors within the individual public hospital, both human and technological, such as planning, preparedness, general staff training, clinical coder readiness, adequate staffing and systems readiness. National concerns the decision-making, planning and funding of the Saudi MOH and alternative national bodies overseeing the implementation. Where several articles expressed the same argument, the most compelling was cited.

Health information concerns the need for correct and accurate data, which implies correct clinical documentation by the physician as the starting point. As ICD-10 is far more detailed than ICD-9, a big step-up was needed by physicians and, hence, the term CDI (clinical documentation improvement) was coined by health information experts, to describe the training that physicians need to undergo (Table 1).

The organizational category defines the management attitude, planning, training, support and implementation assistance necessary in the hospital for a successful implementation (Table 2).

The national category emphasizes the need for a national supervisory body dedicated to standardization in coding; this includes the meeting of technological data standards to establish data sharing and exchange, the overview of training needs and the supply of coders. The final article describes the successful implementation in Singapore, under a team of Australian experts, of specific relevance to Saudi Arabia (Table 3). Table 4 below shows the developing nations represented by Thailand in this study.

In Thailand, clinical coding has largely been driven by the dedication of civic-minded doctors, led by Dr Wansa Paoin, aware that ICD classification provides a route to improving national healthcare. An extra category, "Regional", was added to the Thailand literature. Once Thailand was up-and-running with ICD-10, they offered assistance to their neighbours in the APN (Asia-Pacific Network). The regional articles document the assistance given to Lao PDR, as well as Dr Paoin's "Simplified ICD-10 edition", presenting the most generally used day-to-day codes for beginners. The article in the Organization category brings in a new theme, as the researcher points a finger at "corrupt" hospitals that "doctor" their clinical coding to increase their benefits from insurers (Table 4).

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Table 1. The matrix of health information studies from developed nations, with publication type				
Author	**Country**	**Title**	**Format**	**Factor**
O'Malley et al. (2005)	US	Measuring diagnoses: ICD code accuracy	Report	major potential for errors arising purely from miscommunication between patient and physician
Cheng, Gilchrist, Robinson, and Paul (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, in the audit clinical documentation errors exceeded coding errors
Michel and Jackson (2009)	Australia	Australian hospital data: not just for funding	Article	hospital data, basis of research stats, incorrect hospital data means incorrect statistics
Price and Robinson (2011)	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
Moczygemba and Fenton (2012)	US	Lessons learned from an ICD-10-CM clinical documentation pilot study	Article	greater specificity demands greater clinical documentation detail
Husty and Newell (2013)	US	ICD-10: cracking the code	Article	Clinical documentation is the source of all medical information
Shepheard (2018)	Australia	What do we really want from clinical documentation improvement programs?	Article	Clinical Documentation Improvement (CDI) benefits, data, patient, reimbursement

Table 2. The matrix of organizational studies from developed nations, with publication type				
Author	**Country**	**Title**	**Format**	**Factor**
Johnson (2004)	Canada	Implementation of ICD-10: experiences and lessons learned from a Canadian Hospital	Conference	awareness, leadership support, strategic planning, education/ training, technical compliancy, vendor readiness, the unforeseen
Santos, Murphy, Baxter, and Robinson (2008)	Australia	Organizational 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, David, Sacconi, Glover, and Marriot (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

At the health information level, the researchers refer to the low competency of isolated clinical coding in the past, the inadequate clinical documentation of physicians and the multiple systems for claims submissions. One contrasting later article refers to the high uptake of CDI. The two articles in the organization category document the poor working conditions due to the lack of training, poor technological infrastructure, general staff shortages and language difficulties. At national level, there is no supervisory body and a lack of national data standards. The last article

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Table 3. The matrix of national studies from developed nations, with publication type				
Author	**Country**	**Title**	**Format**	**Factor**
Lalonde and Taylor (1997)	Canada	Medical classification systems in Canada: moving toward the year 2000	Article	multiple data standards weaken the value of health statistics
Roberts, Innes, and Walker (1998)	Australia	Introducing ICD-10-AM in Australian hospitals	Article	ICD-10-AM requires higher coder anatomy education
Innes, Peasley, and Roberts (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 are vital
Libicki and Brahmakulam (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, Koeldnik, and Miocevich (2009)	Australia	The coding conundrum: a workplace perspective	Article	coder shortage, undervalued role
Dimitropoulos, Cumerlato, Shamim, and Madden (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

records that in the case of the multidisciplinary diabetes treatment pathway, some of the professionals in the team (GP, endocrinologist/paediatrician, dietician, podiatrist, as well as possibly opthalmologist, obstetrician, exercise physiologist, psychologist and diabetes educator) cannot communicate through a single unified system, whereas Saudi children exhibit the third highest rate of Type I diabetes in the world (Table 5).

5. The resultant factors

Combining factors from the developed and developing (Thailand) nations tables:

Health information demands accurate clinical documentation and clinical coding. The Saudi literature indicates this has been lacking but shows evidence of ongoing coding and CDI training. However, the Thailand message is that it is important to start somewhere and if one does not have the qualified coders, simplify the coding initially that they can make a start (Table 6).

Again, at the organization level, the Thai literature promotes regional support and simplification of materials to commence. The developed nations' comprehensive implementation plan gives a breakdown detailing strategic planning, education and training, team assistance, additional staffing, technical compliancy and vendor readiness. This contrasts strikingly with the Saudi factors, namely lack of participatory input, physician resistance, language barriers, lack of training, inadequate technology, and possibly most serious of all; low staff morale (Table 7).

The importance of data standards issue is confirmed by the Canadian article. The Thailand attitude states that they have data standard problems, yet carry on doing as best they can. Here, it should be noted that the Australian and US literature makes no reference to data standards, as these have been long assumed and it is only that in the case of Canada, with two

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Table 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
			Organization
Pongpirul, Walker, Rahman, and Robinson (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, Oi, and Yamamoto (2009)	Japan	Current status of education on health information management around the world (Conference)	HIM university and alternative HIM qualifications in Thailand
Ingun, Narkpaichit, and Boongerd (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, Yuenyongsuwan, Yokobori, Endo, and Kim (2018)	Thailand	Development of the ICD-10 simplified version and field test	coding support, ICD-10 Simplified
Paoin et al. (2017)	Thailand	Activities of WHO-FIC Asia-Pacific Network (Conference)	Laos ICD-implementation; coding support, ICD-10 Simplified, SMoL

national languages, different provinces had different systems, in the past. In terms of training, Thailand has established a university coding course, which Saudi Arabia has not. On the count of national/regional support, while Saudi Arabia has chosen the Australian modification, several other Gulf neighbours have gone for the US ICD-10-CM system, which indicates a lack of regional consideration that could reduce vendor costs. This is unfortunate based on the estimation that health information costs in Saudi Arabia are roughly triple those of the US and EU (Table 8).

Table 5. The matrix of studies from a developing nation (saudi arabia), with publication type		
Author and Year	**Title and Publication Type**	**Health Information**
Farhan, Al-Jummaa, Alrajhi, Al-Rayes, and Al-Nasser (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 (2015a)	Electronic health records: Use and barriers among physicians in eastern province of Saudi Arabia (Article)	inadequate clinical doc, inevitable coding errors
Bah et al. (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)
Combs (2016)	The Impact of Clinical Documentation Improvement on the International Stage (Article)	Quote from Dr W Lo on the strong uptake of CDI in KSA
		Organization
Al-Ahmadi and Roland (2005)	Quality of primary health care in Saudi Arabia: a comprehensive review (Article)	Impediments to better quality healthcare: management, professional organizational culture; poor technology infrastructure; no professional development or health professional materials; staff shortages, language difficulties with high percentage expats
El Mahalli (2015b)	Adoption and barriers to adoption of electronic health records by nurses in three governmental hospitals in Eastern Province, Saudi Arabia (Article)	Inadequate training, poor technology systems, computer illiteracy
		National
Almalki, Fitzgerald, and Clark (2011)	Health care system in Saudi Arabia: an overview (Article)	MOH challenges: No national standards. Professional development ignored Staff shortage, questions of funding, insurance
Alkraiji (2012)	Issues of the adoption of HIT related standards at the decision-making stage of six tertiary healthcare organizations in Saudi Arabia (Thesis)	MOH authoritarian, no consultation. No national advisory body or health data standards. Lack of compliancy for ICD-10-AM with existing HIT & US vendors. Poor staff morale, physician resistance.
Albishi (2011)	Health Information Management in the Kingdom of Saudi Arabia (Mag)	National HIM organization, SAHI, formed
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

NB: The list is abridged, with articles on similar topics by the same author removed

6. Discussion of the findings

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.

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. It is evident that a good deal of Saudi research has been conducted while the researchers were at universities located in Developed Nations and the research is based on ideal standards. Alternatively, according to the experience of Thai researchers, the reality of healthcare in developing nations necessitates adaptation to circumstances (Pongpirul et al., 2011) and there is no

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Table 6. Developed and developing nations in term of health information factors

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) Inadequate clinical documentation, inevitable coding errors (El Mahalli, 2015a)	According to coding error studies, Thailand makes do with many poorly trained coders who do not attain a high level of accuracy. (Sukanya, 2017) 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 clinical documentation improvement 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, 2011) Email from Will Lo is proof of CDI training in KSA (Combs, 2016) Strong presence of CDI at AHIMA MECI SUMMIT 2017	CDI is not yet mentioned in Thailand literature sources. The Roadmap to ICD-10 by Dr Paoin refers to the need for training of physicians in good clinical documentation (Paoin, 2007)

Table 7. Developed and developing nations in term of organization factors

Organization

Developed Nations	Saudi Arabia	Developing Nations
Implementation plan		
A comprehensive implementation plan includes organizational 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 et al., 2017).	Lack of MOH consultation with HIM professionals about individual institution systems and requirements Physician resistance and general low staff morale (Al-Ahmadi & Roland, 2005). Poor technology infrastructure and systems. Power outages. (El Mahalli, 2015b)	Thailand and APN countries operate on a level that ranks participation and consultation as fundamental (Founkham, 2016). The Thais use innovation and intra-regional support as a means of overcoming lack of resources (Phadouangdeth, 2015)
Organizational training and materials		
Training and adequate provision of materials within the organization 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. Perpetual language barriers. Computer illiteracy (El Mahalli, 2015b)	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 minimize costs (Paoin, 2007).

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Table 8. Combining developed and developing nations sources		
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). A national supervisory body and approved national educational curriculum are essential (Brouch, 2000).	No national data standards reflecting in low interoperability (Alkadi, 2016; Alkraiji, 2012) No national supervisory body other than the MOH serving that role (Alkraiji, 2012). There is a recently formed hospital accreditation body External authoritarian control by MOH. Poor technological infrastructure; currently lacking compliancy for ICD-10-AM (Alkraiji, 2012) [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). The Thai Medical Informatics Society serves as a national classificatory/coding body (Paoin, n.d.). 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) 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.	Thailand offers a 2-year pre-Bachelor qualification and 4-year Bachelor degree in HIM and coding (Yokobori et al., 2009). 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 and Brahmakulam (2004), Saudi Arabia 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 US and European Union (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.

quick fix to building a National Health System and gradual progress toward a long-term target is the only way (Ingun et al., 2015). The Saudi sources often compare the Saudi situation with OECD standards, while in Thailand they have accepted the reality of their developing status and work within that.

It is evident that while many factors put forward by the Saudi writers as stumbling blocks do exist, a combination of most of these factors has not prevented Thailand from an achieving a valid ICD-10 implementation and the creation of a National Health System. The two literatures are underpinned by contrasting attitudes of pessimism and optimism. In conclusion, the factors influencing the implementation of ICD-10 in Saudi MOH hospitals are:

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(1) 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 previous coding quality levels achieved by Saudi researchers indicate that they achieved a level below the expectations of OECD nations, but were relatively equal to the level achieved in hospitals in Thailand. However, the pressure exerted on overworked professionals and technicians is undoubtedly detrimental to the quality of their output and sustaining an unhappy workforce is almost impossible. Essentially clinical documentation and coding forms the core of an ICD-10 implementation. What is essential is that a start is made because it is a long road and a long learning-curve to achieve the ideal levels aimed at in nations with a long history of morbidity coding. Clearly, much can be achieved, despite the negative factors.

(2) Organizational plan: the necessity of the individual organizational 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. Organizational training is unlikely to be successful in the face of staff shortages.

(3) Organizational technology: poor technology infrastructure, system failures due to power problems, and lack of compliancy are factors which will cause staff to become demotivated, as well as the negative technical implications and the loss of recent work.

(4) National health data standards: while it is true that many data standards are missing, it is equally true that this will not impact directly on individual hospitals commencing ICD-10 coding.

(5) 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.

(6) National implementation costs: the costs of ICD-10 implementation are estimated to be three times those of the US and EU nation costs. Additionally, training costs have the added burden of training in languages dictated by the variety of expatriate staff.
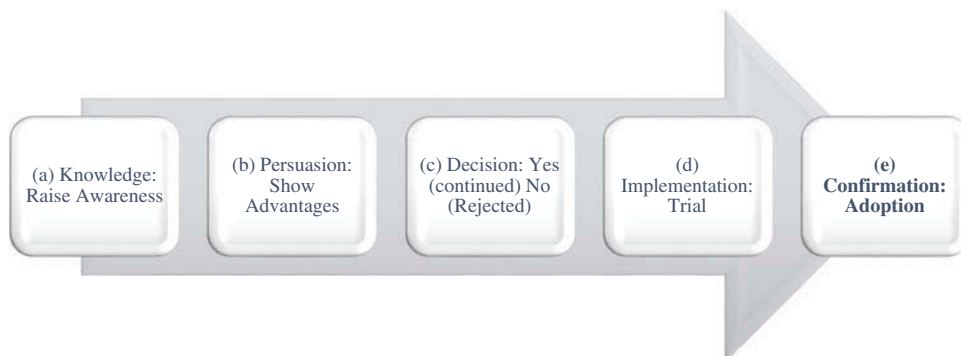
7. Proposed theoretical framework

Theory should ideally guide practice, and practice should be a source of theory, so that theory and practice inform each other (Creswell, 2009). However, there is little theory to guide the implementation of clinical coding in Saudi public hospitals. Some theories used in previous studies on implementing IT innovation, such as the Unified Theory of Acceptance and Use of Technology (Venkatesh & Zhang, 2010) were examined. Only Rogers' Theory of Diffusion of Innovations (Rogers, 2003) seems applicable. 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 lists five processes leading to the acceptance or rejection of an invention: (a) knowledge, (b) persuasion, (c) decision, (d) implementation and (e) confirmation (see Figure 1).

This theory 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

Figure 1. Study theoretical framework.

Source: (Rogers, 2003)

| (a) Knowledge: Raise Awareness | (b) Persuasion: Show Advantages | (c) Decision: Yes (continued) No (Rejected) | (d) Implementation: Trial | (e) Confirmation: Adoption |

ideas are introduced to individuals to better meet their needs. There are six factors that may affect the diffusion of an innovation: (a) relative advantage, (b) compatibility, (c) complexity, (d) trial-ability, (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.

Currently, Saudi public hospitals are not equipped with the necessary staff skills, training possibilities, technology infrastructure, staff capacities and, most desirable, an organizational spirit of motivation, mutual support and recognition of the importance of the role everyone plays.

8. Conclusion

A systematic review was utilised to identify the factors impacting on an ICD-10 implementation in developed and developing nations. The researchers made an assumption that Rogers' Theory could describe the theoretical framework for implementing ICD-10, which serves as a preparation for his major study to be conducted in Saudi public hospitals. Without revealing the overall results of the quantitative survey and qualitative interviews that provided the data from the public hospitals that constituted the study, two respondent demographic categories sound a warning. The first indicated that under 10% of those employed in the medical records departments have any kind of training in clinical coding. The second indicates that less than 15% of the complete sample has ever had basic awareness training in ICD-10. This is extremely disheartening at a time when the implementation should have been in full swing and suggests that an alternative sociological model, such as an organizational application of Maslow's Hierarchical Triangle must play an important role in how this implementation proceeds. Thus, until the Saudi MOH faces the fact that purchasing a national package is not the end and that the importance of basic training and adequate technology has been established, Saudi public hospitals will find themselves at the bottom level of the Maslow Triangle, unable to rise to the next.

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