E-healthcare in Taiwan

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Abstract: The proliferation of the internet has enabled many distance services that would not have been available otherwise. One of them is e-health. Many services in healthcare such as medical advice and distance diagnosis can be delivered over the internet. Providing healthcare services over the internet electronically is called e-health. The purpose of this study is to investigate e-health in Taiwan. A survey of websites for e-health was conducted to examine the available services and their development. The results indicate that e-health services include contents for physicians, contents for patients, e-commerce applications and e-care to patients. Among them, disease information and patient advising were the most popular functions (about 90% of the sites provide them), whereas e-commerce was less popular (less than 20%). The results are interpreted by the transaction cost and other models.

Keywords: Electronic commerce; e-health; web-based systems.

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1 Introduction

Electronic commerce and web-based applications have grown substantially in the past several years. It is generally understood that the internet is going to change the nature of many businesses. Healthcare that provides services to patients is no exception. The internet is considered capable of supporting interactive communication and distance treatment in the healthcare sector. *E-health* that delivers healthcare services over the internet is changing business and medical practice and affecting every facet of healthcare. For example, health providers may adopt internet technology to support their operations. Hospitals can build their websites to expand their reach to their patients. They can also integrate the internet into their internal health information systems to improve operational efficiency. E-health companies that operate only on the internet are also emerging in the virtual world.

Proper use of the internet can create two major lines of benefits: one is related to patient care itself and the other is related to the supportive operations such as claim processing and hospital administration. For example, a number of healthcare providers, including the Mayo Clinic and Johns Hopkins Hospital, have either partnered with commercial contents providers or spun off their own websites to meet patient demand for healthcare information and to provide physicians with a resource into which they can comfortably channel their patients. Two of the largest hospital chains, Tenet and Columbia/HCA, got involved in separate e-procurement companies to solicit their hospitals' online purchasing business [1].

Due to this international trend, an increasing number of healthcare services are available online in Taiwan. A recent survey on internet usage indicates that internet users in Taiwan have reached 5.57 million (about 25% of the population) and more than 15% of internet users look for healthcare information [2]. Although the numbers are not very impressive compared to 43% of internet users looking for healthcare information in the USA [3], the development of e-health in Taiwan has grown rapidly in the past three years [4].

In order to understand the healthcare services available online in Taiwan, we conducted a web-based survey. The observations are organised into a framework that classifies e-health functions and contents. Explanations of why certain functions are more popular than others based on the transaction cost theory and other e-health development models are provided. The findings allow us to have a thorough understanding of the status of e-health in Taiwan. The rest of this paper is organised as follows. First, the nature of e-health and its evolution are reviewed. This is followed by a framework for classifying web-based healthcare services. The research method of this study is then described. Finally, research findings are presented and discussed.

2 Development of e-health

The internet is a powerful media through which digital services can be provided more efficiently and effectively. It provides four levels of support: information, interaction, transaction and transformation. In this section, we review the scope of e-health and its application levels.

2.1 The scope of e-health

Healthcare is a large sector that involves many players such as patients, physicians, nurses, other care providers, healthcare provider organisations, healthcare payers, regulatory agencies, pharmacies, labs and healthcare information vendors [1]. As e-health refers to electronic exchange of healthcare data or information across organisations and electronic delivery of certain services, its scope may be described by four Cs: connectivity, content, commerce and care.

2.1.1 Connectivity

The first level of service, which is also the foundation of e-health, connects different parties electronically for easy reach. Valuable information, new service, patient care and transactions can then be built on top of it. The internet offers an excellent channel for doing so.

For example, connecting health providers and insurance companies allows claims to be processed over the internet to improve efficiency. It reduces billing and reimbursement costs. Hill Physicians Medical Group (Hill), a large California practice association, automated nearly half of their claims volume within one year and reduced their per claim processing cost by nearly 40% after implementing an internet-based claims submission system. Another application is sharing medical records. Holy Grail transformed its paper-based medical records into electronic medical records (EMR) that are potentially accessible to all necessary providers and possibly to the patients [5]. Traditionally, each health provider writes and preserves a separate medical record. This often causes problems when patients transfer from one hospital to another. Internet-based EMR can simplify the process of record sharing and reduce redundant paperwork, unnecessary treatments and medical errors. Unless involving parties are connected, other higher-level services would not be possible. Therefore, connectivity is the foundation of e-health.

2.1.2 Content

The major value of e-health is the data and information available on the internet. They offer to individuals (and patients in particular) the possibility of investigating almost any topic of interest and to compare data from many different sources [6]. The provision of medical and health information not only improves the information asymmetry between physicians and their patients, but also reduces the load of physicians. As a physician of the University Hospital in Cleveland, Ohio, reports: "when you talk to patients about something major (health problem), they may remember 10 percent. The internet allows them to ask questions again and get information that was hard to get without access to a medical library" [7].

Now, most healthcare organisations have provided general health information on the internet to add value for their consumers. Some websites also allow consumers to register and get interactive advice from healthcare providers [8]. Moreover, some patient-oriented websites contain information relevant to the patient's understanding of the medical process, including diagnosis and differential diagnosis, treatment and its side effects and methods of follow-up, including regular monitoring tests, the natural history of the disease and its prognosis [7].

Medical professionals can also use world wide web (WWW) to obtain up-to-date information, or to exchange data and knowledge. For example, the WebMD Practice built by WebMD.com provides professional information as well as administrative and clinical services online. The content offered by the WebMD Practice includes online access to medical journals, practice guidelines, an online program for continuing medical education (CME), business training for practice management and virtual community.

2.1.3 Commerce

The third kind of service available in e-health is transaction and electronic commerce. In the past few years, online transactions enabled by the internet have been booming very fast. Broadly defined, electronic commerce is a modern business methodology that addresses the needs of organisations, merchants and consumers to cut costs while improving the quality of goods and services and increasing the speed of service delivery [9]. There are three distinct classes of electronic commerce applications: inter-organisational business-to-business (B2B), intra-organisational (within business) and business-to-consumer (B2C) [10]. In e-health, electronic commerce is referred to as conducting supportive services that allow efficient operations of healthcare organisations and financial transactions over the internet [1].

From the perspective of B2B e-commerce, the internet can facilitate medical-surgical purchasing, administrative and clinic services online. A large hospital may buy thousands of items in a year, including pharmaceuticals, medical-surgical supplies, radiology and laboratory supplies, medical devices, cleaning and laundry supplies and services etc. E-procurement will significantly save supply chain costs for institutional buyers. Two types of procurement models exist. One is electronic supply chain, while the other is e-marketplace. Supply chain is necessary if a group of suppliers maintains a more dedicated relationship. Electronic marketplace allows more unsolicited players to join the market. For example, Neoforma.com announced that they had undertaken to provide e-commerce services to 6,500 healthcare organisations. Some commercial e-health companies had built e-marketplace to facilitate transactions for suppliers and institutional purchasers. For instance, Medibuy.com and Channelpoint.com concentrate on information about health related products and services from multiple providers and allow the buyer to search, order and complete the transaction on their websites.

There are also many B2C opportunities for web-based e-commerce in healthcare. Health-related products and services likely to be sold widely over the web include: repeat prescription drugs, over-the-counter drugs, durable medical equipment, vitamins and homeopathic medicines and home fitness equipment. Health insurance also can be sold over the internet [11].

2.1.4 Care

On top of the above services is the ultimate application of e-healthcare: *telemedicine.* Telemedicine is defined as the use of electronic health data or image to support the practice of medicine from a remote location [1]. With little regulation in place yet, some healthcare consumers and providers are venturing into this new territory by dispensing health advice online and even prescribing pharmaceuticals for a fee. Although prescribing drugs over the internet is controversial, online consultation for patients

seeking Viagra is already available through websites such as viagrapurchase.com with a 48-hour delivery of pharmaceuticals [11].

Technology has also realised internet-based treatment that allows patient monitoring from a remote place, makes distance treatment and computerised health records. With electronic medical records, patient information can be accessed on a real-time basis for diagnosis and treatment. Making patient records internet-accessible may allow patients to preserve and be aware of their medical records. For example, Drkoop.com encourages consumers to keep track of their health histories and to manage their own health status.

2.2 The adoption and evolution of e-health

As trading partners convert to new internet-enabled systems, new types of competition for patients emerge. As cost reductions and process efficiencies prove out, healthcare organisations will face increasing pressure to adopt e-health in multiple areas. DeLuca and Enmark observed the development of e-health and proposed an adoption model that identifies characteristics of early, mid-stage and advanced stage for direct healthcare providers to transform into e-health. Table 1 summarises the functions at each stage. As shown in the Table, early e-health adopters tend to focus on business process automation (such as electronic claims submission), static information presentation (a basic website), or a pilot telemedicine effort. Mid-stage adopters have generally developed business automation and static capabilities and look for opportunities to extend and build on what they have already invested. Advanced adopters have either been through the cycle of early and mid-stage activities, or are willing (or required) to accept the risks inherent in embryonic, high-risk, high-payback technology development and management [1]. This model helps healthcare organisations to position themselves in e-health development and to find a better way of adopting e-health technologies.

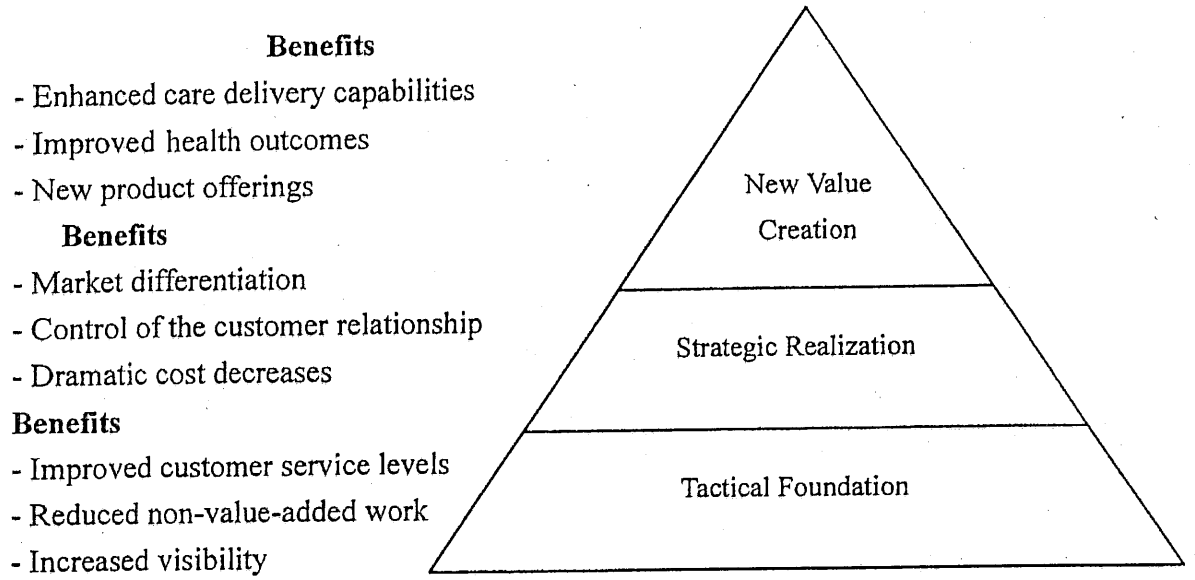
Table 1 Characteristics of three different adoption stages

Stage	*Early*	*Midstage*	*Advanced*
General approach to e-health	• Static presentation of information • Direct automation of exiting processes	• Process changes combined with more advanced technological support	• Integration of e-health processes and technologies.
Business applications	• Inventory and supply chain management. Employee benefits and recruiting functions online • Electronic claims submission	• Electronic referrals/ authorisations • Electronic claims status checks	• Trading partners can check receivables status via corporate extranet
Clinical applications	• Website offers 'find a physician' or 'specialist' capabilities	• External access to healthcare organisation intranet/extranet for associated MDS • Electronic orders and results	• MD-to-MD secure messaging • Clinical continuing education/ distance learning
Consumer applications	• Static web-based presentation of information	• Limited interactivity; • Subscriptions to newsletters available	• Consumer/patient access to scheduling; scheduled appt • EMR

Source: Adapted from Deluca and Enmark [1]

From the strategic perspective, Lanser proposes a three-stage e-health transformation model for healthcare organisations, as shown in Figure 1. In the first stage, internet technology is used to create a tactical foundation that can serve as a platform to launch a more comprehensive e-health strategy. In stage 2, organisations should use the internet to provide more than static information by including mechanisms for interactive communication. In the final Stage, the promise of internet technology is fully realised and the healthcare experience is transformed on every level with new product offerings and new approaches to care delivery [3]. Healthcare organisation leaders can use this model to develop their strategies and to maximise their benefits in healthcare's e-volution.

Figure 1 Stages of e-health transformation



Source: Adapted from Lanser [3]

Liang and Huang [12] develop a consumer choice model based on the transaction cost theory, which allows us to evaluate which healthcare related products and services are suitable for electronic markets and why they are suitable. The consumer choice model asserts that customers who choose the channel that minimises their transaction costs are affected by transaction characteristics such as uncertainty and asset specific. This model can help us better understand why certain services are more popular than others.

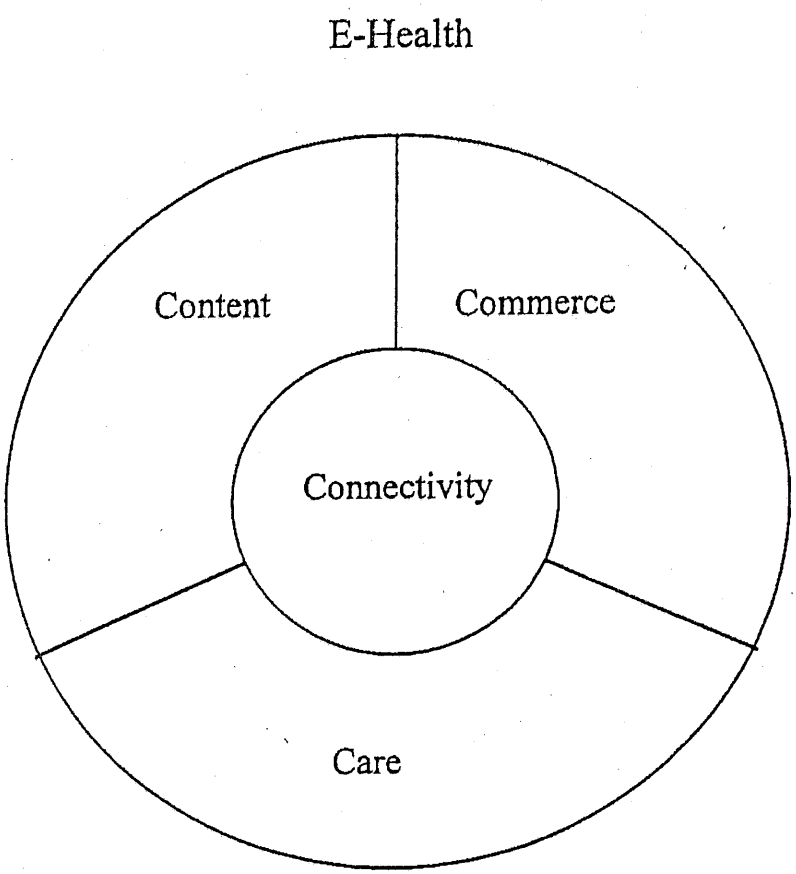
3 A framework for service classification

To summarise the scope of e-health and the possible services in each category, a framework as shown in Figure 2 is used to analyse e-health in Taiwan. The Figure shows that the core of e-health is internet connectivity, which supports content, commerce and care of e-health, where:

- Content is the provision of health and care related information.
- Commerce includes functions for processing business transactions.
- Care includes conducting treatments or care to patients.

Connectivity provides the infrastructure for content-related services. It includes site availability, security and privacy issues. Since most sites were easily accessible through the internet, we did not find availability to be a problem. Security and privacy issues are discussed separately. In the following discussion, possible services in content, commerce and care are summarised.

Figure 2 The scope of e-health



3.1 Content

Information available from e-health sites can be categorised into two types: information for patients and general public (consumers) and information for professionals (physicians). The following are available contents.

3.1.1 Content for physicians

1 Medical news (NEWS).
2 Online access to a wide range of clinical references and medical library (REF).
3 Online programs for continuing medical education (CME).
4 Virtual community or Bulletin Board System (BBS) for communications (Comm).
5 Subscription to newsletters (Lett).
6 Connection to drug database (DDB).
7 Employment opportunities (EMP).

3.1.2 Content for patients and general public

1 Information about health and disease (Disease).

2 Virtual community or BBS for communication (Comm).

3 Health records management (HRM).

4 Subscription to newsletter (Lett).

5 Making an appointment with a doctor (Appoint).

6 Online health evaluation and health education program (HEDU).

3.2 Commerce

3.2.1 B2B e-commerce: two types of B2B e-commerce exist:

1 Supply chain management that connects to suppliers (SCM).

2 E-marketplace that provides centralised transactions for multiple providers and purchasers (EM).

3.2.2 B2C e-commerce: six types of services are available:

1 Online repeat prescription (Rx).

2 Over-the-counter (OTC) pharmaceuticals.

3 Online care service supplies ordering (Supp).

4 Online auxiliary equipment sales (AUX).

5 Online vitamins and supplements sales (VITAMINS).

6 Online insurance sales (INSURANCE).

3.3 Care

1 Patient monitoring (MONIT).

2 Distance treatment (TREAT).

3 Disease and treatment advice (ADVICE).

The above framework covers existing services available in e-health. We use it to analyse the functions provided by the e-health sites in Taiwan. Security and privacy issues are important for maintaining quality connectivity [13].

4 Research methodology

The e-health providers in Taiwan include medical centres and e-health companies. In this study, 13 medical centres and eight major commercial e-health companies were chosen for analysis. Since e-health is provided through web pages, the functions and contents

present on a website are a good representative of what the company is offering. Therefore, the study was performed on the selected websites.

Content analysis was used in the study. Content analysis is a systematic, quantitative scientific method which has been for measuring the content of messages for centuries [14,15]. After analysing 19 studies that apply content analysis techniques to the WWW, McMillan found that this research technique could be applied to a dynamic environment [16].

The development of a comprehensive and mutually exclusive categorisation scheme by which individual recording and context units are described is the single most important component of content analysis [15]. The framework of e-health service classification (see Figure 2) is used as our categorisation scheme. All functions and related content in the web pages were explored in sufficient detail to ensure accuracy. The observed features were recorded.

In content analysis, consistent coding has a significant effect on the reliability of the findings. Coding of web-based content is no different except that researchers must take a number of added precautions due to the complexity and volatility of web-based content. If websites are checked at different times by different coders and/or if the context unit is not clearly defined, error could be introduced [15]. Wassmuth and Thompson's method is to let a task to be performed at a site and have two coders perform that identical task at exactly the same date and time [17]. In our study, two coders were trained using web pages of an e-health company and a medical centre before actual coding. If a disagreement was found, they would discuss and resolve it before moving on. To avoid the volatility of web pages, we carefully scheduled the coders to view the same websites in the same day. The inter-coder reliability that reflects the judgement of two coders being determined nonrandomly is above 90% (based on the formula by Holsti [18]).

5 Findings from the survey

The survey results indicate that, although most of the e-health functions are already available in Taiwan, their popularity differs. In general, websites medical centre provided more information than virtual e-health sites. Information for patients was more popular than that for the physician. E-commerce is still not very common in Taiwan, but most websites provide advice for medical care.

5.1 Content services

5.1.1 Content for physicians

Statistics about the information provided to physicians are shown in Table 2. As we can see, clinical reference and medical library were the most popular function (67% of sites). Medical news and employment opportunities ranked second and third. Connection to the medical database and subscription to an electronic newsletter were the least popular ones. In fact, none of them offered electronic newsletter to physicians. This may be because physicians are not used to acquiring medical information through e-newsletters. Two commercial e-health companies had special portals for physicians and provided a wide range of medical journals and reference literature.

Table 2 Statistics of websites that provided content for physicians

Types of contents	*e-health sites (Sample=8)*		*Medical centre sites (Sample=13)*		*Total (Sample=21)*	
	No.	*Ratio*	*No.*	*Ratio*	*No.*	*Ratio*
REF	2	25%	12	92%	14	67%
NEWS	3	38%	10	77%	13	62%
EMP	0	0	11	85%	11	52%
CME	1	13%	3	23%	4	19%
Comm	1	13%	1	8%	2	10%
DDB	1	13%	1	8%	2	10%

5.1.2 Content for patients

Statistics about the information for patients are summarised in Table 3. Most e-health websites offered free information such as medical news, diseases and e-newsletters. Some websites provided online health assessment and online health education programs. One commercial e-health company, d-health.com, declared that they had a health record management system online. Users were allowed to save their personal health records in the system. The health record management system would dynamically trace and report their health status to the user.

The most popular services provided on the websites of medical centres were diseases and health information, appointment with doctors, online health assessment and health education programs. All medical centres offered free health and disease information. All, except one, had an online appointment service. A special function offered by five medical centres was the virtual community that allowed patients to interact with physicians and other patients online to discuss various issues of concern.

Table 3 Statistics of websites that provided content for patients

Types of contents	*E-health sites (Sample=8)*		*Medical centre sites (Sample=13)*		*Total (Sample=21)*	
	No.	*%*	*No.*	*%*	*No.*	*%*
Disease	6	75%	13	100%	19	90%
Appoint	0	0	12	92%	12	57%
HEDU	3	38%	8	62%	11	52%
Lett	6	75%	1	8%	7	33%
NEWS	6	75%	0	0	6	29%
Comm	2	25%	5	38%	5	24%
HRM	1	13%	0	0	1	5%

5.2 Commerce applications

5.2.1 B2B e-commerce

Among the 21 websites surveyed in the study, only four employed B2B e-commerce. Interestingly, the virtual e-health sites only adopted the e-marketplace mechanism, while the websites of medical centres only adopted the supply chain management (see Table 4). The reason that pure e-health providers adopt e-marketplace may be because this mechanism gives them more flexibility in connecting to various pharmacies, clinics and other associated agencies. The medical centres, on the other hand, use supply chain management to maintain existing relationships with certain suppliers.

Table 4 Results of B2B e-commerce

Types of B2B	*E-health sites (Sample=8)*		*Medical centre sites (Sample=13)*		*Total (Sample=21)*	
	No.	*%*	*No.*	*%*	*No.*	*%*
SCM	0	0	2	15%	2	10%
EM	2	25%	0	0	2	10%

5.2.2 B2C e-commerce

The survey results of B2C e-commerce are shown in Table 5. As we can see, online sales of healthcare related products were not very common. Among the pure e-health sites, only one sold auxiliary equipment and another sold vitamins and other supplements. The two medical centres that provided online B2C services were the Veterans General Hospital and the Buddhist Tzu-Chi General Hospital. The Veterans General Hospital allowed online processing of home care services. It organised physicians, nurses, social workers and related professionals into groups to provide homecare to special patients who needed to stay at home. The patients could use the internet to request necessary services. The Buddhist Tzu-Chi General Hospital allowed auxiliary equipment such as rolling chairs, hearing aids and special shoes for diabetic patients.

Table 5 Results of B2C e-commerce

Types of B2C	*E-health sites (Sample=8)*		*Medical centre sites (Sample=13)*		*Total (Sample=21)*	
	No.	*%*	*No.*	*%*	*No.*	*%*
AUX	1	13%	1	8%	2	10%
Supp.	0	0	1	8%	1	5%
VITAMINS	1	13%	0	0	1	5%
Rx	0	0	0	0	0	0
OTC	0	0	0	0	0	0
INSURANCE	0	0	0	0	0	0

Other B2C e-commerce applications, such as online prescriptions, OTC pharmaceuticals and insurance that were found in the e-health sites in the USA were not found in Taiwan. This may be due to different regulations or the nature of different countries and their cultures.

5.3 *Online care services*

Among the three types of care services, providing medical advice was the most popular. Eighty-eight percent of the e-health sites and 92% of the medical centres provided this service. Distance treatment and patient monitoring were available from medical centres but not from pure e-health sites (See Table 6). The general format for providing advice is through email account or online question-and-answer functions that allow patients to ask questions and get answers from physicians over the internet. Three medical centres offered distance treatment through which physicians diagnosed patients using the image transmitted on the internet. Two medical centres used the internet to transmit patient monitoring data to watch their status.

Table 6 Different types of online care

Types	*Commercial health sites Sample=8*		*Hospital websites Sample=13*		*Total Sample=21*	
	No.	*%*	*No.*	*%*	*No.*	*%*
ADVICE	7	88%	12	92%	19	90%
TREAT	0	0	3	23%	3	14%
MONIT	0	0	2	15%	2	10%

Security and privacy issues are essential for e-health. Most of them have firewall protection. Some B2B websites claim that the transaction data will not be released. Authentication and protection at the Secure Socket Layer (SSL) are the most popular security mechanisms adopted by e-health sites.

6 Discussion and conclusion

The survey results provide us with much insight into the current status of e-health in Taiwan. Although e-health in Taiwan is still at an early stage, it evolves rather quickly. Most of the websites focus on providing information services in the DeLuca and Enmark Model and the first stage (tactical foundation) of Lancer's Evolution Model. If we rank the services by their availability in the sample sites, the top ones are disease information, medical advice (tie at 90%), clinical reference (67%), medical news (62%), appointment (57%), health evaluation and education and job opportunities (tie at 52%). Except the last, all are focused on patient needs. That is, most e-health sites are designed for patients and as a channel for medical information exchange. This could be because time is still short for the healthcare organisations to offer e-health. Given that the tactical stage is almost complete, the next step should probably focus on e-commerce and e-care.

The reason that e-commerce and online medical care are not popular, even though they are the kernel of medical services, may be explained by the transaction cost theory. Higher level services have higher transaction costs and are hence more difficult to be

transformed to the internet platform. Liang and Huang [12] found that asset specificity and uncertainty were two major factors affecting consumer acceptance of ordering online. The more specific a product is to a particular consumer, the less likely it is that the consumer will order online. Similarly, the higher the risks involved in ordering and using the product, the less likely the consumer will be to order online. Table 7 shows that the availability levels (percentage of websites that offered the services) of different e-services match the transaction cost factors pretty well. The services having relatively lower asset specificity and uncertainty are ranked higher in the Table.

Table 7 Factors affecting service popularity

E-health services	*Specificity*	*Uncertainty*	*Availability (%)*
Disease information	Low	Low	90
Medical advice	Low	Medium	90
Clinical reference	Low	Low	67
News (physician)	High	Low	62
Appointment	High	Low	57
Health evaluation	Medium	Medium	52
Job opportunities	High	Low	52
Newsletter	Medium	Low	33
News (patient)	High	Low	29
Communication (patient)	High	Medium	24
Continuing education	High	Medium	19
Distance treatment	High	High	14
Communication (Physician)	High	Medium	10
Drug database	High	Medium	10
Remote monitoring	High	High	10
E-marketplace	High	High	10
SCM	High	High	10
Health record management	High	High	5

Another factor that may affect the development of e-health in different countries is its cultural and geographical nature. Culturally, patients prefer seeing a physician to ensure that they are treated correctly. Geographically, Taiwan is a small island with more than 23 million people. Hospitals and other healthcare facilities are easily available for most patients. This may prohibit the development of e-health, particularly those services that involve high specificity and high uncertainty. Nonetheless, we still see rapid growth in e-health sites. We can expect that more and more services will be online.

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