

# Maximizing Healthcare Delivery and Management through Technology Integration

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## Chapter 8

# An Analysis on the Utilisation of Health Information Technology to Support Clinical Operation of Chinese Medicine

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### ABSTRACT

*Chinese Medicine (CM) has become increasingly demanding globally. Recent World Health Organisation traditional and complementary medicine strategy of integrating CM to Western Medicine (WM) indicates that it is crucial that CM developments have strong literature, scientific, and evidence-based medical approval and support. To achieve this, there is a need to form a synthesis foundation or platform for future studies. This chapter serves to discover this synthesis that is suitable for CM by discussing the basics of inquiring and Knowledge Management (KM) systems. It suggests that CM should follow a combination of Hegelian and Kantian inquiring systems with the support of Singerian and Leibnizian inquiring systems and KM features. This proposed synthesis is one of the first, if not the first study to apply Churchman's inquiring systems into the context of CM and differentiate them from WM.*

### INTRODUCTION

Information Systems/Information Technology (IS/IT) have been adopted in healthcare to facilitate superior service and delivery to patients (Lin et al., 2013, 2014c; Wickramasinghe, 2013). Examples of this can be seen in hospitals and clinics daily operations, such as ambulatory blood pressure measurement using automated devices which is now considered a more sensitive predictor of cardiovascular outcome than

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conventional measurement (O'Brien et al., 2000). In other cases, doctors use telemedicine equipment like Tele-radiology and Tele-surgery to diagnose and treat patients (Hojabri & Manafi, 2012). Using IS/IT to assist doctors, specialists, and nurses in decision making can also be found in various hospital divisions. One good example of a decision support system (DSS) is linking characteristics of patients with chest pain to software algorithms recommending specific action (Ferlie et al., 2012). Technology has taken healthcare to a digital era and it is likely and will continually service healthcare with advanced technology (Lin et al., 2013, 2014c; Wickramasinghe et al., 2005). However, there is little IS/IT utilisation in complementary and alternative medicine (CAM) practice (Lin et al., 2013, 2014c). Therefore, we look into one of the CAM - Chinese medicine (CM) practice. The analysis of CM clinical operation activities can help identifying suitable IS/IT involvements and solutions.

The chapter is organised in the following sections: firstly, brief background information about current international CM practice is introduced; its position in world healthcare; why CM is important and hence proper IS/IT system should be studied and implemented. Secondly, typical CM clinic daily operations, activities, processes are identified and analysed. Thirdly, a new and suitable synthesis is suggested for CM developments. Fourthly, based on the proposed theory, possible and suitable IS/IT involvements and solutions are listed. Finally, this chapter concludes with the summary of contributions.

## **BACKGROUND**

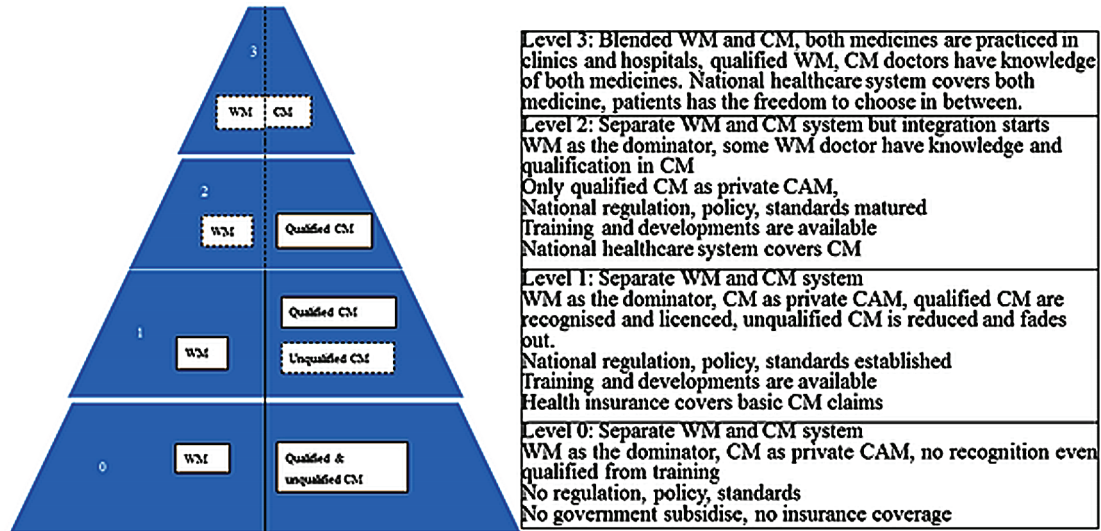
There are about 80% of the world population use CAM treatments (WHO, 2013). In Australia the number of people using CAM is rising. Research shows that the number of visits to CAM practitioners by adult Australians in year 2004 to 2005 reached 69.2 million, while the number of visits to primary care or general practice (GP) was 69.3 million in the same year (Xue et al. 2007). CM is one of the most popular CAM practices today (Lukman et al. 2007). There are 4,157 registered acupuncturists in Australia (CMBA, 2014) and more than 10 million visits to acupuncturists every year (Xue et al., 2008). CM is considered by many patients to have fewer side effects; more effective treatment to the root of the disease; and is good for the overall health of patients (Chi, 1994). Unlike western medicine (WM), CM's unique methods of diagnosis (combine inspection, auscultation and olfaction, inquiring, and palpation in every diagnosis) give each patient individualised treatment (Chi, 1994). This approach, to some patients, is a benefit and an advantage.

### **CM Strategic Movements**

The World Health Organisation (WHO) summarised its traditional and complementary medicine (T&CM) strategy 2014 to 2023 (updated from strategy 2002–2005) in three areas: 1) a knowledge base to allow T&CM (including CM) to be managed actively through appropriate national policies that understand and recognise the role and potential of T&CM; 2) ensure quality assurance, safety, proper use and effectiveness of T&CM by regulating products, practices and practitioners through education and training, skills development, services and therapies; and 3) promote universal health coverage by integrating T&CM services into health service delivery and self-health care (WHO, 2013).

Countries around the world are making efforts to implement WHO's T&CM strategy at their own pace. In Canada, a comprehensive regulatory framework was introduced to CM. Policy, regulation, and guidelines were developed for CM practitioners to follow (WHO, 2013). In United States, the National

Figure 1. CM & WM integration map  
(Adopted from Lin et al., 2014a) Source: ECIS 2014



council for certification of acupuncture and Oriental Medicine developed assessment guidelines and examinations for acupuncturists and CM herbalists (Boodeker & Kronenberg, 2002). In Switzerland, CM is covered by the nation's compulsory health insurance program announced by the Federal Department of Home Affairs in 1998 (WHO, 2013). To assist CM strategic movement, it is helpful to identify and illustrate the different stages of CM and WM integrations. Figure 1 demonstrates these stages and it can also be used as a road map for implementation design, progress and updates.

Stage three in Figure 1 has the highest integration between CM and WM. It is also WHO's vision and goal that is to have a blended system which takes the best of each and compensates for the potential weaknesses in each (WHO, 2013). However, to date, this stage can be only seen in China.

## CM and WM in China

As the birth country of CM, this traditional medicine has dominated the country's health system for thousands of years until the Opium war (Chi, 1994). Western power and invasion shook the Chinese self-confidence as well as CM. Reformers at the time turned to science as the salvation for China and considered WM as part of the new western science wonders. Supported by scientific evidence, WM was considered to be more advanced than CM (Chi, 1994). Chinese experienced and compared the treatment of both medicine types and they gradually shifted their preference to WM. The study of Chi (1994) suggested when WM was introduced to the majority of Chinese, advanced transportation and trade supported adequate supply of drugs and equipment which helped the sustainability of WM in China. CM lost its dominance from the early twentieth century until recently when large Chinese civilisations acknowledged the importance and necessity of modernisation (Chi, 1994). In this process, some intellectuals and key government officials believed that adopting various levels of western science should be accompanied by perfecting traditional Chinese culture. They proposed that CM must learn from WM to gain scientific knowledge, evidence and approval; on the other hand WM must study the popular and widespread spirit

of CM (Chi, 1994). Today, China is the only country in the world which has the two medicine types practised alongside each other at every level of the healthcare services (Hesketh & Zhu, 1997). Almost 95% of general hospitals where WM is practised include CM departments and provide CM services to patients. Hesketh and Zhu (1997) reported that 40% of the prescriptions from WM hospitals are CM and equally 40% WM prescriptions are from CM hospitals and clinics. All WM schools devote around 15% of curriculum time to CM; similarly CM students must undertake some compulsory courses from WM (Hesketh & Zhu, 1997). In China, WM is seen as more effective in acute situations or where the aetiology is known, while CM is more effective for immune conditions, chronic illness and where the aetiology is unknown (Hesketh & Zhu, 1997).

## **CM in Australia**

Australia has achieved some of the most impressive outcomes in implementing the WHO's strategies (CMBA, 2014). They are highlighted below:

- The CM profession is now included in the National Registration and Accreditation Scheme (NRAS). National registration of practitioners, acupuncturists, and dispensers of Chinese herbal medicine commenced on the 1st July, 2012 (CMBA, 2014).
- Policies, registration guidelines, codes and standards were created and published to assist the CM profession.
- CM undergraduate and postgraduate courses are offered in Australian tertiary education system.
- Accreditation standards and processes for consultation were developed by the Australian Health Practitioner Regulation Agency (AHPRA) and Chinese Medicine Board of Australia (CMBA) (CMBA, 2014).
- CMBA website is created which enables online service delivery and communication. Chinese Medicine Portal (CMP) is created and serves as an online CM knowledge pool where information and clinical data can be retrieved and accessed (Yang et al. 2009).
- AHPRA will directly allocate cost funding to CMBA to assist various activities undertaken by the agreement and strategies (CMBA, 2014).

Despite these remarkable achievements, our analysis suggests that much work and attention is needed for integrating CM into the Australian health care service delivery and self-health care. Therefore, CM and WM integration in Australia is at stage one (Lin et al. 2013, 2014a). CM authorities and individuals are working towards stage two where only qualified CM physicians are allowed in clinics and WM doctors are trained and have basic knowledge of CM. The two systems are still separate but more overlap and cross over occurs with more referrals and co-workers (CMBA, 2014).

## **CM PRACTICE AND ITS CLINICAL ACTIVITIES**

CM is a system of primary health care that works holistically to maintain or restore balance, harmony and order in human bodies. CM philosophy is based on the Yin/Yang principle of balancing and harmonising conditions within the body (Hsu, 2001, Liao, 2011; Wang et al., 1999; Xue and O'Brien, 2003). The origins of CM go back thousands of years, and work with the philosophy that balanced and

*Table 1. CM Five elements*

Elements	Zang Organs	Fu Organs	Sense Organs	Body Tissues	Passions	Fluids	Pulses
Earth	Spleen	Stomach	Lips	Muscles	Thought/Anxiety	Saliva	Moderate
Fire	Heart	Small intestine	Tongue	Vessels	Joy	Sweat	Surging
Metal	Lung	Large intestine	Nose	Skin and hair	Sorrow	Nasal discharge	Floating
Water	Kidney	Urinary bladder	Ears	Bones	Fear/Fright	Spittle	Deep
Wood	Liver	Gallbladder	Eyes	Tendons	Anger	Tears	Taut

(Adopted from Liu & Liu 2009 p 23)

free-flowing Qi (energy) results in health, while stagnant or imbalanced Qi leads to disease. According to these philosophies, life energy is rhythmically channelled through a network of mutual influences between the five elements and the corresponding organs of the human body (Huang & Chen, 2007; Liu & Liu, 2009; Zhao et al., 1994). Table 1 summarises the key aspects of CM.

## **CM Diagnosis and Treatments**

CM practitioners use four diagnosis methods: inspection, auscultation and olfaction, inquiring, and palpation (Huang & Chen 2007; Zhao et al., 1994). Inspection begins with the physician understanding and predicting the pathological changes of internal organs by observing abnormal changes in the patient's vitality, colour, appearance, secretions, and excretions (Huang & Chen 2007). Auscultation and olfaction involve 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. A patient's "stinky" smell, for example, usually indicates heat syndromes while foul and sour smell implies retention of food (Huang & Chen 2007). Inquiring means the physician asking the patient about his/her condition such as chills, fever, perspiration, appetite, thirst, and pain, Huang and Chen (2007) explain. In 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 & 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 & Wang 2011). A correct diagnosis can only be made based on a comprehensive and systematic analysis of a patient's condition at the point of care. This explains why CM diagnosis and treatments are different for the same patient and disease at different times (Kaptchuk, 2000; Lin et al., 2013, 2014c). CM physician's expert knowledge and comprehensive analysis of each patient's unique health condition is a key which differentiates between the two types of medicinal practices.

CM treatments can be a combination of the following: herbs (including leaves, seeds, roots, flowers, fruits, minerals and animal products); acupuncture, moxibustion, tuina (Chinese remedial massage), cupping, qigong and diet therapy (Xue & 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).

## **CM Clinical Activities**

CM, as a CAM in developed or western countries is typically practised in small clinic settings which are very identical to the Primary Care or General Practice (GP) (Ben-Arye et al., 2008; GP NSW, 2011; North, 2008). It follows the common GP clinical activities which include three major processes: reception; physician consultation and diagnosis; prescription and treatments (GP NSW, 2011; AHPRA, 2014).

Reception: appointments (booked and walk-in) scheduling is commonly the starting point of a medical care for both the patients and the clinics (GP NSW, 2011; AHPRA, 2014). It is one of the most resource demanding daily tasks (GP NSW, 2011; AHPRA, 2014). A first-time-visit patient is asked to fill in a form which provides the clinic with the patient's personal details and medical histories. This information is usually stored in the GP clinic file system electronically. However, most CM clinics are still recording these records on paper (Lin et al., 2013; 2014c). Our observation on ten CM clinics in Melbourne Australia indicates that men-made administration problems occur under this manual system. In summary they are: 1) file lost and misplace. Patient files can be misplaced at different categories, storage locations. This is because: a) clinics categorise and store patients file in a surname – given names sequential order. Some patients such as the Chinese usually read and write their surname first. This is the opposite of the Europeans who usually put their given names before their surname. b) different pronunciation and word. When Chinese names are recorded by PinYin (like English alphabets) without tones, it can be pronounced and referred to a range of different characters or words (Lin et al., 2014c). Hence, searching for the patient's file involves challenges, efforts and clarifications. 2) file management obstacles. Paper recording and storage make patient information update and management less efficient. 3) handwriting problems. Everyone writes differently, so it is sometimes difficult to read and understand the handwritten records.

In CM clinics, the receptionist also handles payments and insurance claims. As CM is not covered by Medicare Australia, patients must cover the cost privately. Some private insurance companies give certain percentage of rebate on acupuncture and remedial massage (Zheng, 2014).

Physician consultation and diagnosis: CM diagnosis methods are unique and different from WM, this is stated in details in the previous sections. To date, many CM diagnosis are recorded manually into the patients' files by physicians during the consultation. CMBA has launched policies, standards, and requirements on patient files. All CM clinics in Australia should record and report the mandatory elements of patient personal details in English (CMBA, 2014). Where records are maintained in a language other than English, should a copy of a patient's records be requested by the patient, or required by the CMBA or an authorised third party, it is the responsibility of the CM practitioner to provide at their own expense an English translation of the patient's records or cover the cost of this service according to CMBA (2014).

Prescription and treatments: after consultation and diagnosis, the physician may give the patient a treatment plan. The patient may be referred to a specialist for more specialised treatments or be transferred to hospital for an emergency care. It is very common that the patient is required to come back for a subsequent treatment. CM prescriptions and treatments cover wide ranges of products. The most common prescription is Chinese herbal medicine with acupuncture treatments (Kaptchuk, 2000; Liao, 2011; Liu & Liu, 2009). CMBA require CM practitioners provide information on treatments/therapies being used (including herbal, pharmaceutical, manipulative, dietary, and psychological); diagnosis, treatment principles, and recommended treatment plans; all procedures conducted including details of all acupuncture points and stimulation method; any medicine prescribed, administered or supplied for

the patient or any other therapeutic agent used (including name, strength, quantity, dose, instructions for use, number of repeats and details of when started or stopped); discussion about possible side effects or alternative forms of treatment; details of how the patient was monitored and the outcome in progress notes (CMBA, 2014).

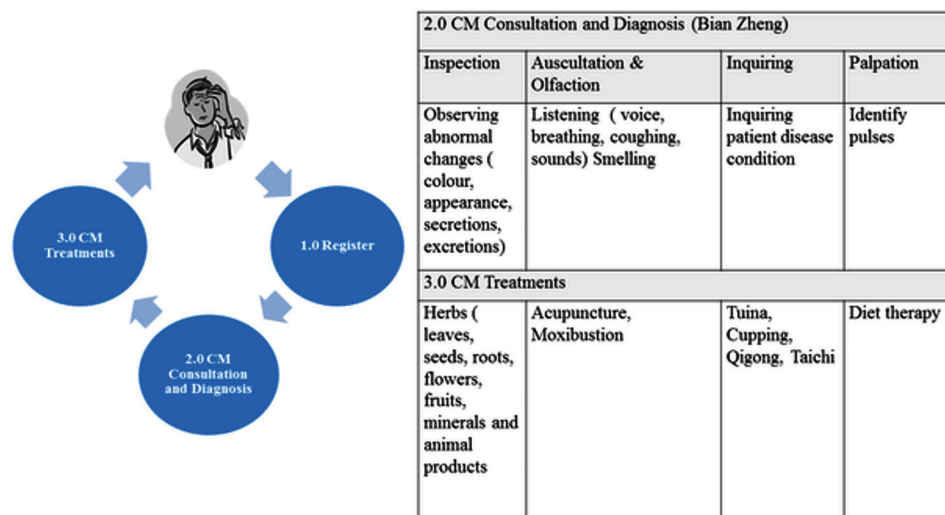
Herbal prescription is usually prepared by dispenser(s) after receiving the written prescription from the physician (Chi, 1994; Lu et al., 2004; Xue & O'Brien 2003). There are usually multiple packs of the same herbal combinations for each prescription. These packs are double checked by a second dispenser for accuracy (Chi, 1994; Lu et al., 2004; Xue & O'Brien 2003). Instructions of how to prepare and take the medicine are written and given to the patient. Any further questions can be answered before the patient exits the clinic.

## CM Diagnosis and Treatment Processes

The above mentioned CM clinical activities and processes give us the understanding of CM clinic basic daily operations. The comparison of these operations to typical GP is important in analysing and developing a suitable IS/IT solution for the CM clinics. To achieve this, it is first necessary to map the processes. Figure 2 demonstrate this in details.

The CM processes in Figure 2 are a close match to WM clinics. Swisher et al (2001) analysed and modelled WM clinic processes which consist of: registration; check-in; examination (including pre-examination and post-examination); exit interview; and check-out (Swisher et al., 2001). In Swisher's model, a patient books a visit with a clinical staff prior to consultation in the registration process. In Check-in, patient's initial medical information is collected before examination. Next a physician collects more extensive medical information from the patient (pre-examination) if necessary; diagnoses the patient and prescribes treatments (examination); additional medical information is collected if any (post-examination). A physician performs the final consultation and diagnosis in exit interview process

*Figure 2. CM Patient diagnosis and treatment processes  
(Adopted from Lin et al., 2014c)*



(Swisher et al., 2001). Comparing these WM processes with CM, we have found that Swisher's registration process matches the CM 1.0 process in Figure 2. The check-in and examination processes match CM process 2.0. The post-examination is really the 3.0 process in Figure 2. 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 CM clinics can expect as much benefit from a IS/IT solution as we are now witnessing in WM clinics.

## **Problems and Challenges of CM**

Today CM clinics still operate its clinical activities manually; many CM practitioners use their first language to record patients' syndromes and treatments (Lin et al., 2013, 2014c). This creates language difficulties to others. It is also hard to implement standards, and to encourage an internationally recognised and registered practice. A patient's medical 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 analysing and diagnosing the patient without the proper and adequate technology and equipment. As an ancient treatment to human diseases, CM today has a huge collection of herbs and medical equipment. Managing these medicines and equipment manually is a continuous resource and space-demanding task to the CM clinics.

Research has attempted to build and transfer the voluminous information and knowledge in Chinese herbs, acupuncture, syndromes, and treatments to a knowledge-based system which can be retrieved online or through Intranet. 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). The existing research and developments have some limitations: 1) only include or focus on limited or small amount of Chinese herbs with no or limited resources in Chinese acupuncture or vice versa (Yang et al. 2009), hence it is incomprehensive. 2) lack of evidence support on information production (Yang et al. 2009). 3) not an IS/IT system solution for CM clinics and practitioners to handle their daily key processes (Lin et al, 2013; 2014c). 4) no system functions and features on clinical medicine management (Lin et al.,2013, 2014c). 5) there is not a suitable synthesis to support or give a solid base or foundation for the IS/IT developments (Lin et al.,2013, 2014c; Yang et al. 2009). Further, a study of the current CM clinic management system (consisting of SmartTCM Australia, TCM Herbalist Israel, TCM Organiser Canada, and Shen Professional Venezuela) also indicates some significant concerns including:

- Incorrect use of the Chinese language as well as non-comprise to other languages except Chinese and English (Lin et al, 2014a).
- Not a secure multi-user and access which can accommodate administrator, physician, and dispenser (Lin et al, 2014a).
- Cannot be used on multi system and device (Lin et al, 2014a).

The most important limitation of the above all is that the synthesis of IS/IT developments so far has been mainly studied and applied to WM. It is our contention that blindly adopting these theories and technologies is not the best solution for CM. This view is supported in practice when we look at Enterprise Resource Planning (ERP) systems such as SAP and Oracle as they have tried to conquer the Chinese market by simply applying the same tools and techniques without first understanding and mapping the

underlying circumstances and requirements. Xue et al. (2005) noted that “most ERP systems are designed by western IT professionals and the structures and processes embedded in these systems reflect western cultures. Implementation failures tend to occur when Chinese companies attempt to adopt foreign ERP systems.” (Xue et al., 2005, p. 280). To avoid similar failures, it is therefore necessary to systematically examine the basis of the synthesis. Search and form a theoretical foundation that is suitable for CM practice. This is described in details in the next sections where we analyse the different inquiring and knowledge management systems.

## **SOLUTIONS AND RECOMMENDATIONS**

The preceding section has indicated that CM practice is distinct and different from WM, simply adopting the existing IS/IT solutions which are designed and developed for WM, is fundamentally flawed and would thus not be the best approach for CM developments (Lin et al, 2013, 2014c). To form a foundation and synthesis for CM, this section reviews and analyses the basics of inquiring and knowledge management (KM) systems. In so doing, we propose a new theory that is more suitable for CM developments. Once this is done, then any CM system developments such as a CM Clinic Management System (CMCMS) can be built-on-top.

### **Inquiring Systems**

Churchman defined the five inquiring systems: Leibnizian, Lockean, Hegelian, Kantian, and Singerian (Courtney et al, 2005; Churchman, 1971). Each of them represents a type of inquiring organisation from a system view of knowledge creation, examination, and management (Wickramasinghe, 2005).

#### **Leibnizian, Lockean, and Singerian Inquiring System**

Leibnizian inquiring system is a closed system with a set of built-in elementary axioms that are used along with formal logic and analysis to generate more fact nets (Churchman, 1971; Courtney et al., 2005; Hall & Croasdell, 2005;). Knowledge creation is limited as the Leibnizian system use only formal logic and mathematical analysis to make influences about cause and effect relationships (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). They focus on reliability and replication. Organisational memory and knowledge expand within its internal boundary to achieve accuracy and repetition. Therefore they deal with problems that are highly structured with few unknown variables (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). KM is concentrated on manipulating the organisation’s explicit knowledge such as documents describing goals, plans, and standard operating procedures. Courtney (2001), Hall and Croasdell (2005), Mason and Mitroff (1973), Parrish and Courtney (2012) have all explained that tacit knowledge gets little emphasis in this organisation which leads to difficulties to adapt and maintain in a changing and non-consequential environment. IS/IT most suited to the Leibnizian inquiring systems are types of expert systems. Nonaka et al (1998) explained this form of KM in the combination mode of knowledge creation. He stated, “combination involves the conversion of explicit knowledge into more complex sets of explicit knowledge” (Nonaka et al., 1998, p. 674), and new knowledge is generated as an externalisation of editing and systemizing.

Lockean inquiring system is a close system in which community members sharing a common language and mindset supported by strong relationships and communication (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). Lockean organisations develop organisational beliefs, practices, and rituals. These values are passed on, shared and perpetuated within the organisation through attention to symbolic references such as legends and/or well-respected authorities (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). Knowledge is socially constructed through observation and discussion. Examples of IS/IT used in Lockean inquiring system are: repositories such as data warehouses (storing observations), data mining (analysing the observations), and groupware tools like emails (facilitating the communication and sharing) (Courtney, 2001). According to Courtney (2001) the Lockean organisations exemplifies Nonaka's socialisation mode of knowledge creation. Socialisation is about sharing individual's tacit knowledge to those "if the self becomes part of a larger self" (Nonaka et al., 1998, p. 674).

Singerian inquiring system is guided by two basic premises. The first is to establish a system of measures which specifies steps to be followed in resolving disagreements (Churchman, 1971; Courtney et al., 2005; Hall & Croasdell, 2005). The second is the strategy of agreement. When disagreements occur for various reasons, and when models fail to explain a phenomenon, new variables and laws are introduced to provide guidance and overcome inconsistencies (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). Problem fragmentation or partitioning helps Singerian organisations make sense of the situation by sorting out the known and unknown, then it processes the unknown further, generating cycles of disagreement and agreement until the problem is fully investigated and understood from all sides (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). The Singerian has the purpose of creating exoteric knowledge for choosing the right means for one's end. Knowledge must be connected to measurable improvements that are judged not only by organisational standards but also by what is good and ethical for all of society (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). The Singerian inquirer believes that problems and knowledge domains are non-separable; everything is connected to everything else; from any source, discipline, and profession; and so they are analysed as wholes. Knowledge of all forms is considered which include: tacit and explicit, deep and shallow, declarative and procedural, exoteric and esoteric (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). Nonaka's socialisation and externalisation modes are emphasised in the Singerian inquiring system style as a discourse may involve many perspectives. The Singerian approach is best supported by network based such as groupware and web-based to allow virtual information gathering and learning because of its need to include a wide range of individual stakeholders (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). Repositories and document management systems are supportive tools for information gathering and dissemination process.

## Hegelian Inquiring System

Hegelian inquiring system is based on the belief that the best way for knowledge creation is by observing a debate between two conflicting ideas (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). There are three major players in the Hegelian system. The first player constructs a strong conviction of a fundamental thesis with great efforts of maximizing supporting materials. The second player does the same thing as the first only with an opposite worldview of the

thesis - antithesis. The third player analyses the debate and constructs a new and larger worldview that is synthesis of the thesis and antithesis. In this style, knowledge is gained by reflecting and resolving diametrically opposed perspectives (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). Hegelian organisations have little structure or formal mechanism for guidance; however it is assisted by group support systems that include negotiation and arbitration. Knowledge to be managed in such environments consists of information from the three players and the interaction dialogues (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973). IS/IT solutions that support Hegelian inquiring systems include: groupware that is designed to support and facilitate arguments among stakeholders in order to help them understand the specific elements of each other's proposals; repositories that hold the debate data; document management software and/or analysis tools for developing points to support either the thesis or the antithesis (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973).

In a Hegelian inquiring system, knowledge creation can be seen as consisting of Nonaka's socialisation and externalisation (Courtney, 2001). Socialisation as it involves three players' interaction and debating. It is through this social process, tacit and explicit knowledge of the thesis and antithesis are externalized (Courtney, 2001; Hall & Croasdell, 2005; Nonaka et al., 1998).

### Kantian Inquiring System

The Kantian inquiring system is designed to incorporate both multiple perspectives and facts to determine models that are best-fit for the situation (Churchman, 1971; Courtney et al., 2005; Hall & Croasdell, 2005). Using Leibnizian fact nets to support its data analysis, Kantian inquiring systems perform various modelling techniques to interpret and explain the causal connections between perspectives and the observations (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). Kantian organisation depends on communication, organisation memory, understanding of the modelling, stability of rules and regulations. In this style, knowledge is managed in both empirical and theoretical approach (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). The perspectives can be heavily analytical as it uses multiple analytical methods for interpreting data. Learning is disseminated through the group members and KM may be enhanced by the use of a system design to discover and distribute information (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012). The Kantian inquiring system tends to be sensible to the environment. It is focused on flexibility, relationships, organisational development through contingency theory and the best-fit between itself and the environment; hence it can react quickly and effectively to problems and changes. This type of inquiring system is suitable for moderately uncertain situations, unstable environments and complex problems of high-to-moderate structure (Courtney, 2001; Hall & Croasdell, 2005; Mason & Mitroff, 1973; Parrish & Courtney, 2012).

The Kantian inquiring system can be seen in Nonaka's internalisation mode which includes both tacit and explicit knowledge (Courtney, 2001; Hall & Croasdell, 2005; Nonaka et al., 1998). The system uses machine-learning algorithm and models input by experts to analyse incoming information and add the processed information/models to the organisation's memory, according to Courtney (2001), Hall and Croasdell (2005), Nonaka et al. (1998). Examples of IS/IT in Kantian are: World Wide Web (www), databases, model management systems, decision support systems, and effective information systems.

## Inquiring Systems for WM

Healthcare Information Systems (HIS) have been largely developed to produce expert systems, theorem-proving systems, problem-solving and decision-support systems, algorithm-generating systems, databases, and repositories in WM (Ferlie et al., 2012; Liao, 2003). Hence the existing HIS developments and solutions are mostly in the categories of Leibnizian and Lockean inquiring systems. As mentioned earlier, Leibnizian inquirer creates fact-net, expert systems perpetuating experiential knowledge. This can be seen in HIS, for example, electronic knowledge repositories, storing codified knowledge for future reuse; Clinical decision support systems (DSS), linking characteristics of patients with chest pain to software algorithms recommending specific action (Ferlie et al., 2012). This kind of DSS take information from various data sources and use these data to provide assistance with the structured portion of the semi-structured decision (Parrish & Courtney, 2012). This is an early form of a Kantian inquirer stated by Parrish and Courtney (2012), as the human decision maker must rely on intuition and experience to assist them with the unstructured portions. Singerian inquiring system's great emphasis on ethical behaviour can be seen in most HIS where medical ethics and professionalism are mandatory and expected to maintain strictly in practice. An example of this is a DSS which is developed and implemented with the guidance and principles of patient safety, quality performance, regulations, and policies (Parrish & Courtney, 2012).

## Inquiring System for CM

The unique characters, diagnosis, and treatments of CM indicate that CM healthcare is a complex open environment. There are many variables, inputs, and perspectives to consider and communicate. This is a feature common to Kantian inquiring systems as it generates hypotheses on the basis of the inputs received from various knowledge sources (Churchman, 1971; Courtney et al., 2005). The Kantian inquiring system is also able to use explicit and tacit knowledge to consider the many interpretations of the inputs. Knowledge is compared allowing the inquirer to consider ways and/or different modelling to create and incorporate new knowledge (Churchman, 1971; Courtney et al., 2005).

We also see that CM exhibits features common to Hegelian inquiring systems since CM tries to resolve conflicts and proposes enlarged synthesis. As a result the problem is completely dissolved (Courtney et al., 2005; Hall & Croasdell, 2005; Morr & Subercaze, 2010). Hegelian's ability to understand all behaviours, forms, processes, arguments, and technologies support CM's comprehensive and systematic view of human diseases. CM philosophy emphasises inner self-controlled system connectivity and balance between Yin and Yang energy. Any disorder is a result of failure and/or imbalance of the system (Huang & Chen, 2007; Lu et al., 2004; Zhao et al., 1994). Hence resolving, strengthening, and rebalancing the system with duality wisdom (Wickramasinghe, 2005) is a key in CM practice.

Additionally, as Kantian and Hegelian rely on Leibnizian inquiring system's fact net to generate knowledge (Courtney, 2001; Hall & Croasdell, 2004; Moody & Shanks, 1999), then Leibnizian inquiring system is used as part of the knowledge base. This includes, for example: repositories, models, CMBA regulation and guidelines for CM practitioners in Australia, and the CM Portal. Furthermore, Singerian inquiring systems' strong emphasis on ethical conduct is extremely important to any HIS and is thus also relevant in the CM context. Patient autonomy, welfare and social justice must be considered and built-in as principles and guidelines in any CM IS/IT developments and solutions.

*Table 2. Mapping inquiring systems to CM and WM*

Inquiring Systems	Hegelian	Kantian	Singerian	Leibnizian	Lockean
Western Medicine					
Chinese Medicine					

(Adopted from Lin et al., 2014b) source: HICSS 2015

Table 2 illustrates the inquiring systems based on our discussion. From this table, we can see the different IS/IT design and development focus between the two types of medicine practices. WM IS/IT developments are mainly in the Leibnizian and Lockean inquiring systems with Singerian inquirer's ethical guidance (highlighted in a dark colour). Furthermore, research tends to indicate some early Kantian inquiring systems using DSS in WM (highlighted in a lighter colour). Our research suggest that CM IS/IT developments should be primarily in the category of Hegelian and Kantian inquiring systems (highlighted in a dark colour) with the support and principles from Singerian and Leibnizian inquiring systems (highlighted in a lighter colour). No colour, or white in Table 2 represents no IS/IT solution to date that fits this type of inquiring system respectively in WM or CM.

## Knowledge Management (KM) Systems

KM systems are designed and developed to support and enhance knowledge intense tasks, processes, and projects for the purpose of knowledge creation, storage, retrieval, transfer, refinement, reuse, revision, and feedback (Maier & Hadrich, 2011). Typical KM systems contain data and knowledge sources; infrastructure services; integration services; knowledge services; personalisation services; and access services (Maier, 2007; Maier & Hadrich, 2011).

Data and knowledge sources include organisational internal and external information and knowledge, data warehouse, document management, personal information management, contents from Internet, WWW, and groupware (Maier, 2007; Maier & Hadrich, 2011). This research analyse the CM clinic's information and knowledge in these categories through the case study. For example, how does the clinic manage its medicine documentations? What are the key elements in managing this with IS/IT?

Infrastructure services provide basic functionality for synchronous and asynchronous communication, data and electronic assets management, extraction, transformation, and loading (Maier, 2007; Maier & Hadrich, 2011). For example, Intranet infrastructure services provide messaging, teleconferencing, and file transferring. In this case the research looks into the clinic's IT infrastructure services for messaging and files transferring.

Integration services help to meaningfully organise and link knowledge elements from a variety of sources. Integration is often used to analyse the organisation knowledge base and manage the multi-dimensional metadata (Maier, 2007; Maier & Hadrich, 2011). The research looks into how the clinic manages external information and knowledge such as films and laboratory test results in assisting diagnosis and treatments.

Knowledge services involve 1) discovery functions such as searching, mining, navigation, and visualisation (Maier, 2007; Maier & Hadrich, 2011). 2) publication functions like structuring, formats, and contextualisation (Maier, 2007; Maier & Hadrich, 2011). 3) collaboration functions include skill/expert management, knowledge sharing, awareness, and experience management (Maier, 2007; Maier

& Hadrich, 2011). 4) learning functions that use tools and techniques for authoring, managing courses, tutoring, learning paths, and examinations (Maier, 2007; Maier & Hadrich, 2011). In this category, the research analyses if any expert knowledge system is used in the clinic; if the physicians use any DSS in assisting diagnosis and treatments; how does the clinic manage its reporting and standards required by the CM authorities; how do the clinic practitioners search, order, and manage their medical/herb information; what are the major concerns and key elements in this area when using IS/IT?

Personalisation services can organise a portion of the KM system contents and services for specialists and/or specific roles (Maier, 2007; Maier & Hadrich, 2011). For example personalised or role-oriented knowledge portals; personal information management and digital assistant. The research looks into if there are any personal devices and applications that the practitioners are using or like to use; how the clinic manages these personalisation services. User access level of the clinic medicine practice is also studied.

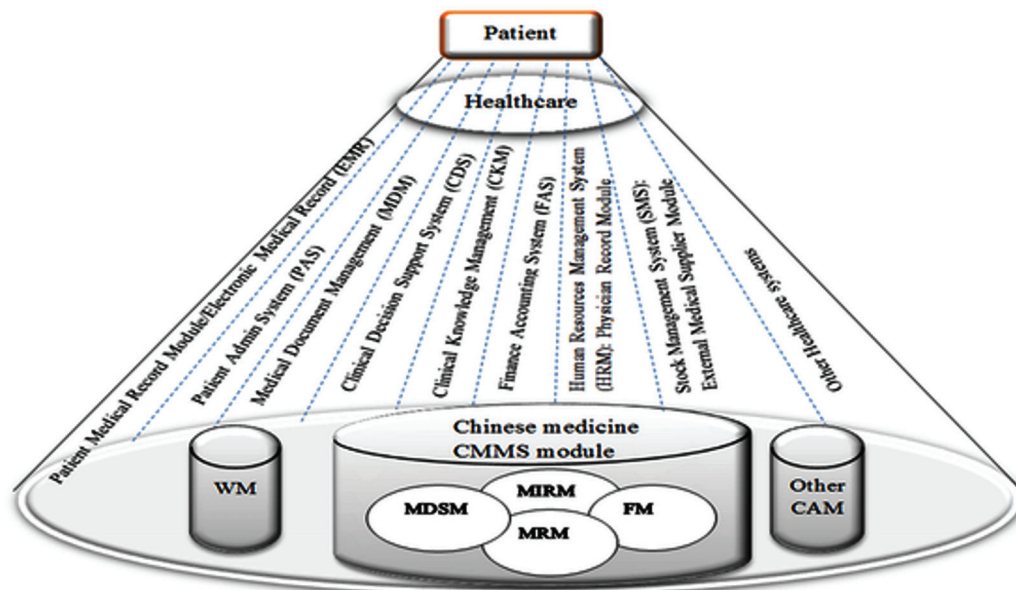
KM architecture and characteristics are important elements which must be considered in CM developments. Table 3 summaries the systems that are suitable for CM information systems.

*Table 3. Information systems for CM*

		CM Inquiring Systems				
	Lockean	Singerian	Leibnizian	Kantian	Hegelian	KM Systems
Inputs	Goals, decisions, standards, procedures	Units, standards	Fact net	Knowledge sources, organisation memory	Mission statements	Data and knowledge sources; infrastructure services; integration services; knowledge services; personalisation services; access services
Given	Organisation memory, structure, and culture	System of measures	Standards, operating procedures, rule base	Tacit and explicit knowledge, working theories	Opposing views	
Process	Negotiation, communication, consensus building	use variables to overcome inconsistency	Cause and effect analysis, inference	Knowledge scanning, association building	Arbitration	
Output	Ambiguous reduction	New measures, exoteric knowledge	Error detection and correction, suggested course of action	Integrated and timely knowledge	Conflict resolution, enlarged perspective, new strategic direction	
Knowledge perspective/mode	Socialisation	Socialisation, externalisation	Combination	Combination	Socialisation, externalisation	
IS/IT	Communication repositories, groupware, networks	Groupware, networks, repositories, document management	Models, Decision Support Systems (DSS), expert systems, document management	Database, knowledge and model bases, management systems, www	Repositories, groupware, negotiation systems	

(Adopted from Lin et al., 2014b) source: HICSS 2015

*Figure 3. CMCMS design processes*



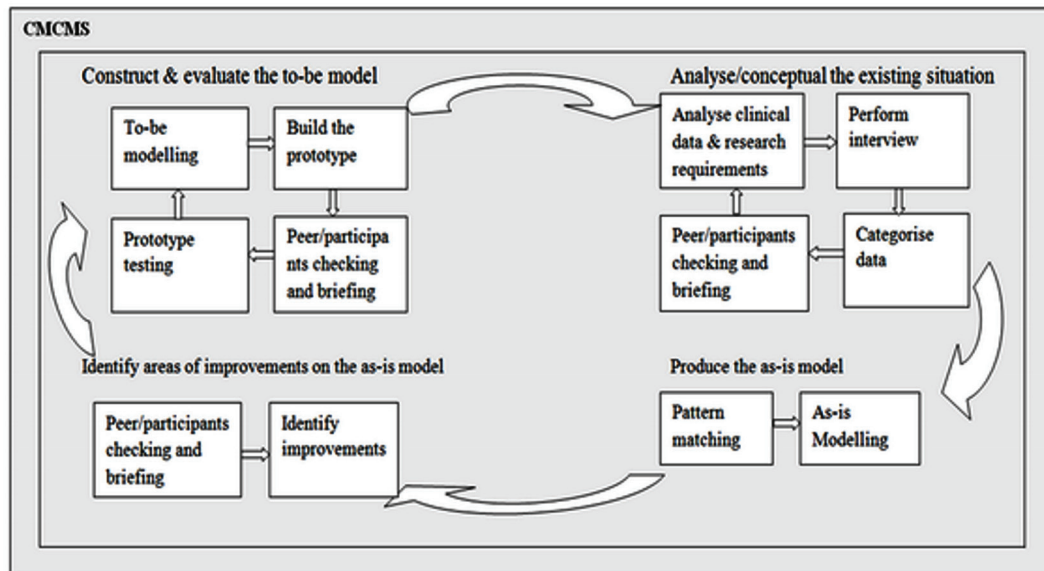
## **FUTURE RESEARCH DIRECTIONS**

For CM to be integrated with WM in developed countries like Australia, there is more pressure for it to be more evidence based and have a more scientific and systematic structure in its delivery. We contend that IS/IT tools and techniques can play a key role in achieving this goal. As an extension of the proposed synthesis, this research looks into developing the CM clinic management system (CMCMS).

## **The CMCMS Study**

The CMCMS development uses a mixed methodology of Case Study (CS) and Design Science (DS) to guide the various activities. CS is a commonly used and well-recognised research strategy in Healthcare Services and IS research (Yin, 1994, 1999). It attempts to examine a contemporary phenomenon in its real-life context, Yin (1994, 1999) stated. Through a typical CS, the research domain can be examined and a deeper understanding of the key and critical circumstances and conditions can be unearthed (Flick, 2014; Yin, 1994, 1999). Additionally, CS tools and techniques such as semi-structured interviews, thematic and artefact analysis provide valuable data and information for developing the CMCMS and thus are incorporated. DS methodology has its roots in the field of engineering and science (Hevner et al., 2004). It “seeks to create innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, management, and use of information systems can be effectively and efficiently accomplished” Hevner et al. (2004, p.76) said. DS is often used in developing executive information systems and system support emerging knowledge processes with effective development methods and system solutions for particular user group requirements (Hevner et al., 2004). This study goes through four DS processes: 1) analyse the existing situation: in this process the clinical data and research requirement are reviewed and analysed; semi-structured interviews are

Figure 4. CMCMS environment and modules  
(Adopted from Lin et al., 2014c) Source: IJBET 2014



carried out in the case clinic guided by the interview questions; data is collected, categorised and peer reviewed. 2) situation design: the existing clinical (as-is) situation is modelled and analysed. Existing models and patterns from the literature are compared and mapped in this process. 3) improvements: areas of improvements, design, reengineering are identified with peer and domain experts contribution and advices. 4) evaluation: a range of IT tools and techniques are used in designing the system solution. These include: Business Process Modelling, Unified Modelling Language (UML) diagrams, and prototyping. The prototype and modules are then evaluated with specification, expectation, and precise scope. Figure 3 portrays these four processes.

## The Conceptual Model

The CMCMS conceptual model identifies the environment, players, components, and integrations of CM system developments with other sectors and systems of healthcare. The primary driver/player in this diagram is the patient. That is because without the patient, none of the services are necessary. Therefore, all activities, systems, healthcare sectors are sharing a fundamental goal – a patient centred healthcare services (Epstein et al., 2010) with quality and efficiency.

At the need of care, a patient can trigger any of the components in Figure 4. The listed systems and modules under healthcare can be shared and information can be accessed and used across sectors. The broken line/link has the indication of communication and integration. The CMCMS has few internal modules which are: Medicine Item Record Module (MIRM), Medicine Decision Support Module (MDSM), Forecast Module (FM), and Medicine Reports Module (MRM). The MIRM contains detailed information about medicine items such as item name, category, item model, location at the clinic, vendor, manufacturer, reorder level, stock level, discontinued comments, transaction number, quantity, current on-hand quantity, transaction type, and payment information. The MDSM can support demand analysis,

point-of-use, economic order quantity, reorder point system, can-order system, and safety stock. The FM can provide information for the clinic on what medicine should be ordered, in what amount, and in which season. MRM handles clinic medical reports including: medicine usage report, medicine order report, financial and payment report, patient medicine prescription report, and patient treatment report.

## **CONCLUSION**

This chapter compares CM with WM in clinical activities and processes; diagnosis and treatments; IS/IT utilisations and clinical management systems. It advocates that IS/IT solutions and developments can support superior CM delivery. This in return can assist in achieving WHO's goal of having both types of medicines practiced alongside with complements to each other - a high level harmonisation and a more patient-centred approach. This chapter also discussed that CM IS/IT developments should follow a synthesis that is a combination of Churchman's Hegelian and Kantian inquiring systems with the support from Leibnizian and Singerian inquiring systems. This new synthesis extend Churchman's inquiring systems theory into a new domain within healthcare and combining the inquiring system with a design science approach for actually designing and developing a proposed solution. The proposed CMCMS provide an example and suggestion for CM clinics to migrate from manual system to a IS/IT solution which can be also used as assistance for both the CMBA and the individual CM practitioners in maintaining regulations and standards.

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