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服務雲端運算系統的隱喻學研究

A metaphorical study on usage of public health service cloud computing system to counter issues of aging population in Singapore

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Abstract

This study attempts to investigate the issues of aging population in the context of Singapore through metaphorical approach and the potential of tapping on the collaborative characteristics of a health service cloud computing system to meet the needs in elderly care, hence allowing active aging. The use of electronic health records (EHR) in various countries, particularly the meaningful use of EHR in USA is examined to understand its current features and usage. By employing conceptual mapping and blending of metaphorical study, the concepts in cloud computing are probed to gain better understanding on the characteristics of the technology. Similarly, with concepts drawn from an eco-system blended with concepts in a health service system, the characteristics of EHR and finally the characteristics of a health service cloud computing system are illustrated. With understanding in aging population, present usage of EHR and potential of cloud computing in Singapore, multi-methods research consisting of intensive interviews and archival document collations are employed. Triangulation amongst the datasets collated using open coding via ATLAS.ti resulted in 6 issues of concern in aging population pertaining to the Singapore context to arise, namely (i) primary care, (ii) familial support, (iii) awareness in health maintenance and transparency in information, (iv) improved efficiency and accuracy in healthcare with seamless transfer of care and (v) intermediate care and (vi) collaboration between stakeholders. Further analysis of the results draws up the possibilities for enhancing meaningful use of health service cloud computing system for active aging, which criteria are: (i) empowerment and ownership, (ii) sustainable homecare and (iii) seamless transfer of care. Finally, a conceptual mapping of health service cloud computing system and the criteria for effective aging give rise to a model framework that is set for active aging.

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Chapter 1: Introduction

With the increasing affluence of people in developed countries, public health has become one of their major concerns. 'Public health is the science and the art of preventing disease, prolonging life and promoting physical health and efficiency through organized community efforts for the sanitation of the environment, the control of community infections, the education of individual in principles of personal hygiene, the organization of medical and nursing service for the early diagnosis and preventive treatment of disease, and the development of social machinery which will ensure to every individual in the community a standard of living adequate for the maintenance of health.' (Winslow, 1920, p.23). Based on statistics collated by World Health Organization updated till March 2010, it is clear that developed countries such as the United States of America and Canada, various parts of Europe such as United Kingdom and Norway and numerous countries in the Asia-Pacific which includes Australia, are having the highest expenditure in the world of about US$1001 to more than US$5000 per capita in terms of public health (World Health Organization, 2010). These figures have undoubtedly displayed the huge emphasis on the development of public health across affluent countries in the world.

Indeed, while public health problems faced by developed countries may not be as glaring as those of the less developed, there too exists some trying and teething crisis. According to statistics by the United Nations (2009), the recurring problem of aging population is definitely much more pronounced among the more developed countries as compared to the lesser developed. With higher life expectancy yet low fertility rate in these developed countries, health maintenance is of utmost importance as contribution of healthy older communities in the country's economy becomes essential. The issue of health maintenance has thus risen to a global concern. The idea of 'active aging', defined by WHO as the process of optimizing opportunities for health, participation and security in order to enhance quality

of life as people age, is a goal that countries facing the silver tsunami hope to achieve.

Together with capabilities to tap on the rapid developments in technology, affluent countries are able to put in substantial investments to find ways in taking care of their peoples' well-being. In 2008, some 50 Forbes companies in United States pooled in their resources in the construction of a non-profit online health service system, Dossia, using the latest cloud computing technology. The construction of this online health service system is to fulfill the objective of providing Americans a more systematic way to monitor their health and also that of their family members, which will in turn empower employees to keep their families' health in check. This created a win-win situation for both employers and employees as work efficiency will predictably increase with better maintenance of health condition. Soon after, commercial companies like Microsoft and Google also discovered the potential of such health service systems and thereafter, with their vast knowledge in cloud computing, started to improvise and establish partnerships with relevant vendors to create an even more well-rounded health service system. While the Dossia system wasn't targeted at aging population but public healthcare for all Americans, the concept of having ownership in monitoring health for oneself and family can help improve efficiency, faster and prompt medical advice, enhance preventive measures to health problems, thereby fulfilling the essentials of good public health support. Other than USA, many other countries such as Denmark and Canada have also been constantly looking into turning the effective use of cloud computing into the area of healthcare. Hence, the tapping of the enormous potential of using IT in healthcare is one key factor to improving healthcare in today's world.

With American's system as a basis for investigation and using the ecosystem as a metaphor to examine the critical characteristics between the stakeholders and processes to be in place to devising a successful health service cloud computing system for varying context, with specific attention to how the cloud computing technology contributes to filling up the gaps of

the current system to tackle the issue of aging population in Singapore.

In the literature review section of this research, the development and use of electronic health records in various countries will first be studied, with particular attention in the USA's approach, which has provided documentation of how a system can be attuned towards meaningful use of electronic health records. Cloud computing technology, which is the key component that makes the electronic health records system possible, will then be discussed. The use of concepts of metaphors is then applied to further comprehend the characteristics of cloud computing use in electronic health records. With understanding of electronic health records and cloud computing technology, the case study of USA's Dossia Health Service System will make use of the metaphor of cloud computing to decipher the various services and stakeholders which ensure the functionality of a patient-centered health service system. This then leads to the appreciation of a functional health service cloud computing system apt for active aging intended by mapping onto the unique characteristics of a metaphorical conceptual blend between cloud computing and ecosystem. Finally, the issue of aging population in the context of Singapore will be discussed to provide a better picture of predicted situation brought about by aging population in the profile of Singapore society, and current electronic health record system used in Singapore will be looked into. These background knowledge then lay the foundation towards formulation of three research questions that can be investigated in this study on how the application of a health service cloud computing system can assist in achieving the needs of elderly care in Singapore, thereby allowing active aging to take place.

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Chapter 2: Literature Review

2.1 Electronics Health Records (EHR)

With the relentless technological advancements and the increasing emphasis in health maintenance, the use of electronic health records have been one of the latest innovation to be pushed forward in many developed countries, though still at its infancy stage. Some countries, such as the United States of America (USA) and countries in Europe, have put in tremendous efforts to link up the entire country pertaining to healthcare. Electronic Health Records systems may bring about multiple benefits to healthcare, similar to other industries such as banking or online retail which provide convenient, efficient, and customer-centered services (Detmer, 2009). Indeed, electronic health records promise to improve and modernize healthcare worldwide (Kushniruk et al., 2010).

2.1.1 The development of EHR

The first EHR in USA, one of the pioneering countries in this field, began in the 1960s, where a vast number of hospitals and clinics initiated projects to suggest way for storage of large amount of medical records which were previously in paper-form (National Center for Research Resources, 2006). These medical records are important for the fundamental goal in the retrieval of accurate health information of patients so as to arrive at the correct diagnosis. However, EHR provided more dimensions for improvements in healthcare services other than rectifying the initial storage problem. EHR can also provide additional functions such as interactive alerts and order system within medical field. These were some functions served in the early days of EHR usage. Hence, an EHR at this stage is a computerized version of an individual's health record that may contain a person's full health and medical record or other health results, in conjunction with a more traditional paper-based patient chart (Urowitz et al., 2008).

As EHR continued its development, its functionality in response to the development of information technology led to further expansion of its utility. The widespread use of internet allowed more cross-functional interaction, and improves efficiency in health services, such as advance booking of medical appointment by patients, or access to medical history of patients in different care settings. In USA, according to NCRR's review (2006), the components of EHR were focused mainly on (i) administration, (ii) nursing, (iii) laboratory, (iv) clinical, (v) radiology and (v) pharmacy, in which better coordination between caregivers could be established to provide more efficient medical care to patients. The effectiveness of adoption of shared information via EHR in USA was observed in several studies on medical diagnosis and treatment. One such use was the employment of electronic health records system initiated by the New York City Department of Mental Health and Hygiene (DOHMH) for the monitoring of patients with Sexually Transmitted Diseases (STD). Data were inputted via electronic health records to drive medical and programmatic decisions. Results have shown that the electronic health records system has helped to facilitate access to medical records across and within clinics and to allow assessments of patient characteristics and service provision, as well as has provided readily analyzable data that have led to changes in clinical practices, including more effective staff use, increased disease detection, and increased clinic capacity (Paneth-Pollak et al., 2010). Also, a study on cancer had also been enhanced through the effective use of data mined from records of cancer-stricken patients, making more effective analysis and research possible (Poh, 2009).

Studies of effective adoption of EHR were also evident in Europe. An example was the case of EHR usage in Denmark, whereby its electronic healthcare system within the country helped to provide a more comprehensive and all-rounded healthcare service to its people. Its 'Connected Digital Health in Denmark' is an organization which aims to create a coordinated health service between the caregivers such that information can be made readily available

when necessary via the national e-health portal that caregivers and citizens can have access to. Citizens could log onto the portal "to book appointments electronically, request for renewal of medications, review their own patient summary including medications, discharge summaries and laboratory results over the Internet" (Kushniruk et al., 2010). The input and updating of patients' record was made easy due to a standardized procedure and forms used throughout the whole country. It could be observed that the utilization of EHR was emphasized mainly on medical information of patients for caregivers, while the participation of patients was limited to the administrative component. Electronic health records at this present stage are defined as repositories of patients' health data and information which allows the mobility i.e. the possibility of accessing information from different locations by different users in the management of patient care and healthcare resources (Kushniruk et al., 2010). These information may come from different systems and can be made available for a longitudinal view of the patient's health history.

Today, primary healthcare has been identified as an element which needs to be reinforced such that patients and their close ones can play an active role in taking charge of their health conditions. A patient-centered health system has been widely regarded as the solution to various delivery gaps of the current primary healthcare processes, which are more often than not, presently still focused on the convenience and responsibilities of caregivers. However, to achieve the full impact and fully exploit the potential of EHR, improvements must be made to the current system to increase engagements of patients themselves. Medical results must flow back to clinical professionals and patients so that well-informed decisions can then be made with the most current findings (Detmer, 2009). Hence, a safe, timely, efficient, effective, equitable and patient-centered system should evolve to improve the current state of electronic healthcare system. Also, the idea of a 'medical home', which are highly-integrated team-based practices that enhance patient-centered care through routine patient feedback and

better access, is believed to be able to improve clinical efficiency and quality with better coordination amongst various players in health maintenance. According to Bates and Bitton (2010), this patient-centered care system builds on the central idea of electronic health records, yet transformed to fully utilize the functionality of the present usage of electronic health records to better tackle healthcare problems especially in the area of chronic illnesses which requires constant monitoring. Several studies have also proven that the involvement of patients can increase the effectiveness of healthcare. A study on involving diabetic patients in their health monitoring process by providing access rights to an interactive electronic health records in Washington, United States, have shown positive results in maintaining better health conditions of the diabetic patients (Ralston et al., 2004). In addition, another study which focused on cognitive heart failure patients also proved to improve monitoring of health conditions through participation in the online health records system (Ross et al., 2004). These proposed patient-centered components to be included to improve current EHR systems are crucial to reduce cost of healthcare while at the same time improve the quality and safety of care. In Canada, there is also a growing shift into the use of e-health, with noticeable increase in the adoption of electronic health records, having a target of 50% of Canadians having their health records available to their health providers (Urowitz et al., 2008). Canadians have also recognized the importance and advantage of making patients and their family take charge of their own health status, and is looking at ways in which a shift of EHR usage can be done to include the self-monitoring component, thereby creating a Personal Health Record (PHR).

However few and trivial they may be, features of a patient-centered healthcare are indeed evident in many health systems. With rapid improvements in today's technology, it is obvious that countries are putting in effort to push the use of EHR to a higher level such that

larger involvement of patients and primary care units can be tapped upon to create a more effective and meaningful use of EHR.

2.1.2 Shifting the Paradigm - USA's initiative towards a patient-centered healthcare system

With President Obama's pledge to pump in US$50 billion to achieve the goal of creating a electronic health record for each American, USA can be regarded being one of the most advanced users the of electronic health records. Indeed, USA has realized the importance, and definitely the lack of primary care within the healthcare system. A patient-centered healthcare system has been identified as a crucial model to address the delivery gaps that have been prevalent in the common medical providers-centered healthcare model (Bates & Bitton, 2010). Yet, even today's leading electronic health records system is unable to fully explore the functionality of a patient-centered healthcare system. According to a study done by the National Research Center of America, Stead and Lin (2009, pp. 20-24) has organized a list of expectations in which the electronic health records system should meet:

- *Comprehensive data on patients' conditions, treatments and outcomes.*
- *Cognitive support for healthcare professionals and patients to help integrate patient-specific data where possible and account for any uncertainties that remain.*
- *Cognitive support for healthcare professionals to help integrate evidence-based practice guidelines and research results into daily practice.*
- *Instruments that allow providers to manage a portfolio of patients and highlight problems as they arise within both individual patients and populations.*
- *Rapid integration of new instrumentation, biological knowledge, treatment modalities, etc., into a "learning" healthcare system that encourages early adoption of promising methods but also analyzes all patient experience as experimental data.*

- *Accommodation of growing heterogeneity of locales for provision of care, including home instrumentation for monitoring and treatment, lifestyle integration, and remote assistance.*
- *Empowerment of patients and their families in effective management of healthcare decisions and execution, including personal health records (as contrasted to medical records held by care providers), education about the individual's conditions and options, and support of timely and focused communication with professional healthcare providers.*

With reference to the final criterion on empowerment of patients and families, it is a clear indication of the necessary development of a patient-centered electronic health records system to enhance its meaningful use.

Also, to ensure meaningful use of funds pumped into the establishment of IT into healthcare in America, the Centers for Medicare and Medicaid Service in USA published a Proposed Rule on Meaningful Use of Electronic Health Records and began a 60-day public comment period on December 2009 (Murphy, 2010). With consolidation of more than 2,000 comments, the final criteria for meeting "meaningful use" were divided into five initiatives:

1. Improve quality, safety, and efficiency, and reduce health disparities.

2. Engage patients and families.

3. Improve care coordination.

4. Improve population and public health.

5. Ensure adequate privacy and security protections for personal health information.

Based on the above two studies on the objectives of the revised electronic health records implementation in USA, some coherence in their goals can be observed. The key guidelines directing the system are mainly the fulfilment of having more coordination within the major stakeholders in healthcare and most importantly, to engage the patients and families by taking

ownership of their health, which then in turn improve the quality and efficiency of public health. These health organizations in USA have identified the future of healthcare system – increased effectiveness with the assistance of IT. The electronic health records system of the future shifts a caregivers-centered paradigm, one which more often than not, deals with acute remediation, to a patient-oriented system, which thus gives more time and space for effectual treatments and at the same time, shares the responsibility between the stakeholders.

As observed, the USA's electronic health records system lead the way for the international big picture of healthcare systems of the future with the rapid progression of IT capabilities, which encompass more forward-looking objectives to be satisfied. Also, since the implementation of the electronic health records systems in America, studies have shown that they have helped improve and maintain the strong patient-doctor trust while improving workflow (Shield et al., 2010).

In this study, we will be selecting the USA electronic health records system as a reference for the subsequent prototyping of a general electronic health record system suitable for adaptation in different settings, particularly the Dossia Health Service System set up by some 50 Fortune companies. Their objectives echo that of the above, and this non-profit organization created a health service cloud computing platform which addresses the several health maintenance issues of the American society. It is essential to understand how the recently cloud computing technology helps realize the objectives pertaining to a meaningful usage of EHR.

2.1.3 A patient-centered approach to tackling issues of aging population

With the increasing global attention given to issues that are expected to arise due to the silver tsunami, many studies have also focused their attention on the necessary elements which can aid in the healthy aging of the elderly members of the society. One of the most significant aspects of effective future development in healthcare of aging population is the decreasing

reliance on hospitals or medical institutions, but rather regular and effective care coordination and communication between professional healthcare and home healthcare, such as the success of the John Hopkins Home Care Group Geriatric Team (Frock & Barnes, 2003). In Canada, research has also shown the need for more competent and smoother integration primary care into its healthcare system for more effective care of the elderly (Bergman et al, 1997). SIPA, a system which focuses on integrated primary care for frail elderly in Canada, aims to provide professional advice and assistance for elderly patients and family in terms of home care which in turn empower patients and their family in choosing institutional health care, relieve hospitals in acute treatments and last but not least, reduce social costs by enhancing competency of primary care. Examples above indicated the concept of 'home care' in the Western culture: presence of professional care in a home-based setting where sound medical treatments can be administered. However, the Eastern culture may have its variation pertaining to the idea of 'home care'. In a study on needs of Chinese elderly care indicated that with emphasis in the mandatory responsibility of children to take care of their elderly parent and hence with old age revered as enjoying support of family and even multi-generational system (Dong & Simon, 2009), elderly without family members by their side faced higher socioeconomic and psychological burden. Familial support in the Chinese culture will hence constitute a large part of its primary care. This variation in culture also highlights the dissimilar needs in elderly care.

In addition, the maintenance of healthy behaviours of elderly has also been indicated as one of key areas to ensure active aging. Active maintenance, which aims to incorporate the concept of ownership and tertiary prevention, especially in the area of sustaining functionality in times of chronic illnesses, thereby taking the initiative to maintain healthy lifestyle even before reaching "old age"(65 years old), is deemed as one important way to successful aging (Marquez et al., 2010).

As such, to promote and achieve a more effective form of aging, a patient-centered approach is one important strategy to adopt such that needs of the elderly are appropriately taken care of. While the idea of 'home care' and 'ownership of own's health' are key purposes to building a patient-centered system, needs of elderly in varying cultures, such as that of the Singapore's aging population, may differ. It is thus essential to identify the requirements of Singaporean elderly before structuring a functional patient-centered health service system.

2.1.4 Cloud Computing in EHR

To assure success in the use of electronic health records, the participants of medical care, a well-planned set of processes and a sound IT structure have to be present to produce the desirable results expected of the health system (Stead, 2009). Also, the key element of electronic health records is its function to enable prompt and real-time communication which hence encourages team care. This functionality of electronic health records is made possible with the use of cloud computing technology.

The term 'cloud' in information technology, is a network of servers or even individual PCs interconnected in a grid (Boroujerdi & Nazem, 2009). To put it simply, with the emergence and extensive usage of internet, the hardware and software placed together to make data transmitted within them useful is typically known as the 'cloud'. Several researches on cloud computing bore different types of definitions for the newly inaugurated technology. A more technical definition would be: 'Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.'(Armhein et al, 2010, p.6). In other cases, 'a cloud' is referred to as "a network of servers that run the services that can be used as collaborative platforms", whereby a server farm is simply a set of servers linked together to provide more storage and more computing power than a single

server can provide (Hastings, 2009, p.10). Another simpler definition states that 'Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centres that provide those services' (Armbrust et al, 2010, p.50).

Whichever the definitions are, one consistent characteristic of cloud computing in employing the concept of 'cloud' to metaphorically describe the new computer technology, is the capability to now make use of a 'Internet network' to provide 'services' with shared data across the entire network without the need of human management in the technical aspects. Considering the various aspects of meaningful use of EHR, these are important features and dimensions of cloud computing which makes a health service cloud computing system possible to accomplish its goals. The extreme storage space allows for massive exchange of information and resources which then aids in the collaboration between the many different users improves the ease of utilizing the platform. Finally, the mobility and the capability for prompt feedback having employment of cloud computing technology are two critical aspects which appeals one towards its use. These features are also essential elements which makes effective home care and self-monitoring of health conditions, especially in chronic illnesses possible in elderly care.

In terms of today's electronic health records' performance, the weakest domains of the present operations are its team care component, which is the care given by the cooperation of different caregivers including doctors, nurses, social workers, specialists etc, and its care transition component, which is the movement of patients' records as they transfer from one place to another (Bates and Bitton, 2010). Timely communication is effectively the most important aspect to be rectified in order to increase the functionality of these two domains. As mentioned, the features of cloud computing are its capability to allow storage and sharing of large amounts of information, and more crucially its mobility and capability for instant

feedback are the very elements which remediate the shortcomings of the current EHRs, and are essential in the construction of a patient-centered system that consequently improves healthcare yet saves social cost in elderly care.

2.1.5 Delivery modes of cloud computing

To understand how cloud computing plays a role making a patient-centered health platform useful for elderly care possible, it is necessary to understand the information delivery model of cloud computing. There are basically three delivery models for cloud computing services, namely 'Software as a Service' (Saas), 'Platform as a Service' (Paas) and 'Infrastructure as a Service' (Iaas). Saas is a form of software service where consumer uses an application but has no idea and control over the operating system or any network infrastructures that supports it. In Paas, consumer uses a hosting environment for their application, having control over the applications but no control of operating system or supporting network infrastructures. For Iaas, consumer uses the fundamental computing tools such as storage, processing power and networking components, and has control over the operating system, storage, applications, but has no control over the cloud infrastructure supporting its functions. As observed from these three delivery models, the 'cloudy' features of cloud computing lies in the infrastructures that are engaged to execute the computing processes, where consumers' requests are transmitted to the cloud of infrastructures, vast and unknown. In addition, soft, amorphous and opaque in nature, we certainly could not see what has happened within them, as our job was simply to use them to perform our necessary tasks. To understand the metaphor of 'cloud' in computing, it will be useful to look at the taxonomy of cloud computing to understand the interaction of the cloud clusters at different levels of cloud computing. Figure 1 is a taxonomy diagram from the Cloud Computing Use Cases Whitepaper proposed by the discussion groups supported by Creative Commons Attribution Share Alike 3.0 Unported License.

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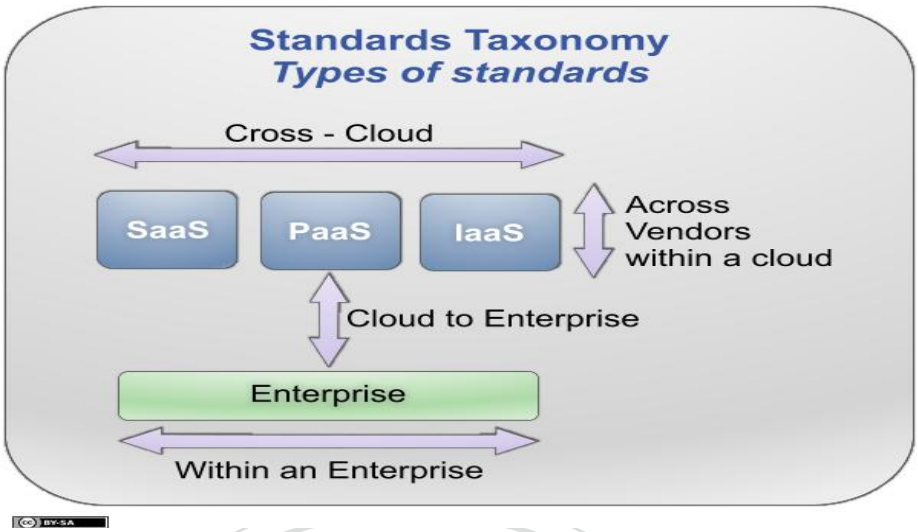

Figure 1: Standards of cloud computing taxonomy (Cloud computing case use white paper, 2010)

The emergence of cloud computing allows better efficiency and has made the idea of 'sharing' easily executable. Users from different communities benefit from the ability to share information and applications via the internet (Du, 2009). By allowing the possibility of a group of computers to be linked together, the users in the network will be aware of one another and hence, will be able to share resources and information across the network. Enabling sharing of information between different stakeholders in a healthcare system is one important feature to allow a more wholesome care to be given to elderly care. Referring to Figure 2, we can understand the basic architecture of cloud computing. A user interface has to be established for ease of usage for users and consolidation of list of available services and information. User will then select a service in which the system management selects the appropriate service and hence forth, data is launched and web application activated. It is not difficult to observe the heavy interdependency that existed within all the components in the cloud, and also with information and data linking them together. Such properties of cloud computing allows the possibility of coordination of various stakeholders in healthcare to have access to timely medical information, which hence enhance the efficiency of medical services.

With respect to the issue of achieving active aging, the possibility that cloud computing technology can uncover in terms of the various types of services that can be incorporated into an electronic health system, lends a helping hand towards fulfilling the possible needs of effective elderly healthcare.

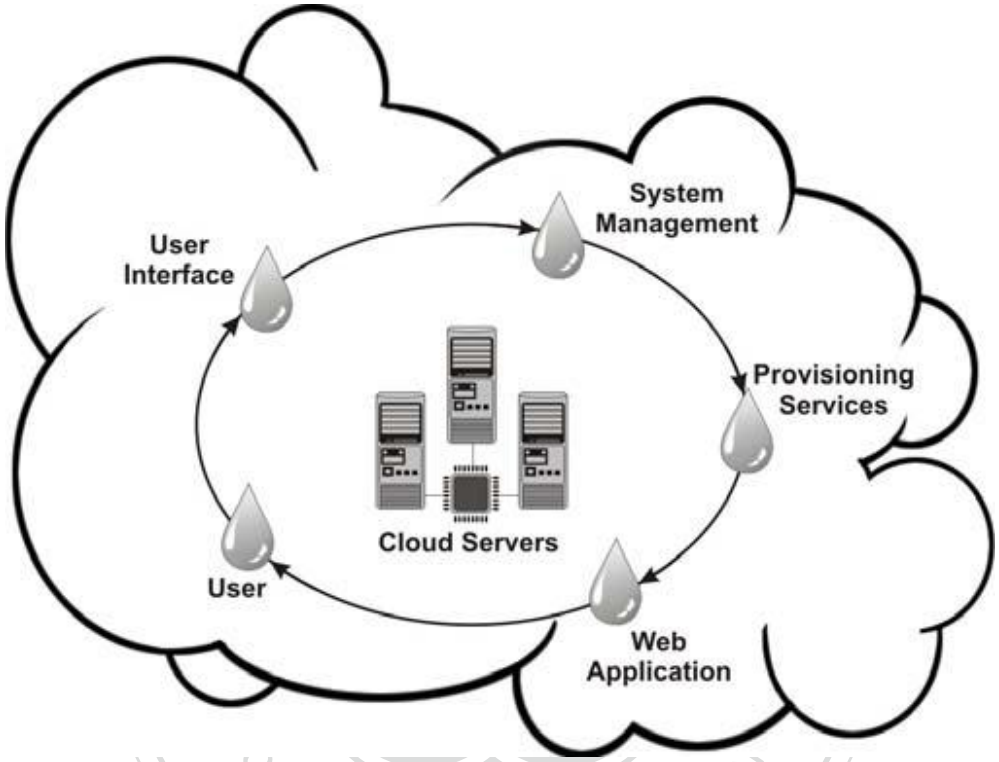

Figure 2: The architecture of cloud computing (Boroujerdi & Nazem, 2009)

With some understanding on the properties of EHR and the features of cloud computing which can then be put together to enhance the system, it is necessary to look deeper into the potential of such a marriage of the two segments. In the later chapters, a metaphorical approach will be employed to probe further on the aspects of both EHR and cloud computing technology that finally results in a health service cloud computing system.

2.2 Concepts of metaphor

According to James C. Maxwell in the late 18th century, metaphors (of images and models) are instruments of a creative mind, which are products of science as well as tools with capabilities in generating science. There has been a growing conviction in recent times that metaphor, despite being non-literal, vague and cannot be directly verifiable, still plays a large part in the scientific conceptualizations and functions which constitute scientific discovery. Metaphors found in science language serves as descriptive purposes most of the time, usually that of a primary system of the intended formula of 'A is B' (Radman, 1997). Metaphors have the capability to stretch a particular idea into a meaning which is much more far-reaching than its literal one, which will assist in the generation of more innovative and newer ideas. Hence, it is undeniable that the usage of metaphors will be the path towards inciting more creativity and innovations.

2.2.1 Using metaphors for new inventions

Metaphors should not be treated exclusively as verbal instruments but more importantly, should be regarded as instruments of thought and tools which are capable of conveying new cognitive contents (Radman, 1997). In fact, the job of metaphors is to rearrange existing meanings of referents in the intended metaphor such that new significations which have yet to exist evolved. According to MacCormac in 1971, metaphors have a hypothetical nature because they are able to suggest new meanings. The metaphorical bridging of the new and old is the precise mechanism to make cognitive shifts possible as metaphor is able to fulfil the need to explain the new in terms of the old. New concept formation is usually a recombination of old facts and ideas rather than the formation of new ones, which is the combinatory matching of existing elements (Radman, 1997). This mediation old knowledge to gain and acquire new knowledge is the key purpose of using metaphor for generation of new meanings and inventions. An exemplary view by Petrie (1979) which states that

‘metaphor can provide a rational bridge from the known to the radically unknown, from a given context of understanding to a changed context of understanding’ (p.440), very well summarizes the cognitive link between the old and new ideas generated from metaphors. As we understand and seek new sense in the regions of possible signification, these meanings are liberated from the constraints of their most evident and this crucial step allows the establishments of new semantic standards.

As we have seen, metaphors serve various functions. They may be used to assist us in the understanding of abstract and complex ideas and concepts, or they may be used for communication purposes, helping to transfer ideas from one domain to another (Ortony, 1993). On a more constructive basis, metaphors can also serve as a ‘trigger point’ for more conceptual developments, and may offer greater scope for generating novelty and innovation, known as a ‘live’ metaphor (Hardy & Pablo, 2009), Metaphors become a ‘driver’, which are used to generate innovation and change by stimulating different ways of thinking and acting. Alternatively, new metaphors may be an outcome (Rodrigues, 2006).

Thus, the use of metaphor to decipher and understand the workings of new systems and ideas are effective ways to elicit and spark off newer possibilities which can be central towards the birth of effective initiative. In the study of the health services cloud computing system aimed at aging population, a metaphorical approach will be adopted to investigate the effectiveness, operationability and the maintenance of stability in the system.

2.2.2 Conceptual metaphor

Concepts are important in our daily functioning as we allow the concepts which we have accumulated through experiences to play a large part the way we perceive the world. Our conceptual system play a crucial role in defining our everyday realities and more often than not, it is essentially a metaphorical way in which we think, experience and deal with our everyday lives (Lakoff & Johnson, 1980). The correspondence between two frames with a

systematic connection of basically an “A is B” relationship, where A is the concept to be comprehended and B is the concept used for comprehension of A, is known as conceptual metaphor (Koveces, 2006). Presence of the source domain in explanation of the target domain is prevalent in conceptual metaphor. Relations of the dimensions of concepts and experiences which construct the final conceptual system that explains a particular phenomenon make up the possibility of fitting a concept into an experience (Lakoff & Johnson, 1980). Hence, it is necessary to pick out the relevant and important aspects of an experience, then categorize and understand it by fitting into existing dimensions of concepts which were previously acquired.

2.2.3 Conceptual blending in metaphors

When the coming together of two or more concepts do not result in mapping onto one another, but are integrated to form new perspectives, we talk about conceptual blending (Koveses, 2006). Conceptual blending, first introduced by Fauconnier and Turner in 1998, saw that metaphor comprehension requires the transformation rather than transfer of properties from one concept to another. Conceptual blending suggests that the metaphorical correlation of concepts sets up a number of blending processes in which the imaginative capacities of meaning construction are evoked to produce emergent meaning (Cornelissen, 2006). To understand the idea of conceptual blending, the idea of mental spaces has to be investigated. Mental spaces are smaller constructions of concepts evolved for the purpose of understanding and action (Fauconnier & Turner, 2002). Among the mental spaces, they are further divided into several roles: the input spaces which contains the concepts, the cross-space mapping which connects counterparts in the input spaces, the generic space which maps onto each of the inputs and contains what the inputs have in common and finally the blended space which is the new space that contains the emergent concept that maps the counterparts that links all input spaces and the generic space.

With a generic space encompassing the basic features of our metaphors, we merge the characteristics of our inputs spaces, thereby creating a blended space which uniquely fits our conceptual needs. The strengths of conceptual blending theory are that it provides an account of how metaphorical meanings are actively constructed and that the 'products' of metaphorical mappings are more influential when they adhere to a set of specific principles known as the 'optimality principles': a set of constraints under which metaphors are most effective. We shall make use of the integration principle, which states that representations in the metaphorical blend can be manipulated as a single unit (Cornelissen, 2006).

Conceptual blending is used in this study to understand the arising of innovation and new ideas by looking in-depth the concepts within each unit of representation. We shall make use of the theory of conceptual blending as a start to understand how the process can be utilized for further innovations and new meanings.

2.2.4 Applying conceptual metaphor of 'cloud' on 'computing'

Cloud clusters exist among the three delivery models and a massive cloud across all the vendors, providing services for the enterprise (Jaeger et al, 2008). This can also be observed in Figure 1, which illustrates the relationship between the cloud clusters. These cloud clusters gave a metaphorical idea of a cloud of services on the internet, which is flexible enough to accommodate different levels of sophistication, and is evolving all the time, rapid and furious. Other than its 'opaque', 'soft' and 'amorphous' nature in the services provided through the internet as mentioned earlier, there also exist different layers of the 'clouds', within each, serving varied functions and having different forms of interaction between the cloud clusters. In fact, the clouds referred to in cloud computing are so alive and unpredictable that they can be as small as a piece cirrus cloud, servicing a simple application, or be combined to become a massive cumulus humilis, huge enough to undertake some mammoth computing and storage facilities. Because of its flexibility, these services on the internet, like the moving

clouds in the sky, can also form links and connections within one another, increasing their capabilities and functionality and ability to travel across the globe. Enter the cloud, which spreads computing resources across a swath wide enough to achieve major increases in efficiency and utilization. With access to IT resources increasing and costs decreasing, a perfect storm for transformation on a massive scale is forming (Murray, 2010). This, is the very idea of the evolvement of cloud computing.

A source and target mapping of the concept of 'Cloud' as the source domain and this latest 'Internet Computing Technology' as the target domain can be seen as follows:

***Source*: CLOUD**		***Target*: INTERNET COMPUTING TECHNOLOGY**
Opaque	→	Inability of users to know the data-processing process sent to the network of computer systems.
Amorphous	→	Ability to hold small or large amount of data.
Soft	→	Mobility of information and use of applications at different locations.
Transformed from water	→	Capable of transforming inputted information and data.

A conceptual blending done between cloud and computing technology allows for more detailed and specific features of both inputs to be sifted out and placed into a generic space. In this case as shown in Figure 3, both inputs allows operating procedures of system to be unknown to users, ie. an opaque system, has massive space for storage and also expansion in terms of technology advancements, and finally the nature of mobility of clouds can also be mapped onto this particular advantage of mobility that the computing technology can now allow with possible usages in any venues that has computers and internet accessibility. Specific to supporting successful aging, these features of the generic space opens up possibilities in giving more ownership to the users and family members in maintaining a

healthy lifestyle with increased mobility and easier timely access to information on healthcare issues.

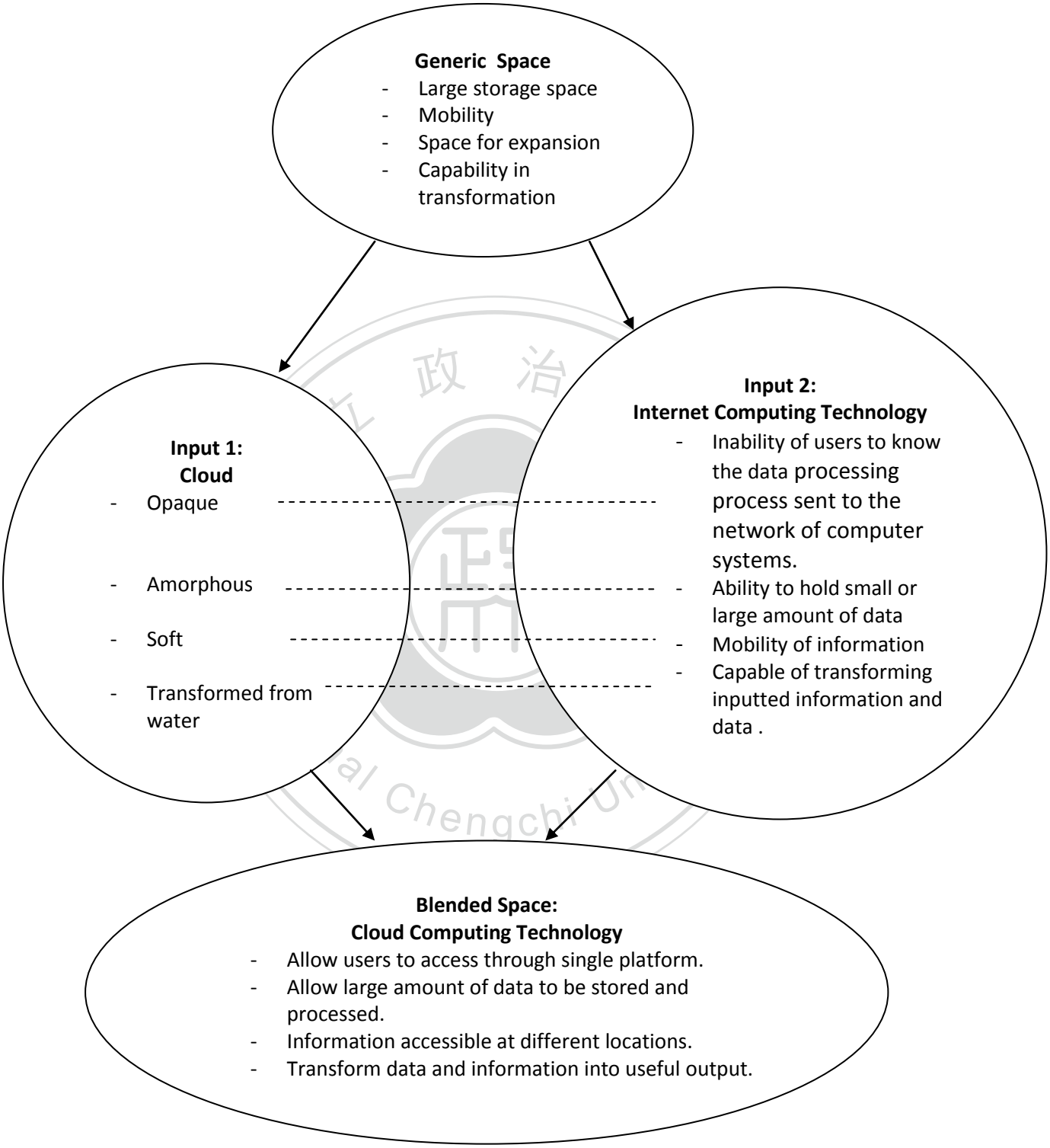

Figure 3: Conceptual blending between cloud and computing technology

Cloud Computing Technology henceforth evolved in the blended space, where these specific features are included to provide the winning edge of this technology.

While users and services forms the major part of the system, one of the crucial ingredient to ensure the operationability of the system is the data inputs from each players. From the concept of cloud, it can be understood that the element 'water' is the main component which make up the cloud. Indeed, as elderly care involves largely on the availability of clear information such that proper primary or home care can be given. Similarly, the main constituent for the computing technology to function is the presence of data. Another mapping which is as follows evolved:

***Source*: Cloud**		***Target*: Computing Technology**
Water	⟶	Data from participants in the system

With understanding in the main features of EHR and key characteristics of cloud computing technology based in its metaphorical understanding, the Dossia Health System can now be explored to identify vital stakeholders and their roles such that its functionality can be fulfilled.

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2.3 The Dossia Health Service System

Initiated by 50 Fortune companies in USA, the vision of Dossia is to transform the American healthcare system by reducing waste and facilitating better care by developing and making widely available a lifelong personally-controlled health record. Dossia hopes to achieve their aim through empowering the people and their doctors to be active partners via a comprehensive and secure access in individual health information.

By understanding the Dossia Health system including its functions, services and operating platform online, we can have a better picture of the benefits it provides to its users and how this system coincides with the vision of meaningful use of EHR specific to countering issues of aging population as mentioned in the previous chapters. By looking at the current phenomenon of electronic health care system, we can look at how it is applicable to future usage. Table 1 presents the association between the various stakeholders within a healthcare system and the roles which they play to ensure the functioning of the system.

Table 1: Players and their responsibilities in Dossia Health Service System

Players	Responsibilities
Dossia System Committee (organized by the group of 50 Fortune companies)	Regulates and maintains the effective running of the system. Ensures that the operations within the system platform adhere to the objectives and guidelines.
Users (Patients and family)	Actively using the system and the relevant equipment, thereby providing substantial amount of data and information to other players in the system for analysis.
Non-medical caregivers (including social workers, fitness coach,etc)	Comprehend medical data of patients and provide necessary non-medical assistance.

Medical Providers (including family doctors, hospitals, etc)	Analyse relevant data (from users, vendors or within medical providers) and transform them into useful health information, which can then be utilized by users, thereby providing superior medical care. Consolidate medical information for research enhancements.
Health equipment vendors (medical instruments such as blood pressure monitors, heart-rate monitors, calorie measuring machine, pedometers, etc)	Provide equipment and devices which can be synced with the Dossia online platform. Data collated from equipment should be transformed into useful information which can then be utilized by users or other players in the system (e.g. for analysis by medical providers)
Technology Providers (cloud computing technology)	Create a cloud computing system which supports the technology of the various players in the system. Ensures the smooth transmission of data and into the system for analysis and finally useful information back to the rest of the players with sound web applications for all players within the system.

By understanding the mechanism behind cloud computing comprising of Paas, Saas and Iaas components and the elements present in the Dossia system, Figure 4 presents the interdependent relationships amongst the players.

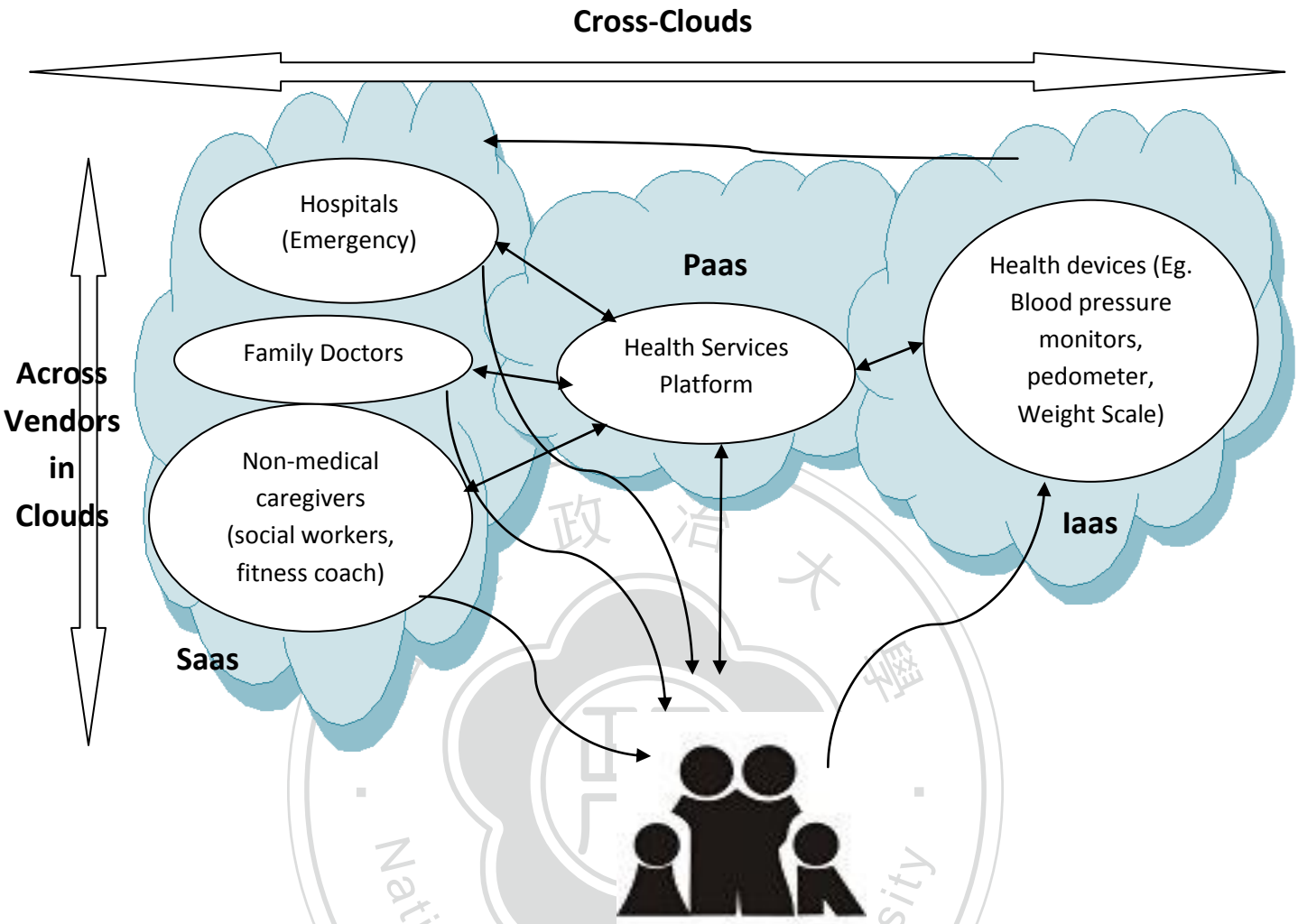

Figure 4: Pictorial representation of system in Dossia Health Service Platform

The concept of Paas, Saas and Iaas adopted from cloud computing allow the meaningful use of cloud computing stated by USA policy to be realized. While the responsibilities of the stakeholders in Dossia system as shown in Table 1 assemble the healthcare system in place, the functionality of these stakeholders are made workable due to the operating structure of cloud computing system.

In the Paas segment where a service platform has to be established, the Dossia System Committee played a crucial role in creating a model in which the objectives of an effective healthcare system are realized by setting rules and regulations and determining the vision and mission of the Dossia Personal Health System.

The Saas segment, which is one of the largest and vital segments of the cloud computing system, is determined by a number of players in the Dossia system. Firstly, the medical providers such as doctors, hospitals, nurses, pharmacists etc, are the key stakeholders who ensure that the necessary services are available for users. In addition, the non-medical caregivers such as social workers and fitness coaches also provide services to accomplish the non-medical assistance needed by users, which include patients and their family.

Finally, in the Iaas segment, the key role has to be played by the technology providers, who are responsible for the building of the healthcare services cloud computing infrastructure. From the interface of the service platform, necessary linkages between various stakeholders in the system to the friendliness of user-interface of service platform, technology providers are accountable for tapping onto the advantages of the interdependent relationship between in the system. Most importantly, the timely communication and prompt feedback feature at any time and place has to be executed seamlessly to fully exploit the advantage of cloud computing technology.

As the fundamental goal of the Dossia system is to reduce wastage and facilitate better healthcare for the Americans, the users of the Dossia system inevitably shape all three segments of the health cloud computing system. Indeed, the needs of users be it in terms of practical healthcare services or health information, affects decisions in objectives setting of the hosting platform, the healthcare services to be provided and the infrastructure to support the requirements. Thus, a patient-centered healthcare system evolved.

The sustainability and stability of a system requires specific rules and principles which help to maintain its functions and guarantee its worth of existence. With a comprehensive understanding of Dossia Health Service Platform and the background behind the USA's move to develop its EHR system, the role of cloud computing technology to realize a better-rounded patient-centered healthcare system becomes apparent.

In the context of this study, the objective of a patient-centered healthcare system is to address the needs of major stakeholders in the elderly care system. While the stakeholders in the Dossia Health Service System may be serving a different purpose, their intention to enable a more wholesome healthcare system within the American society, though may not be regarded as a perfect system, may still serve to shed some light regarding the key criteria necessary for a functioning electronic healthcare system catered to confront the silver tsunami in time to come.

The functioning structure of Dossia Health System has also revealed one important factor which contributes to its proper functioning: the interdependent association between the various stakeholders responsible for the three main delivery modes. Next, we attempt to apply ‘ecosystem’ as a metaphor to appreciate this co-reliant structure that makes an operational health service cloud computing system possible.

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2.4 Characteristics of ecosystem processes

Ecosystem is a biological environment in which dynamic interactions happen between plants, animals, and microorganisms and their environment working together interdependently as a functional unit. Ecosystems, being open systems, are constantly changing due to internal or external influences, thereby causing imbalance (Donavan, 2010). Two key elements of a biological ecosystem is (i) the interaction between the different respective elements of the physical environment, and (ii) the relationship between the different elements of the environment. Also, ecosystem can be seen as having a dynamic and complex dimension, with ecological interactions within elements via free flow of energy and matter among them.

Each member within the ecosystem are related and will interact with each other, performing their specific roles to ensure all mutual benefits to every single living thing the system and to enable the proper function of the process, equilibrium has to be maintained. In other words, ecosystem processes worked together to ensure that the particular ecosystem is able to operate and perform its function effectively. The 'cooperative' nature of ecosystem can evolve in an endless reciprocal cycle through the process of co-evolution (Bateson, 1983), where each element of the ecosystem is of relevance to the other members, and as such, variations in one element will result in evolutionary responses of others (Corallo, 2007).

2.4.1 Determining if a health service system satisfy the characteristics of an ecosystem

With our knowledge in the 'source and target' domains relationships in understanding conceptual metaphor, we can investigate if the health service system can be metaphorically represented with the concept of ecosystem. Based on the understanding of ecosystem and the characteristics within the ecosystem processes, three main characteristics (i) the interdependency (cooperative) nature, (ii) the co-evolution process, (iii) the openness and dynamism with free flow of energy or matter present in ecosystems are an important characteristics which can be observed in ecosystems. In fact, many business systems and

structures employ the concepts of ecosystems' unique characteristics. For the case of a health service system, the three characteristics have to be observed for the ecosystem metaphor to stand.

(i) Interdependency (Cooperation) nature of the system

Interaction is exceptionally critical in the case of an ecosystem, where the idea of 'shared fate' is of utmost importance. This interdependency is the foundation to a stable, productive and creative system (Iansiti and Levien, 2004). Each element in the ecosystem will contribute essential inputs which are vital for the survival of the other elements. In the case of a health service system to tackle elderly care, relationships are built between various elements essential for the functioning of the system. These elements include the users who are empowered to monitor their health and provide critical health information to the system, the medical providers such as the family doctors and hospitals which provide medical services and advices to the users, the technology service providers which collect information and digest them into useful figures, which are then disseminated to the other members of the system for appropriate actions. Also, the element which regulates the health service system (such as the 50 Fortune companies which initiated Dossia) plays one of the most crucial roles that enable the operation and innovation in the system, known as the keystone element. In the case of Singapore's aging population issue, the governing agency takes on the role of the keystone player in the health service system. Each element depends on one another's proper actions such that they, too can function, which then also facilitates the effective running of the health service system.

(ii) Co-volution

Closely related to the interdependency and the cooperative nature between elements in the ecosystem, co-volution emphasizes the close relation between all elements in the ecosystem. In a health service system, since one action of an element will affect the other, adaptation

become a crucial step to take such that proper functioning of the system can continue. For example, changes in demographics will influence the services provided by medical providers, thereby generating response actions within the system. Also, differences in lifestyle, habits, cultures and policies will also trigger co-volution to happen to sustain the system. This also answers the high possibility of changes in lifestyles that can occur to elderly and their caregivers due to elderly or chronic health problems.

(iii) Openness and dynamism of system

A biological ecosystem, being an open system, will encounter entries and exits of elements from time to time, resulting in the free dynamic flow of matter or energy within it. Just like the nature's system, a health service system is also open to providing assistance to health solutions according to needs, and will experience increase of decrease in number of users and allow entry of enhanced services with the adherence of regulations. Hence, a dynamic system is formed with constant changes in services, objectives and regulations due to changing environment and needs. This openness in system once again plays an important role in sustaining an effective healthcare network when needs and demands of users change. The mappings between these 3 main features can be seen as follows:

Source: **ECOSYSTEM**		***Target:*** **HEALTH SERVICE SYSTEM**
Interdependency between elements in the ecosystem.	→	Interdependency between each participant in the healthcare system.
Evolution of living things due to changes in environment for sustainability.	→	Co-volution of services due to changing needs for sustainability.
Open system with entrances and exits of members in the system.	→	Open and dynamic system with constant changes to fulfil changing demands and needs.
Presence of water transformed in various forms	→	Presence of medical data and information of various forms.

Once again, looking into the specific features of a health service system and an ecosystem, several important characteristics can be taken from the two input spaces into the generic space. Both health service system and the ecosystem rely on the interdependent nature of participants in each system to support and maintain their functions. Also, both have the potential and capability of evolution, thereby improving the operations of the systems. Finally, the openness of both systems allows for entrance and exit of different players in the systems.

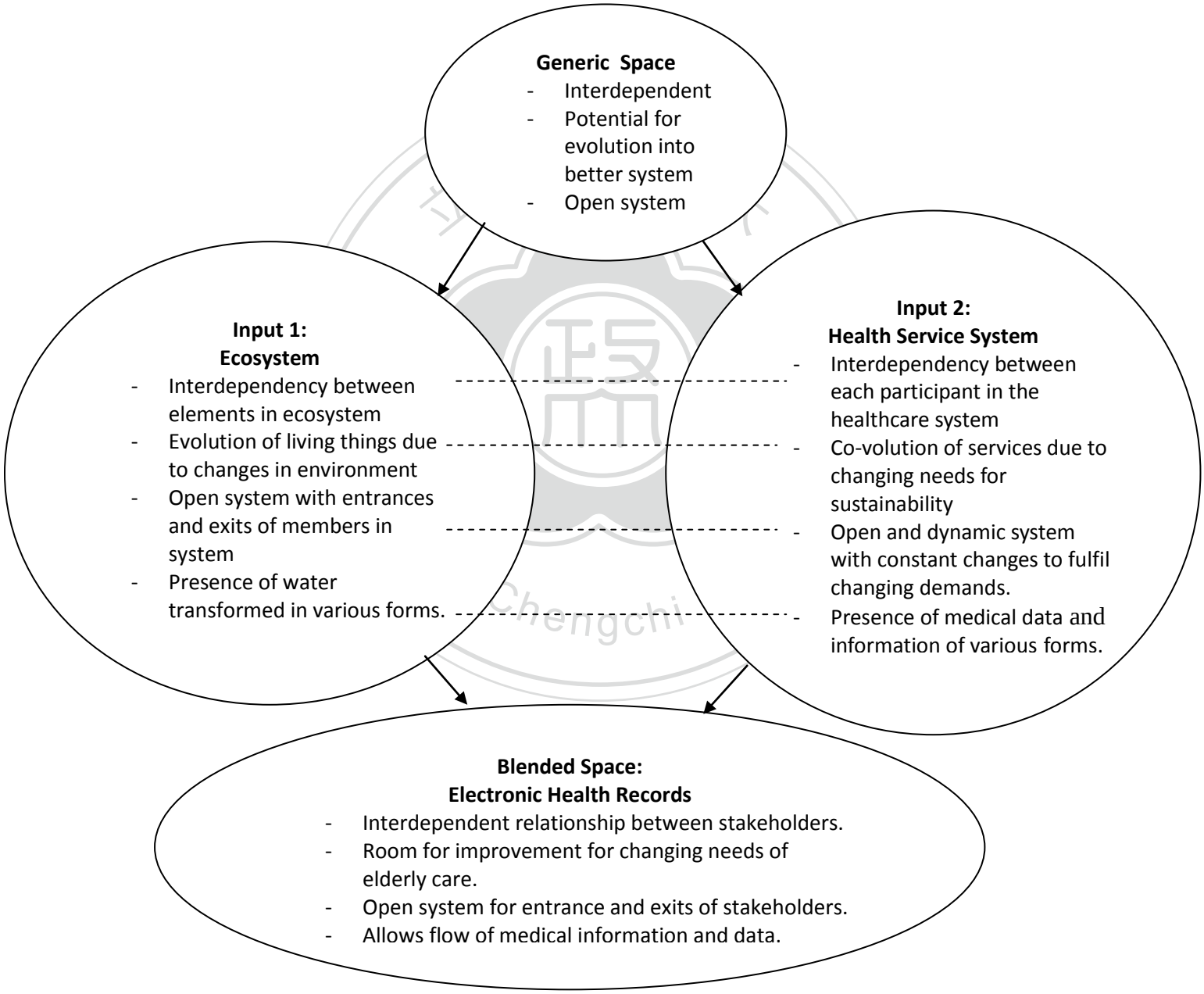

Figure 5: Conceptual blending between health service system and ecosystem

The electronic health records system that can be established to counter issues of aging population is the result of the blend and encompasses these three specific characteristics in the generic space as shown in Figure 5, which are crucial for the functioning of a system to cater to successful aging.

The three main characteristics in the generic space are focused on features of co-operation and possibility for more collaboration, which adheres to the spirit of public health service.

With the satisfaction of the three main characteristics of biological ecosystem, it can be concluded that a health service system to successful aging can be metaphorically explained by the behavior of a biological ecosystem, forming linkages and evolutions which mimic the nature.

2.4.2 Sustaining the effectiveness of the ecosystem

Many studies have been done on the use of ecosystem as a metaphor in business structures. Just like a biological ecosystem, a firm is not simply a member of a single industry but part of a business ecosystem that crosses a variety of industries (Moore, 1993). Firms are able to co-evolve, bringing new creativity and innovations. They are also able to cooperate with one another to attain a particular goal. This is in line with the characteristic of a biological ecosystem, where each member of the business ecosystem shares the fate of the network as a whole. Like biological ecosystem, a business system is made up of a large number of participants which are interconnected and dependent on one another for mutual benefits and effectiveness. According to Iansiti and Levien in 2004, the effectiveness and health of a business ecosystem depends on:

(i) niche creation – which is the ability of the ecosystem to exhibit capability of variety and support for diversity of species,

(ii) productivity – which is the ability to transform technologies and other raw materials of innovation consistently into lower costs and new products and

(iii) robustness – which measures how much the business ecosystem is able to maintain or survive any changes or disruption caused.

In the case of a health service cloud computing system for elderly care, while it may not be a profit-earning business system, the three specific features of an effective business ecosystem are also evident in its function. By studying the Dossia system of USA, we understand that the objective of the companies which initiated the health service system is to empower the public a higher ownership in health maintenance, which is also one main aspect towards better elderly healthcare. The health service cloud computing system has to perform its health maintenance functions based on the materials available in order to be on an 'up and running' condition. These raw materials come in the form of health information of users, which are then converted into useful information via the updated modern technologies from different medical providers and from cloud computing technologists. Needless to say, the objective of the functions that this health system can provide for elderly care has to be clear and realistic, which will then help shape the productivity aspect of the system. Just like a nature ecosystem, a constructed health service cloud computing system should be able to withstand the changes that may be encountered, such as the onset of chronic diseases commonly seen in elderly health ailments. Hence, each respective stakeholder, particularly the medical providers, of the system has to perform their role to their best ability such that the system can execute its utility without being affected by modification. In fact, these stakeholders have to build mechanisms which are robust enough to counter adjustments in the system. Finally, to fulfill the objective of self-monitoring and ownership of health maintenance, the numerous features of the system have to display capabilities to support a diverse pool of users, with different health concerns and having different needs and assistance. In addition, it was believed that the use of an ecological metaphor in the deciphering of business is effective in the explanation of the lack of boundaries and the need for a systematic

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vision (Moore, 1997; Iansiti & Levien, 2004). This is in line with the idea of ecosystem as an open system, susceptible to constant changes due to niche creations, thus improve productivity and boost the robustness of the system.

2.4.3 Concept of keystone metaphor in ecosystem

The concept of keystone metaphor, which in a biological ecosystem, is the member which exerts the greatest influence on an ecosystem. The role of biological keystones is to maintain the proper healthy functioning of the ecosystems via specific behaviors with effects that will propagate throughout the entire system (Iansiti & Levien, 2004). In a business ecosystem, the use of keystone metaphor can be matched with the particular element that is central to the productivity, enhancement of robustness and encouragement of niche creations within the system. They provide a stable and predictable platform which other participants in the system can depend on. The removal of keystone member of an ecosystem will be detrimental to the entire system, which may eventually lead to the collapse. Also, the keystone member will act to improve the system, which also ensures its own survival. In the case of Dossia system, the 50 Fortune companies which initiated the setting up of the health service cloud computing system with the aim of increasing the ownership of Americans on health maintenance, took on the role of a keystone member of the Dossia system. They specify the objective of the system and regulate the 'members of the system', which are the medical providers such as hospitals, family doctors, health fitness monitoring vendors, etc, such that the system is adhering to rules and regulations and fulfilling its purpose. In the case of a system for aging population issues in Singapore, there too exist a keystone member who can ensure that needs of various stakeholders in the system are met. Hence, the role of the keystone member holds a crucial role in ensuring the functionality of the system.

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2.4.4 Conceptual blending of cloud computing technology and electronic health records system

The unique partial characteristics that are present in the generic space that blended the cloud computing technology, together with the generic space that blended the electronic health records system can be further blended, picking out the advantageous characteristics which should be present to make up the necessary functions of an operable health service cloud computing system, thereby creating a stable, wholesome and sustainable system that can satisfy the demands for elderly care in Singapore. Referring to Figure 6, the generic spaces from both blends undergo integration which led to the evolvement of another generic space, which consists of the following characteristics:

(i) Interdependency between the different components in order to sustain the functionality of the system,

(ii) Potential for niche creation, with the capability adjust and pro-create and make improvements so as to support the diversity or evolution of new stakeholders or participants in the open system,

(iii) Potential for transformation of technology, which is also an evolution process where technology can be adjusted to support shift in the needs of the system, such as in terms of mobility of usage or space for storage of massive data and information,

(iv) Capable of building the robustness of the system, where it has to be sturdy enough to sustain and support the needs of the users, which is thus closely linked to its potential for niche creation and transformation of technology.

The above four key partial characteristics are important aspects which serve to fulfil the conditions of a successful health service cloud computing system for elderly care. With them in mind, a new blended space, a health service cloud computing system emerged as shown in Figure 6.

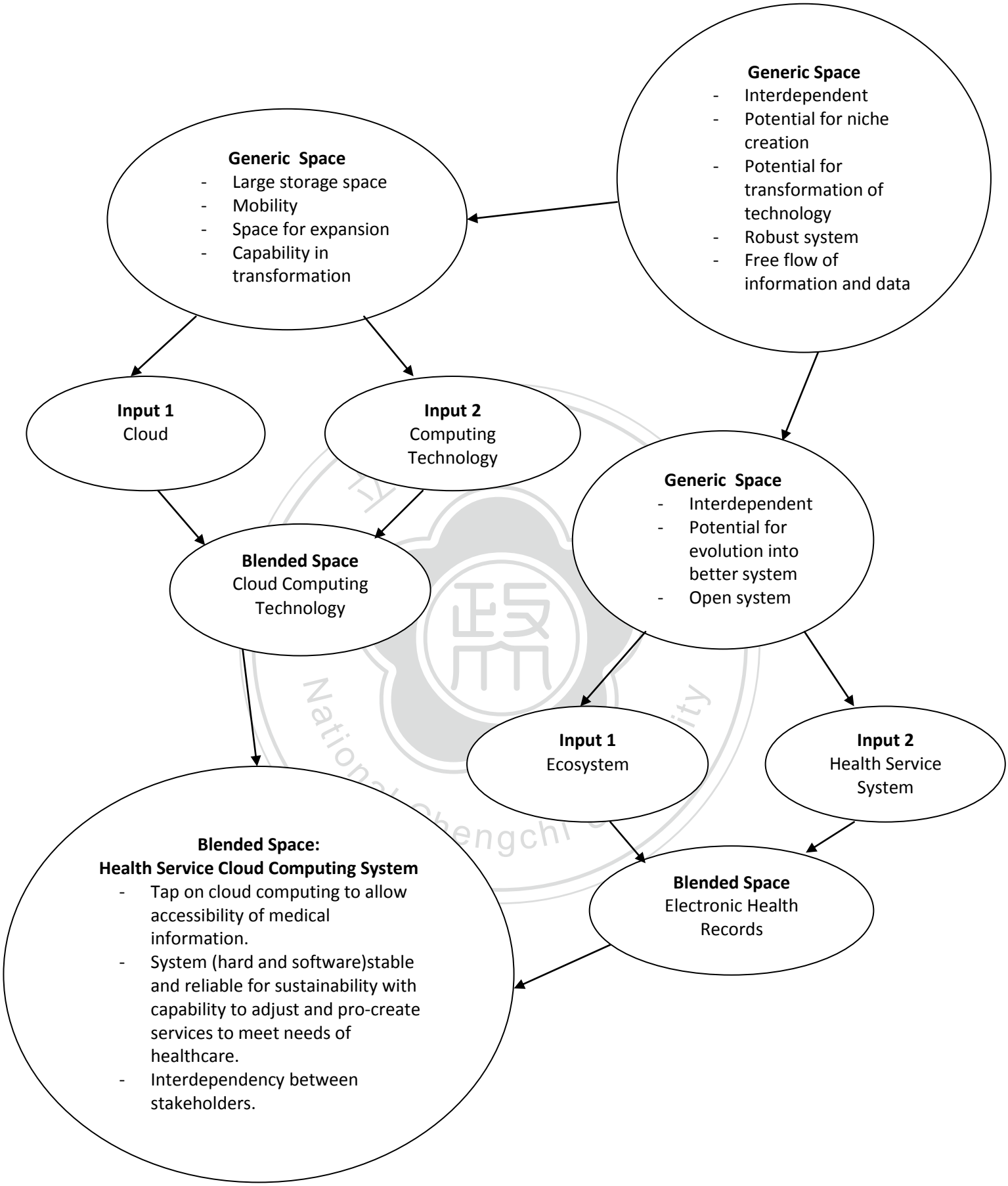

Figure 6: Conceptual Blending between cloud computing technology and Electronic Health Records (EHR)

By tapping onto the key advantages of both inputs, this blended space allows a maximization of the workability of a practical and effective health system which can match the requirements and accomplish the objectives of a sound health service cloud computing system that targets the tackling of aging issues.

Using the idea of conceptual blending for new meanings, the necessary concepts to achieving and ensuring active aging has to be investigated, such that a blending process can be done with the health service cloud computing system to create one that is specific to the tackling of aging population issues in Singapore.

2.4.5 The component that links - Water as a metaphor for data and information

In the context of health service platforms using cloud computing technology, we can see that the next critical need of consumers that has to be fulfilled to make these health service platforms desirable to customers is their ability to provide mobility of information and to provide instantaneous critical feedback on their health condition. It can be easily seen that the key ingredient for the accomplishment of these goals are the 'health information' provided by consumers and 'health feedback information' given by the platform, including information given by stakeholders. This flow of information is once again vital in supporting ownership of health maintenance and sustainability of primary and home care can be enhanced as they are equipped with the necessary health information of the elderly they are taking care of.

While little studies have been done on water as a metaphor of information, there were numerous studies built on the basis of religion, depicting water as an essential and critical part of life. A study on the use of water as a metaphor in Christian novel 'Praisesong for the Widow, The Women of Brewster Place and Beloved', saw the significance of water as of nutritive value, one component essential for the source of life and well-being (N'Guessan, 2009). Such studies on the vitality of water lay the foundation in understanding water as a critical source for livelihood.

From the two concepts used as our input spaces in Figure 4, namely the concept of cloud and ecosystem, it can be identified that that a critical component that makes up each of these concept is the ingredient “water”. Clouds are mainly composed of water while the ecosystem cannot survive without the presence of water. By mapping the vitality of water in these spaces onto the health service platform system, we can understand that just like water that links the ecosystem and clouds, the presence of information is the crucial component to make the functioning of the service possible, providing the links between the services and consumers.

2.4.6 Opening possibilities - Entailments of water

Metaphorical entailment refers to the imparting of a characteristic of the source domain to the target domain by logical means (Lakoff & Johnson, 1980). Hence, considering the characteristic of water, a significant feature is its fluidity, which in physics terms, is the ability to flow. This characteristic, when mapped onto information on health service platforms, coincides with consumers’ need for ‘mobility of information’.

Also, expanding our concept of water onto its significance towards users and the different places or ways in which water can be found, we can extend an entailment of the metaphor ‘water’ by understanding the ‘need for instantaneous critical feedback information’ as that of our tap water in today’s world, which fulfils our critical need for survival (ie water) at the instant with a turn of the tap. For example, the invention of a ‘tap’ as the entailment for supply of water also increases the mobility of our vital need for water. Mapping this idea onto the successful functioning of health servicing platforms sparked off the idea of providing “taps” in the form of computer systems for users to overcome the problem of having critical information instantaneously and with high accessibility. In other word, the many entailments of water transform it into more importantly, a ‘driver metaphor’, which can initiate more innovations with respect to the more efficient transfer of data and information between each

members of the health service cloud computing system. It is hence necessary to understand the possibilities and obstacles faced when implementing a health service cloud computing system for countering problems of aging population, then find ways to “drive” and initiate solutions to these concerns.

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Chapter 3: Aging Population in Singapore

One of the fastest aging populations in Asia, Singapore faces the challenge of implementing policies which can assist in accommodating the changing population structure in the approaching years. According to the Inter-Ministerial Committee on Aging Report since 1999, it was estimated that Singapore's elderly population will increase to a whopping 19% by 2030. This age structural transitions will affect supply and demand factors within a society, putting pressure on key life cycle stages and consequently policies catering to the needs of populations at specific ages (Pool, 2000). Hence, many aspects have to be fine-tuned to cater to the altering needs of changing age structure, and one of the most vital features to be considered for the maintenance of the aging population is the health care system.

3.1 Problems of aging population in Singapore

Based on the key annual indicators of Singapore 2009 -2010 done by Statistics Singapore, it was indicated that the median age of Singaporeans have been on the rise, presently at 37.4 years and is expected to rise up to 41 years of age by 2030. Referring to Figure 7, it can be observed that the spread of residents above the age of 50 years old have increased tremendously over the decade while birth rates have been on a decrease. Other than low birth rates, the increase in the average life expectancy of Singaporeans inevitably reduces the old age support ratio. Referring to Figure 8, the diminishing old age support ratio since 1970 to 8.2 residents aged 15-64 years old per elderly resident (in this case, elderly resident refers to resident 65 years of age and above) in 2010 would inevitably put on a larger burden on the younger age group now and possibly the future.

Population aging will result in alarming declines in support ratios and also significant increases in productivity and per capita income by raising investment in physical and human capital since longer life, lower fertility, and population aging all raise the demand for wealth needed to provide for old-age consumption (Lee & Mason, 2010). In an economic point of

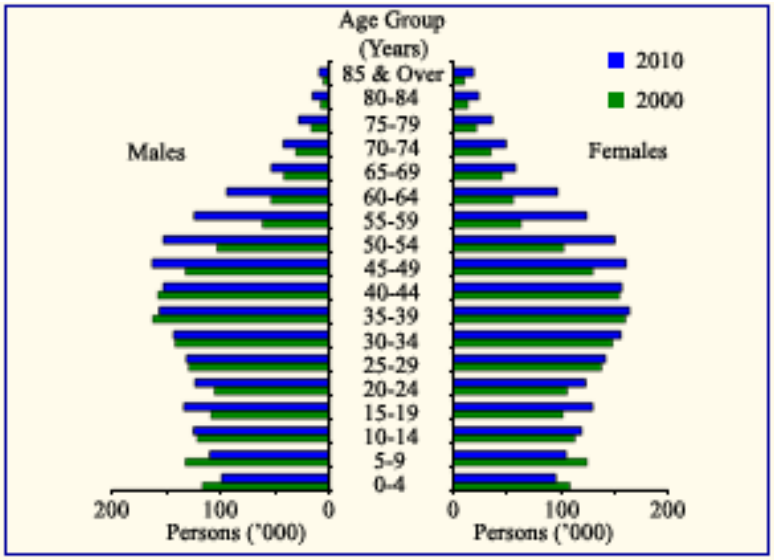

Figure 7: Population age pyramid (Statistics Singapore, 2010)

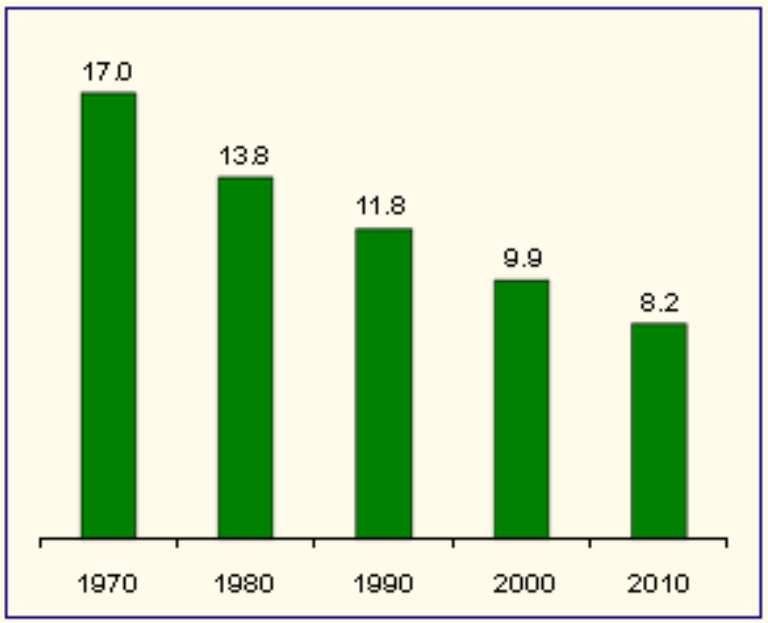

Figure 8: Old age support ratio (Statistics Singapore, 2010)

view, this demographic change may lead to rising payroll taxes and welfare policies reforms which threaten to place huge pressure on the economic growth of the country. However, the detrimental situation can be reversed as this group of the population can also help bring economic benefits instead of becoming a burden towards economic growth. While increasing

birth rate seems much a straightforward solution, keeping the older group of population as part of the human capital can also reverse an aging problem to one which brings economic benefits. The increased in life expectancy and active economic behaviour of the constantly increasing older population create not only an additional reserve of labour resources but can also increase sources of consumer demand, which is the primary significant driving force of economic growth (Nikova, 2010). At this point, one important criterion to fulfil so that the elderly population can perform a value-added role in the society is the maintenance of good health. With the rising cost of health and social support system, it is essential for proactive steps to be taken such that individual and environmental changes promotes active aging, thus sustaining aging population (Marquez et al., 2009). Unfortunately, it is the poor maintenance of health and chronic illnesses which plagued the older population, which results in subsequent increase in healthcare cost. Hence, looking into ways in keeping a healthy older population is one key solution to the countering the problems of aging population.

Similarly in Singapore, health care policies for the elderly have been receiving a lot of attention in the past year. Active promotion in awareness of health care issues among the elderly population in general has been in the pipeline (Chan, 2001). The approach that Singapore adopted is more often than not closely linked to the fundamental traditions of Asian culture, which consists of strong family ties and filial piety.

3.2 Importance of familial support in Singapore

Familial support has been one of the most important and traditional pillars in the care-giving system of elderly (Chan, 2001). The goal of most Asian governments is to develop programmes that do not undermine family support which is perceived as far superior to state-based support, both morally and financially (Ofstedal et al., 2001). In Singapore, the government deem familial support as the ideal source of support for the aged. As such, the Singapore government aims to develop a delicate mix of both family support and individual

capabilities of old age preparation in the policies implemented which takes care of the social well-being of the elderly. Healthcare, once again, is one crucial component in ensuring the interest of this growing group of members in the society. For example, the implementation of the Central Provident Fund (CPF), which is a compulsory savings plan for every working adult in Singapore, is one such policy which allows the individual to possess the monetary capability to take care of his/her health, while family members, particular the children of these elderly, are also able to do their part by using their CPF funds for hospitalization and medical fees.

While the reliance on familial support has been its key strategy, it is also essential to investigate how it is effectively applicable to the reality of the Singaporean culture. To ensure smoother route to aging in face of the upcoming silver tsunami, it is first crucial to identify the keystone objectives, policy structures and needs of the Singaporean society so as to determine the necessary ingredients for the establishment of an effective healthcare system.

3.3 Present EHR system in Singapore

Singapore is no exception in making use of advancement in technology in attempt to improve its healthcare services. The Electronic Medical Records Exchange (EMRX) system launched presently in Singapore has allowed some medical institutions in Singapore have gone 'paper-less' while many hospitals have also gone 'film-less' as diagnostic images are digitised while their pharmacy ordering procedures have also adopted electronic ordering processes. Steps have also been taken to establish an integrated healthcare system, with clusters of hospitals having financial, administrative, health service management and electronic health records as an integral part of their hospital operations and extending them to other caregivers for smoother care delivery (Lam, 2010). However, the major drawback of EMRX is that it still remains as a document-level of exchange. Without a standardised and structured set of data, it is currently impossible for healthcare services in Singapore to be able to seamlessly share

documents and images across clusters thus making ‘smarter’ clinical or care delivery decisions.

Singapore, upon understanding the recent rapid advancements of IT, is also keen on tapping onto the new computing technologies to create a health record known as the National Electronic Health Record System which is truly personalized and can be made available everywhere. It is one healthcare system which seeks to integrate healthcare services beyond acute care, and should be designed to include other providers in the community who play crucial roles in giving right-site services, and most importantly to raise the level of chronic disease management and empower patients to proactively look after their health, which are also vital features for successful aging. In all, the future of Singapore’s electronic healthcare system aims to include all members of the healthcare ecosystem, not just professional medical providers.

The traditional nature of Singapore’s family system yet faced with the aging population problems encountered due to modernization makes it a unique case when examining its conditions needed for the setting up of a health service cloud computing system. Considering the vision of Singapore in creating a well-rounded electronic health service system and its clear recognition of exploiting the advancements of IT to realize its objectives, the role of cloud computing technology becomes significant.

3.4 Tapping on cloud computing for healthcare in Singapore

While the motivation to setting up a health service cloud computing system in USA primarily aims at countering the problems of high medical costs, the aging population problem faced by Singapore can also tap onto the advantages brought about by the system because:

(i) The system enables constant monitoring of health conditions, an important step in health maintenance especially for chronic illness monitoring purposes or keeping a healthy lifestyle.

(ii) Family members can take on the role of monitors in health conditions of the elderly members in the family with the accessibility of information brought about by the computing technology, which adheres closely to the familial support policies of the Singapore government.

(iii) With already well-established public healthcare services and technology support system, the health service cloud computing can further enhance the effectiveness of the entire healthcare network by emphasizing their interdependencies, including making users assume a greater responsibility.

(iv) While many of the advantages focus on the macro level such as saving social cost and economic growth, individuals, senior citizens and their family members alike, possess the motivation to maintain their health, which will not only save rising medical costs in Singapore, but also reduce the burden of the support group, who are more often than not the children of these senior citizens.

From the understanding of the present usage of EHR and ideas of meaningful use of the latest cloud computing technology to enhance patient-centered health service system in the context of Singapore's aging population, together with some knowledge on the demographical background of Singapore so as to better tackle with the context of aging population in the culture, three main research questions which targets at the quest for a more meaningful and significant use of a health service cloud computing system for active aging in Singapore.

Research Question 1:

What are the major issues of aging population healthcare in Singapore?

Research Question 2:

What are the recommended criteria necessary for active aging in Singapore?

Research Question 3:

How can the criteria for active aging enhance the meaningful use of a health service cloud computing system for active aging in Singapore?

With these three research questions in place being answered, these information can be utilized to come up with a model framework which can address the ingredients necessary for a health service cloud computing system for active aging via the use of conceptual blending technique, which is also the method used previously in our understanding of systems which are already in place.

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Chapter 4: Research methodology – Multi-methods research

A multi-methods design involves the completion of research, either qualitative or quantitative on their own, then used together to form essential components of one research project (Bryne and Humble, 2007). Qualitative research methods are mostly defined as techniques associated with the gathering, analysis, interpretation and presentation of narrative information (Teddlie and Tashakkori, 2009). In this study, qualitative research is deem as a more informative form of research method since the presence of a variety of stakeholders will require a more in-depth interpretation of patterns, relationships and phenomenon. With its multi-dimensional views necessary to be collated from different perspectives in terms of healthcare, policies and underlying needs, a more complex qualitative research model has to be adopted. Multi-methods research simply mean the combination of more than one type of research methodology for a more thorough understanding of research topic (Clark, 2010). Researchers will typically collect multiple forms of data rather than rely on a single data source, and then all data will be reviewed, make sense and organized into categories or themes that cut across all the data sources (Creswell, 2009). In this case, with a range of roles from different stakeholders in the healthcare system, it is necessary to adopt more than one research methodologies to achieve a more comprehensive model of a possible health service cloud computing system targeting at aging population issues.

4.1 Data collection

Two methods of research are employed in this study, namely intensive interviews and archival documents collation. Intensive interviews were conducted with personnel from government agencies responsible for the healthcare system of Singapore, medical providers such as doctors and nurses and potential users who are indeed potential support group for elderly care. Questions were focused mainly on the present methods of medical records handling, concerns and needs of stakeholders in the healthcare system with regards to scope

performed in health maintenance and views on aging population issues from a personal and overall perspective. Main interview questions can be found in Appendix 1. Further follow-up questions were asked during the interview process to elicit participants' responses in more in-depth manner. Interview responses were then transcribed and analyzed. Face-to-face, telephone and email internet interviews are done in this method.

Other than interviews, other data sources such as archival documents in terms of (i)ministerial speeches by the related ministries regarding healthcare policies and initiatives (Ministry of Health, Singapore), (ii) reports on healthcare policies and (iii) newspaper articles on healthcare and eldercare initiatives, were also done to help reveal concepts pertaining to the effective and meaningful use of a health system when tapping on cloud computing technology. Table 2 indicates the pool of data that are obtained from different sets of stakeholders:

Table 2: List of intensive interview stakeholders and archival documents

Stakeholders	Retrieval of data from:
Governing Agency	(i) Interviews of 2 personnel (A and B) from Ministry of Health(MOH). (ii) 10 ministerial reports and speeches on aging population and healthcare policies and initiatives. - Article 1: Speech by Permanent Secretary on Agency of Integrated Care. - Article 2: Ministerial Speech by Minister of Health on healthy Singaporeans. - Article 3: Speech by Senior Permanent Secretary.

	- Article 4: Ministerial Speech by Minister of Health on polyclinics going paperless. - Article 5: Speech by Permanent Secretary on tackling challenges in healthcare. - Article 6: Ministerial Speech by Minister of Health on healthcare reforms. - Article 7: News Report on Healthcare policies reforms in elderly care. - Article 8: News Report on integration of healthcare. - Article 9: Report on elderly care. - Article 10: Report on elderly care policies.
Professional Medical Providers	Interviews of 5 medical professionals (3 doctors, 2 nurses) - Doctor A and C from public hospitals - Doctor B from private hospital - Nurse A and B from public hospitals
Singaporeans	10 potential Singaporean users (A to G who are potential caregivers for their parents, and H to J who are elderly aged above 65 with some form of chronic illness) - Singaporean A: 32 years old - Singaporean B: 36 years old - Singaporean C: 40 years old - Singaporean D: 39 years old - Singaporean E: 55 years old - Singaporean F: 63 years old - Singaporean G: 46 years old - Singaporean H: 66 years old

	- Singaporean I: 70 years old - Singaporean J: 68 years old

4.2 Triangulation

'Triangulation refers to the combinations and comparisons of multiple data sources, data collection and analysis procedures, research methods, investigators, and inferences that occur at the end of the study' (Teddlie and Tashakkori, 2009, p.27). More specifically, in this study, the use of data triangulation, which involved the use of a variety of data sources in a study, is used to understand the inter-relationships between the various stakeholders in the healthcare system of Singapore. This triangulation design compare results, validate, interpret and corroborate the findings based on the findings from the different qualitative findings, thereby having a valid, well-substantiated conclusion about a single phenomenon (Creswell and Clark, 2007).

From the two main types of data collection methods employed, namely intensive interviews and archival documents collation, collation is done via ATLAS.ti software, which allows specific coding of key ideas and themes in each set of data, then formed into links which thereby evolved the theory which consists of criteria necessary for the creation of a more efficient health service cloud computing system that focuses on the aging population issues of the Singapore society. Identification of categories for collection of data through open coding with the assistance of ATLAS.ti software are done from each set of data to identify the variety of concepts raised from the data, and collating them into numerous specific categories. Open coding, which involves the defragmentation of text and pulling out relevant concepts into various components, is the initial process which then leads on to the more advanced axial coding process (Strauss & Corbin, 1998). Theorizing process takes place with the integration and refining of theory such that theoretical saturation is reached and is known as selective coding (Strauss & Corbin, 1998). In this study, concepts in the collated data were first

identified in a large range with the aim of answering the research questions in this study during the initial open coding process. Subsequently, axial coding was done by drawing links and relationships built between the various concepts identify and thereafter categorized into evidences which support the key concepts.

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Chapter 5: Results

With the collation and analysis of the data from the two type of research methods, namely through intensive interviews and archival documents collation from relevant sources, key concepts which are regarded as the elements necessary for proper functioning of a health service cloud computing system to enable active aging are analysed through the use of ATLAS.ti qualitative coding program.

The inter-relationships between the various concepts are coded and categorised and the key element which ensures that the system is able to perform its desired outcomes is the idea of having it as an enabler such that collaborations between the stakeholders are possible. Data are qualitatively analyzed from the datasets comprising of intensive interviews and archival documents of ministerial speeches and publications and newspaper articles through triangulation of findings from the various categories and sources. 6 main categories are identified through the coding process using ATLAS.ti, which allows datasets to be analyzed and categorized. They are: (i) primary care, (ii) familial support, (iii) awareness in health maintenance and transparency in information, (iv) improved efficiency and accuracy in healthcare with seamless transfer of care and (v) intermediate care and (vi) collaboration between stakeholders. This categorization is important when dealing with the large amounts of data which may consist of different concepts. The categorized raw data of the datasets in terms of intensive interviews and archival documents collated via ATLAS.ti can be found in Appendix 2. These 6 categories of concepts above is a depiction of the key issues which should be looked into in the context of the aging population in the Singaporean context, which hence addresses research question 1 of this study.

5.1 Primary Care

Emphasis on the role of primary care in the system is evident especially in the views of the keystone governing members and the medical professionals. The governing agency sees that

contribution by the family physicians as crucial to allow better empowerment of the patients, and thus increase the efficiency and effectiveness of elderly care. As mentioned via the governing personnels and through official ministerial speeches and press releases:

Governing personnel A: *We need a person who is coordinating the care and this person has to be a well-trained family physician. Because the aliment health problems of an elderly patient can be broadbased and wide, you will need a doctor who has the breadth and knowledge. One of the key thrust is to strengthen primary care sector. in order for the family physician to take good care of the patients' health, financing have to be done right too because today seeing a GP don't have incentive to look at more complex diseases compared to cough and cold in the profit-maximization point of view.'*

Article 5: *Most of the elderly will have health conditions that require long-term chronic care, rather than short-term acute hospital care. GPs (general practitioners) and polyclinics (government-funded clinics) will play important roles in the care of the elderly sick.*

Primary care sector, in the keystone members' point of view, has to be strengthened so as to provide assistance to elderly patients, especially those with chronic illnesses.

Medical professionals interviewed also indicated that the role of family physicians should be one that is '*first contact with the patients*', and will be escalated to the hospital care level only when there are insufficient facilities and capabilities to handle the treatments. While it may not be an obvious concern towards the potential patients on the capability of their family physicians, Singaporeans interviewed have indicated the distrust towards neighborhood general practitioners in handling any serious medical treatments other than common cough and cold symptoms – *'If I cut my finger, where can I go other than A&E? I don't trust GP to give the right care.'*

5.2 Familial Support

Another key aspect that is deemed important with the study of the datasets collated is the role of familial support in the eldercare system. The term 'homecare', coined by the governing agency and medical professionals, emerged as a term dubbed in the fillial piety that should exist in the society with ingrained Asian values. As such, homecare is multi-faceted, and is regarded as the support of the family members, though other stakeholders may play a part in ensuring its wholesomeness.

Governing sectors see homecare as an avenue to take care of the emotional aspect of the elderly on the intangible side, while improving the efficiency of healthcare for elders. As mentioned by governing personnels, *'If home care can be developed, it can actually lessen the burden and support aging in place which is essentially what people aspire to – nobody wants to age and die in a place away from home. Additional healthcare support to be delivered in homes will go a long way.',* and based on a ministerial speech which mentioned that *'the priority of our healthcare institutions should be to get patients well again so that they can go home.',* it can be evident that homecare is one big sector in which the governing agency will develop as a strategy to counter the issues of aging population. Singaporeans who are either caregivers or elderly also indicated the knowledge of achieving efficiency through homecare. Interestingly, it was also mentioned rather frequently the preference to be home-based. Quoting from one of the Singaporeans interviewed:

Singaporean E: '*Home care with chronic problem – best managed at home. Healthcare cost will be lesser. Healthcare is usually standard, no variation, will save time and money. Patients will also prefer to be at home.'*

Taking into consideration the views of medical professionals, while they welcome the need for a more capable homecare system, as quoted from Nurse B in the dataset, commenting that *'family support is a huge direction towards elderly healthcare in the future' and 'chronic problems are best managed at home as healthcare is usually standard without much*

variation, which will hence in turn save time and money.', issues were raised regarding the true medical knowledge that home caregivers possess, which in turn reflects its effectiveness. Singaporeans interviewed too perceived the need for homecare as essential. They understand the culture within which the care of their parents should be the children's responsibility, as said by a middle-age Singaporean who *'agrees that family support is crucial in eldercare. Children of the elders have the responsibility.'* Also, many see the need to be sensitive towards the emotional needs of the elders, since family ties are important in an Asian context. Quotes from medical professional and Singaporeans are as follows:

Doctor C: *Family support is important since we also have to take care of the emotional needs (of the elderly).*

Singaporean I: *Home is usually best preferred. Family ties are important (for the well-being of the sick elderly).*

One unique feature in the Singaporean family is the engagement of domestic helpers in the homecare system. Indeed, with most of the support group having to work, domestic helpers are solutions towards the day care of elderly who are at home. Identifying such a trend, the governing agency is considering the development of homecare to include domestic helpers as part of the plan. '*There is a possibility of training the domestic workers to support the care because Singapore is in a unique situation because Singapore is in a high density of housing and high dependency on domestic foreign helpers. Some of them are well-educated in home country. They can be trained to take care of the elderly more.'*, as indicated by governing personnel B. There is however an obvious divide between the views of the governing agency to that of the medical professionals. Doctors interviewed questioned the appropriateness of the high dependence on domestic helpers in homecare, as they are still lacking in the necessary medical knowledge especially in more complicated cases of health problems, Quoting from a Doctor B of a local public hospital when asked about the possibility of

tapping onto domestic helpers in elderly healthcare, *'Domestic helpers - not professional medical helpers. They are not trained. It is not appropriate in specific cases.'*

5.3 Awareness in health maintenance and transparency in information

The lack of awareness in health maintenance and how the implementation of the transparency in medical information can assist in improving this aspect are extensively mentioned in the data sets, especially by medical professionals. Meaningful use of a health service cloud computing system will not be possible without the awareness of the users in seeing the need to maintain their health. As Doctor A mentioned, *'Singaporeans are weak in awareness of health maintenance and preventive medicine. They don't want to change their lifestyle. While Singaporeans are supposedly well-educated, they are still not aware. People still smoke, drink and their diet is quite bad. There is a strong lack in awareness.'* In fact, typical Singaporeans interviewed expressed that they see the need to visit the doctors and to take care of their health only when they discover symptoms of sickness, for both their elderly family members of themselves. Based on the data, all 10 Singaporeans interviewed were adamant about the need to keep constant track of their health conditions or that of their elderly at home. A common mentality towards health maintenance is as such –

Singaporean B: *'I don't really care on maintenance and prevention. For my parents, only when there arise a condition, then will I monitor.'*

In addition, there is also a strong need from the Singaporeans to have more knowledge on the necessary medical information, which includes possible medical treatment recommendations, hospitalization fees and information on diagnosis. As indicated by some subjects:

Singaporean E: *'As a (home) caregiver, I will wish to know which hospitals or doctors are good at cure of any diseases. These information should include reviews from patients or feedback from doctors. Current situation is such that we will ask around which doctor or*

hospital is good, or go online to look for specialists. If there is a credible source that can give treatment recommendations, it will be helpful.'

Singapore F: *'Hospital operations can be more transparent. Hospitalization costs are important information also. Direct calculation of hospitalization cost, use of medicare, insurance etc and how much must I fork out should be available. Now, you know the cost only after hospitalization and care.'*

Singaporean J: *'Singapore is not transparent in terms of hospital information – Information like cost of treatment, information on diagnosis and recommended treatment to follow-up. I find that they will tell me the information only after treatment.'*

The governing agency also has their concerns with regards to the awareness of proper health maintenance within the people. It is inclined to educating and inculcating into the people the concept of taking charge and being aware of their health which will reduce costs of healthcare. From a press release on health promotion and prevention, Article 10: *' We want to keep Singaporeans healthy so that they do not come into the healthcare system int he first place, especially the high cost acute sector. Other than Health Promotion Board's prevention and education efforts, we are helping Singaporeans detect and treat disease early through health screening, in GP (general practitioners) clinics and in the community such as NTUC's Wellness Centers. Our Restructured Hospitals are helping the frail elderly and patients with chronic diseases manage their medical conditions better so that they stay well.'* Therefore, awareness of health maintenance is the key issue that the governing agency would want to address.

5.4 Improved efficiency and accuracy in healthcare with seamless transfer of care

The idea of seamless transfer of care via the use of health service cloud computing system occurred as a tool which will in turn improve efficiency and accuracy in eldercare. From the

keystone member's point of view ie. the govening agency, another reason in the pushing through of such a personalised health record system is to enhance the collaboration between the different stakeholders within the healthcare system. As indicated by a ministerial speech, Article 3: *'Healthcare providers no longer need to shuttle individual paper records to and fro, reducing unnecessary repeat tests and ensure improved safety and continuity of care for the patients'* with *'no more problem with misplaced medical records or bad handwriting.' , 'We are enabling the doctors and nurses to gain instant access to patients' medical history. What medical illness is the patient suffering from? Which medication is he on? Is his diabetes under control? Has he been immunised against seasonal flu? Is it time for him to undergo an endoscopy? What is his family history? What is his drug allergy? Access to this information allows the doctors to make timely decisions and interventions. It also reduces the likelihood of human error.'*

Article 5: *'The government may need to play a more active role in the design of services and the integration of care. Our objective is to enable our patients to move seamlessly across different institutions. Integration of care is critical so that we can care for patients in the most appropriate setting at lower cost.'*

Article 9: *'The end-goal is to create an environment where Singaporeans can move seamlessly across providers, without repeated testing, duplicative care of falling through the cracks. This will allow chronically-ill patients, frail elderly and even the well to receive the care and attention they need, where they need it the most, at a price that they can afford.'*

In the medical providers' and users' point of view, the capability of a system to allow transfer of information will ideally allow seamless transfer of care between different caregivers with the instant accessiblity of individual patients' medical information. It also allows medical professionals to give timely medical decisions, avoid miscommunication due to inaccurate transmission of medical conditions of patients to each caregivers, saves time as there is no

need for unnecessary repetition of tests, thereby gives safer medical care. Doctors interviewed indicated that the advantage of a shared system that increases collaboration within health caregivers is that *'there is no need to repeat medical history from one hospital to another, making (transfer of care) easier and more convenient.'* Singaporeans interviewed also welcome the enhancement in collaboration as *'if everybody has a single source of information, they don't have to tell again and again what is the problem.'* and *'it will be easy for us to know the condition to do own research. It will also be easy for us to tell another doctor what is happening. It improves miscommunication.'* Hence, from the datasets, it is clear that the hope to enhance efficiency and improves accuracy of diagnosis and healthcare, thereafter leading to seamless transfer of care is evident in the various stakeholders in elderly care.

5.5 Intermediate care sectors

Issues pertaining to the roles of intermediate care sectors also arise amongst the governing agency and the medical professionals. While emphasis is placed mainly on homecare, many are concerned with the amount of professional care outside hospitals that can ensure that elderly are properly taken care of. Key issue is this context is the availability to support eldercare outside the means of hospital and beyond the capabilities of homecare.

Governing personnel B: *'They need to raise nursing standards in the nursing homes, to deal with increasingly complex needs of the elderly, including caring for elderly. For community hospitals, they need to develop stronger medical capabilities to mange more complex sub-acute cases, so that we can discharge patients from there helping patients to save, and to help free up more beds.'*

Article 8: *'The Ministry(of Health) currently supports several home care services, including home medical, home nursing, rehabilitation, and dementia day care services. As the next step, we are working with the stakeholders to develop viable models to deliver more coordinated*

and integrated healthcare services to the home. We recognise that the caregiver is the key to successful home care. Nevertheless, we need to recognise that there are limitations of home care, brought about by smaller family sizes and frailty from increasing life expectancy'.

Concerns of medical professionals, particularly doctors, are geared towards the limited medical knowledge of home caregivers, and thus the importance of the role of intermediate care units within the system. As indicated by a private doctor, *'Family members may not have the expertise to take care of the elderly patients. Intermediate care is necessary.'*

5.6 Collaboration between stakeholders

Collaboration between stakeholders is the unanimous agreement comprehended from all 27 of the datasets where indication of such an initiative is essential to improve elderly care. From the data collated, one unanimous direction which points towards the need for better integration of healthcare services surfaced. Personnel A from the Ministry of Health stated that '*We need data, information of patient in order to make decisions on when they can move down to different care settings and in terms of financing, or what sort of help they may need. Electronic health records is one major and most significant enablers towards integration of care.',* while a ministerial speech on enhancement of healthcare services expressed the following: *'There should be better integration of services between the hospitals, polyclinics and other community care providers. As chronic care require many healthcare professionals to work in teams, the sharing of medical records is critical. Technology has now enabled us to this, though rolling it out nation-wide will take a few more years. We will make it happen and bring real benefits to both the patients and the providers. This will transform the way we deliver care to patients, achieving better care coordination and disease management. It should translate into better health outcomes for our patient',* which hence clearly spelt out the intention of the governing agency in tapping onto electronics healthcare to maintain a more wholesome collaboration between different groups of caregivers, particularly in elderly

care since their objective, as mentioned in speech article 2 of the data set, is to *'enable our patients to move seamlessly across different institutions. Integration of care is critical so that we can care for patients in the most appropriate setting at lowest cost. To facilitate smooth patient transitions, we need to strengthen collaborative partnerships between primary care, hospitals and the long-term care sector. For the frail elderly in particular, a multidisciplinary approach with close collaboration between doctors, nurses, allied health professionals and social workers is essential, given their multi-faceted needs.*'. Datasets related to ministerial speeches or articles related to initiatives of the governing agency, as well as interviews of governing personnels indicated the common acknowledgement that collaboration between stakeholders is deem a solution to better the present medical care.

Medical professionals who expressed their views in having stronger collaboration between stakeholders in eldercare saw the initiative as a tool to empower the people in taking ownership of their health, especially in the monitoring of chronic illnesses. A doctor from a private hospital sums up the benefit in enhancing collaboration via cloud computing system '*A personalized health records system can aid in the acute treatment of patients with chronic diseases, and prevent unnecessary treatments of chronic conditions.'* Also indicated by Doctor A from a public hospital, *'I am not first contact (to patients). Polyclinics can have a good system that is linked to us, that will be good. Now we do have, but the records that we can pull from them are in bits and pieces, not comprehensive. GPs (general practitioners) are not linked to us at all, so we don't know anything, so that is quite bad.'*, while Nurse A, a caregiver in the intensive care unit of a public hospital said, *"If they are well-tuned with their own health, they can monitor on their own. Some procedures like taking their own blood pressure can be done by the patients themselves, and if simple information can be made accessible to patients, they can use them for their own reference."*

In view of the reaction of Singaporeans, who are the direct users and beneficiaries, with the implementation of a health service cloud computing system to enhance elderly care, most do not reject the idea of having more information and knowledge in taking charge of the health conditions of themselves and their family members, and are more than willing to take on the role of self-management, in which they understand will also save them medical cost and at the same time maintain good health conditions.

Singaporean C, with parents aged above 60 years old, *' It will be good to have a personalized health record system. I can monitor if conditions (health conditions) have improved.'*

Singaporean H, a 66 year-old, indicated that a system like this can '*help me monitor my blood pressure problem.'*

From these 6 main issues identified, we can observe that firstly, the prevalence of chronic illnesses is among the common ailments of elderly patients. More often than not, they are usually long-term and require constant attention, hence not cost-efficient and practical to be taken care of in the hospitals at all times. Hence, the need for awareness for proper maintenance of health and the available professional assistance is necessary to reduce the risk of health problems. This also brings on to the issue of the role of caregivers in family members. As mentioned, the idea of filial piety is deeply ingrained in the values of the Singaporean culture. As such, the responsibility of the children in taking care of their elderly patients is deemed as a mandatory act. However, in face of the silver tsunami and the much smaller support ratio who can perform the caregiving roles, the pressure onto which this support group of younger Singaporeans is a trying problem to consider. Hence, in view external support, in this case the need to provide more professional assistance that can be available near to homecare is one problem which has to be tackled, while internally, the capabilities of homecare has to be enhanced so that the task of elderly caregiving can be performed with ease. Thirdly, the over-reliance on hospitals in terms of all forms of elderly

care, especially in acute treatments has to be looked into. Views from medical professionals in hospitals and from the governing agency indicated the pressure that hospitals will face with the subsequent aging of population which in turn raises social costs and may also lead to the over-dependent phenomenon on hospitals. Therefore, other areas of care, specifically the primary and intermediate care sectors, have to be enhanced so that pressure can be relieved from the hospitals, and transfer of care can be made, which also reduces cost and increase convenience. Also, these factors highlight the multi-faceted needs of the elderly patients, as indicated from the data sets in the research. Indeed, other than the tangible costs that have to be considered, the emotional needs of the elderly have to be put into consideration too. Being close to family and away from hospitals is always welcomed by the elderly patients who have to undergo long-term treatments. The ability of various stakeholders in elderly care have to possess the capability to allow seamless transfer in care so that needs can be met, and at the same time, care is not compromised.

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Chapter 6: Discussion

Concepts of the results presented earlier are further analyzed and theorizing of the 6 categories of concepts takes place via axial coding, where concepts identified from open coding are now linked to form relationships for broader and more abstract concepts. The realization of the subsequent three main abstract concepts is derived through the analysis of the 6 main concepts presented in the results. Analysis was initially performed with ATLAS.ti through open coding of the data collated and triangulation done between the data from intensive interviews and from archival document collations to achieve the 6 main issues of aging population in Singapore. Further analysis via axial coding mainly between these issues results gives forth to more abstract concepts which can address the possible criteria for more effective aging in the Singapore context. Figure 9 gives an illustration of the inter-relationships between the concepts analyzed at different levels, from the 6 categories of issues of aging population in Singapore to the extraction of the key theories that emerged, which are namely (i) empowerment and ownership, (ii) sustainable homecare and (iii) seamless transfer of care. These three main theories encompass the needs of elderly care and hence addresses research question 2 of this study to explore possibilities and the criteria for active aging in the context of Singapore. In this discussion, the role of a health service cloud computing system in the realization of these needs is also further analyzed and understood with the considerations of these proposed theories for active aging in mind.

The importance of collaboration between the various stakeholders in elderly healthcare is one of the main ideas proposed from the research to tackle the aging population issues indicated. This list of recommended stakeholders for the system in Singapore's context with the aim to tackle aging population issue was drawn upon the analysis of the sets of data from the two research methods, where certain requirements to fulfill the needs of elderly care are picked

out and relevant stakeholders are highlighted, together with the inputs from the previous study on the

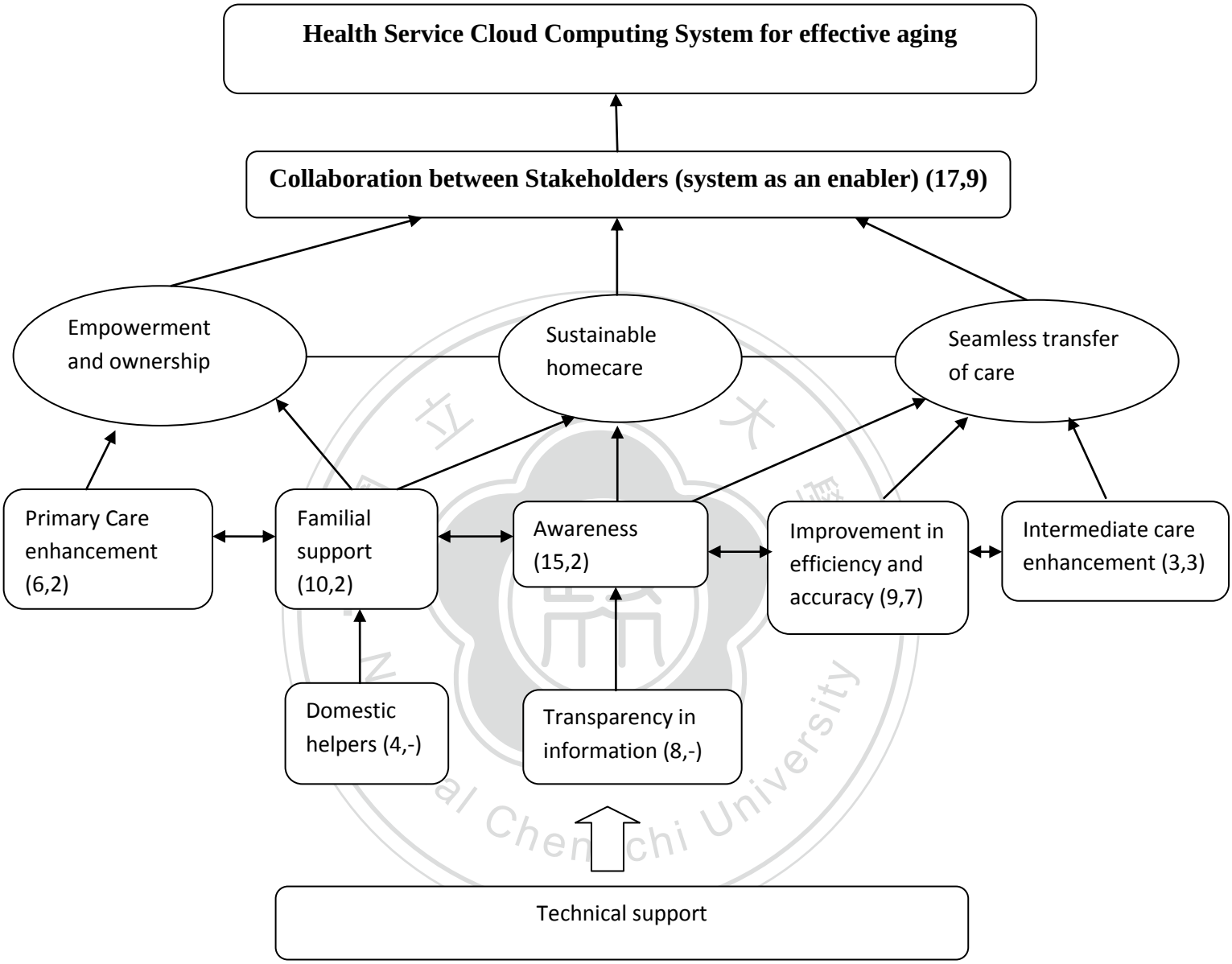

Figure 9: Inter-relationships between concepts derived from coding and analysis of data. *Values in brackets represents the number of occurrence of the concept in datasets in (*intensive interviews, archival documents*).

American's health service cloud computing system which is applicable to the Singaporean context. However, while the need for collaboration between these stakeholders is essential, the extent to which they can contribute and participate in the collaboration may vary, with some to a larger extent. Referring to Table 3, the possible stakeholders within a proposed health service cloud computing system for effective aging can be identified.

Table 3: Possible stakeholders in health service cloud computing system for elderly care in Singapore.

Possible Stakeholders	Remarks
Governing Agencies	Include agencies drafting public healthcare policies, technology and elderly welfare care.
Family members	-
Primary Care Sectors	Primarily family physicians (private and public clinics)
Social Workers	-
Domestic Helpers	Foreign domestic helpers who are aiding employer in elderly homecare.
Intermediate Care Sector	Including nursing homes, elderly homes and rehabilitation centers.
Hospitals	Including private and public hospitals.

Comparing the potential stakeholders that arise from this research with that of an existing system of USA, ie. Dossia System, interesting roles can be observed. For example, the emphasis on family members and the presence of domestic helpers for homecare to be effective and the presence of social workers and intermediate care sectors for seamless transfer of care after intensive medical treatments in hospitals. These unique features are possibly the result of differing cultures and values within the society in comparison to that of the Americans. As such, the result also emphasized the notion that a varying culture and values motivating the workings of the society, in this case particularly in eldercare, is

imperative to creating a sound health system, countering the likelihood of a one-size-fits-all option. Hence, while a skeleton on the necessary ingredients for an effective health service cloud computing system for active aging can be proposed, looking deeper into specific needs of the people in the particular society is an even more essential research. With the deliberation of the findings in this research, which are the three key theories that evolved through analysis of the 6 main issues of aging population in Singapore found through triangulation of the datasets, the possibilities that can be looked into so as to satisfy the needs of elderly and the caregivers to achieve more effective aging can be further discussed subsequently. This hence addresses research question 2 of the study.

6.1 Empowerment and ownership

The set up of a health service cloud computing system can assist in fulfilling various aspects of healthcare, performing its role as an enabler to achieve patient-centered services and features, which in turn creates a personalized health records system- one keeps all medical history and records of each and every person in the country, and is made accessible to users of the platform. Firstly, the presence of a system like this can assist in the empowerment of patients since users of the system now plays a more significant role and thereby takes ownership of the maintanance of their own health. Referring to the 6 main concepts derived from the initial open coding of datasets, three concepts, namely the primary care enhancements, familial support and awareness of health information can contribute to establishing empowerment and ownership within the stakeholders. The Singapore government acknowleges the need for ownership of healthcare by the patients themselves, and intends to pump up initiatives to increase awareness of self-maintenance in health, while the medical caregivers are equipped with appropriate skills and tasked to engage and motivate patients into taking responsibility of their own condition. With empowerment and ownership entrusted to the people, the pressure of relying entirely on professional caregivers

will be lessen with the ability of the elderly and their family members to be aware of maintaining their health. Such ownership and empowerment can hopefully be transformed into better knowledge in monitoring in health conditions, especially in long-term chronic illnesses which are common ailments in elderly healthcare, thereby relieving the strain on costs, both socially and individually.

Medical professionals in hospitals, where acute care services are highly sought and manpower stretched, welcome the idea of patients having more ownership in their health, especially in the areas of chronic illnesses which weighs heavily on the manpower of hospital care. Many interviewed see the potential of having patients and their family members in playing a bigger part in their personal healthcare, which other than assist in the over-reliance on hospital care services, will also improve efficiency and accuracy of diagnosis when medical tests need not be repeated and medical history can be accurately conveyed. Echoing the same sentiments, Singaporeans who will be the direct beneficiaries of the system, most do not reject the idea of having more knowledge and taking charge of the health conditions of themselves and their family members, and are more than willing to take on the role of self-management, in which they understand will also save them medical cost and at the same time maintain good health conditions. Being 'in the know' about their health conditions is what the elderly and their family members hope for. With better comprehension of their situations, it will only do good to the maintenance of their health and seek professional help in time if the need is detected. This will inevitably put elderly patients in better care with higher capabilities of staying vigilant towards changes in their health, by themselves or caregivers at home. This will in turn form the foundation of a system than enables empowerment and ownership of health conditions of individuals.

To empower the Singaporeans and help alleviate the pressure from elder care, it is crucial that information is readily available and transparent enough such that prompt actions can be made

in times when decisions need to be made. These decisions include issues such as sourcing and recommendations of medical treatments and calculation of hospitalization costs. To a larger extent, follow-up information towards specific care in elderly can also be made available, like simple medical knowledge or care giving tips so as the enhance the capability of patients and their family in taking care of their health conditions. In this way, ownership is encouraged and with more information on hand, it will assist in the empowerment of Singaporeans in managing health issues, whether for themselves or for their elderly family members. The use of information technology, specifically the use of cloud computing technology, provides an effective tool towards a faster and more accurate sharing of information within the stakeholders in eldercare.

Empowerment and ownership in health maintenance will not be possible without the presence of awareness in healthcare within the people. This brings us back to the issue of information availability, where enough knowledge has to be transmitted to the people so as to make confident and informed choices. Even with a sound health service cloud computing system in place, it will not be beneficial to eldercare if the people have no motivation or do not see the advantage in the self-monitoring process and the confidence to make healthcare decisions. However, based on the interviews collated in this research, necessary information pertaining to healthcare are not easily accessible and transparent enough for the people to handle their healthcare issues or to make decisions in terms of medical needs. Transparency in healthcare information and efforts to increase awareness in healthcare maintenance is one area in which the keystone agency should beef up on.

Empowerment established via the system should not be contained in the area of patients or family members. In fact, with larger awareness and sharing of information through successful collaboration between the different stakeholders, relevant caregivers are also empowered to give better services and informed health advices when necessary. Such as the role of the

primary care sectors, which have the potential to be a suitable caregiver for chronic elderly illnesses and a key source of professional medical advice outside the scope of hospitals, enhancement and making patients informed and build trust in the capabilities of these family physicians is also a form of empowerment towards the primary care unit in playing a more substantial role in the elderly care.

6.2 Homecare as key pillar of support for effective aging

Elderly healthcare is more often than not, a long-term process, which requires financial and time investments. Filial piety, in the Singaporean government's point of view, is one principle deeply adhered in the Singaporean culture and family support is deemed as an ideal source of healthcare support pertaining to the increasing number of aging elderly. As mentioned earlier, the keystone member deemed one of the key pillars of a workable elderly healthcare system as the presence of familial support. Indeed, with strong Asian values ingrained in the Singaporean culture and the relentless messages on filial piety sent by the governing agencies, taking care of their elderly parents is assumed to be mandatory in the society. Hence, taking care of their sick parents at home is a common sight. For the plan to make family members effective in supporting elderly care, it is essential to relieve the pressure on the support group and as such, much has been done to work on the capabilities of homecare services. It can be evident from the various ministerial releases and speeches from the dataset that homecare is one big sector in which the governing agency will develop as a strategy to counter the issues of aging population. With strong participation of the family members of the elderly patients, homecare system can be better managed with the involvement of others besides the elderly patient, who can better assist in the monitoring and maintenance of the already unwell elderly patients. In addition, recuperation at a home-setting is highly welcomed in elderly patients, which hence also takes care of the emotional needs of the elderly patients. With familial support in place, it will in turn strengthen the

ability for more empowerment within the patients including their family members, thereby taking better ownership of health conditions within the family.

However, as expressed by many of the Singaporean subjects who are interviewed, resorting to the employment of domestic helpers at home to take care of the elderly is one way out for families whose members are out at work. With the realization of such a trend, the governing agency is considering the development of homecare to include domestic helpers as part of the plan. Hence, other than family members, the role of domestic helpers in the sustainability of homecare has to be seriously considered.

As such, homecare capabilities have to achieve a certain standard before it can become effective. As mentioned earlier in this chapter, the availability of necessary medical information and advice is one important collaboration between medical providers and home caregivers. Sharing of information among stakeholders within the system will certainly be vital in sustaining the effectiveness of homecare, which aids the accuracy of care administered by caregivers at home.

6.3 Primary and intermediate care support for seamless transfer of care

However, doubts raised by medical professionals on the capabilities of home carergivers to specific treatments which requires more specialized knowledge should not be overlooked. Indeed, medical professionals expressed their concerns with regards to the amount of medical knowledge that family members, and their engaged domestic helpers, have and how realistic it is to intend to depend highly on family care, especially when specialized professional healthcare is necessary. Many times, elderly ailments are long-term processes, and it is definitely inefficient in cost and in healthcare services to be relying solely on hospitals for care. Tranferance of care from hospitals to other forms of healthcare is hence crucial to ensure efficiency in health services. Homecare, while has its role to play in the elderly care, should be enhanced with support from other avenues to ensure its sustainability. To achieve a

seamless transfer of care, other stakeholders that have been identified to support is system is the primary and intermediate care sectors.

Primary care in Singapore, is regarded mainly as the family clinics and government-aided clinics known as the polyclinics. From the results, the lack of trust between the people and the primary caregivers in Singapore is emerged, where their services are deemed to be employed only in times of 'cough and cold' symptoms. The primary care sectors can play a more active role when care is transferred to homecare, as professional medical knowledge will be useful to maintain a more sustainable homecare system. With the presence of the health service cloud computing system where medical records are shared, seamless transfer of care can be achieved with better understanding of the health conditions of the elderly through timely and accurate exchange of information. The capabilities of primary care sector can be further explored, so that pressure on acute care in major hospitals can be relieved and eventually medical costs can be saved.

To tap onto the capabilities of the primary care sector through the use of a linked up cloud computing platform, it is first crucial to motivate them into the participation of such as system. Financial concerns in the setup of the system in a more often than not, small-scale family clinic, does not appear to have the incentive to do so for these general practioners. Assistance in the setup of the infrastructure and the advantages in having the ability to get timely exchange of medical information of potential patients have to be looked into by the governing agency intiating it. Also, the possiblity of empowering the primary care sectors into more rigorous treatments can be made possible only if trust is built between the people and their family physicians. This trust can be established only with more confidence in the primary care and, surely, the upgrading of skills of the family physician who have been a general practitioner for too long a duration and definitely, as mentioned earlier, the spread of

message to inform and educate the people in the tapping of a cheaper and more convenient resource nearer to their doorsteps via the system.

While simple monitoring of chronic illnesses like heartrates and blood pressure can be easily and conveniently monitored at home or through primary caregivers, some conditions which requires more specific and professional care, as mentioned by medical professionals during interview and the acknowledgement by the keystone governing agencies, cannot be ignored. Hence, the capabilities and the financial aids pumped into the intermediate care sectors are essential to allow a seamless transfer of care for the patients.

6.4 Collaboration through health service cloud computing system for effective aging

From the three key concepts that are crucial to the building of an integrated healthcare system discussed and the understanding of the stakeholders which can assist in fulfilling these concepts, it is clear that the main concept which supports the whole umbrella of needs and requirements in elderly care of Singapore is the idea of collaboration. Collaboration appears to be the key towards achieving a wholesome healthcare system within which effectiveness is improved, costs can be reduced, needs can be met and most importantly, the healthcare services are enhanced to enable effective aging to take place. Hence, setting up of a system which makes collaboration between key stakeholders in eldercare possible, serves to reach out as enablers to fulfill objectives of a meaningful use of a health cloud computing system. The extent to which various stakeholders play in the collaborative process vary, depending on the health conditions and required treatments of the patients, sharing and receiving medical information is bound to differ. However, the concept of collaboration is made possible because of the ability for sharing of information to take place, thereby linking different stakeholders and allow them to undertake necessary actions accurately and promptly. Indeed, collaboration is important in this context for better consolidation of resources and information so that better elderly care can be administered. The action of sharing of

information is possible due to the usage of cloud computing technology, which enables free flow of information across stakeholders in elderly care. This idea of collaboration through the use of cloud computing technology attempts to investigate the role of cloud computing in setting up a patient-centered health service cloud computing system that can assist in more effective aging in face of the silver tsunami.

Without a strong and sound technical infrastructure, collaboration would not be possible and the various criteria stated above on the making of an effective system to tackle issues in elderly care will go to null. As mentioned by a doctor in a private hospital who is currently using electronic health system for storage of medical records:

'We need a good computer system that doesn't crash. The system crashes far too often. It is slow and a hassle to wait very long for the information to load. We can click on the icon and wait for very long for the data to load. It is faster to be hand-written in this case. We are not being able to keep up. Other industries are able to keep up (with the advancing technology) but not us. Money comes from government, if they don't give us the support we cannot do it. Also, we do not have the expertise to maintain the system. There should be some initiative in the ministry part to pledge money and support instead of something ad-hoc for the system to work. We need professional to maintain the system instead of someone who does it part-time.'

A technical infrastructure which is not robust enough to support the intensive collaborative usage of such as system will pose as a huge obstacle towards the success of the health service cloud computing system. Similarly, with medical institutions in the private sectors, there is no financial incentive to enhance its IT capabilities to support the system. With this in mind, keystone governing agencies have to look into providing financial aids and appropriate financial support in order to build up the capabilities of the health service cloud computing system to fulfill the various collaborative criteria for effective elderly care.

With knowledge of the key characteristics of a health service cloud computing system in mind, a conceptual mapping between the two input spaces, namely the characteristics of health service cloud computing system and the necessary criteria for active aging can be done to demonstrate the effective use of the system to match the required needs, in this context, a health service cloud computing system that targets on elderly care. Figure 10 illustrates the mapping process, which provides a model framework based on the research results that addresses research question 3, which looks into the recommended criteria necessary to enhance meaningful use of a health service cloud computing system for activeaging.

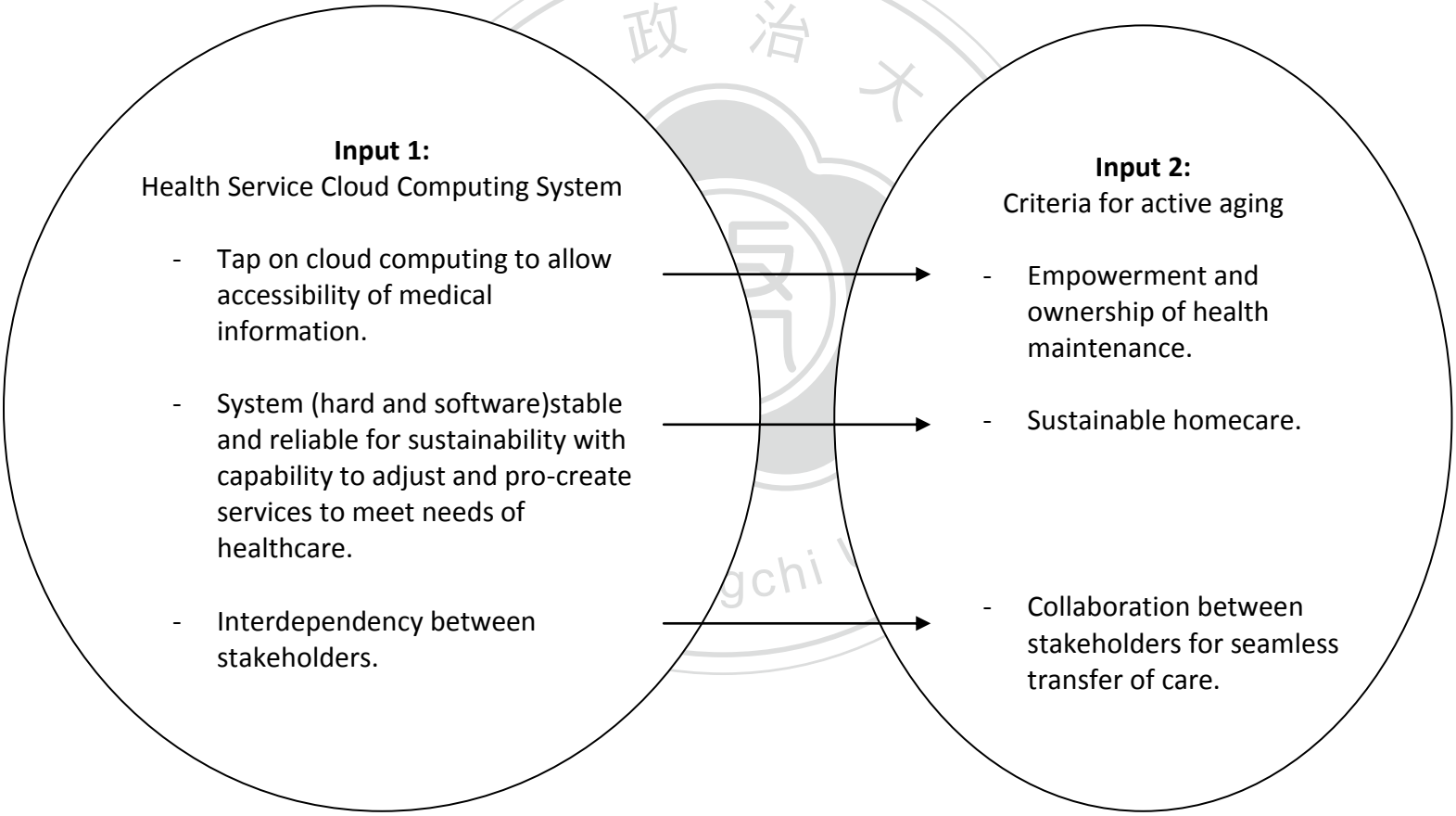

Figure 10: Conceptual mapping between health service cloud computing system and criteria for active aging

Input 1 is derived from the an understanding through a conceptual blending process previously between electronics health records and cloud computing technology to a blended space which holds the concepts of a health service cloud computing system. Input 2 consist of

the concepts derived from the results of this research and indicates the necessary criteria needed for active aging in the Singapore context. Figure 10 illustrates the mapping process between the two input spaces.

The concepts of the two input spaces are mapped with one another to form a relationship between the characteristics of the health service cloud computing system and the criteria for active aging. This mapping process demonstrates how the key attributes can be tapped upon to ensure that the potential of a health service cloud computing system can be fully utilized to assist in addressing issues of aging population in Singapore. As such, more specifically, the marriage of the concepts of the two input spaces will result in the following characteristics of a health service cloud computing system for active aging. They are:

- Interdependency and coordination between stakeholders to provide care specific to health conditions of elderly to ensure seamless transfer of care.
- Sharing of medical information, including available treatments and medical costs between stakeholders for sustainable homecare.
- Allow ownership and empowerment in health maintenance.

This is a result of the combination of previous knowledge and the findings from this research, which addresses the context to which issues of aging population in Singapore can be more effectively tackled with the use of a health service cloud computing system. With specificity towards the problem of aging population, thus the needs for elderly care required, it is crucial to ensure that a system, with the presence of the latest computing technology to improve the health services, can be utilized meaningfully such that needs can be met.

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Chapter 7: Conclusion

Tapping on the latest technology of cloud computing to realize needs in healthcare is a global approach adopted by many countries today. Indeed, the undeniable advantage of the cloud computing technology to make communication linkages possible has open up more avenues for healthcare to move towards a more wholesome system. In this study, one area of healthcare, particularly the area of elderly healthcare is looked into, to understand how can the needs of the elderly be addressed, and to a wider spectrum, the needs of the caregivers so that more convenient care can be administered. The study on elderly care in Singapore is especially apt at this point of time, with the facing of the aging of the baby boomers leading to the silver tsunami while the decrease in birth rates subsequently leading to the small numbers in support group is one crucial social problem to be tackled. From this study, the presence of a health service cloud computing system to be catered for elderly care will improve efficiency of health services and accuracy of diagnosis through collaboration between the stakeholders, which is deemed important especially in elderly health ailments, which are often chronic and requires long-term care.

From this study, the concept of empowerment and ownership is extended further to more influence and the key idea of collaboration allows this aspiration to be possible. Empowerment and taking ownership of individuals' health conditions can reduce social costs and allow better care to be administered to elderly patients if they themselves and their caregivers can have clearer understanding of situation. Preventive measures can also be taken to better manage elderly health. Also, empowerment is not limited to patients themselves, but also to family members who take care of the elderly patients, the family physicians and intermediate care sectors like nursing homes, which should play an important role in enhancing the transfer of care from hospitals to a lower-end health service. This brings on to the next two concepts of sustainable homecare and having seamless transfer of care. With

more information accessible to the stakeholders, confidence in caregiving will be enhanced, hence elderly chronic ailments can be better managed, which finally gives an advantage towards an aging population as they are healthy enough to contribute further to the economic growth of the nation and also leading to the lowering of social cost.

The key idea of this research shows the possibilities of a much more interactive, connected and extensive collaboration that can take place with the advancement of technology, and in this case, the use of the cloud computing technology. Potential of the cloud computing system is far-reaching, and with good understand of our needs and capabilities, it can be put into good use to become enhancements and solutions to many issues faced.

In this study, the use of metaphorical study, particularly the idea of conceptual mapping and blending, gives a new insight into understanding innovation in a different way. Concepts are drawn from the studies via triangulating and analyzing the prior in-depth literature reviews of previous knowledge and together with results obtained from using qualitative research methodologies that target to, in this aspect, the issues of aging population in Singapore. These concepts are then further studied to evolve broader and more abstract concepts which seek to explain the needs of elderly care in the Singaporean culture. As such, a model framework which on using a health service cloud computing system that addresses the needs of Singapore in tackling issues of aging population evolved in this study. Hence, the idea of incorporating traditional research methodologies and tapping on the way of understanding systems through the use of metaphorical studies gives a brand new dimension in our strategy in terms of the thinking process through our research results, and is also a new way in which assessment of the suitability and workability of a system can be made. On a smaller scale, it is hoped that more studies can be done using similar strategy on healthcare cloud computing system that serves varying needs and culture. Towards a more ambitious aspiration, this study

hopes to serve as a start for further studies to involve the use of metaphorical study strategies as a new way towards more innovation and creativity.

This study provides a model framework in the context of Singapore, which attempts to fulfil the needs for elderly care, which requires attention with the aging population issues arising. However, this study is not an actual system, but rather a prediction and an envisioning of the future development of the healthcare system that can be built. Interviews and documents collated as datasets are mostly based on present situation and in anticipation of possibilities and envisage of needs for the oncoming silver tsunami. Hence, the workability of this model framework remains unknown. Modification may also be necessary with changes that may take place in the future in terms of the landscape in elderly care.

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References

Armbrust, M., Fox, A., Griffith, R., Joseph, A.D., Katz, R., Konwinski, A., Lee, G., Patterson, D., Rabkin, A., Stoica, I. & Zaharia, M.(2010). A view on cloud computing. *Communications of the ACM, 53(4),* 50-58.

Amrhein, D., Andrew de Andrade, P.A., Armstrong, J. E., James, A.B., Bruklis, R., Cameron, K. (2010). Cloud computing use cases white paper version 3.0 ed., Cloud computing use case discussion group.

Bates, D.W., & Bitton, A. (2010). The future of health information technology in the patient-centered medical home. *Health Affairs, 4(2010),* 614-621.

Bateson, P. G. (1983). *Optimal outbreeding: In Mate choice.* Cambridge: Cambridge University Press.

Bergman,H., Beland, F., Lebel, P., Contandriopoulos, A., Tousignant, P., Brunelle, Y., Kaufman, T., Leibovich, E., Rodriguez, R. & Clarfield, M. (1997). Care for Canada's frail elderly population: Fragmentation of integration? *Canadian Medical Association, 157(8),* 1116-1121.

Bernard, H.R. & Ryan, G.W.(2010). *Analyzing qualitative data: Systematic approaches.* Thousand Oaks, California: SAGE Publications.

Boroujerdi, M.M. & Nazem, S.(2009). Cloud computing: Changing cogitation about computing. *World Academy of Science, Engineering and Technology,* 1112-1116.

Bryne, J. & Humble, A.M. (2007). An introduction to mixed method research. *Atlantic Research Centre for Family-Work Issues,* 1-4.

Chan, A. (2001). Singapore's changing structure and the policy implications for financial security, employment, living arrangements and health care. *Asian MetaCentre Research Paper Series, 3,* 1-21.

國立政治大學 National Chengchi University

Clark, V.L.P. (2010). The adoption and practice of mixed methods: U.S. trends in federally funded health-related research. *Qualitative Inquiry, 16(6),* 428-440.

Corallo,A., Passiante, G. & Prencipe, A.(2007). *The digital business ecosystem.* Northampton, Mass: Edward Elgar Publication.

Cornelissen, J. P. (2006). Making sense of theory construction: metaphor and disciplined imagination. *Organization Studies, 27(1),* 1579–1597.

Cornelissen, J. P. & Kafouros, M. (2008). The Emergent Organization: Primary and Complex Metaphors in Theorizing about Organizations. *Organization Studies, 29(7),* 957 - 978.

Creswell, J.W. (2009). *Research design: Qualitative, quantitative and mixed methods approaches.* Thousand Oaks, California: SAGE Publications.

Creswell, J.W. & Clark, V.L.P. (2007). *Designing and conducting mixed methods research.* Thousand Oaks, California: SAGE Publications.

Detmer, D.E. (2009) Electronic health records: Their time has come. *Issues in Science and Technology*, 57-60.

Dong, X. & Simon, M.A. (2010) Health and aging in a Chinese population: urban and rural disparities. *Geriatrics Gerontology International, 10,* 85-93.

Du,W. (2009). Towards a community-based personal cloud computing. *Proceedings of World Academy of Science, Engineering and Technology*, 41, 901-907.

Fauconnier, G. & Turner, Mark. (1998). Conceptual integration networks. *Cognitive Science, 22(2),* 133-187.

Fauconnier, G. & Turner, M. (2002). *The way we think: Conceptual blending and the mind's hidden complexities.* New York: Basic Books

Hardy, Z. & Paulo, A. C. (2009). Merging, masquerading and morphing: Metaphors and the World Wide Web. *Organization Studies, 30(08),* 821–843.

Hastings, R. (2009). Cloud computing. *Collaboration 2.0,* 10-12.

Iansiti, M. & Levien, R. (2004). *The keystone advantage: What the new dynamics of business ecosystems mean for strategy, innovation and sustainability.* Boston, Mass: Harvard Business School Press.

Jaeger, P. T., Lin, J., & Grimes, J. M.(2008). Cloud computing and information policy: Computing in a policy cloud? , *Journal of Information Technology & Politics*, 5(3), 269-283.

Kovecses, Z.(2006) Language, mind and culture: A practical introduction. USA. *Oxford University Press.*

Kushniruk, A., Borycki, E.& Kuo, M.H.(2010) Advances in electronic health records in Denmark: From national strategy to effective healthcare system implementation. *EFMI Special Topic Conference in Reykjavok, 18(2),* 96-99.

Lakoff, G.& Johnson.M. (1980).Metaphors we live by. Chicago. *University of Chicago.*

Lam, P.M. (2010, Mar 3). Updates on the national electronic health records system [Qn 302]. Retrieved from http://www.moh.gov.sg/mohcorp/parliamentaryqa.aspx?id=23922

Lee, R. & Mason, A.(2010). Some macroeconomic aspects of global population aging. *Demography, 47,* 151-172.

Leonard, J.L.(2008). Is Canada ready for patient accessible electronic health records? A national scan. *BMC Medical Informatics and Decision Making,* 8(33).

Lev S. Kuchment.(2004), The hydrological cycle and human impact on it, *Encyclopedia of Life Support Systems,* Eolss Publishers; Oxford ,UK.

Lombard, C. G.(2005). Conceptual metaphors in computer networking terminology. *Southern African Linguistics and Applied Language Studies,* 23(2), 177–185.

Marquez, D.X., Bustamante, E.E., Blissmer, J. & Prohaska, T.R.(2009). Health promotion for successful aging. *American Journal of Lifestyle Medicine, 3(12),* 12-19.

國立政治大學 National Chengchi University

McCormac, R.M.(1971). *A cognitive theory of metaphor*. Cambridge, Mass: MIT Press.

Moore, J. F.(1993, May/June). *Harvard Business Review: Predators and prey: a new ecology of competition.* Retrieved from http://hbr.org/1993/05/predators-and-prey/ar/1

Moore, J. F. (1997). The death of competition: Leadership and strategy in the age of business ecosystems. New York: Harperbusiness.

Murphy, J.(2010). The journey to meaningful use of electronic health records. *Nursing Informatics, 28(4),* 283-286.

Murray, A., & Mohamed, M.(2010). Are you ready for the coming knowledge cloud? [Article]. *KM World*, 19(4), 22-22.

National Institute of Health.(2006). *Electronic health records overview.* McLean, Virginia: National Center for Research Resources.

N'Guessen.K.G.(2009) The metaphor of water in Praisesong of the widow, The women of Brewster place and the beloved. *Université de Cocody-Abidjan.*

Nikova, M.K.(2010). Older people: new opportunities of just another limitation? *Russian Social Science Review, 51(4),* 16-33.

Ofstedal, M.B., Chayovan, A. Chan, Y.L. Chuang, A., Perez & A.I. Hermalin.(2001). 'Policies and programs pertaining to the welfare of the elderly', in A.I. Hermalin (Ed.), *The Well-Being of the Elderly in Asia: A Four-Country Comparative Study*, Ann Arbor, Michigan: University of Michigan Press.

Ortony, A.(1993). Metaphor, language, and thought, in *Metaphor and thought.* A. Ortony (Ed.),1–16. NewYork: *Press Syndicate,Cambridge University Press*.

Paneth-Pollak,R., Schillinger, J.A., Borrelli, J.M., Handel, S., Pathela, P. & Blank,.S.(2010). Using STD electronic medical record data to drive public health program decisions in New York City. *American Journal of Public Health, 100(4),* 586-590.

國立政治大學 National Chengchi University

Petrie, H.(1979). Metaphor and Learning, in Ortony, A. (ed.) *Metaphor and Thought* Cambridge: Cambridge University Press.

Poh, A. (2009). Integrating clinical and genomics data. *Bio-IT World, 8(2),* 28-33.

Pool, I.(2000). Age-structural transitions and policy: frameworks. *Paper presented at the IUSSP Conference on Age Structural Transitions and Policy Implications,* November 8-10, Phuket, Thailand.

Radman,Z. (1997). *Metaphors: Figures of the mind*. Boston, Mass: Kluwer Academic.

Ralston, J.D., Revere, D., Robins, L.S. & Goldberg, H.I. (2004). Patients' experience with a diabetes support programme based on an interactive electronic record: qualitative study. *British Medical Journal, 328,* 1-4.

Rodrigues, S.B. (2006). The role of metaphor in an evolving corporate context. *Paper presented at the 22nd European Group on Organization Studies Colloquium,* Bergen, Norway.

Ross, S. E., Moore, L. E., Earnest, M. E., Wittevrongel, L. & Chen-Tan, L. (2004). Providing a web-based online medical record with electronic communication capabilities to patients with congestive heart failure: randomized trial. *Journal of Medical Internet Research,* 6(12).

Rudestam, K.E. & Newton, R.R. (2007). *Surviving your dissertation: A comprehensive guide to content and process.* Thousand Oaks, California: SAGE Publications.

Shield, R.R., Goldman, R.E., Anthony, D.A., Wang, N., Doyle, R.J. & Borkan, J. (2010). Gradual electronic health record implementation: New insights on physician and patient adaptation. *Annals of Family Medicine, 8(4),* 316-326.

Statistics Singapore. (2010). *Key annual indicators*. Retrieved from http://www.singstat.gov.sg/stats/keyind.html.

Stead, W.W. & Lin, H.S.(2009). Computational technology for effective health care: Immediate steps and strategic directions. *Committee on Engaging the Computer Science Research Community in Health Care Informatics. Computer Science and Telecommunications Board, National Research Council.* Washington, D.C.: National Academies Press.

Strauss, A. & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory.* Thousand Oaks, California: SAGE Publications.

Teddlie, C. & Tashakkori, A. (2009). *Foundations of mixed methods research.* Thousand Oaks, California: SAGE Publications.

The metropolitan field guide. (2010). *The hydrologic cycle [Diagram of the hydrologic cycle]*. Retrieved from http://www.metrofieldguide.com/?p=91.

Urowitz, S., Wiljer, D., Apatu, E., Eysenbach, G., DeLenardo, C., Harth, T., Pao, H., & Stead, W.W. (2009). Electronic health records. *Information Knowledge Systems Management,* 119-143.

United Nations population division. (2002). World population aging: 1950 -2050. Retrieved from http://www.un.org/esa/population/publications/worldageing19502050/

Winslow, C.E. (1920). The untilled fields of public health. Science, 51(1306), 23-33.

World Health Organization. (2010). Health expenditure in the world [Data file]. Retrieved from http://www.who.int/nha/en/index.html

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Appendix 1: Intensive Interview Questions

Governing Agency:

1. What are the problems of aging population that the Singapore government foresees in the near future?
2. What are the major concerns regarding Singapore's aging population? What are the plans to counter problems of aging population presently and in the future?
3. Talk about the employment of electronic health records in Singapore. (How wide is the usage of EHR in Singapore? Who are the players and users in EHR? Any policy guidelines or institutional structure in place? What kind of technology is employed presently?)
4. What is the vision of the agency regarding the creation of a truly personalized National Electronic Health Records system?
5. How do you think this personalized health records system can assist in enhancing elderly healthcare in Singapore?
6. What are the problems/concerns encountered as of now in the creation of the National Electronic Health Records system?

Doctors (Hospital):

1. What is your area of specialization?
2. How do you handle patients' medical records presently?
3. Talk about the usage of EHR in your work environment?
4. How do you think EHR can be further improved to better cater to your needs in improving the health services that you provide?
5. What are your views on health problems due to aging population in Singapore?
6. If a personalized electronic health record system is put in place, how do you think it can help you in your job? Advantages and disadvantages? What are the problems you foresee?
7. How do you think this system can assist in reducing acute health care in patients with chronic illness?
8. Do you think a personalized health record system can assist in better health maintenance of the elderly? Why?
9. How much do you think Singaporeans are aware of the importance of health maintenance?

Potential Users:

1. Are you a caregiver to your parents? Or, do you foresee yourself to be one?
2. What kind of assistance do you think will b useful when performing the role of a caregiver? Any concerns?
3. Have you heard of a personalized health records system?
4. How do you think it can help you as a caregiver to the elderly in your family?
5. When do you think you will access the medical records of the elderly whom you are taking care of?

6. What other features do you think you will wish to see in such a system?
7. In terms of your own personal health maintenance, what are your concerns? When do you see a doctor?
8. When do you think you will look into your medical records?
9. What are your retirement plans?
10. Do you think a healthy lifestyle is necessary for successful aging?

*Questions are not exhaustive. Further questions will be asked for during interview for more insights and deeper understanding.

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Appendix 2: Results of research data

a. Collaboration between stakeholders:

Intensive Interviews:

Governing personnel A: *We need data, information of patient in order to make decisions on when they can move down to different care settings and in terms of financing, or what sort of help they may need. Electronic health records is one major and most significant enablers towards integration of care…..*

The vision is that any healthcare givers are able to access the reports, whether govt, private or GPs.

Governing personnel B: *Most work is done in harmonizing system -putting everybody in the same platform. Records can be accessed across different clusters. What lacks is in the private sectors.*

Singaporean A: *I can keep track of my parents' health conditions.*

Singaporean B: *I don't need to repeat the conditions all over again if the medical information is shared.*

Singaporean C: *' It will be good to have a personalized health record system. I can monitor if conditions (health conditions) have improved.*

Singaporean D: *Chronic illness: good to have PHR(personal health record) , can monitor to see if condition has improved.*

Singaporean E: *Allows me to monitor the health of my parents.*

Singaporean F: *If information is easy to understand, it will be useful to keep track of condition.*

Singaporean G: *Will be useful for chronic illnesses, like high blood pressure or heart problems.*

Singaporean H (patient): *Helps me monitor my blood pressure problem*.

Singaporean I (patient): *Monitoring system is a good to have*.

Singaporean J (patient): *I need not redo my medical tests every time I visit a different doctor or hospital.*

Doctor A (Public): *I am not first contact (to patients). Polyclinics can have a good system that is linked to us, that will be good. Now we do have, but the records that we can pull from them are in bits and pieces, not comprehensive. GPs (general practitioners) are not linked to us at all, so we don't know anything, so that is quite bad.*

Doctor B (Private): *A personalized health records saves cost and time in terms of treatment.*

Doctor C (Public): *A personalized health records system can aid in the acute treatment of patients with chronic disease, and prevent unnecessary treatment of chronic conditions.*

Nurse A: *If they are well-tuned with their own health, they can monitor on their own. Some procedures like taking their own blood pressure can be done by the patients themselves, and*

if simple information can be made accessible to patients, they can use them for their own reference.

Archival documents:

Article 1(speech): *There should be better integration of services between the hospitals, polyclinics and other community care providers. As chronic care require many healthcare professionals to work in teams, the sharing of medical records is critical. Technology has now enabled us to this, though rolling it out nation-wide will take a few more years. We will make it happen and bring real benefits to both the patients and the providers. This will transform the way we deliver care to patients, achieving better care coordination and disease management. It should translate into better health outcomes for our patient',*

Article 2: *enable our patients to move seamlessly across different institutions. Integration of care is critical so that we can care for patients in the most appropriate setting at lowest cost. To facilitate smooth patient transitions, we need to strengthen collaborative partnerships between primary care, hospitals and the long-term care sector. For the frail elderly in particular, a multidisciplinary approach with close collaboration between doctors, nurses, allied health professionals and social workers is essential, given their multi-faceted needs.*

Article 3: *We aim to engage and motivate patients into taking responsibility of their own condition.*

Article 4: *enabling the doctors and nurses to gain instant access to patients' medical history. What medical illness is the patient suffering from? Which medication is he on? Is his diabetes under control? Has he been immunised against seasonal flu? Is it time for him to undergo an endoscopy? What is his family history? What is his drug allergy? Access to this information allows the doctors to make timely decisions and interventions. It also reduces the likelihood of human error.*

Nurses now play key roles as care managers in the management of patients with chronic diseases, in partnership with the doctors. For example, they teach the diabetics to monitor their blood sugar every day, so that they are reminded of the importance of their daily diets. The case managers are trained with appropriate skills to engage and motivate patients into taking responsibility for their own conditions

Article 5(Speech by MOH): *we need to build up capacity, including new community hospitals (CH), nursing homes and train more skilled manpower. Community hospitals play an important role in helping some patients transit from their acute hospital stay to their return home. Timely and appropriate CH care - results in lower re-admission rates and improved quality of life for patients, especially our elderly.*

Article 6: *So far, our "many-helping-hands" approach to community care has served us well to deliver affordable services. Going forward, the Government may need to play a more active role in the design of services and the integration of care. Our objective is to enable our patients to move seamlessly across different institutions. Integration of care is critical so that we can care for patients in the most appropriate setting at lowest cost.*

Article 7: *With collaborative effort, elderly care can be enhanced.*

Article 8: *Efforts have been made to strengthen collaboration between stakeholders in public healthcare.*

Article 9: *To facilitate smooth patient transitions, we need to strengthen collaborative partnerships between primary care, hospitals and the long-term care sector. For the frail elderly in particular, a multidisciplinary approach with close collaboration between doctors, nurses, allied health professionals and social workers is essential, given their multi-faceted needs*

Article 10: *The development of the non-acute sectors is crucial to greatly enable integrated care to happen. We have all gradually come to the realisation that acute-centric, hospital-based systems are not sustainable solutions to cope with rapidly ageing populations and the increasing prevalence of chronic diseases. Having strengthened the entities in the non-acute sector, the focus of our efforts and of this conference is to discuss how the providers can come together to provide coordinated, coherent, high quality care. The end-goal is to create an environment where Singaporeans can move seamlessly across providers, without repeated testing, duplicative care or falling through the cracks. This will allow chronically-ill patients, frail elderly and even the well to receive the care and attention they need, where they need it the most, at a price that they can afford.*

b. Primary Care

Intensive Interviews:

Governing personnel A: *We need a person who is coordinating the care and this person has to be a well-trained family physician. Because the aliment health problems of an elderly patient can be broadbased and wide, you will need a doctor who has the breadth and knowledge. One of the key thrust is to strengthen primary care sector. in order for the family physician to take good care of the patients' health, financing have to be done right too because today seeing a GP don't have incentive to look at more complex diseases compared to cough and cold in the profit-maximization point of view.*

Governing personnel A: *Allow GP to see a lot of patients and also empower patients. More efficient and scale up homecare a lot more.*

Governing personnel B: *Most of the elderly will have health conditions that require long-term chronic care, rather than short-term acute hospital care. GPs and polyclinics will play important roles in the care of the elderly sick.*

Our primary care is not accessible. After 9pm, can't find a GP easily, so people turn to A&E.

Public need to know their alternatives .This is a major gap.

Singaporean F: *If I cut my finger, where can I go other than A&E? I don't trust GP to give the right care.*

Singaporean H: I *go to the hospital for major injuries or medical care. Don't think GPs has the capability.*

Singaporean J: *My family goes to GP only for minor illnesses, like cold.*

Archival documents:

Article 5 (Speech by Minister of Health): *Most of the elderly will have health conditions that require long-term chronic care, rather than short-term acute hospital care. GPs and polyclinics will play important roles in the care of the elderly sick.*

Article 8: *We have to begin reaching out to the GPs and exchanging electronic medical records with the community hospitals.*

c. Familial support (including domestic help enhancements)

Intensive Interviews:

Governing personnel A: *If home care can be developed, it can actually lessen the burden and support aging in place which is essentially what people aspire to – nobody wants to age and die in a place away from home. Additional healthcare support to be delivered in homes will go a long way.*

Governing personnel B: *There is a possibility of training the domestic workers to support the care because Singapore is in a unique situation because Singapore is in a high density of housing and high dependency on domestic foreign helpers. Some of them are well-educated in home country. They can be trained to take care of the elderly more*

Singaporean B: *Agree that family support is crucial in eldercare. Children of the elders have the responsibility.*

Singaporean D: *In an asian culture, elderly would not want to be left alone in nursing homes. The company of family is equally important of an ill elderly. Domestic helpers are important assistance for elderly care at home.*

Singaporean E: *Home care with chronic problem - best managed at home. Healthcare cost will be lesser. Healthcare is usually standard, not variation, will save time and save money. Patients will prefer to be at home. Help from domestic helpers can assist in elderly care too.*

Singaporean G*: smaller family structure is an issue. In the past , it is duty of family but it becomes more difficult going forward. Social safety net has to be strengthened so that the younger population feel less pressured. Family support is huge direction towards healthcare in future*

Singaporean I: *Home is usually best preferred. Family ties is important.*

Doctor B: *Domestic helpers - not professional medical helpers. They are not trained. It is not appropriate in specific cases*

Doctor C: *Family support is important since we also have to take care of the emotional needs (of the elderly)*

Nurse B: *family support is a huge direction towards elderly healthcare in the future' and 'chronic problems are best managed at home as healthcare is usually standard without much variation, which will hence in turn save time and money. Also, patients prefer to be at home and we don't expect a patient to be back in hospital every 6 months for a diabetic problem. Help from domestic helpers can be useful.*

Archival documents:

Article 4: *The priority of our healthcare institutions should be to get patients well again so that they can go home. To make this happen, acute hospitals, community hospitals and nursing homes are thinking hard about helping patients maintain contact with their families by explaining the patient's care plans and goals, facilitating family visitations and home leave arrangements.*

Article 10*: enhance the home care sector. My Ministry currently supports several home care services, including home medical, home nursing, rehabilitation, and dementia day care services. As the next step, we are working with the stakeholders to develop viable models to deliver more coordinated and integrated healthcare services to the home. We recognise that the caregiver is the key to successful home care. Nevertheless, we need to recognise that there are limitations of home care, brought about by smaller family sizes and frailty from increasing life expectancy. We will have to be realistic and recognise that home care may not be for everyone, given that the home care model can be relatively expensive and skills-intensive.*

d. Awareness in health maintenance and transparency in information

Intensive Interviews:

Governing personnel A: *patients have to play a huge role because driver of diseases is lifestyle driven -eg. factors such as lack of exercise, obesity are really major causes of such diseases. There is only so much that government and doc can do. Patients need awareness and motivation to change. So part of the purpose of a PHR is that patients have a bigger awareness of his or her own health. System to support patients who really want to change his/her own behavior.*

Doctor A: *Singaporeans are weak in awareness of health maintenance and preventive medicine. They don't want to change their lifestyle. While Singaporeans are supposedly well-educated, they are still not aware. People still smoke, drink and their diet is quite bad. There is a strong lack in awareness*

Doctor B: *Healthcare is not cheap. A lot of time patients don't know about the resources for help because many of them are illiterate. Usually picked up by doctors and nurses, then referred to social workers. Cost is afloat. Difficult to publish it online. Can give estimate cost and range.*

Doctor C: *Weak in awareness of health maintenance and preventive medicine. They don't wna tot change their lifestyle. Supposedly well-educated Singaporeans, they are still not aware. People still smoke, drink and their diet is quite bad. Lack in awareness.*

Nurse A: *Computer can do trending. Looking at particular results, they can show a visual at a click. Can call up past records easily and can do a graph trending.*

Nurse B: *Patients usually sees a doctor only when they are sick.*

Website to key in information and auto-tabulate cost of medical fees. Currently there is a patient service centers to assist the patients. Help them tabulate medical costs and subsidies they can use.

To come out from own pocket to maintain health is difficult. They will consult doctors only when an illness arises. This results in a problem for the rampant acute treatment in hospitals

Singaporean A: *Finance wise is a big concern. Insurance is important, especially on critical illness. A PHR is only a record for the doctors. It don't seem to have any use for the patients*.

Singaporean B: *I don't really care on maintenance and prevention. For my parents, only when there arises a condition then will I monitor. But at that point of time, it will be more personal already.*

I will go into the info only when a condition happens

Singaporean C: *I don't really care on maintenance and prevention. For my parents, only when there arises a condition, then will I monitor*

Singaporean D: *Regular checkups. I don't think the system can help me! Just reminder to go for medical checkup.*

Singaporean E: *As a (home) caregiver, I will wish to know which hospitals or doctors are good at cure of any dieseases. These information should include reviews from patients or feedback from doctors. Current situation is such that we will ask aroung which doctor or hospital is good, or go online to look for specialists. If there is a credible souce that can give treatment recommendations, it will be helpful*

Hospital operations can be more transparent. Hospitalization costs are important information also. Direct calculation of hospitalization cost, use of medicar , insurance etc and how much must I fork out. Now, you know the cost only after hospitalization and care.

Singaporean F: *Self: when I am sick then I go to a doctor. Parents side: also when they are sick.*

Singaporean G: *Better don't find out. I am a little extreme. As for parents, I will encourage them to go for medical checkups. I will be part of the caregivers in an event for parents' falling ill.*

Singapore H: *Cost of the illness, type of treatment they will give. Recommended treatment to followup. Information on diagnosis and treatment. The cost and type of treatments line up together. Whether locally have the expertise or not. Singapore is not transparent in terms of hospital information.*

I find that the information that they will tell me after treatment, but can't find the information easily.

Singaporean J: *Singapore is not transparent in terms of hospital information - Information like cost of treatment, information on diagnosis and recommended treatment to follow-up. I fint that they will tell me the information only after treatment.*

Archival documents:

Article 6: *'We want to keep Singaporeans healthy so that they do not come into the high cost acute sector. Other than Health Promotion Board's prevention and education efforts, we are helping Singaporeans detect and treat diseases early through health screening, in GP clinics and in the community such as at NTUC's Wellness Centres. Our Restructured Hospitals are helping the frail elderly and patients with chronic diseases manage their medical conditions better so that they stay well.*

Article 10*: We want to keep Singaporeans healthy so that they do not come into the healthcare system in the first place, especially the high cost acute sector. Other than Health Promotion Board's prevention and education efforts, we are helping Singaporeans detect and treat diseases early through health screening, in GP clinics and in the community such as at NTUC's Wellness Centres. Our Restructured Hospitals are helping the frail elderly and patients with chronic diseases manage their medical conditions better so that they stay well.*

e. Improved efficiency and accuracy in healthcare with seamless transfer of care

Intensive Interviews:

Doctor A: *there is no need to repeat medical history from one hospital to another, making (transfer of care) easier and more convenient.*

Doctor B*: It is a time-consuming process to assess whether each patient can afford.*

Doctor C: *It will b easy for us to know the condition to do own research. IT will also be easy for us to tell another doctor what is happening. It improves miscommunication.*

Nurse A: *We will be able to retrieve patient information from other hospitals or from A&E, prior to retrieval of the casenotes. This would be beneficial for the immediate management of the patients in emergency situations.*
Advantages: wider access of notes, increased legibility of notes

Singaporean A: *Would wish that doctors can also readily access medical information.*

Singaporean C: *if everybody has a single source of information, they don't have to tell again and again what is the problem.*

Singaporean E: *There is no need to repeat medical history from one hospital to another. Easier and more convenient. A centralized database. Information also includes hospitalization history and which doctor attended to you.*

Singaporean F: *If everybody has a single source of information, they don't have to tell again and again what is the problem. Even within the institution there is this pertinent problem.*

Singaporean G: *It will b easy for us to know the condition to do own research. IT will also be easy for us to tell another doctor what is happening. It improves miscommunication.*

Archival documents:

Article 2: *To facilitate smooth patient transitions, we need to strengthen collaborative partnerships between primary care, hospitals and the long-term care sector. For the frail elderly in particular, a multidisciplinary approach with close collaboration between doctors, nurses, allied health professionals and social workers is essential, given their multi-faceted needs*

Article 3: *healthcare providers no longer need to shuttle individual paper records to and fro, reducing unnecessary repeat tests and ensure improved safety and continuity of care for the patients'* with *'no more problem with misplaced medical records or bad handwriting.' , 'We are enabling the doctors and nurses to gain instant access to patients' medical history. What medical illness is the patient suffering from? Which medication is he on? Is his diabetes under control? Has he been immunised against seasonal flu? Is it time for him to undergo an endoscopy? What is his family history? What is his drug allergy? Access to this information allows the doctors to make timely decisions and interventions. . It also reduces the likelihood of human error.*

Article 4: *no more problem with misplaced medical records or bad handwriting…making care here safer and better*.

Article 5: *the Government may need to play a more active role in the design of services and the integration of care. Our objective is to enable our patients to move seamlessly across different institutions. Integration of care is critical so that we can care for patients in the most appropriate setting at lowest cost.*

Article 6*: better integration of services between the hospitals, polyclinics and other community care providers. As chronic care require many healthcare professionals to work in teams, the sharing of medical records is critical. Technology has now enabled us to this, though rolling it out nation-wide will take a few more years. We will make it happen and bring real benefits to both the patients and the providers. This will transform the way we deliver care to patients, achieving better care coordination and disease management. It should translate into better health outcomes for our patients.*

Article 7: *Healthcare providers no longer need to shuttle individual paper records to and fro, reducing unnecessary repeat tests and ensure improved safety and continuity of care for the patients.*

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Article 9: *The end-goal is to create an environment where Singaporeans can move seamlessly across providers, without repeated testing, duplicative care or falling through the cracks. This will allow chronically-ill patients, frail elderly and even the well to receive the care and attention they need, where they need it the most, at a price that they can afford.*

f. Intermediate care sectors

Intensive Interviews:

Governing personnel B: *they need to raise nursing standards in the nursing homes, to deal with increasingly complex needs of the elderly, including caring for elderly with dementia. For community hospitals, they need to develop stronger medical capabilities to manage more complex sub-acute cases, so that we can discharge patients from there helping patients to save, and to help free up more beds.*

Doctor B: *family members may not have the expertise to take care of the elderly patients. Intermediate care is necessary*.

Doctor C: *Intermediate care units such as nursing homes still play an important role in elderly care. Cannot be neglected.*

Archival documents:

Article 2: *enhance the home care sector. My Ministry currently supports several home care services, including home medical, home nursing, rehabilitation, and dementia day care services. As the next step, we are working with the stakeholders to develop viable models to deliver more coordinated and integrated healthcare services to the home. We recognise that the caregiver is the key to successful home care. Nevertheless, we need to recognise that there are limitations of home care, brought about by smaller family sizes and frailty from increasing life expectancy. We will have to be realistic and recognise that home care may not be for everyone, given that the home care model can be relatively expensive and skills-intensive.*

Article 8: *The Ministry(of Health) currently supports several home care services, including home medical, home nursing, rehabilitation, and dementia day care services. As the next step, we are working with the stakeholders to develop viable models to deliver more coordinated and integrated healthcare services to the home. We recognise that the caregiver is the key to successful home care. Nevertheless, we need to recognise that there are limitations of home care, brought about by smaller family sizes and frailty from increasing life expectancy'*

Article 10: *we need to build up capacity, including new community hospitals (CH), nursing homes and train more skilled manpower. Community hospitals play an important role in helping some patients transit from their acute hospital stay to their return home. Timely and appropriate CH care - results in lower re-admission rates and improved quality of life for patients, especially our elderly.*