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Using IS/IT to Support the Delivery of Chinese Medicine: The Design of a Chinese Medicine Clinic System

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Abstract

Using Information System/Information Technology (IS/IT) in Chinese Medicine (CM) has not been discussed much, if at all, in the literature. This is unlike the numerous references to the role for IS/IT to support various aspects of western medicine practice. Though the diagnosis and treatments between western medicine and CM are different, the clinical processes are similar. Thus, we contend that by implementing IS/IT system solutions, CM practice can also enjoy many benefits. CM practice relies on expert knowledge, hence applying knowledge management (KM) concepts to any proposed Chinese Medicine Clinic System (CMCS) is a necessary critical factor in the design of suitable IS/IT solutions in this context. This paper serves to identify a role for IS/IT in assisting CM clinic daily key processes as well as identify key system features and functions for a suitable CMCS.

Keywords

e-health, IS/IT for healthcare, healthcare delivery, Chinese medicine, clinic management system

INTRODUCTION

Given today's healthcare challenges, most if not all, Organization of Economic Cooperation and Development (OECD) countries are focusing on ways to incorporate information systems / information technology (IS/IT) to facilitate superior healthcare delivery. In particular, they are looking to design and develop suitable e-health solutions (Wickramasinghe and Schaffer 2010). However, to date these solutions have solely focused on supporting the delivery of western medicine.

Healthcare, though, is not only restricted to western medicine practice. In today's 21st century in particular, we are witnessing an increased global trend of treatments in complementary and alternative medicine (Lu et al. 2004). One such development is in the area of Chinese Medicine (CM) which now is considered to be a scientifically and clinically approved form of medicine that has considerably less side effects and complications as compared to western medicine (Shi and Lu 2006). Moreover, Chinese herbs like ginseng (or RenShen) are widely sold and used by many western physicians while many western medical practitioners have taken courses in Chinese acupuncture (Kaptchuk 2000). Despite the rapid growth in the embracement of CM, research and study into the role for IS/IT implementations to support and enable CM practices is at best very limited. To address this void, this paper reports on a research in progress that serves to focus on examining the potential for using IS/IT tools and techniques to assist CM clinics and thereby support enhancing the delivery of CM practices. As healthcare processes heavily depend on both information and knowledge (Lenz and Reichert 2007), we will look into the field of knowledge management (KM) to identify IS/IT involvements in healthcare processes.

Why IS/IT Can Support Superior Healthcare Delivery

Voluminous data and information permeate a physician's clinic or a hospital and processing these data manually has and continues to negatively impact healthcare costs as well as make the healthcare system inefficient and ineffective (Wickramasinghe and Schaffer 2010). Hence, IS/IT systems which coordinate organizational tasks, provide information at the point of care, reduce clinical and/or hospital cost and support quality healthcare delivery are being embraced (Lenz and Reichert 2007). Such IS/IT solutions are now playing a critical role in healthcare delivery because they offer several advantages over manual approaches as follows: (1) Facilitate delivery of care: IT can help deliver care to people who are located in remote areas, and who do not have access to hospitals or clinics. For example, doctors may use telemedicine equipment such as Tele-stethoscope, Tele-biologic diagnosis equipment, Tele-radiology, and Tele-surgery to diagnose and treat patients because they provide greater accessibility and availability to healthcare solutions (Hojabri and Manafi 2012). (2) Improve quality of care: IT can help to provide easier, safer and faster access to patient data including laboratory results, therapeutic procedures, medication administration, clinic notes, and billing. This allows the healthcare professionals to access the right data and information at the right time (Austin and Boxerman 2003). This results in informed-based diagnosis, acceleration of communication, and reduction in medical errors (COCIR 2012). Further, a computerised physician order entry (CPOE) systems, for example, allow bar code reading to match patients to their prescribed medications (Bernstein 2007) which in turn can serve to reduce medical errors (Ball and Lillis 2001; Bates 2000). (3) Reduce cost and save time: IT can help healthcare professionals to access health information in a timely manner. This reduces the issue of staff shortage as well as increases efficiency. Clinical and administrative costs can be reduced by avoiding the duplication of medical examinations and unnecessary visits. For example, by embracing cloud technology, the Swedish Red Cross was able to save 20% on their IT operating costs. This action led to freeing 25% of people's time to focus on more strategic tasks, better supporting the core missions of the organization (Microsoft 2011). (4) Support better management and monitoring: Patients learn how to control and manage their diseases correctly with the help of online disease management systems. This is particularly important in the context of chronic diseases. Features like "Ask a physician", web based nurse line or call centre assist patients to take control of their disease rather than solely rely on a doctor (Ball and Lillis 2001). (5) Provide decision support: Web-based clinical decision support systems can give automatic alerts and warnings to physicians. For example, a community hospital in USA used a computerised alert system to target 37 drug-specific adverse reactions. They detected opportunities to prevent injury at a rate of 64 per 1000 admissions; 44% of the true positive alerts had not been recognized by the physician (Bates 2000). Thus, there is strong evidence in the literature to show that IS/IT can provide and enable superior healthcare delivery. Hence, we contend that IS/IT can also support the delivery of Chinese Medicine (CM). In order to demonstrate this, it is first important to identify key aspects of CM.

CHINESE MEDICINE (CM)

CM began in China thousands of years ago at the time when Chinese philosophy, astronomy and literature were developed to maturity (Liao 2011). At that time, key individuals gained experiences in how to deal with human diseases by natural methods, such as acupuncture, Qigong (mind controlling), and herbs (Wang et al. 1999). Further, many of these individuals began to summarise these practices and thereby developed a theory based on their philosophical and social knowledge which in turn formed the origins of CM (Wang et al. 1999). Succinctly, CM follows two philosophies: (1) A homeostasis perspective that focuses on the integrity of human body, and emphasises the close relationship between human body and its social and natural environment; and, (2) A dynamic balance perspective with an emphasis on the movement in the integrity (Lu et al. 2004). Table 1 summarises the key aspects of CM. As can be seen from this table, CM is different and distinct of western medical practice but also heavily perhaps even more reliant on tacit knowledge and expertise of the practitioner. A point which is made more apparent when we look at the processes involved with CM diagnosis.

Table 1. CM Five elements (adopted from Liu and Liu 2009 p 23)

Five elements	Five Zang (principal) organs	Five Fu organs	Five sense organs	Five body tissues	Five passions	Five fluids	Five pulses
Wood	Liver	Gallbladder	Eyes	Tendons	Anger	Tears	Taut
Fire	Heart	Small intestine	Tongue	Vessels	Joy	Sweat	Surging
Earth	Spleen	Stomach	Lips	Muscles,	Thought/Anxiety	Saliva	Moderate,

Metal	Lung	Large intestine	Nose	Skin and hair	Sorrow	Nasal discharge	deep and thin
Water	Kidney	Urinary bladder	Ears	Bones	Fear/Fright	Spittle	Deep

CM diagnosis

CM practitioners use four basic methods for diagnosis: inspection, auscultation and olfaction, inquiring, and palpation (Huang and Chen 2007; Zhao et al. 1994). Diagnosis and treatments are based on an overall analysis of the patient's symptoms and signs. This process is called "bian zheng" (differentiation of syndrome). "bian" means discrimination or classification, while "zheng" means syndrome (Zhao et al. 1994). Inspection begins with the physician understands and predicts the pathological changes of internal organs by observing abnormal changes in the patient's vitality, colour, appearance, secretions, and excretions (Huang and Chen 2007). The second method auscultation and olfaction include listening and smelling. The physician listens to the patient's voice, breathing, coughing, and sounds emanating from the internal organs. Ear and stethoscope may also be applied in this process (Huang and Chen 2007). A patient's "stinky" smell, for example, usually indicates heat syndromes while foul and sour smell implies retention of food (Huang and Chen 2007). Inquiring is about getting information from a patient about his/her disease condition. Examples of common inquiries are chills and fever, perspiration, appetite and thirst, and pain (Huang and Chen 2007). Regarding palpation, the physician would put his/her first three fingers on the radial artery of a patient's wrist. A trained and skilled physician can detect over 30 different pulse qualities (e.g. floating, sunken, weak, and bounding) on each of the 12 pulses (Zhu and Wang 2011). The pulse qualities help the physician to identify the condition of the related organs. These four approaches are used in combination in every diagnosis and cannot be separated or omitted (Zhu and Wang 2011). A correct diagnosis can only be made based on a comprehensive and systematic analysis of a patient's condition.

CM treatments can include any of the following: Chinese herbs (i.e. leaves, seeds, roots, flowers, fruits, minerals and animal products), acupuncture and moxibustion, tuina (Chinese remedial massage), cupping, qigong and taichi, and diet therapy (Xue and O'Brien 2003). All treatments aim to increase human body's resistance to diseases and prevention by improving the inter-connections among self-controlled systems (Lu et al. 2004).

Problems and challenges of CM

Today, CM clinics still follow the manual administration method in recording and managing its clinical information. Although these CM practitioners are experts in their skills, some of them are not good at English. So it is often that patients' records and treatments are written on paper and in the practitioners' first language. This creates language difficulties for others. It is also hard to implement standards, and to encourage an internationally recognized and registered practice. A patient with some medical history record can come in many forms including films, images, telegraphs, and electronic medical record (EMR). CM doctors found it difficult to store these crucial evidences in assisting, analysing, and diagnosing the patient without the proper and adequate technology and equipment.

Capturing and transforming the voluminous information and knowledge in Chinese herbs, acupuncture, syndromes, and treatments to an IS/IT system is challenging. Some research has attempted to build and transfer these tremendous information and knowledge to an information knowledge-based system which can be retrieved online or through Intranet. Dasherb, a joint Sino-German venture since 2002 (Dasherb 2013), has an herb database contains lists of common Chinese herbal medicines that can be searched by Latin name, English name, and Pinyin Name (a pronunciation of Chinese characters). Complementary and Alternative Healing University (CAHU), California, U.S.A has developed a comprehensive online Dictionary of Chinese Herbs. Each herb is explained in details including pharmaceutical name; botanical name; Japanese, Korean, and Cantonese pronunciation; distribution of the herb; properties (characteristics); Channels (meridians) entered; medical functions; actions & indications; chemical ingredients; recommended dosage; samples of formulae, toxicity and cautions (CAHU 2013). A similar development has been done in Australia by the CM team at RMIT University. The RMIT Chinese Medicine Portal (CMP) is an online CM knowledge pool where information and clinical data can be retrieved and accessed (Yang et al. 2009). Some CM expert systems and applications are developed for certain diseases or particular treatment. For example, a Chinese acupuncture expert system can assist physician on acupuncture prescription, needle insertion position, and acupuncture points usage (Lam et al. 2012). These developments have few limitations: (1) Incomprehensive: Most development and resources only include limited or small amount of Chinese herbs with no or limited resources in Chinese acupuncture or vice versa (Yang et al. 2009). (2) Lack of evidence support on information production and synthesis (Yang et al. 2009). (3) Not an IS/IT system solution for CM clinics and practitioners to handle their daily key processes. (4) No standards and compliances to government regulations and assessments. (5) No system functions and features on clinical stock

control and management. (6) Lack of system integration. Most expert systems and applications are designed as a stand-alone with limited integration with others.

In Australia, the Chinese Medicine Board of Australia (CMBA) was established in 2011. CMBA provides guidelines, standards, registrations, and assessments to the CM practitioners in Australia. It is important to CMBA that an IS/IT solution is available and used by CM patients and practitioners. For many CM clinics and doctors, an IS/IT solution is essential for the following reasons: (1) To be registered and practice CM in Australia following CMBA regulations, assessments, and standards. (2) Transfer the paper process of managing clinic information to an electronic system. (3) Facilitate access to healthcare, share health information, especially patient information.

In this paper, we propose that the solution lies in the design and development of a Chinese medicine clinic system (CMCS). The idea of such a system is to help CM clinics and practitioners with their daily key processes and activities. The system will have functions and features such as create and store patients' records; generate reports, forms with built-in templates to meet governments' regulations and guidelines. It is anticipated that such system should have multi-lingual capabilities and would require a unique sub system to facilitate better management of the vast CM stocks.

What areas can IS/IT help in CM

In order to develop the proposed CMCS it is first necessary to map the processes that take place in CM clinics. This is done in figure 1.

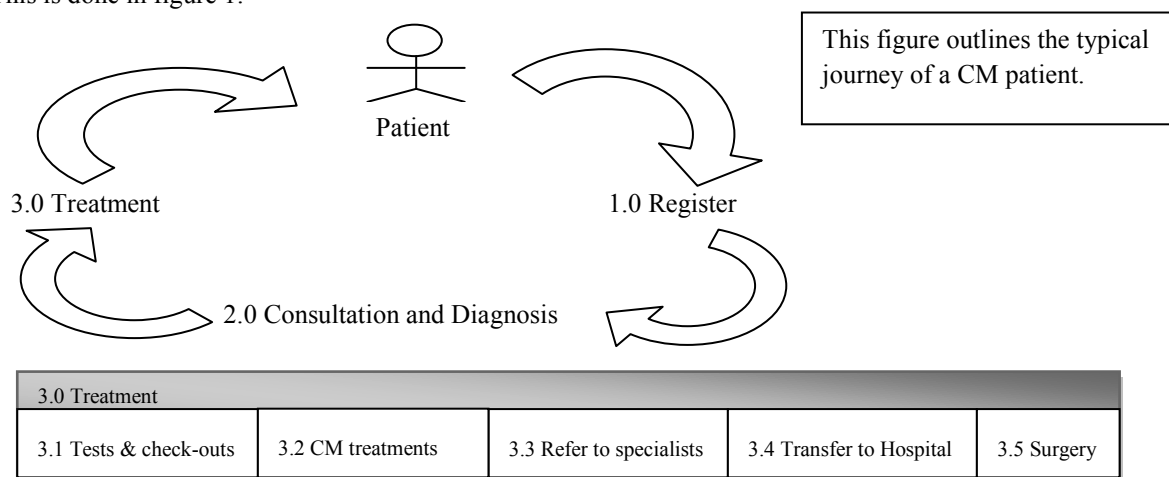


Figure 1: CM Patient diagnosis and treatment processes

In these processes, after consultation and diagnosis, a CM doctor may give the patient a treatment plan: the patient is given Chinese herbal medicine and/or other kinds of treatments; the patient may be referred to a specialist for more specialised treatments or be transferred to hospital for an emergent care. It is very common that the doctor asks the patient to come back for a subsequent treatment.

The CM processes in Figure 1 are a close match to the western medicine clinics. A typical western physician clinic patient process is analysed and modelled by Swisher et al. (2001) and include: (1) Registration, (2) Check-in, (3) Examination (including pre-examination and post-examination), (4) Exit interview, and (5) Check-out (Swisher et al. 2001). In the registration process, a patient interacts with a clinical staff prior to treatment. In Check-in, clinical staff spends time with the patient collecting initial medical information prior to examination. In the examination process, physician collects more extensive medical information from the patient (pre-examination) if necessary; diagnoses the patient and prescribes treatments (examination); and additional medical information is collected if any (post-examination). The exit interview is a process where a physician performs the final consultation and diagnosis. A patient may interact with the clinical staff before exiting the clinic in the final check-out process (Swisher et al. 2001). Compared with the above-mentioned processes, Swisher's registration process matches the 1.0 process in figure 1. The check-in and examination processes match figure 1 process 2.0. Swisher's post-examination is really the 3.1, 3.3, 3.4, 3.5 processes in figure 1. Instead of having exit interview and check-out, we realise that the processes can flow back and be repeated for some patients. This may suggest that we can expect as much benefit from the proposed IS/IT solution in the context of CM scenarios as we are now witnessing when IS/IT solutions are applied to western medical clinics.

The differences between CM and western medicine clinic processes are, however, in the methods of diagnosis, ingredients in the medicine, the treatment approaches and the philosophies of human disease. Furthermore, CM

doctors and clinics do not perform surgeries, lab tests and check-outs. Therefore, IS/IT involvements and implementations in these processes between CM and western medicine practice are similar.

Base on figure 1 CM clinic processes, we can identify the following IS/IT involvements.

- When a patient schedule or walk-in a CM clinic for a treatment, the patient triggers the registration process. A scheduling resources or facilities system manages registration which includes booking and scheduling. This system coordinates scheduling of all care providers resources, identifies conflicts with other appointments for patients or provider resources which include clinical staff, materials like diagnostic equipment, and preparation requirements such as anaesthesia consultation (COCIR 2012). This system is usually a part of a Patient Administration System (PAS) which administers patient personal information, admission, discharge, and transfer (COCIR 2012).
- Electronic Medical Record (EMR) information systems. The purpose of this system is to record and host information of patients' electronic files. EMR is a patient medical record in digital format generated and maintained in a healthcare institute such as a hospital or a clinic (Hannan 1996). EMR includes data and information such as demographics, medical history, medication and allergies, immunization status, lab test results, and radiology images (Hannan 1996).
- Medical Document Management information system (MDM). MDM manages and supports different electronic and digital patient medical documents and files (Mitamura 2010). These files contain data and information such as scanned pdf files, care episodes, test results, diagnosis, and referrals. Functions of MDM include computer-assist document/file entry, indexing, administration, file/document storage, access/retrieval, and archive (Mitamura 2010).
- Clinical Knowledge Management (CKM) and Clinical Decision Support system (CDS). CKM is a repository which contains codified knowledge such as a practical set of rules and guidelines derived from experts (Wyatt 2001). CKM often comes together with CDS, as it is the back-end database where CDS depends on or gets reference from. CDS is a program assisting healthcare professionals and physicians with decision-making tasks by linking dynamic individual patient health observations (Wyatt 2001). For example, a drug-drug interaction checker requires a database of drug names and their interactions (Sittig et al. 2010). In CM, when a CKM like the CMP is available, it can assist CM practitioners in checking/confirming a Chinese herb's toxicity and cautions, hence make better decisions on the amount of usage of such herb.
- Finance and Accounting systems (FAS). This refers to patient billing, insurance claims, activity analysis and cost accounting (COCIR 2012). This system is usually a built-in of PAS either directly or through EMR. The system can assist clinical staff to find a medical procedure, diagnosis, treatment and their prices with codes to optimise billing and reimbursement.
- Logistic and Resource systems. This includes Human Resources Management System (HRM), Facility and Equipment Management System (FEMS), and Supply Chain Management (SCM) or Materials Management System (MMS). HRM manages clinic personnel. This includes: clinic staff planning, staff details and scheduling; employee time and attendance; payroll and controlling (COCIR 2012). FEMS controls and monitors clinic facility and equipment; describes and tracks their deployment, inspects and maintains the clinical equipment by clinic policies and procedures (COCIR 2012). MMS or SCM assists in planning, implementing, and controlling all movement and storage of materials and inventory from point-of-origin to point-of-consumption. Functions of MMS are: ordering purchase, stock management, warehouse/materials management, supplier management/sourcing (COCIR 2012).
- Integrated healthcare network/system and security systems. Although some of the systems above can be stand-alone, but most of the above sub systems are built-in or connected with others. An integrated network or system to support the exchange, processing and storage of information and knowledge in between these systems is essential.
- Security is another essential area in the design of a suitable CMCS. Key areas to consider should include protecting patient and health information through access control and passwords, encryption, and firewalls; system backup, archive, and recovery; secure database with implementation of authorisation.

Another final difference between CM clinics and practices compared to western medicine is the amount and reliance on expert tacit knowledge. A study on a group of six people with stomach pain who were diagnosed by western medicine doctor and then CM physician has shown a significant difference. Based on the knowledge and theory of western medicine practice of analysing tendency to narrow diagnosis to an underlying entity, the

western medicine doctor used upper-gastrointestinal x-rays or endoscopy by means of a fiberscope, diagnosed all six patients as having peptic ulcer disease. According to the western medicine doctor, all six patients suffered from the same disorder and were given the same prescription. However, the CM physician found the differences in each patient, diagnosed six different syndromes and prescribed six different herbal formulas (Kaptchuk 2000). The CM physician's expert knowledge and comprehensive analysis of each patient's unique health condition set the differences of the diagnosis and treatments. Therefore, we consider that the proposed CMCS should also incorporate the techniques and strategies of KM, in particular evoke key knowledge transformations.

KNOWLEDGE MANAGEMENT (KM)

KM is a process of continually managing knowledge of all kinds to meet existing and emerging needs, to identify and exploit acquired knowledge assets and to develop new opportunities (Quintas et al. 1997). KM is about designing and implementing processes, tools, structures, systems and culture to facilitate knowledge capture, sharing and re-use to enhance organizational performance (Gottschalk 2005). Long and Lai (2005) summarised KM as a set of systematic actions which include establish strategies and procedures with proper utilization of technologies. This ensures the acquisition, storage, conversion, sharing, application and generation of knowledge can be effectively performed.

Integral to KM is of course the knowledge construct. Nonaka (1994 p14) notes that "knowledge is created and organized by a flow of information, anchored on the commitment and belief of its holder". Goodson (2005 p 148) refers to knowledge as an "insight, experience, and creativity that exist within people expressed through explicit and tacit communication events". Polanyi (1966) further categorised knowledge into two types: tacit and explicit. Tacit knowledge is gained from experiences and "by doing". It is accumulated through individual's experiences, actions, ideas or values he or she embraces (Polanyi, 1996). This type of knowledge is very hard to express and formalise hence it is also difficult to share with others. Explicit knowledge, in contrast, can be expressed in words, numbers, and diagrams hence it is easier to be captured, used, and shared. Organizations must be aware that these two types of knowledge are equally important.

The form of the knowledge can be changed in several ways. In particular, Nonaka et al. (1998) defined key transformations as: tacit to tacit through socialization; tacit to explicit through externalization; explicit to tacit through internalization; and explicit to explicit through combination. This process is known as the knowledge spiral. When people share experiences, like a master pass his or her knowledge to the apprentice through an apprenticeship, tacit knowledge can be transferred to tacit. Through a combination or conversion, explicit knowledge can be edited and systemized into more complex sets of explicit knowledge. This usually happens in a formal learning of facts (Nonaka et al. 1998; Rao 2005). Tacit knowledge is transferred to explicit knowledge that can be understood by the others through the use of metaphors and analogies (Nonaka et al. 1998). Wickramasinghe et al. (2006) use this in a healthcare context and explain, for example, that a surgeon answers the questions of why he does a particular procedure in a certain way. The tacit knowledge of the surgeon is captured and can be used and made available for the others. Explicit to tacit occurs as conversion of new explicit to tacit knowledge of individuals. Examples of this are on-the-job-training, simulations, and experiments (Nonaka et al. 1998).

It is important to note that knowledge do not transfer automatically by itself. Socialization, Externalization, Internalization, and Combination (Nonaka et al. 1998) involve participants' interaction, cooperation, collaboration, reflection and management. It is equally important to note that knowledge transformation is not a one-way street. Tacit knowledge can be transferred to explicit, and the newly formed explicit knowledge can be transferred to either tacit or explicit knowledge. Hence, managing knowledge and knowledge transfer is important. Wickramasinghe et al. (2006) illustrated the generation of these two types of knowledge during the healthcare process. We would like to take a step further here to show the knowledge transfer through some examples. Moreover, we identify the IS/IT involvements in these processes in table 2 below.

Table 2. Healthcare knowledge transfer

HealthCare Process	Knowledge transfer	Example	IS/IT involvement
Symptoms	Explicit to tacit	A well medical self-educated patient may claim that he/she is suffering from diabetes (explicit), as some of the symptoms he/she has experienced are close match to the disease (tacit).	A patient is well medically educated by browsing medical information on the Internet. This medical information were prepared and made available for the public with the use of IT.
Primary	Explicit to	A doctor listens and records the patient's	A doctor records the patient's

diagnosis	explicit	symptoms (explicit) and diagnoses the patient's illness is diabetes (explicit).	symptoms through an electronic device. Patient's records are stored at the clinic level or as an EMR which can be accessed nationally.
Referral	Tacit to tacit	A doctor will refer (tacit) the patient to do a set of tests, or seeing a specialist (tacit).	An electronic referral letter can be generated and sent to a specialist or laboratory for testing with details of testing items.
Second opinion	Explicit to explicit / tacit to explicit	The test results will show some data and/or information (explicit) to confirm if the patient is diabetic (explicit). A specialist may find that the patient has additional illness (tacit) and further tests may be required (explicit).	Test results are updated automatically through electric medical equipment. These results are transferred to the doctor or specialist electronically.
Confirmation	Explicit to tacit / tacit to tacit	All test results (explicit) confirm the patient's illnesses (explicit). A specialist confirms the original diagnosis from the doctor (tacit to tacit).	Confirmation of a patient's illness is recorded in patient's file or EMR.

Why KM is important?

Healthcare is one of the most complicated systems in our society today. It has many dimensions and involves many parties to collaborate in order to deliver a quality care to a patient, such as clinical/hospital administrations, physicians, specialists, nurses, radiologic technology technicians, psychologists, lab technicians, financial clerks, insurance companies, and department of health of the country. It is unarguably important that knowledge is captured and created from all parties and participants. It is equally important that all this knowledge is made available to all others in order to deliver quality healthcare to a patient at the point of need. Research has shown that KM can increase performance, develop partnership, evaluate risks, organize management and enhance economic value (Morr and Subercaze 2010). Through the use of proper KM tools and techniques, knowledge can be formalized, shared, structured, and organized so that organization knowledge assets will not be lost. A human mind can only obtain limited information and knowledge. A western medicine physician must be aware of hundreds of medical references, biological tests, thousands of imagery tests, and surgical interventions (Wickramasinghe et al. 2006). Additionally, they must know the medicines' potential effects and prices. KM helps healthcare professionals to focus on acquisition, knowledge storage and retrieval, as well as other activities such as learning, strategic planning and decision making. Thus, we will incorporate a KM focus on the design and development of the CMCS.

CHINESE MEDICINE CLINIC SYSTEM (CMCS)

The proposed structure for the CMCS is anticipated to be a system structure which contains multiple sub-systems. Further, the CMCS should be an integrated system where information and knowledge can be stored, shared, retrieved, managed, and processed. In addition, the CMCS should contain functions as detailed in table 3.

Table 3. CM system functions

Functions	Systems
Clinic staff personal information, available working time & date, provider number.	HRM
Clinic bookings, scheduling, cancellation	PAS, HRM, FEMS
Patient personal information (must follow CMBA's guidelines), including: Patient agreement (scan and upload signed clinical statements) patient medical history, insurance details, etc.	EMR
Consultation	EMR, MDM, CKM, CDS
Syndromes Chinese medicine syndromes (pre-diagnosed with suggested treatments) – link with its symptoms and signs	EMR, MDM, CKM, CDS
Diagnosis Clinical conditions (pre-diagnosed with suggested treatments) – link with its commonly seen syndromes	EMR, MDM, CKM, CDS

Medicinal formulae – link with its analysis and modern research	
Treatment - Chinese herbal medicine	EMR, MDM, CKM, CDS, SCM, FAS
Link and search with herbal monograph database	
Link and search with stock control and price	
Link and search with patient accounts (for calculation and invoice)	
Alert practitioners restricted herbs before prescription	
Herbal prescription of each diagnosis and treatment - must be written in multi-lingual (PinYin, Chinese characters, English, Latin)	
Treatment - Acupuncture	EMR, MDM, CKM, CDS, SCM, FAS
Assistance in acupuncture methods, points, acupuncture needles and time	
Link and search with acupoint monograph database	
Link and search with stock control and price	
Link and search with patient accounts (for calculation and invoice)	
Acupuncture prescription of each diagnosis and treatment - must be written in multi-lingual (PinYin, Chinese characters, English, Latin)	
Massage (TuiNa)	EMR, MDM, CKM, CDS, FAS
Assistance in massage methods, points/area, time	
Link and search with patient accounts (for calculation and invoice)	
Reports & forms with templates	EMR, MDM, FAS
Tax invoice includes specials, discounts and GST	
Sick leave, referral letter, herbal preparation instructions for patients	
Reports for government and authorities	
Case report - must be written in multi-lingual (English and Chinese)	
Upload & scan external files (pdf, image, X-ray films, medical reports etc.)	EMR, MDM
Stock (medicine) management	SCM
Herbs (including dry raw herbs, pills, tablets, powder, etc.)	
Acupuncture needles, points – link to monograph database	
Other stocks : treatment equipment, moxa, devices	
Stock tracking - reorder alert, reorder list/report	
Add/subtract stock and export to MS Excel	
System network	Integrated healthcare system, security system
LAN access - multi location, multi user	
System security – access control, virus management, information security	
Mobile access to the system	
Back-up with reminder function (hard disc, USB, etc)	

Base on the proposed CMCS system structure and functions, a system prototype will be built, tested, and validated. CM clinics and practitioners will participate in the testing and evaluation, their feedback will be taken to further refine and enhance the system. For the CMCS to be implemented in CM clinics not only must it have user support but it is also very important that it is modified and governed by international policies and standards. For example, CMCS must follow CMBA patient records guidelines and principles when recording patients file using EMR.

CONCLUSION

This paper reports a research in progress study to design and develop an appreciate CMCS. Specifically, it has served to identify the importance and advantages of using IS/IT CM healthcare contexts. Further, we have identified the key activities in the processes of CM clinical practice that can benefit from IS/IT. The paper also draws attention to the need to map key KM concepts in transferring CM knowledge and practice for clinical usage. This study is the first step in developing the CMCS. Next steps will include creating the CMCS and its sub systems, using mobile and/or cloud technology in CM practice, and IS/IT in CM education.

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