

**ASSESSING MALAYSIAN HEALTHCARE
PROFESSIONALS' PERCEPTION AND INTENTION IN
UTILIZING CLOUD COMPUTING MEDICAL RECORD**

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DECLARATION

I hereby declare that:

(1) This GBMZ2016 Research Project is the end result of my own work and that due acknowledgement has been given in the references to all sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

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DEDICATION

Thank to my wife and daughter who endure while i work toward accomplishment of the study for months. The hard work occupied the time which was suppose to be with them. With this i promise to replace with double the love and time.

I would like to thank Mr. Hen Kai Wah for his guidance and support during the planning, execution and writing of this dissertation. Without his help, the study will probably end up to be an ordinary paper without real contribution to the world of science.

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ABSTRACT

Title: Assessing Malaysian healthcare professionals' perception and intention in utilizing cloud computing medical record

The application of cloud computing based medical record is still at the infant stage in Malaysia. This condition is compounded by the fact that healthcare industry typically slow in adopting new technology. However, with the features offered by cloud computing based medical record, the technology is attractive and promising as a prominent technology of future healthcare. Unified Theory of Acceptance and Use of Technology (UTAUT) were well established and developed in the western countries. However, this model is never tested in the context of accessing cloud computing in the healthcare setting, particularly in Malaysia. Patient privacy is expected to be a main consideration when new technology is introduced in handling patient data. Hence, trust is expected to be an important component. Trust component, which has always been left out from the UTAUT might need further exploration. The study aims to assess the validity of UTAUT as a tool to assess the use intention of cloud computing based medical record in healthcare industry of Malaysia. The study also assess the perception of trust and its relation to the cloud computing use intention in patient care. The exploration of the difference between subgroups of participants like general practitioner, doctor working in hospital setting and nurses was carried out. Self-administered questionnaire used to assess the general perception of doctors and nurses about the concept of cloud based electronic medical record application in hospital and clinic. Correlation between the perception and intention was then analyzed using statistical analysis software. Acceptance level of medical professionals is generally high. Concern of patient's data confidentiality appeared to be the main obstacle when adopting the technology. UTAUT is a valid model to assess the perception of medical professionals and predict the use intention. Trust plays an important role and might be included in development of new technology acceptance model which assesses the application of cloud computing technology in healthcare industry.

CHAPTER1

INTRODUCTION

1.1 Background to research

Amazon has been the pioneer in cloud computing since cloud-based services which including storage, computation and human intelligence through the Amazon Mechanical Turk which was introduced in 2002. This development was followed by introduction browser-based enterprise applications by Google which make a significant milestone (Arif, 2009). Owing to Google large customer base(Kolakowski, 2011), Google has the capability to offer an affordable or close to free cloud computing application and yet reliable and secure. Looking at the trend and potential demonstrated by the case of Google, the technology has the potential of benefiting small and medium size healthcare facilities. There is sufficient reason to believe that, cloud computing is able to increase efficiency of healthcare work processes without huge investment in IT hardware. This allows healthcare administrator and medical practitioners to focus more in providing medical care and leave the IT application to

experts in the field. Moreover, the issue of upgrading of the application can be automated and effort free.

These charges would be favourable for the small and medium enterprise because it is charged as per use or monthly basis(Iyer, 2012). The bill size usually based on package needed. Price paid will increase with additional features added to the package in tandem with the expansion of the company. There is no more cost of software integration and the cost of customised application is shared by many customers. This feature allow better capital budgeting as hospital just need to consider the cost for the service rather than the whole IT infrastructure, support service and service upgrading.

Software is keep up-to-date and the hospital will have access to product and technology experts who serve a large client base. It also allows improve access to patient data using multiple devices(Grandis& Brady, 2011). Sharing of information and collaboration become easier and convenient. This approach enable employees use the latest version of updated software at all time, avoid the job interruption in changing software and avoid incompatible software. The applications tend to be more affordable as well as predictable with monthly subscription pricing. This approach enabled the company focus in its core business. Another benefit of the application of cloud technology is, it's very elastic(Das, 2011)Scale in and out becomes easier while the hospital in different phases of development choose the technology features which are more useful and cost efficient to them.

Cloud computing is convenient and well accepted by business community but it is relatively new to the healthcare industry. Usage of this technology in healthcare industry is generally limited by the concerns of confidentiality of the patients' data(Benaloh, Chase, Horvitz &Lauter, 2009). In view of a great potential of convenient patient data storage and sharing derived from these cloud computing capabilities, the use and the intention to use the technology warrant proper exploration. Barrier to the adoption of the technology needs to be looked into especially by hospital administrators.

Traditional method of medical record storage is not effective. Paper storage inhibits

circulation of medical information because of its bulk and the need for manual retrieval and transportation. There is also storage issue by increasing number of patients with time. Moreover, paper-based medical record made duplication of record difficult. Losing a patient folder usually mean losing part or all of the patient's medical information permanently(Ian, 2011). This missing information will potentially lead to duplication of unnecessary procedures and investigations. Inaccurate prescription might occur and this is the main preventable medical error which saves life. Making patient medical record available anytime and anywhere via technology innovation allows doctor to make accurate decision.

However, there are also disadvantages which come along with the adoption of the cloud technology. The vendors serve large client base with standardised product. Certain features which are critical to the organisation might not be available and the hospital is finding it very difficult to work around with the condition without a team of in-house IT experts since the service has been outsourced. This condition limits the control of the hospital's IT resources.

Recently, the conservative public funded healthcare system in United Kingdom- National Health System (NHS) announced the plan to move its medical database to cloud. A company called Flexient has been appointed to start the pilot project(Amar, 2011). Now, with the cloud computing, NHS's patient can expect better communication between their General Practitioner (GP) and the hospital consultants, and yet at the same time they have complete control over who should be allowed to view their medical record. The move highlighted the important role of the technology in future healthcare.

1.2 Problem statement

Models which predict technology acceptance are well established but they were developed in the western world(Kholoud, 2009). It is expected to be robust in estimating the level of technology acceptance while a new innovation is introduced to work place.

However, when taking local culture and social economy environment different into account, the well developed technology acceptance research might not be accurate and applicable in the east. There are good evident which show that culture influence the adoption of IT innovation(Paul & Lin, 2002). Due to the marked differences of culture in the east, there is good reason to believe that the determinant of the technology acceptance behaviour will differ. However, research done on Unified Theory of Acceptance and Use of Technology (UTAUT) which carried out in UK and Jordan, demonstrated that the model established in the western culture can be transferred to a non-western culture although with varying degrees of explanation power. (Kholoud, 2009)

There are many studies researching technology acceptance in multi-culture society of Malaysia (Cheah ,Teo&Oon , 2011;Ramayah, Osman, Azizah&Malliga, 2009;Zarehan, Nahariah&Ong , 2009). None of these studies carried out in the field of healthcare. Hence, this study is particularly relevant in investigating the validity of the technology acceptance in our local community specific to hospital environment.

Development of a technology acceptance research based on local population is critical in order to promote new technologies in Malaysia. Technology acceptance research in healthcare industry helps hospitals' Board of Management understands the key success factors of new technology adoption when new innovation to improve work flow and patient care is introduced.

For healthcare sector, organisation culture will be expected to have major impact on adoption of certain technology. This impact is especially significant for healthcare industry where patient data protection and confidentiality is utmost important and required by law. The most costefficient and fast moving cloud computing technology might not receive wide acceptance even though it bring breakthrough in its application.

For this reason, trust to the technology and its provider might be an important variable which determine the intent to use of the technology. Empirical evident had shown that, trust might be important in influencing technology usage especially, when user perceived the technology to be uncertain or high risk. (Faqih, 2011;Kaasinen, 2005;Lui& Jamieson 2011)

1.3 Significant of the study

In general, there is no study associated to assessment of Technology Acceptance done for healthcare worker in Malaysia. Hence, the validity of UTAUT application in Malaysia generally and Malaysia healthcare worker specifically, is unknown. This study aims to confirm that UTAUT model as a predictive tool for technology acceptance of cloud computing in healthcare industry. The study also aims to explore the differences of perception between nurses and doctors and identify the differences among doctors.

1.3.1 Individual level: Patient

The application of cloud computing based Electronic Medical record (EMR) is expected to empower patient in the management of their medical record(Li, Yu & Lou, 2010).This is because with the wide spread use of the technology under the secure public sharing platform supported by effective and strong regulatory system, the data of the patient can be shared between their physician with permission. The control of the data ultimately belongs to the patient and patient decides on whom to share the data when they seek treatment from medical professional.

Patient can participate in medical data collection by recording their vital signs like blood pressure, blood sugar and etc and the data is stored in the cloud with password protection(Rolim , 2010). Patient primary physician will gain access to patient medical data in real time. System can be set to create an alert to physician or nurse manager if there are vital signs which exceed the reference range. With these features, medical practitioners will never miss the early dangerous signs if patient is cooperative. Action can be taken early, advice will be more appropriate when there is sufficient medical data available and intervention can be carried out more accurately with cloud computing.

Most of the healthcare innovations are costly and often not affordable by most patients. With the existence of cloud computing, and economy of scale, cost can be drive down(Minott, 2012). Patient and practitioners just need to pay for whatever they used or pay monthly subscription(Marketsandmarkets.com, 2012). This features, allows widespread adoption of the technology and enables smooth upgrade of IT technology while moving along after adoption. Prompt professional service can be ensured as patient will have the lower barrier to seek advice from multiple healthcare providers at the same time. The cyber law should allow this to happen by making transfer of data on demand compulsory with minimal cost. The cloud features encourage healthy competition and those who are good and cost effective will win the market share and excel in the business.

1.3.2 Individual level: medical practitioner

The participant of the study- medical practitioner will be benefited by better understanding of their view and perception. Different subgroup of medical practitioners might have different view point about cloud computing based EMR as they deal with different stakeholder and external environment. For example, general practitioners might have resistant toward this technology innovation because their competitive advantage is their presence in that location. Over a long period of practice, general practitioners (GPs) accumulated significant client base and also their medical records. The effective data sharing with cloud computing will make the switching of primary GPs relatively easy and risk free. Hence, GPs might perceive the adoption of the technology as a threat to their business.

When patient hop from one GP to another, the sharing of data will make the medical management of the primary GP under scrutiny by peer as access can be allowed by patient. This will potentially create medical legal issue because of miscommunication as it is a norm that not all communication with patient is documented in the medical note.

Hence, this survey will identifies potential obstacles to the adoption of the cloud based EMR in Malaysia. Policy maker can utilise the finding of this study to remove the obstacles in order to make adoption of cloud based EMR possible. This is particularly relevant to healthcare policy maker as doctors usually have greater say in selecting technology that they want especially for doctors in private practice and GPs(Appleby, 2012). Creating a change to these groups of highly intelligent professionals is not an easy task. Removing the obstacles might be more relevant.

More importantly, the study tests UTAUT model for the first time in Malaysian healthcare medical professionals. We assume that UTAUT to be able to predict usage intention and actual use of technology, but this is just an assumption.

1.3.3 Organisation level

The application of cloud computing based EMR is wide. Its application can be potentially nationwide and it will eventually affect healthcare organisation. Different organisation has different organisation structure and different set of stakeholder. Hence obstacles of adoption will be very different.

Finding of this research will help the administrator of healthcare institution supports and motivates medical professionals in their transition to cloud computing based EMR. The administrators can use UTAUT model to understand the areas to focus in, in order to encourage the usage of certain group staffs.

The study explores the construct of trust in the technology acceptance as it is perceived to be promising construct which might affect the acceptance level. Trust is important as healthcare data is extremely sensitive(Johnson & Swain, 2012). Breach of patient information might make medical practitioner and healthcare institution liable should there be any medical dispute. The finding of the research will guide the study in the area of trust in technology acceptance of healthcare workers in using cloud computing based EMR.

1.3.4 National level

It is essential to have an integrated healthcare record for patient in future. Plan should be drawn from now and it should include the introduction of concept of how to bring the technology to medical community and all patients. This will include regulatory framework on data sharing and healthcare data security.

The addition of trust into the model will be investigated as a possible element which might increase the power of prediction. This research is just a start to look into the

UTAUT-Trust model which might possible explain the large part of the medical professional perception.

1.4 Research questions

1. What are the perception and intention of Malaysian medical professionals in using the cloud computing based medical record at work place?
2. What is the validity of UTAUT in predicting the use of cloud computing based medical record among Malaysian medical professionals?
3. Is trust an important construct in predicting intention to use of cloud computing based medical record compared to the established contrasts of UTAUT?
4. What are the reasons of resistance toward cloud computing based medical record among medical professionals in Malaysia?

1.5 Objectives of the study

- 1) Investigate the perception and intention of Malaysian medical professionals to use the cloud technology in their work place.
- 2) Validate UTAUT as a model to predict use of cloud computing bases EMR in Malaysia medical professionals.
- 3) Investigate trust as an additional construct to UTAUT in assessing use intention of cloud computing base EMR.
- 4) Investigate between group different in term of intention to use and different of regression model.
- 5) Analyse the possible reasons of resistance toward cloud computing.

1.6 Scope of the study

The study target populations are practicing medical professionals at private and public institutions. Medical professional is defined as doctors and nurses. This study will assess their perception about the concept of cloud computing based EMR in their workplace. They will be asked to grade their Internet exposure and experience in using cloud computing technology. They will then answer a series of questions in order to assess technology acceptance of the participant. There will be additional set of questions to assess the participant's trust in the technology. Participant will then answer questions to assess their intention to use the technology in their workplace.

This study does not cover other medical personal like pharmacist and lab technician because of the type of technology we aim to assess. As electronic medical record is mainly used by nurses and doctors, thus the target of the study is only limited to these two subgroup of healthcare staffs.

There is no well defined geographical location and named healthcare institution of which the study is targeting. It is because some of the participants were recruited online. This measure enable higher participant recruitment over short period of time as it is not easy to get medical professional to involve in the study.

The research is designed to contribute to body of knowledge in the following several ways:

1. It test the model of UTAUT for the first time on Malaysian Healthcare professionals
2. It tests UTAUT for the first time for application of EMR with cloud computing which is still remote in its implementation but promising
3. It tests trust as a promising new construct in addition to current variables of UTAUT model. Its potentially be a more reliable predictive tool for technology acceptance of cloud computing in healthcare industry.

-
4. It provides a descriptive analysis of what healthcare professionals perceived about cloud based EMR and their concern about the adoption of this technology in future.
 5. It identifies the differences between 2 very distinctive subgroups of medical professional which are nurses and doctors. It's also designed to identify the different of perception between private versus public doctors and GPs versus medical doctors in hospital practice.
 6. The finding of the study will give a direction of how to study the application of cloud technology in healthcare and its acceptance model in larger scale.
 7. The finding of the general perception of medical professional will facilitate planning for cloud computing adoption in healthcare by policy maker.

CHAPTER 2

LITERATURE REVIEW

2.1 Internet

Internet is a complicated interconnected computer networks. Since the born of Internet Protocol Suite (TCP/IP) in 1982 and the concept of worldwide network was introduced via this interconnected protocol suite (TCP/IP), the technology underwent a dramatic development. Since mid 1990, the technology started to give the major impact to cultural development and commercial practice of most people in the world("Internet," 2012). With the emergence of email and voice over Internet protocol, mode of communication between people change dramatically. This was followed by cropping of social network, blog and E-commerce, the flow of information become more efficient and the way that business was managed change in a tremendous way.

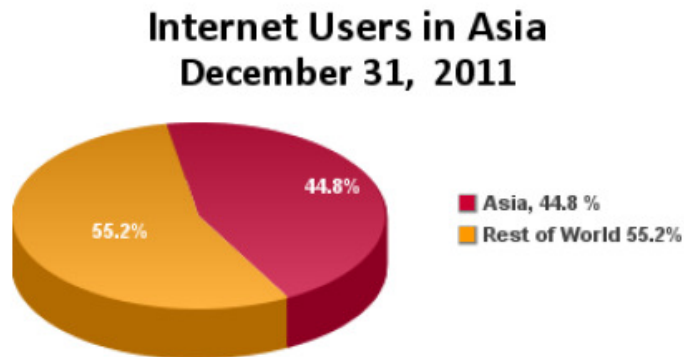
Now, Internet connectingmillion of business entities, government agencies, educational institutions with personal computers. The world might not be the same if there is any day that the Internet connection is disrupted. Managers who are not familiar with the technology innovation will inevitably lag behind of competition.

2.1.1 Internet usage in Malaysia population compared to world/regional in general

Based on the recent statistic presented by Internet World Stats: usage and population statistic, the Internet usage by Malaysian is encouraging. The snapshot based on the statistic on 31st December 2011, Asian contributes about 44.8% of total Internet user of the world and it contribute to 56% of total world population(Internet World Stats, 2011). The overall Internet penetration rate for Asia is 26.2% in contrast to 41% for population outside Asia. The average of Internet penetration for the whole world is 32.7%. These data show that, Asia still lack behind the rest of the world in general.

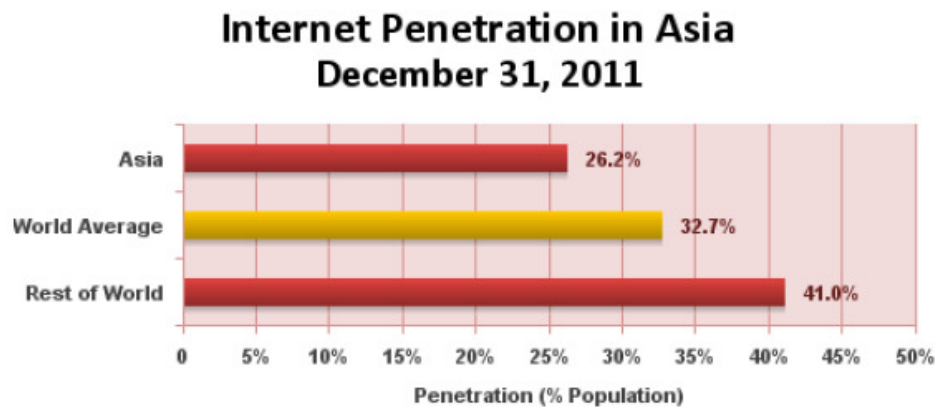
The same statistic shows that, the Internet penetration for Malaysia is 61.7% which represent the 17.7 million of Internet user. This makes Malaysia ranked 7th with just behind Korea, Japan, Brunei, Singapore, Taiwan and Hong Kong. Another encouraging fact is, 43% of all Malaysia population use Facebook, which is also a form of cloud computing.

Figure 1: Internet Users in Asia



Source: www.internetworldstats.com/stats3.htm
1,016,799,076 estimated Internet users in Asia for 2011 Q4
Copyright © 2001-2012, Miniwatts Marketing Group

Figure 2: Internet Penetration in Asia



Source: Internet World Stats - www.internetworldstats.com/stats3.htm
1,016,799,076 Internet users in Asia estimated for 2011 Q4
Copyright © 2001-2012, Miniwatts Marketing Group

2.2 Cloud technology

Cloud computing is a general term for anything that involves the delivery of technology over the Internet. Cloud technology has been defined by National Institute of standards and Technology (NIST), US Department of Commerce as a model for enabling 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 cloud provider interaction (Wayne & Jansen, 2011). Another well cited journal of Michael Armbrust define the cloud computing as “Both the applications delivered as services over the Internet and the hardware and systems software in the data centers that provide those services”. (Michael, Armando &Rean, 2010, p.50)

With the technology, service provider tap the mass market and consumer can enjoy the complete service on demand and pay for whatever they are using. The access to service becomes more convenient using multiple devices with just connecting with Internet. The cost is potentially cheaper compared to conventional setting as there is economic of scale; enable multiple tenants to share common resources securely and

fully utilisation of professional expertise. However, even with huge potential, this application of this technology in healthcare still expected to face significant obstacles. One of the few controversies is privacy and security of the data stored with third party.

There are several deployment models of the cloud computing technology. The brief summary of the model can be found below(Wikipedia, 2012):

- 1) Software as a Service: Sometime referred as on demand software whereby the software and its data stored and hosted on cloud at different location. Consumer conveniently access to the software using Internet and browser. Software will be managed centrally. Regular onsite maintenance for traditional client-server application which disrupts work flow can be avoided. Up front cost will be reduced as the service will be charged per used or per month and there is economy of scale of management of software centrally. There is less to spend on hardware and in in-house technical support as most of the application will be managed by the cloud provider.
- 2) Infrastructure as a service: This is the features needed most by healthcare industry to cope for the increasing demand of medical record storage. Storage of data can be centralized at remote location with powerful security features offered by cloud provider. Normally, the service provider will provide backup and disaster recovery function in the package and the service is managed by engineer centrally. The cloud provider will have more bargaining power to purchase hardware with cheaper price and charge the consumer depending on the storage they use. This service reduces the upfront payment needed for hardware installation during the initial phase of business.
- 3) Platform as a service: This is a computing service from the cloud provider to allow subscriber to develop software on the platform and facilities provided. Usually, the cloud provider will provide the storage, network with security enhanced server in order to allow development and delivering web application

and service by its subscriber. This feature allows efficient use of hardware resources with this efficient scaling and more importantly give remarkable saving for subscriber.

In common term, data center with hardware and software is cloud when it is accessible by user using Internet or intranet. When a cloud is made available in a pay as you go manner to the public, it is called public cloud(Michael et. al, 2010). Private cloud is referred to internal data center for business and not or limited availability to public. It is not generally large enough to benefit from advantages of cloud computing which usually quoted for true public cloud. Michael remarked that, the so called private cloud might get more of the benefit of public cloud through surge computing or hybrid cloud.

2.2.1 Current status & future of cloud computing

Cloud computing has gaining its momentum for recent year. Eric Savitz, SF Bureau Chief at Forbes, interviewed SatyaNadella, Microsoft's President of Server and Tools Business (Abel,2011),Nadella mentioned that many business move their websites to Window Azure while still calling back to their private server for identification and some of the data. At the same interview, Nadella remarked the growing adoption of SaaS solution, especially Office 365, saying that "50% of the fortune 2000 who have used Window is now using their online offering. According to him, many customers who are interested in the virtualisation for cost benefit.

Another separate interview described in the same article involving Lew Tucker (LT), VP and CTO of Cloud Computing at Cisco and Jon Weinman (JW), Worldwide Lead HP (Abel, 2011). The interview includes the discussion about the trend of cloud computing for the next 10 years. LT explain that elasticity has 2 sides: Scaling up when the resource is in need and scaling down when resource is no longer needed. He added that, those who move their internal data centers to a cloud model are going to be successful if "they manage to run it as an Internal Service Provider". JW mentioned that the network connecting enterprise resources to the cloud is a bus on a

single chip. He explains that such a move is needed for homomorphic encryption and cloud security.

Both Tucker and Weinman believe that the border between private and public clouds will slowly disappear. The result of the disappearance will be hybrid clouds, because that's the fundamental nature of the cloud: the ability to run applications on any available resource either internal or external. Weinman added that, "hybrid is best under most circumstances" (Abel, 2011).

Shift the focus back to our neighboring country- Singapore. According to Cloud Maturity Index commissioned by VMware, 63 percent of Singapore firms are either using or planning to roll out cloud initiatives, compared to 53 percent in 2010(VMware, 2011). The survey was compiled by Forrester Research after interviewing 6141 businesses and its IT personals in Asia Pacific Region. Interesting to note that, cloud adoption increase with the size of the organisation with 45% of companies with employee more than 10,000 already using cloud computing. Data privacy has been commented to be the main barrier of adoption (79% of respondents) way ahead of concern of security and integration with existing system.

2.2.2 Use of cloud technology by Malaysia population

Malaysia is not far behind. Forrester Consulting studies show that 64% of Malaysian companies are currently using or actively planning to use cloud technology(Strukhoff, 2011). The same article describes the joining of Multimedia Development Corp (MDeC) and Microsoft Malaysia to MSC Malaysia's Cloud On-boarding Program. This involves the investment of RM 1.1 million to accelerate the local development of software and services in cloud computing.

Cloud is no longer at the infant stage. Business citizen begin to realise that cloud computing promises an efficient way for businesses to utilised software and other IT resources. The business model seem to work well and International Data Corporation (IDC) forecasts that Asia Pacific spending on cloud computing will increase fourfold. ("Cloud computing Malaysia," 2011)

As a cost efficient alternative for advance IT capability in managing business, this technology is particularly important for Small and Medium Enterprise (SME). In Malaysia, SMEs are estimated to comprise 99% of total businesses and provide 56% employment, ultimately contributing to 31% of GDP and 19% of exports (John &Dharazurin, 2011). When talk about the IT resource and human capital needed to run a SME, majority of SMEs is undercapitalised, underserved and underdeveloped. Cloud computing with minimal up-front commitment is one of the way to untapped the potential of SMEs in Malaysia.

The Microsoft sponsored Springboard Survey reveals that while larger Asian businesses are embracing cloud services, SMEs are lagging behind their enterprise cousins with 62% of organisations of more than 500 PCs either having adopted or planning to adopt cloud, while 68% of organisations with less than 50 PCs having no plans to adopt cloud computing(Galligan&Mansor, 2012). This statistic show that, there is much more the authority needs to do in order to encourage the use of the technology.

The Malaysia government has a few major roles to play. The authority need to make sure the availability of affordable high quality broadband, make sure new law doesn't impose unnecessary restriction of free flow of information, right policy to ensure controlled cybercrime, good data protection and privacy. Government support to provide incentive for acquisition of skill in cloud computing technology and encouragement of local software development by providing platform in doing so is crucial.

2.2.3 General Impacts of cloud technology

There are several interesting features of cloud computing which contribute to it rapid wide spread acceptance in business. In this competitive market place, cloud computing economics is the prominent driver of the trend mentioned.

For example, demand for service might vary with time where there is peak load but resource underutilised at other times. Most business experience not only diurnal

variation of demand but also seasonal variation. In this scenario, cloud computing provider allows pay per hour for computing resource. There will still be cost saving even when the hourly rate is higher than the rate of having the IT resource(Thethi, 2009). The flexibility cloud computing is particularly relevant when the demand of a new business cannot to determined for sure. This economic appeal of cloud computing allows business owner to convert capital expenses to operating expenses. This pay as you go feature; allow small businesses with great idea to compete with large corporation at a common battle field. This allows selection of good service through competition and enhances the value to consumer.

Another interesting feature for business is the scalable feature in its application. (Michael et al, 2010). There are three properties which combination gives cloud computing its appeal: Short term usage (scaling up and down according to demand), no upfront cost and indefinite capacity in demand. These features also allow total or partial elimination of up-front cost by cloud subscriber. Hence, cloud computing technology allows small businesses to start on small scale and increase its IT resources like hardware and software subscription when there is increase of the needs. The much reduced up-front capital to start a new business allows entrepreneur to redirect the resources to core business investment.

Moreover, cloud computing is elastic. The cloud software with specific features can be added or removed from the package to meet the demand of business. This elasticity of technology acquisition and utilisation reduce the lead time of change of operation to meet demand and with less cost. This is very relevant to avoid the lock in of capital for underutilised resources. It is estimated that the average server utilisation in data center range 5% to 20%(Armbrust, Fox, Griffith, Jseph, Katz, Konwinski, Lee & Patterson, 2009).Economic of scale and affordable price is another important feature which drives the trend. Remote access of service via Internet that leads to efficient use of IT hardware and management of cloud facilities with IT expert, make this whole concept attractive.

2.2.4 General obstacles of cloud computing application

Top 5 obstacles for growth of cloud computing business were summarised by the same author (as cited in Armbrust et al, 2009). There are briefly listed as below:

1. Not all cloud providers will survive through the business cycle. Hence heavily rely on one cloud service provider will put an organisation at risk of major service disruption when the cloud provider terminate its operation. The solution to this problem is to outsource different business function to different cloud providers in order to reduce risk.
2. Data privacy, security and confidentiality. The general perception for cloud providers is they should have better firewall and security system. This might not be true across the board as bigger company store valuable data and this will possibly invite hacker invasion and all security system contain weaknesses. At the same token, a cloud company might have strong external defence system but there might be stealing of information from its own staffs. Hence external audit by client, legal framework and data encryption by client before storage should be provided by cloud provider.
3. Data lock-in. This condition happens when the data is stored in the application which does not compatible with other application widely used. Hence, data will not be transferable. The condition can be overcome with the standardisation of software and application.
4. Data transfer bottle neck. The cloud provider might have power server but this feature can be easily limited by poor broadband speed and coverage. Hence, cloud computing concept can only be successfully implemented when the subscriber able to access to good, fast and reliable Internet network.
5. Performance unpredictability. This is the universal problem for any vendor selection.

2.3 Electronic Medical Record (EMR)

Basically, EMR is a computerised medical record that can be accessed with concerned of patient privacy, confidential and security from multiple integrated systems at any point of care within the health care enterprise (Haslina&SharifahMastura, 2005) This informatics technology is not extensively studied because of rapidly evolving technology and its complexity. Open clinical which is a nonprofitorganisation created and maintained as a public service. It is supported by Cancer Research UK and under the supervision of an International technical advisory board give a good description of most features and issues of this technology. ("Electronic medical records", 2011).The site summarised the features of EMR and most of the issue related to it applications.

EMR deployment varied greatly from country to country and from specialty to specialty. In most cases it has revolved around systems designed for local use and some for just administrative use. EMR should be the central of any hospital information system as without the existence of EMR, any computerised clinical work flow will not be integrated successfully.

EMR permits more data captured in the way which facilitate transferability and portability. This feature facilitates easier accessibility, processing and integration of data for the benefit of patient. It also makes data mining possible for retrospective research study.

Electronic Medical Record was designed and introduced into market as a perfect solution for decade long problem of healthcare industry with increasing complexity. The ideal EMR should be able to provide complete, accurate, and timely date, alerts, reminders, clinical decision supports, medical knowledge, communications and other aids at all points of care for all healthcare professional at all times in a way the quality of healthcare can be dramatically improved(James, Jonathan, Vimla&Jiajie, 1999). It provides an integrated and structured approach in patient medical information management. With the inherent feature information technology, medical record which keep in electronic form reduce the hassle in tracing medical file, reduce waiting time

of patient and ensure the timely clinical decision making. This reduces the dependence on human and potentially reduces unnecessary repeat laboratory and radiological examination. Repeat examination will not be needed by physician if the institution has highly traceable medical record in the electronic form.

2.3.1 EMR capabilities

A committee of the Institute of Medicine of the National Academies has identified a set of 8 core care delivery functions of electronic health records (EHR) systems. The report was sponsored by the U.S. Department of Health and Human Services. The eight core capabilities are (Institute of Medicine of The National Academies, 2003):

1. Health information and data,
2. Result management,
3. Order management,
4. Decision support,
5. Electronic communication and connectivity,
6. Patient support,
7. Administrative processes and reporting,
8. Reporting and population health.

2.3.2 Benefit of EMR application

For an EMR to be an efficient solution to current healthcare problem, it must first fulfill the first goal which is usability. Even though with addition of useful function and overcome the inherited problem of paper base medical record, current EMR has many non trivial problem which prevent it to be easily accepted by medical professional (James et al, 1999). Below are some of the benefitssummarised by open clinical (Electronic medical records, 2011):

1. As a replacement of paper based medical record which is fragmented, time consuming in content search and labor intensive in tracing and transportation. EMR provides the method to make the modern medical record a single

sharable, transferable, accurate and rapidly retrievable at anywhere and anytime. It requires less space and management resources.

2. Its support research and continuous medical education by making regular retrospective study of health outcome possible and feasible.
3. Provide the base of integrated healthcare IT which includes the activities like electronic prescribing, data sharing and clinical surveillance, radiological and laboratory result tracing and ordering. This feature is especially useful for management of chronic diseases which need long term follow up.
4. Structuring and streamlining clinical work flow with possible automation some of the processes. It can integrate evidence base recommendation with patient demographic data in order to remind healthcare provider during routine clinic visit. This feature has been shown to increase patient compliance with preventive care recommendation (Burack&Gimotty, 1997)
5. Data stored would be analysable for use in clinical research, audit and epidemiology study and disease surveillance.

2.3.3 Barrier of EMR application

There are also several barriers identified for the application of EMR as below:

1. Doubt on clinical usefulness. Beyond safety, current literature provides little evidence about EMR systems' effect on health (Richard, James, Anthony & Federico, 2005). Computerised provider order entry (CPOE), clinical decision support, bar-coded medication management and e-prescribing are four of the technologies that are widely recognised as being able to positively impact patient safety (Hagland, 2003). Other than this, there is hardly any research study which shows the impact of EMR to patient life.
2. Financial burden with high initial start up cost, high maintenance and upgrade cost. Small healthcare facility will find the conventional EMR application unjustifiable.
3. Technology matter. This is related to not user friendly interface with needs of extensive training and lack of integration with other existing functioning system of the hospital.

-
4. Resistance from organisation and certain department or individual. This issue become more pronounces if the technology is not user friendly and need regular retraining.

Even now, EMR still not a straight forward solution to many problem faced by medical professional. Some of the problems are ease of use and high cost of installation.

From the perspective of system functions, several problems related to usability are like cognitive overload because of information overload secondary to poor interface. Design of a interface which a medical professional familiar to, present the patient data logically and support clinical decision making are some of the key features a EMR should have to make it worthwhile for medical professional to continue using them. This issues has underwent several phases of improvement and some system indeed very user friendly.

Having said that EMR is a key system of Hospital Information System (HIS), there is many other IT systems needed to support the healthcare needs of the hospital. The most significant problem is no single software package (Haslina&SharifahMastura , 2005). Hence, the Total Hospital Information System (THIS) implemented in Malaysia is using multiple software package from multiple vendors. There was no one single software in full operation and the needs of multiple training in order to familiarise with features of different software system. This makes implementation difficult (Hussaini, 2002)

These problems highlighted the issue of lack of interoperability which might create problem in data transfer and sharing, radiological image transfer and integration of clinical with non-clinical data. Other than these, interface which is user friendly, easy to use design which consider the cognitive function of clinician probably are important in determining the user intention to use.

In view of all these obstacles, more effort is needed in order to create a technological and methodological innovation in order to encourage the widespread use. Nationwide

electronic health record will not be realised in near future by looking at current slow diffusion of EMR technology with no prominent player in the industry. At current state, only big hospital with large scale of operation find the justification either financially or operationally to install EMR. For smaller hospital or clinic, full scale EMR seems impossible at current moment.

2.4 Cloud computing for healthcare industry

Healthcare industry generally lags behind other industries in term of technology, said Albert Santalo, CareCloud's founder, president and CEO (Joseph, 2012). This phenomenon is more apparent in sole practice in which most doctors' office is operated in small scale and is not linked together.

Healthcare industry faces unique set of problem. A Practice Fusion Survey found that the average American see 19 doctors in his or her lifetime and has a healthcare record of 200 pages thick ("Cloud technology will," 2011). According to Practice Fusion CEO- Ryan Howard, paper is dangerous and inefficient. It does not belong to healthcare any longer. Unlike the search function of electronic medical record, the lack of efficiency in tracing information makes paper base record prone to medical error. Error in paper record can lead to duplication procedure and inaccurate prescription because of typo or ineligible hand writing. Cloud computing bring the convenient of the technology to another level.

For this simple reason, electronic medical record (EMR) solves the vast majority of the problem. However, all this application gives rise to secondary problem. Hence the diffusion of the technology still remains limited. There is now a growing need for an integrated health information system and comparable information to ensure continuity of care and reduced duplication (Ministry of Health, 2011). Health information and communication technology have enormous potential to play a significant role in healthcare transformation. With the innovation of technology, hopefully the objectives of improve patient safety, timely and accurate decision making with decrease medical error can be achieved. Innovation of IT is required at this moment

in order to enhance interoperability via uniform health informatics standard. Well designed and implemented regulatory framework also crucial to improve diffusion and access of the technology.

Patient is beginning to play greater role as a member of medical team and manage their care. Small practices like GPs, while moving forward to serve the IT savvy patient in future, using electronic medical record and the needs to satisfy compliance of regulations may make all IT initiative cumbersome, inefficient or impossible to achieve (Fontaine, Zink & Boyle, 2010).

Despite the dispute about safety and security of cloud computing application in healthcare, the conservative National Health Service (NHS) of Royal Liverpool and Broadgreen University Hospitals embraced the technology. The organisation has selected EMC 's Symmetrix® VMAX™ and Fully Automated Storage Tiering for Virtual Pools (FAST VP) solutions to form the foundations of its Private Cloud environment(Amar, 2011).

James Norman, Director of Information Management and Technology at The Trust, said: “VMAX enables intelligent management of patient data across all hospital sites, making it quicker and easier to access information and get new services up and running.” The organisation hopes to implement the technology in order to enable the access of electronic patient record securely anywhere and anytime(Amar, 2011). The cloud technology allowed the technology usage within budget without compromising system performance.

With cloud technology, the service provided can be totally web based which is partly downloaded to subscriber computer. What the subscriber needs to do is only get good Internet access and an up to date browser. This service can be accessed with multiple devices and the requirement of the hardware or device is not necessary high any more to make the technology run well. If this is a public cloud with large client base, the out front fee is minimal and subscriber pays as they go. The cloud vendor needs to be very competent in order to stay in business.

With cloud computing application in healthcare, management processes will be efficient, with the flexibility to respond dynamically to the latest medical breakthroughs and changing demand of patients. Cloud computing, information management and business analytics will be the key enablers of these capabilities (IBM, 2011).

This business solution potentially changes the initial mode of the technology which limits its wide acceptance. However, there are several and real barrier for cloud computing IT application in this country. The advancement in medical technologies will be the key contributor to escalating cost. For a lot of specialties, medical devices and diagnostic tool cost millions of dollars. With the high up-front cost, the wide spread IT application to the level of day to day patient care in doctor's office probably will not be possible. Some of it has been clearly identified by the authority like inadequate planning for health information system use. Other reasons are as below (Ministry of Health, 2011):

1. Standalone and different IT system used in different healthcare institution.
2. Lack of uniformity of the operational policies
3. Absence of national policy and law which encourage interconnected secure personal health information. Other: lack of enforcement of IT policies.
4. Poor adaptation of system user to new work process which involve new technology
5. Lack of human capital to manage IT operation and maintenance.
6. Huge financial resource requirement (initial capital expenditure and maintenance cost)
7. Lack of national health informatics standard

2.4.1 Impact of cloud technology to healthcare and its potential

Ministry of Health (MOH) Malaysia has identify 5 Technical Working Groups (TWGs) based on the work done by Economic Planning unit (EPU). One of the drivers for health sector transformation is via the creation of K-economy. It consists

of Human capital, Information Technology, Research & development/ Innovation (Ministry of Health, 2011). Hence, it is clear that IT is one of the enabler of positive change to future healthcare.

Currently, healthcare industry is looking for the solution of patient data storage. Physical data storage of paper document is costly and takes up space. Hence the solution must be cost efficient yet capable of solving other complex healthcare issue. The technology should be able to handle massive patient data securely and able to interact with other system seamlessly. Moreover, it should have the feature of disaster data recovery and auto achieving. Even though we know EMR is part of the answer, it is increasingly clear that a lengthy, uneven adoption of non-standardized, non-interoperable EMR systems will only delay the chance to move closer to a transformed health care system (Richar et al, 2005)

Cloud computing is a new IT approach that offers new economic benefits with possible rapid deployment of services and tight IT alignment with business goals (IBM, 2011). However, there is still an unanswered question of whether cloud computing is the future technology. However, we are quite clear that it has the potential of widespread adoption in healthcare. Cloud computing offers attractive option for healthcare administrator as it potentially less costly. This trend is important to solve the problem of fragmented IT application in healthcare which prohibits integration of information and data sharing.

This information availability make possible by cloud computing based EMR, ensures that the most current, complete insights and clinical knowledge are available to support medical professional's decisions. Most critically, it delivers comprehensive, coordinated care which focused on value creation rather than consumption. Information is harvested and repurposed for more appropriate referrals and medical research to support the promise of personalised care(IBM, 2011).

Unpredicted burst in data condition, make some hospital unable to scale up to meet the future growth(Srinivasan, 2011). According to the same author, Cloud is probably the first viable option to support Master Data management of Health care information

to support single truth of data. It provides the common repository accessible option to providers across the globe to reduce data duplication and redundancy. It enables common storage of clinical data from provider not limited to hospital but regional or even the globe. This setting encourages the sharing of clinical information beyond border with permission of patient. Other than it use in improving access to electronic medical record, this technology innovation is potentially very useful in several supportive service of medical practice. These are like laboratory result database, computerised provider order entry (CPOE) and radiology image storage. These moves not only reduce the needs for bigger storage place but also improve pace of how healthcare delivered to patient.

Another excellence feature of the technology is the possibility of participation of patient in his/her own care. With cloud computing, summarised medical record can be accessible to patient. Patient can have self monitoring of his/her medical parameter at home like blood pressure and blood sugar. The data can be shared with his/her healthcare provider and all these essential information will be make available in the cloud and physician access with one click during follow up. If some of the clinical parameter is outside reference range, system can be designed to alert the nurse manager in charge and prompt action can be taken(James et al, 2005).

The cloud based EMR can be made available to physician office and most hospital irrespective of size with minimal upfront payment. Pay rate according to monthly subscription or volume of patient will allow most doctors with small clinic to afford the new technology. If a few dominant players able to concur the market and set the standard to encourage interoperability, healthcare transformation will be possible. It creates a new method of organising care delivery with prominent feature of patient directed care and new way of financing.

The stakeholder of the technology will not only limit to medical professional, hospital administration and patient but also include insurer, community organisation and manufacturer of medical devices. Cloud computing is the potential technology innovation which drive changes for healthcare industry. It supports collaboration and

team base care which involve patient in their own medical care. It needs the ability to use the application base on common set of clinical information with integration with business process requirement. Hence, cloud computing needs an integrated and orchestrated strategy which required good policies and guideline at national level.

US National Research Council concluding in 2009 that current health IT is not designed to adequately support the cognitive work of clinicians (Stead, 2009). Hence, technology acceptance research in the cloud computing based EMR will be very useful in designing technology. It also helps the hospital management in selecting and implementing this technology innovation, and development of training program.

Cloud computing can reduce capital expenditures and reduce the need to replicate hardware environments at each facility (IBM, 2011). It speeds up service and infrastructure availability in order to create service to patient with faster pace.

One of the challenges in its effective application is similar with other healthcare technology. It needs to be simple, intuitive and designed according to how healthcare organisations actually work. Local context needs to be considered and service designer need to make sure that the mixes of delivery model reap the maximum benefit for both medical professional and patient.

2.4.2 The controversies of utilisation of cloud technology in healthcare industry

Application of cloud computing is not something which would give only benefits. It comes with other disadvantages as well. Below are several possible disadvantages:

1. The increase cost for Internet connection. In order to make the cloud computing works; a fast and probably expensive Internet connection is compulsory.
2. Relying on vendor security. The hospital will need to almost totally dependence on security which is managed and provided by cloud vendor. This includes the server and infrastructure management system which is the backbone of the healthcare IT system.

-
3. Issue of confidentiality: The level of cyber security of most hospital might not be enough. It becomes apparent while cloud computing in healthcare is to be implemented and yet to allow the effective use of cloud computing that cloud has to offer. Cloud computing offers the increased access to patient healthcare data regardless of practitioner and patient location. This convenient will increase access but the increase transferability will put the confidentiality of patient data at risk. The magnitude of problem lie not only on single patient data but thousand or even million of patients' information. This issue might just happen when one of the medical professional give away a security password or an intelligent hacker found a small leakage of the firewall.
 4. This issue becomes complex with the complicated storage of data by the system of service provider. It is obvious that, the data stored in the server of service provider is beyond control of the user. Even though, functionally the user benefitted from the service, the risk of healthcare data storage would become higher day by day when the amount stored increase in size. Besides, once data stored, they are usually dispersed over multiple places and it can only be reconstructed when the algorithm of the service provider is known. However, most of the time, it is impossible to get this piece of information.

However, with the cloud computing technology available in the coming digitalized era, it should be utilised in full if it able to increase quality of patient care. Useful tools are often neglected or discarded due to a perceived threat of litigation that stems from a law that originated from a common goal: which is to further patient care as health information moves into an electronic format (Carolina, 2011). Hence, what is needed to is overcome it.

Carolina, 2011 in her review paper suggested several possible solutions to the problem. These include:

1. Government tools like administrative, physical and technical safeguard.
2. Mitigation of risk in the event of security breach or data loss
3. De-identification with randomly assigned identifier devoid of regular patient identifier used in the institution and public file.

-
4. Inform consent from patient in order for patient to aware of the risk and consent for how their health information is kept, transferred and protected.
 5. IT counsel by using reputable service provider to assist with compliance regulation according to particular need of the institution.
 6. User encryption of data and audit of the service provider.

The sources of problem not only lie on the user but also the service providers. The technical specification about security feature of the cloud framework can be negotiated upfront. However, the service provider ultimately will have the right to change some of the security features like level of security needed to protect password, what items need to be encrypted and what don't need and the sharing features. The emerging technological evolving through the life cycle of the product and make some of these changes inevitable. Hence, the security requirement will be altered along the way.

The US HIPAA HITECH Act presents one of the ways to support the exchange of PHI, built on a HIPAA baseline. At the same time, the epSOS European eHealth project is on a path to create a Europe-wide system for patient data exchange between member statescare(IBM, 2011). Malaysia can follow the paths above to facilitate the crafting of cloud computing strategy for healthcare industry and safeguard the security of patient's data.

2.5 Technologies acceptance theories and models

2.5.1 Introduction

Researchers usually have the tendency to analyse a model which is proven to predict IT utilisation. These models are important to administrators in order to understand how to encourage usage of newly introduced technology which might be very

expensive. It is important to study the model intentionally using the existing model with addition of any other constructs deemed to be important.

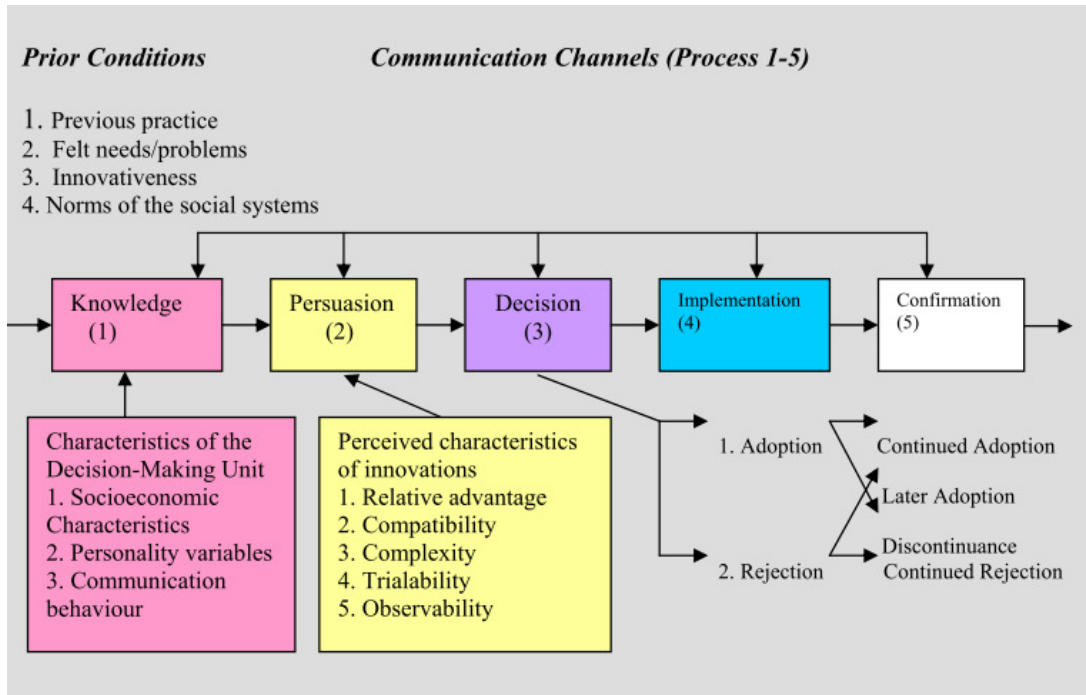
The review will identify gap of literature and it is really an issue in the context of healthcare industry. This close inspection is needed while we talk about cloud computing in healthcare as the resistant is expected to be high.

Research on information technology user has been done extensively. The research mainly focuses in examining user acceptance in using IT and its widespread applications. There are several models developed since 1950s. The models developed are evolving, to better explain IT user intention to use base on the user perception. The user perception might have changes with the rapid development of technology and it might be industry and population specific. (Hu, Chau, Sheng & Tam, 1999)

2.5.2 Innovation Diffusion Theory

Innovation Diffusion Theory (IDT) is the earliest model used to describe adoption of innovation. This theory is based on the decision making process which started with the knowledge about the existence of an innovation. This will be followed by forming an attitude about the innovation before a decision can be made to either accept or reject the innovation. If it is accepted, it should be followed by implementation and confirmation of the idea. This concept was introduced by Roger, 1995 with refining of the concept in later year and being illustrated as per figure 3 below:

Figure 3: Model of Innovation Diffusion Theory



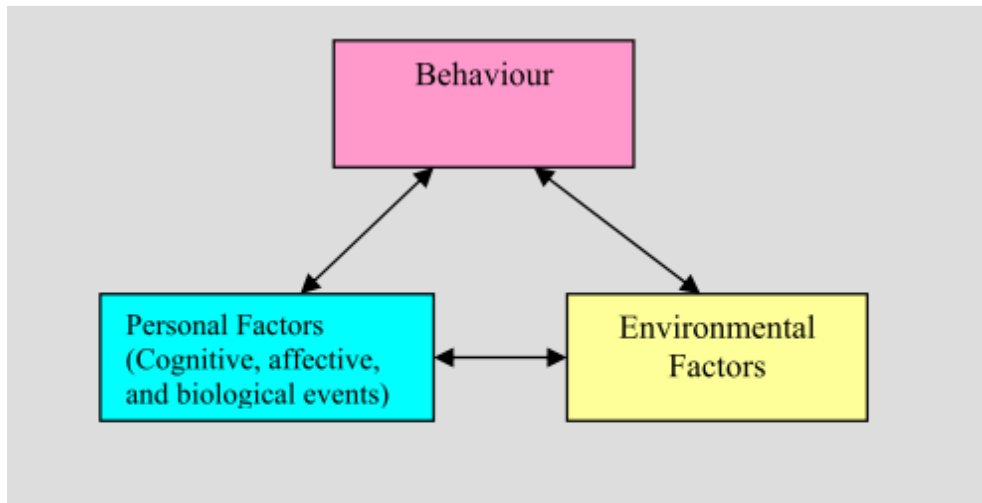
A model of stages in the Innovation-Decision Process (Rogers 1995)

Source: Roger, 1995, *Diffusion of Innovations*, 4th edn, The Free Press, New York, NY.

2.5.3 Social Cognitive Theory

Social cognitive theory is one of the most important theories of human behaviour. The extension of its use in computer technology was introduced by Compaeu and Higgins (1995) which extension provides the prediction in acceptance and use of information technology. This model consists of core construct of outcome expectation which consist of performance and personal affect, anxiety and self efficacy. The model suggests that decision as a product of environmental influences, personal and behaviour interplay. The model of social cognitive theory is illustrated as in figure 4 below.

Figure 4: Model of Social Cognitive Theory



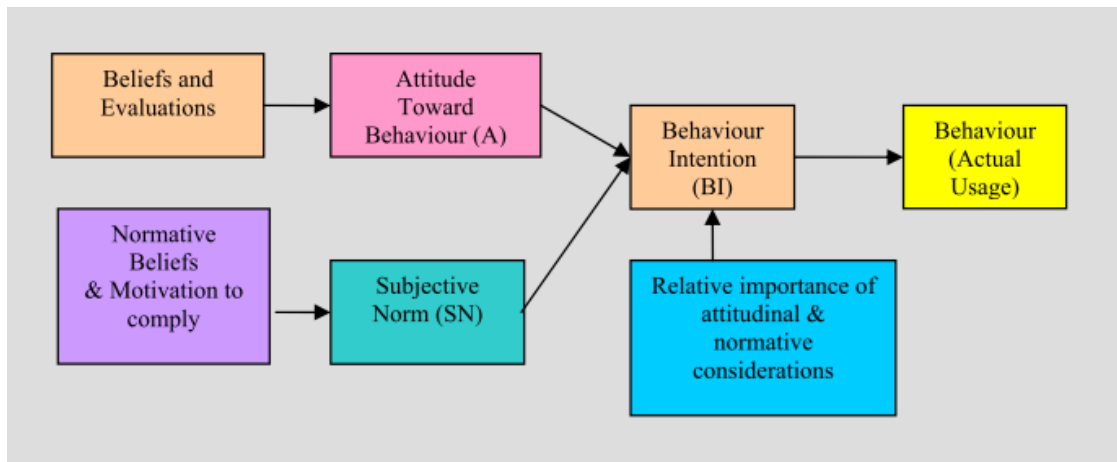
Social Cognitive Theory (Bandura 1986)

Source: Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, N.J.: Prentice-Hall.

2.54 Theory of reasoned action (TRA)

TRA suggests that a person's behaviour is determined by his/her intention to perform the behaviour and that this intention is, in turn, a function of his/her attitude toward the behaviour and his/her subjective norm (Ajzen, 1991). The model bases on two core constructs which consist of subjective norms and attitude toward behaviour. When decision of whether to accept a technology innovation, a person will think about the decision and the possible outcomes of their action before making any decision. This model has been applied extensively in predicting human behaviour in different circumstances including IT usage behaviour. The theory of reasoned action (TRA) is illustrated as in figure 5 below.

Figure 5: Model of Theory of Reasoned Action



Theory of Reasoned Action (TRA) (Ajzen & Fishbein 1980)

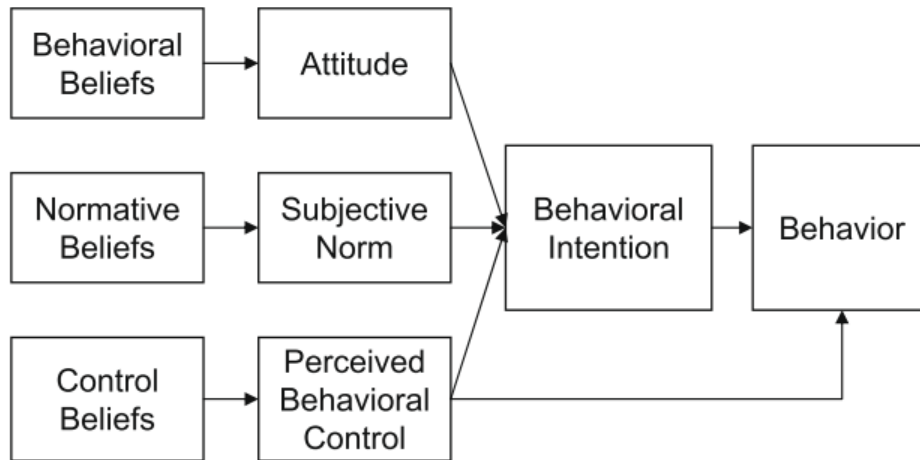
Source: Ajzen, I & Fishbein, M (1980), *Understanding attitudes and predicting social behaviour*, Prentice Hall, <http://search.epnet.com/login.aspx?direct=true&db=aph&authdb=epref&an=UAPSB.AJZEN.PRENTICEHALL.AIHJ>

2.5.5 Theory of Planned Behaviour (TPB)

TPB is an extension of theory of Reasoned Action by introducing a third determinant of intention and perceived behaviour control (PBC) (Ajzen, 1985). The model adds in the element of perceived ease or difficulty of performing certain behaviour in decision use intention. It has been used to help in understanding individual acceptance and usage of many different technology innovations. The theory of planned behaviour is illustrated as in figure 6 as below.

Figure 6: Model of Theory of Planned Behaviour

Theory of Planned Behavior (TPB)

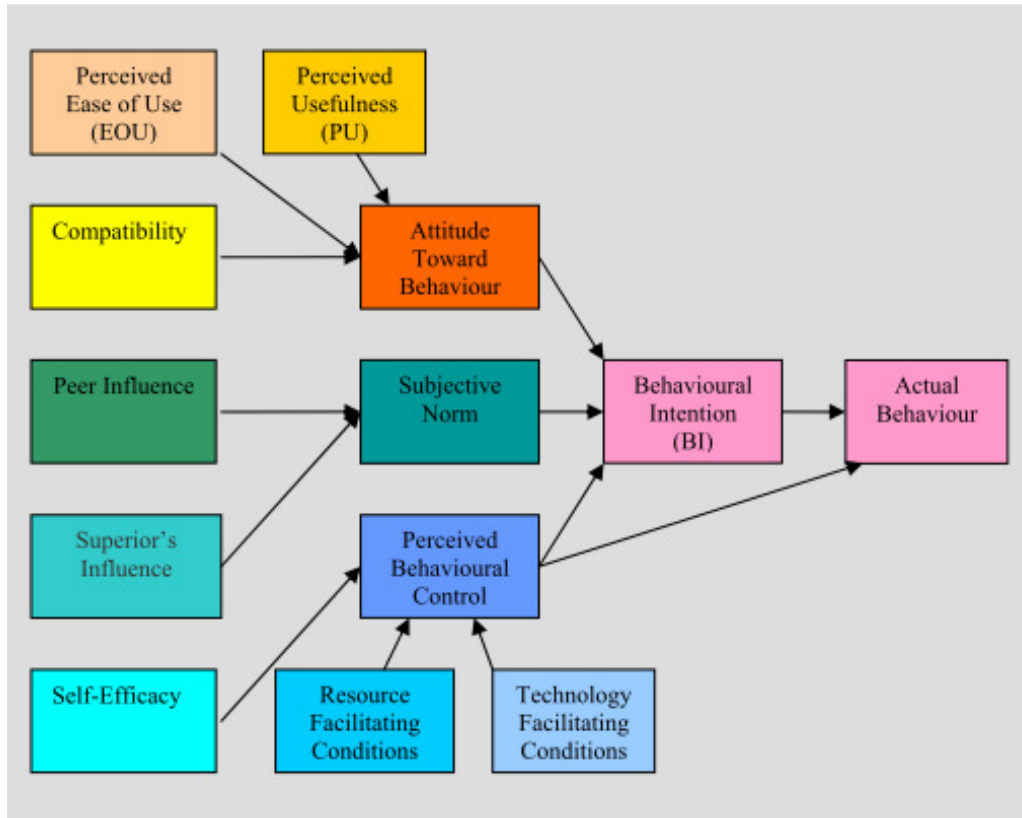


Source: Ajzen, I. (2006, January). Constructing a tpb questionnaire: Conceptual and methodological considerations. Retrieved September 10, 2012 from http://www.uni-bielefeld.de/ikg/zick/ajzen_construction_a_tpb_questionnaire.pdf

2.5.6 Decomposed Theory of Planned Behaviour

This theory was introduced by Taylor and Todd in year 1995. The model suggests that, behavioural intention is the primary direct determinant of actual behaviour (Taylor & Todd 1995a). The constructs of subjective norm, attitude toward behaviour and perceived behavioural control are still valid to be the determinant of behavioural intention. This model seems to have better explanatory power in determining technology usage behaviour. The model of decomposed theory of planned behaviour is illustrated in figure 7 as below.

Figure 7: Model of Decomposed Theory of Planned Behaviour



Decomposed Theory of Planned Behaviour(DTPB) (Taylor & Todd 1995b)

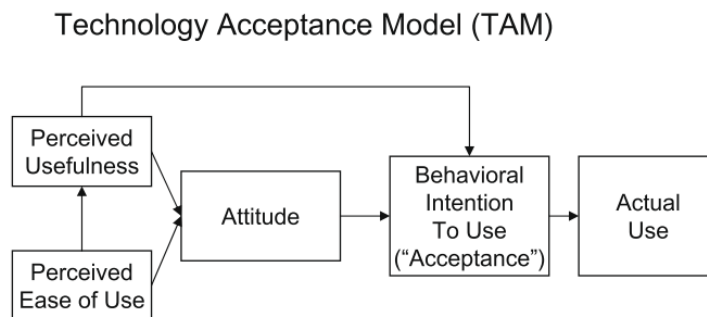
Source: Taylor. S & Todd. P (1995b), 'Assessing it usage: the role of prior experience', *MIS Quarterly*, vol. 19, no. 4, pp. 561-70.

2.5.7 Technology Acceptance model (TAM)

TAM is a widely used model in assessment of information system application in order to predict its acceptance and usage. It was developed by Davis (1989) from Theory of Reasoned Action (TRA). Unlike the other model, attitude construct was excluded in order to better explain intention of use. The two main predictors of attitude toward behaviour are perceived ease of use (PEU) and perceived usefulness (PU).

Generally, TAM specifies general determinants of individual technology acceptance and therefore can be and has been applied to explain or predict individual behaviours across a broad range of end user computing technologies and user groups (Davis, Bagozzi&Warshaw 1989). Over the 10 years, TAM has become well-established as a robust, powerful, and parsimonious model for predicting user acceptance (Venkatesh& Davis 2000). TAM is illustrated as in the figure 8 below.

Figure 8: Model of Technology Acceptance Model



Source: Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-40

One assumption made by TAM is that usage of a particular technology is voluntary (Davis, 1989). It also assumes that, once the intention to use has been formed, one will be free to act without limitation. This condition does not happen in real life as there will be a lot of constraints and limitations like time, resource and constraints from the external environment.

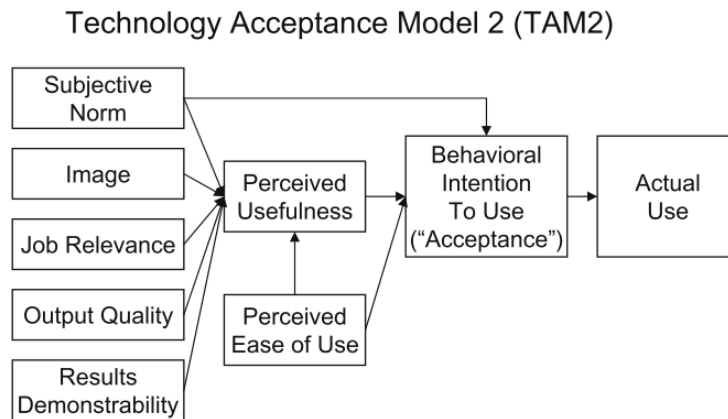
2.5.8 Technology Acceptance Model 2 (TAM2)

TAM2 extended the initial theory of TAM to include subjective norm in order to predict usage intention while the technology acceptance is mandatory. The theory was developed by Venkatesh and Davis in 2000 (Venkatesh& Davis, 2000). Additional key determinants have been added like cognitive instrumental process and social

influence. It was tested both in mandatory and voluntary usage setting and incorporates two additional constructs of cognitive instrumental processes and social influence.

The model enable researcher to identify the possible intervention to increase technology acceptance as it help to understand the effect of change of perception with increase user experience after technology adoption. From the original study on four organisations, this extended model was able to account for 40-60% variance in useful perception and 34 to 52% of variance in usage intention. The concept of Technology Acceptance Model 2 is illustrated as in figure 9 below.

Figure 9: Model of Technology Acceptance Model 2



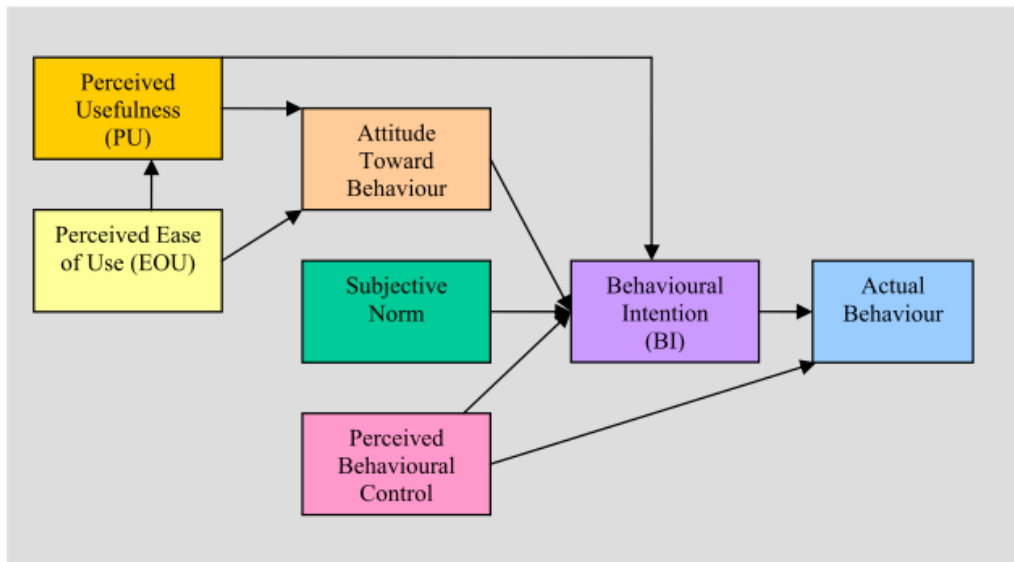
Source: Venkatesh, V. & Davis, F. (2000). A Theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), pp. 186-204

2.5.9 Augmented Technology Acceptance Model (Augmented TAM)

Influence on social and behavioural control factors has been found to have significant influence on IT usage behaviour (Taylor & Todd 1995b; Thompson, Higgins & Howell 1991). For augmented TAM, subjective norm and perceived behavioural control were added to more accurately predict behavioural intention and actual behaviour. The author, Taylor and Todd argued that, this model provides a more complete model of IT usage and it can be applied in experience and inexperienced

user. It is said to sufficiently predict usage behaviour before a person has any experience about the IT system. The theory of Augmented Technology Acceptance Model is illustrated as in figure 10 below.

Figure 10: Model of Augmented Technology Acceptance Model



Source: Taylor & Todd, P 1995b, 'Assessing it usage: the role of prior experience', *MIS. Quarterly*, vol. 19, no. 4, pp. 561-70.

2.6 Unified Theory of Acceptance and use of technology (UTAUT)

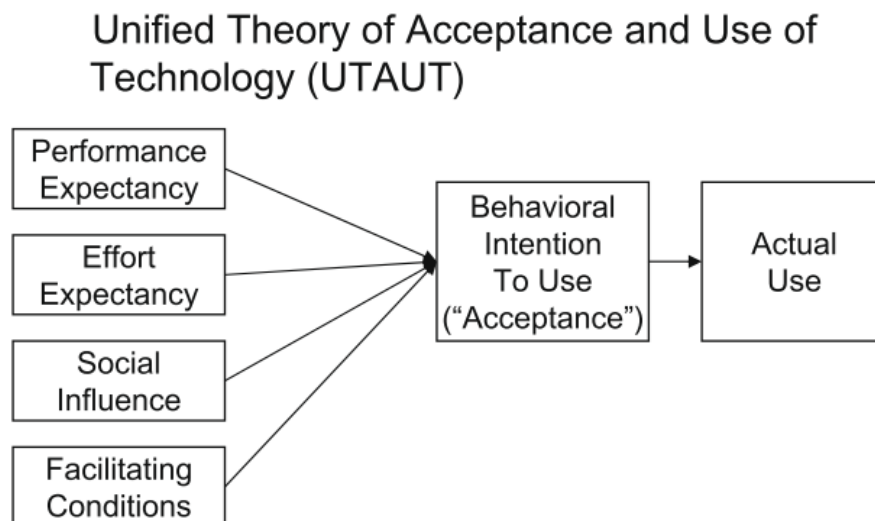
Unified Theory of Acceptance has been shown to demonstrate relatively high explanatory power and provide a more comprehensive understanding of user acceptance of technology. This model is developed by Venkatesh in 2003 aiming to unify eight prominent completing IT acceptances and use models.

UTAUT integrates four moderators and thirty two main effects from previous model in order to form four effects and four moderators that can be used to determine an individual IT acceptance and use. This is illustrated as in figure 11 below.

Basic construct of UTAUT model

1. Performance expectancy: The degree to which a person believe that using the system will help him or her to attain gain in job performance
2. Effort expectancy- the degree to which a person perceives the ease of using the system
3. Social influence- the degree to which a person believe the significant other believe that he or she should use the system
4. Facilitating condition- the degree to which a person believe that the organisation have the technical support to facilitate the use of the system.

Figure 11: Model of Unified Theory of Acceptance and Use of Technology



Source: Venkatesh V, Morris MG, Davis GB, Davis FD (2003). User acceptance of information technology: toward a unified view. *MIS Q* 2003;27:425–78.

For this study, the construct of facilitating condition was not possible as the technology is not currently in use. Furthermore, if the technology is to be implemented, there is still no working framework of how it is going to be done. Hence, inclusion of the construct into the questionnaire will invite answers base on pure assumptions and we expect the predictions in this setting varied among individual.

UTAUT incorporates perceived usefulness, perceived ease of use and subjective norm into performance expectancy, effort expectancy and social influence respectively. New construct of facilitating condition is added to better predict behavioural intention and actual use. Gender, age, experience and voluntariness are modulator of above four constructs on usage behaviour. The evident show that this model has the highest explanatory strength up to 70% (Venkatesh et al. 2003). This figure is higher than any known model form the past. Hence this model was chosen in this study.

Literature of technology acceptance model specifically involving medical practitioners is limited. There is even more difficult to get related data of technology acceptance studies from study population from developing country like Malaysia.

2.7 Study of TAM in healthcare

Clinical system is complex and differs from one healthcare system to another. Hence the fit of health information technology to the clinical system is important determinant of whether the end user use or reject it, misuse it or work around it (Lapointe&RivardL, 2005; Lorenzi& Riley, 2000). Numerous cases of underused, sabotage, resistance and abandonment are evident from this claim (Koppel, Wetterneck, Telles& Karsh, 2008; Patterson, Rogers, Chapman & Render, 2006). There are numerous studies of Electronic Medical Record adoption; however, in depth study of actual degree of usage by medical practitioners is limited.

Technology Acceptance framework was developed in 1980s'. However, it did not develop specifically for healthcare industry. It also never been done in the context of cloud computing technology and more specifically cloud computing based medical record. As healthcare processes are fundamentally different from other industry(Peter &Atanu, 2012), the critical review of the technology acceptance and the validity of model application in local setting are urgently needed.

It is interesting to note that, the limited 16 studies of technology acceptance in healthcare were done in multiple countries. Other than western countries like US, UK and Australia, there are at least 6 studies done in both Taiwan and Hong Kong. Studies topic involves picture archiving and communication system, Computerised Provider order entry (CPOE) and tele-consultation and electronic medical record (Holden & Karsh, 2010). None of the study carried out for healthcare industry in developing country like Malaysia.

Table 1: Summary of reviewed studies of Technology Acceptance Model in healthcare

Table 2

Summary of reviewed studies of TAM in health care.

Study ^a	Technology studied	Population studied and setting	Analyzed sample size (N)	Response rate	Variance explained ^b
Barker et al. [96]	Prototype of a spoken dialog technology for making observations and notes during endoscopic examinations	Physicians (endoscopists) at James Cook University Hospital, UK	10	Not reported (laboratory study)	—
Chau and Hu, Hu and Chau, Hu et al. [32,48,49,95]	Telemedicine technology	Physicians at public tertiary care hospitals, Hong Kong	408	24%	40–44%
Chen et al. [110]	Radio Frequency Identification (RFID) for improving process quality and safety	Fifty-five emergency room (ER) caregivers (physicians, nurses) and 26 information systems staff, at five hospitals in Taiwan	81	Not reported	62% 56% of actual use
Chismar and Wiley-Patton [97]	Internet and Internet-based health applications	Physicians (pediatricians) in Hawaii	89	43%	54%
Duyck et al. [108]	Future picture archiving and communications system (PACS)	Physicians (radiologists) and radiology technologists at Ghent University Hospital, Belgium	56	60%	48%
Han et al. [100]	Mobile medical information system	Physicians (general practitioners and specialists) in Finland	242	42%	70%
Horan et al. [98]	Online disability evaluation system used for patient assessment	Physicians (disability providers) in the US	141	52%	44%
Liang et al. ^c [106]	Personal digital assistants (PDAs) for health care purposes	Pharmacists, physicians, nurses, managers, and others in the US currently using PDAs	173	14%	62% (of actual use)
Liu and Ma [107,112]	Web-based electronic medical records (EMR)	Senior health care trainees in dental hygiene, physician assistants, and radiology staff at hospitals and clinics in the US	77	86%	52%
Paré et al. ^c [101]	Computerized provider order entry (CPOE)	Physicians (general practitioners) at a regional health care network (13 medical clinics, 1 hospital, and 1 laboratory firm) in Quebec	91	73%	55% (of actual use)
Rawstorne et al. [102]	Computerized nursing care plans	Nurses in a hospital in Australia	61	Not reported	29–30% 0–12% (of actual use) 63%
Schaper and Pervan ^d [105,111]	Information and communication technology (ICT)	Occupational therapists in Australia	1605	25%	63%
Tung et al. [103]	Electronic logistics information systems	Nurses at ten medical centers/hospitals in Taiwan	252	72%	70%
Van Schaik et al. [104]	Prototype of a portable computerized postural assessment technology	Physio-therapists in the UK	49	Not reported (laboratory study)	39% (of actual use)
Wu et al. [109]	Mobile health care systems (MHS) including mobile Picture Archiving and Communication Systems (PACS) and mobile order systems	Physicians, nurses, and medical technicians at medical centers/hospitals in Taiwan that had partially or fully implemented a mobile health care systems	123	42%	70%
Yi et al. [99]	Personal digital assistants (PDAs)	Physicians (residents and faculty) in seven family practice residencies in the US	222	74%	57%

Source: Holden, R. J., & Karsh, B. (2010). The technology acceptance model: Its past and its future in health care. *Journal of Biomedical Informatics*, 43(2010), 159–172. doi: 10.1016/j.jbi.2009.07.002

From this important review paper, test of technology acceptance and other models were done and compared. The constructs predict attitude and behavioural intention quite well. Limited evidence shows that behavioural intention predicts usage in two out of three studies. There is also strong relationship as expected, between attitude and behavioural intention. Perceived usefulness is the strongest construct to predict attitude and behavioural intention.

The relationship between perceived ease of use (PEOU) and subjective norm (SN) with behavioural intention is weak. Only half of the study shows that the relationship is positive. However, strong relationship exists between perceived usefulness and perceived ease of use.

Holden (2010) explains that possible reason of non significant effects of subjective norm in predicting intention is due to physician specific characteristic which is independence and immune to peer pressure. The paper point out that, there might be strong influence of age and sex while comparison was done between professions. For example, we expect consultant group to have older study subjects and nurses to be young and female gender.

Holden(2010) concludes that the increase in use of technology acceptance models in healthcare appeared justifiable and many of the relationship of constructs and intention repeatedly validated. It was impressive that, perceived usefulness significantly predicts behavioural intention.

Technology acceptance research is developed outside healthcare, hence some of the constructs and relationship between construct might not be true in healthcare setting. Even though it is true in healthcare setting, the condition might differ for Malaysia population as none of the study conducted in our local multiracial setting.

2.8 Trust

In the area of psychology, trust is viewed as a personality based trait, which is a deep internal feeling which is based in variety of experiences in the individual life (Wang & Emurian, 2005). Social psychologists define trust as the willingness, expectation and risk of one party to another which can be referred to as interpersonal trust (Tan & Sutherland, 2004). Sociologist defines trust as a social structure which is situational constructed and this is named institutional trust (Tan & Sutherland, 2004). Trust is a complex and abstract concept (Ba & Pavlou, 2002) hence its definitions varied. It is usually interchanged with the concept of credibility, reliability and confidence (Wang & Emurian, 2005).

Trust was defined as willingness to be vulnerable based on confidence in positive expectations about the intentions and behaviour of the other (Mayer, 1995). Gefen defines trust as the expectation that the trusted party will behave in an ethical, dependable and socially appropriate manner and will fulfill their expected commitments in conditions of interdependence and potential vulnerability (Gefen, Karahanna & Straub, 2003a). According to Fuller, trust refers to the willingness of one party (the trustor) to be vulnerable to the action of another party (trustee) (Fuller, Serva & Benamati, 2007). Some researchers claim that credibility is an important factor in users' perception and acceptance of online environment (Fogg & Tseng, 1999). Fogg (1999) further explains that trustworthiness is an essential component of credibility, rather than credibility being a cue to trustworthiness. These definitions are well accepted.

The issue of trust in Information System (IS) has become increasingly important issue (Gefen et al. 2003a; Wang & Emurian, 2005). However, the factors that motivate individuals to use online services are still not fully known (Lallmahamood, 2007). Individual decision to use EMR with cloud computing will depend on many factors which are currently not clear but presume to be consistent to established technology acceptance theories. This decision is not only dependent on the characteristics of the

technology but probably more considerations will take place before the user trust the technology.

Cloud computing involve putting data at a location remote from the original location and probably in the third party institutions. It's a known fact that there is inherent important of patient confidentiality. The data security issue becomes crucial as current legal and ethical frameworkrequires a healthcare institution to be extra prudent about data storage. This makes the security issue a primary consideration while making key technology adoption decision related to medical record. The concern is particularly relevant if the internet interaction involve exchange of private and confidential information

Due to all this recent development, trust has become a significant research topic. The success of technology innovation especially if it involves collection of confidential informationlike e-commerce will only be successful when the trust exists for consumer to use the technology. Lack of consumer trust is believed to be the major impediment to the success of e-commerce (Salam, Iyer, Palvia& Singh, 2005).If customer trust online vendor, and have confidence in the service and/or product which they provided, they will be more likely to make purchase decision or reveal sensitive personal information (Wang &Emurian, 2005). Recent research repeatedly demonstrated the positive relationship between trust with customer intention to conduct business with an online company (Gefen et al 2003a, Lui& Jamieson 2011, Tan & Sutherland, 2004)

Not only this, majority of Internet user would engage in online financial transaction if they are ensured that the security and privacy of their personal information and identity can be secured (Tan & Sutherland, 2004; Wang &Emurian, 2005). Hence improving security of technology innovation and its set up are crucial to make sure user comfortable with the transaction. Besides this, establishing right standards contribute to establishing trust since institutional trust is not only based on personal experiences but also interpersonal procedures that coordinate standards

(Ratnasingam, Gefen&Pavlou, 2005). Trust also established when there is positive and frequent communication, good reputation, security and privacy features of the system. The security features should include encryption; authentication and integrity check to ensure online transaction carried out safely. Obviously, without this safety features, service like Internet banking and cloud base electronic medical record will not be entrusted and used.

It becomes inevitable for cloud business to build good reputation and trust with its clients and the potential customers of the client company. The success of E-commerce is highly dependent on the level of trust consumer has to the technology (Ba &Pavlou, 2002; Gefen et al., 2003a; Pavlou&Gefen, 2004; Wang &Emurian, 2003). As trust declines, people will increasingly reluctant to take risk. This phenomenon is especially true while the transaction involves exchanging of personal or financial information in an online environment (Tan & Sutherland, 2004).

In the study of technology acceptance of Internet, Trust has been added to the TAM model in several studies. Gefen et al. (2003b) has included the construct of Trust into the TAM in the study of e-commerce. The study proposed that trust should be included into research model in order to predict intention of online purchase. Another researcher, Chen et al. (2004) included Trust into perceived service quality and compatibility in the TAM model for user acceptance of virtual stores (Chen, Gillenson&Sherell, 2004). Both researchers treat 'Trust' as the use acceptance factor in e-commerce. Trust has also been included into additional acceptance criterion for mobile service by another two researches: Barnes & Huff (2003) and Kindberg al (2004).

The study conducted by Gefen et al (2003a), trust was hypothesized to be stronger for potential customer. The result of the study show statistical significant relationship between trusts with purchase intention. In the study conducted by Ayo, Adewoye& Oni (2011) on Business-to-consumer e-commerce in Nigeria, trust, perceived risk and behavioural intention are found to have significant relationship. The study shows that

risk is the predictor of trust and trust in turn has low significant effect on behavioural intention.

Literature revealed that trust is a complex concept. Researcher still trying hard to understand what it really build up from (Corritore, Kracher&Wiedenbeck, 2003). There is the possibility that, if the construct of trust is better understood and shown to be relevant in predicting technology usage, it can be build into technology acceptance framework. Based on this, the issue of trust become relative important when we are investigating technology related to handling of sensitive data.

2.8.1 Trust in healthcare

The construct was also studied in technology acceptance model involving healthcare professionals. In the study of Tung (as cited at Tung, Chang & Chou, 2008) with population of 252 nurses at Taiwan in using electronic logistics informationsystem, confirms that trust had a positive effect on both behavioural intention to use and perceived usefulness. Trust is the variable with the highest standardised coefficient score (0.25) among all other variables like perceived usefulness (0.23), perceived ease of use (0.22), compatibility (0.14) and perceived financial cost (-0.20) to correlate with behavioural intention. With the structure, researcher proposed that the model accounted for 70% of variance which is considerably high. The researcher suggests that the extended technology acceptance model with trust and perceived financial cost is more explicative than the model without the two variables to predict the nurses' behavioural intention to use.

This is the only literature investigating construct of trust in combination to technology acceptance research. It involves only nurses at different country (Taiwan) and of course a completely different healthcare system and environment. It also involves technology which is completely different from current study.

2.9 UTAUT-Trust model

With the potential of UTAUT and also Trust in predicting behavioural intention to use of cloud computing based electronic medical record, the model of UTAUT-Trust is proposed.

First and foremost, there is a need to make sure that the constructs of UTAUT is correlating with behavioural intention followed by the need to determine the correlation coefficient of Trust. If the correlation is determined, UTAUT-Trust might be the proposed model for further research of cloud based computing in healthcare.

2.9.1 Hypothesis and framework

H1: Performance Expectancy has significant relationship toward intention to use of cloud computing base electronic medical record.

H2: Effort Expectancy has significant relationship toward intention to use of cloud computing base electronic medical record.

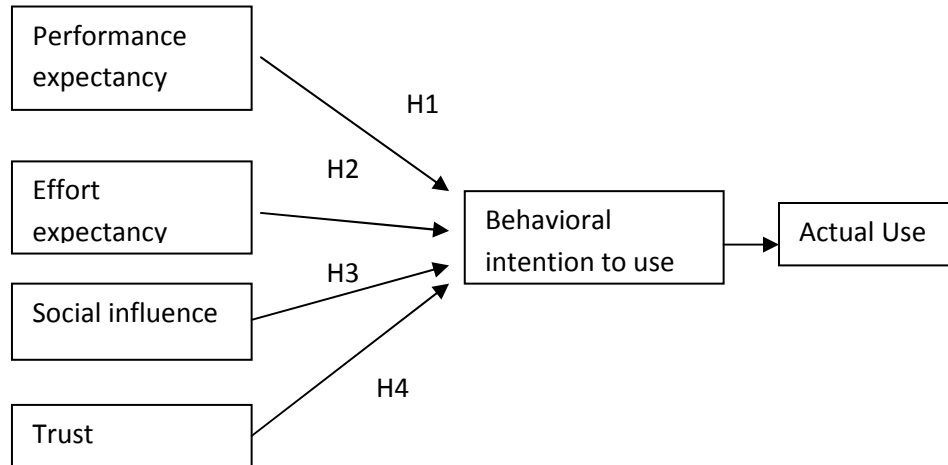
H3: Social Influence has significant relationship toward intention to use of cloud computing base electronic medical record.

H4: Trust has significant relationship toward intention to use of cloud computing base electronic medical record.

H5: There is single model of predictors which explain all subgroups of medical professional.

In our case, the construct of facilitating condition was not able to be determined as the model was base on framework which is not in existence. Below is the suggested framework for the research:

Figure 12: Proposed UTAUT-Trust Model



CHAPTER 3

METHODOLOGY

3.1 Research process

Research methodology provides a way to systematically solve the research problem. Various steps will be studied that are generally adopted by a studying this research problems along with the logic behind them.

The research started with preliminary information collection through the semi-structure interviews involving medical professionals. Open ended questions were asked in order to collect preliminary data. The preliminary data collection is important in understanding the real issue faced by healthcare workers while dealing with medical record and potential application of cloud computing in their work place. This process allows the exploration of additional insight of possible determinant that seem to be important in determining the technology acceptance. The interview also makes the adaptation of questions and clarification of doubt possible.

This measure ensures that all questions going to put up in the questionnaire are well understood. This was done by modifying some of the phases to adapt the local setting.

The general opinions of electronic medical record and cloud computing adoption were obtained from five medical professionals. Concern about the understanding of cloud computing concept was explored. This measure facilitates the development of theoretical framework, model selection and questionnaire formulation later.

More information was then obtained via literature review. This process enables collection of more information and issue related to the topic. This measure generates insight to the real problem faced by healthcare industry. All the information is integrated in logical manner. This helps to conceptualize problem and formulate possible solution for the problem of cloud computing application in healthcare.

After the initial interview, theory about impact of additional constructs which might add to the predictive value of technology acceptance model was identified. This measure facilitates hypothesis generation.

After the questionnaire is created using the selected model, a pretest of the questionnaire was conducted. This measure enables detecting problem in questionnaire design and instruction, ambiguous or bias questions and identify questions which are difficult to understand or easily misunderstood. Specific questions about their opinion in questionnaire wording, sequencing, layout and clarity of the instruction was asked. The time needed to complete the questionnaire was estimated. This was done with 5 medical professionals: 3 doctors and 2 nurses. The data collected from them is not included into the study. After the pretest, there was some minor change to the article design, arrangement and wording in order to improve understanding and ease of filling in of the questionnaire.

3.1.1 Research design

The study is an explanatory in nature as it aims to describe the general perception of doctors and nurses about the concept of EMR with cloud computing application in their workplace. This helps the policy maker to understand the acceptance level of medical professional to this technology innovation.

This is also a correlation study as it identifies important variables that are associated with the problem. It is conducted as cross sectional setting using survey research methodology in order to capture the opinion of participants over the period of two months. This is considered as analytical survey as it will involve finding of relationship between perception and usage intention.

The hypothesis testing offers the enhance understanding of the relationship between variables, explains the variance in the dependant variable. It will eventually establishes the relationship and determine the validity of utilisation of UTAUT in assessing technology acceptance of cloud computing based EMR in healthcare industry. A further step will be taken to investigate the construct of Trust in addition to UTAUT model.

3.1.2 Development of questionnaire

The questionnaire of the study was created by combining the questionnaires validated in known research in order to assess technology acceptance and also trust. As assessment is done for a technology which is currently not utilised by almost all participants, some of the questions were modified or even deleted. Wording of some questions was modified to make it more relevant to the research context. However, the main structure and meaning of the questions was preserved as long as possible. Deletion or exclusion will be done if it is not possible to modify the relevant questions.

All the questions are in English as most Malaysian doctors and nurses use English as medium of teaching in all medical and nursing colleges. Medical colleagues and nursing staffs also communicate in English to certain extend. Translation of some of the difficult wording was provided to make sure that young nurses understand all the questions. Translation of whole question or verification was not done or provided.

A presentation was held to make sure that participant have a basic idea of how EMR and cloud computing works. This measure is needed as most medical professional is not familiar with the term of cloud computing even though they might use the

technology in day to day life. Without the presentation, some of the participant might not be able to imagine how the technology is going to have impact to their work. The presentation is in the form of 15 slides power point explanation. Two video clips also available for further explanation of how EMR and cloud computing work in real working condition of a healthcare worker. These video clips are obtained from EMR advertorial of SAP (SAP TV, 2011) which introduces SAP EMR product. Another video clip is the educational material of VISION cloud (Alexander, 2012).

SAP is a software corporation which currently leading the market of enterprise software that manage business operations and customer relations. VISION cloud is a European Union funded project aims to add innovative functionalities for the future Internet. The primary deliverables of VISION Cloud will be architected and a reference implementation of a cloud-based infrastructure, built on open standards and new technologies, provide a scalable, flexible and dependable framework for optimized delivery of data-intensive storage services.

The supportive material is deemed sufficient to at least make sure that participant understand the technology innovation. The fact has been proven from the better understanding of the topic from initial interview. This fact is unable to be validated as it was not measured. However, the process makes sure that all participants get the opportunity of exposure to general concept before filling in the questionnaire. Deficient of technology detail is not thought to be able to give great impact to the result as the research is mainly testing participant perception and its intention to use the cloud computing based EMR and not only the perception toward the technology.

A cover letter was attached with the questionnaire in order to introduce the purpose and benefits of the study, clarify the issue of confidentiality, no payment, procedure of the study and finally the identity of the researcher. This questionnaire is only for participant who give the consent to allow collection of information, who are medical professional (either doctor or nurses) and who has at least read the power point and video presentations which introduce the concept of EMR with cloud computing.

The survey starts with collection of demographic data of participant. Age, gender, race, job description of participant, job experience in healthcare industry, experience of EMR use with or without cloud computing in work and Internet experience are assessed. The questionnaire utilizes the 5 points Likert Scale for measuring participant perception and use intention. With the Likert Scale, respondents indicate their perception by checking how strongly they agree or disagree with the statements or questions that ranges from very positive to very negative toward the statement. The scale range from strongly Disagree=1, Disagree = 2, neither agree nor disagree= 3, Agree= 4 and Strongly Agree= 5. There are also questions which are open ended. This gives the opportunity to participant in giving their views and concern. The views will be collected and the prominent opinion will be summarised and serves as the possible research question for future.

Respondents are accessed in several aspects as listed below:

1. Performance expectant:
 - Perceived usefulness
 - Job fit
 - Relative advantage
 - Outcome expectation

2. Effort expectancy:
 - Perceived ease of use

 - Complexity

 - Ease of use

3. Social influence:
Subjective norm

Comment: Social factors which potentially affect the perception and behaviour are not included as it assesses the actual condition after use. The participant is not possible to answer the question in the current stage of pre-implementation.

4. Attitude toward using technology:

- Attitude toward behaviour
- Intrinsic motivation
- Affect toward use

5. Affect

6. Trust

7. Intention to use

8. Remarks

This is not an optimal way of collecting data due to lack of coding and comparability. However, a column of remarks was provided in order to collect opinion. These opinions help in identifying areas which need further study in future.

The questionnaire is constructed after combining UTAUT model and validated questionnaire in assessing Trust. The UTAUT questionnaire is obtained from the research paper of Cameron (2007). The major construct of 'facilitating condition' and Perceived behavioural Control (PBC) model is a major construct of UTAUT. They were excluded because of following reason:

- The application of the technology is complex and currently no working model as yet.
- There is no plan for the policy maker to implement the technology in near future.
- The researcher perceives that, if the concept is to be implemented, it is not going to be near future. Hence assessment of perception using current condition will be too vague and beyond imagination.

Table 2: Questionnaire sources and number of items

Construct	Variables	Number of Items	Sources
Performance expectance	Perceived usefulness	6	Davis et al. (1989)
	Job Fit	5	Davis et al. (1989)
	Relative advantage	5	Davis et al. (1989)
	Outcome expectations	7	Davis et al. (1989)
Effort Expectancy	Perceived ease of use	6	Davis et al. (1989)
	Complexity	4	Davis et al. (1989)
	Ease of Use	3	Davis et al. (1989)
Social influence	Subjective norm	2	Davis et al. (1989)
Trust	Trust	10	Gefen et. al., 2003; Koufaris& Hampton-Sosa, 2004
Attitude toward using technology	Attitude	4	Davis et al. (1989)
	Intrinsic motivation	3	Davis et al. (1989)
	Affect toward use	3	Davis et al. (1989)
	Affect	2	Davis et al. (1989)
Intention to use	Intention to use	3	Davis et al. (1989)
Total items		63 items	

3.1.3 Reliable and validity analysis of the instrument

Reliability and validity of the measures can be done with testing goodness of data. Reliability is the extent to which research finding would be the same if the same questionnaire is used again in later date. A measure which is reliable offers consistent result across time if the same procedure of measurement is replicated. This study will

use the Cronbach's coefficient alpha to test the intervariable consistency reliability. According to Sekaran (2003), reliability less than 0.6 are considered to be poor, 0.7 considered to be acceptable, 0.8 or higher are good.

3.1.4 Reliability

The reliability of all variables was tested by measuring the Cronback's alpha. Table * show that, Cronbach's Alpha value for all item is 0.956. According to Hair, BlackBabin, Anderson & Tatham (2005), reliability of the variables is acceptable if the value of Cronbach's Alpha is more than 0.70. Therefore, the instrument used to measure the Intention to use of cloud computing based EMR is reliable.

Table 3: Reliability Analysis

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.956	0.960	63

Validity of the measure is the extent to which the data collected truly reflect the phenomenon being studied. Sekaran (2003), suggested several validity tests for testing the goodness of measure which include construct validity, content validity and criterion-related validity.

3.2 Data collection

This research is conducted in a non-contrived & voluntary setting. A lot of issues of sample selection are not under direct control and there was minimal interference by the researcher of the study. In view of the natural working condition of the participant that is extremely busy, the participant rate is expected to be low and the sampling process might not be optimal.

Due to the consideration above which has been identified during the initial stage of preliminary interview, the online questionnaire was created. Potential participants are approached using emails, announcement in online forum and Facebook close group of medical professionals. With these measures, larger number of medical professionals can be approached, covering a large geographical area. The respondents can complete the questionnaire when they have free time with the high anonymity which is very appreciated by medical professionals. However, there is also problem with this approach. If the participant has any doubt, their doubt usually will not be clarified as there is no dedicated person available for them to ask question.

On the other hand, some participants fill in the questionnaire using the hard copy of the questionnaire. It was personally administered questionnaire like what was conducted using online version. This questionnaire entry was conducted in one of the hospital where the researcher has access to. Doctors and nurses were approached when they completed their Continuous Medical or Nurses Education (CNE) in the hospital. The response rate for this approach is close to 100% but there was limited opportunity of having this kind of session. This is because, medical professional work in shift system and it is extremely difficult to get everyone to fill in the questionnaire in one session.

3.2.1 Variable measurement

1) Independent variables

Independent variables of this study are adapted from existing literature of technology acceptance research. There are 4 independent variables in this study, namely Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Trust (T). Each of these variables, measured with 2 to 23 questions which tailored to local and cloud computing application context. All variables were accessed using the five-points Likert Scale. A total of 48 questions were constructed in order to capture the perception of cloud computing base medical record.

2) Dependent variable

A total of 15 questions were used to assess Attitude toward Using Technology (ATUT) and Intention to Use of the cloud computing base medical record. All of the variables were accessed using the five-point Likert Scale except for some of the questions from the variable of Attitude toward using Technology in which only 2 points were used.

3.3 Population, sampling and data collection

3.3.1 Population

The population of the study is the entire group of doctors, nurses and medical assistants in Malaysia. This target population will be labeled as medical professionals in the study. This group of professions includes 38,000 doctors (Koh, 2011) and 75,000 registered nurses in public and private sectors. The Internet penetration rate for this population is expected to be higher than the average Internet penetration rate of the general population which is 61.7%. As a large number of Malaysian population use Facebook (43%), the researcher expects that there will be a large number of nurses who have Facebook accounts. In fact, some of the study shows that the Facebook penetration for the online population is as high as 72.1% (Socialbakers, 2012). The Facebook population is mainly young & people aged 18 to 44 years old contribute to 74% of total Facebook usage. Hence, the study expects that most nurses and doctors have Facebook accounts.

In order to get sufficient respondents from this busy professional, the respondents from the hospital alone is going to be very tedious for several reasons as below:

- Nurses are doing shift work, they are usually very busy during working hours and leave the hospital immediately after shift work.
- Assembly involving nurses usually conducted in small groups because of shift work. Repeated sampling from one hospital is needed to capture most nurses.
- Doctors are usually very busy as well. This is rare for doctors to willingly spend more than 5 minutes to do something not related to his/her work or personal

matter like filling in a questionnaire without much incentive unless the researcher knows the doctor personally.

- Hospital administration usually will not allow external agents to carry out questionnaire survey for their nursing staff and doctors as it will usually consider as nuisance.

Hence because of difficulty in getting sufficient respondent, other than collecting data of all medical practitioner and nurses at the hospital the researcher has access to: NCI Hospital, invitation via Internet was introduced. Email was sent to all researchers' friend who are doctor and nurse. Posting of messages with link to the research website at wall of Facebook Close group of nurses/medical assistants and doctor was also carried out. This measure, allow target population who are interested to join the study.

3.3.2 Sample size

As a rule of thumb proposed by Roscoe (1975), the sample size should be 30 for each category if the sample is divided into sub-samples.

For this study, the main sub-sample would be nurses, General practitioner and doctor from hospital. Hence the sample size should be at least 30 from each sub-group or 90 respondents. Comparison between private and public medical practitioner as well will be carried out for both nurses and doctors. This will eventually divide the sample into 4 sub-samples. Therefore, optimally the study will need more than 120 respondents.

3.3.3 Data collection

The data collection is done using paper questionnaire at NCI Hospital at Nilai, Negeri Sembilan. Potential participant was given a power point presentation about EMR and cloud computing during their CNE. This was followed by video clips which further explain both EMR and cloud computing. Paper questionnaire was distributed and collected at the end of survey which usually take around 5 minutes. This site is selected because the researcher has the full access to the hospital and management of the hospital agreed to give permission for this academic activity. Hence the response

of the hospital was very encouraging. The application to conduct this kind of questionnaire survey from 4 other hospitals were either being rejected or received no response.

A website was created at <https://sites.google.com/site/healthcarecloudmalaysia/> to present the power point and video clips. An online questionnaire was created using Google Form and all data entered and submitted will be collected in the format of Google Spreadsheet. This questionnaire was inserted to the website and all instructions were given in order to guide the participant on how to read the information before they proceed to fill in the questionnaire. This method was tested in the pre-implementation stage and the feedback for its ease of use is encouraging. Participant just needs to fill the form online and submit after completion. The link of the website was sent using email to researcher's friends who are nurse and doctor. Re-sending of mass emails was done for several weeks. The response rate using this method is expected to be higher as they know the researcher personally.

The link of website also being posted to the closed group of doctors and nurses Facebook page. The administrator of the close Facebook group will usually screen through the member before participation of the close group granted. In the questionnaire, there is also a column for participant to verify their profession. This measure allows exclusion of participant who is not doctor and nurses. The Facebook closed group receive the invitation for the survey are: Malaysia Primary Care Network (<http://www.facebook.com/groups/Malaysianprimecareetwork/>) with more than three thousand members and Malaysia Nurse Forum (http://www.facebook.com/groups/15604721_7776242/) with more than ten thousand members. This was done after permission granted by the administrator of the Facebook page. An event also created by the administrator to invite all their members to fill in the questionnaire. The response via this method is very poor as most members usually not interested to participate. However because of large number of members and repeated promotion of the survey in the Facebook page, the number of participant obtain via this method is encouraging.

3.3.4 Response rate

The participation is on voluntary basis and no personal identity was collected. The overall response rate of the study is unable to be determined. For paper questionnaire and invitation using emails, the response rate is good. The paper has the response rate of close to 100% as all eligible attendee of Continuous Nurse Education (CNE) fill in the questionnaire and return the form at the same day. For online questionnaire, the response rate calculation is impossible. This is mainly because the member of the Facebook who exposed to the posting is not able to be determined.

3.3.5 Data editing and coding

The data is analysed using SPSS software version 20.0.0. Hence, data from Google Spreadsheet was converted into coded number. Data was screened by checking each variable to see if the score was out of range. After identifying the possible outlier, the data is cross checked with initial questionnaire if available. Seven participants with 'other' profession were excluded as the status of the study defined target group was unable to be determined. There are also three participants with missing data of more than 30%. This group was also excluded from the study. Hence, the study population is reduced from initial 151 persons to 141 persons for final analysis.

3.3.6 Data Analysis

The first stage of analysis involves testing of the sample validity and reliability. This would be followed by descriptive analysis of the demographic of the studied population. T test will be utilised to examine the differences between groups. Following this, Pearson correlation analysis will be performed and general linear model will be formulated for the whole group of cohort. Subgroup analysis will be performed as well to discover the different of general linear model of each subgroup. Comparison will be performed for data from the literature.

CHAPTER 4

RESEARCH RESULTS AND INTERPRETATION

4.1 Preliminary data analysis

4.1.1 Missing data analysis

The response from the questionnaire has already been screen through and only questionnaires which are usable included. These measures excluded three cases with more than 30% of data missing. This part of data management was done to clean up the data to a format suitable for multivariate data analysis. However, even with these measures, some missing data values still exist in the data set.

This measure of exclusion of three cases because of significant missing data reduces the sample size but the effect to the study is deemed to be minimal. The next step of the analysis is to ascertain whether the data is missing randomly as non-randomly missing data will lead to erroneous result. The problem of missing data for other respondents is not severe with percentage of ranging from 0 to 3.5%. This is considered to be a common occurrence. This is also within the allowance for missing

data which are inherent in the technique used in this study. The data set remain considered to be representative of the sample.

4.1.2 Imputation of missing data

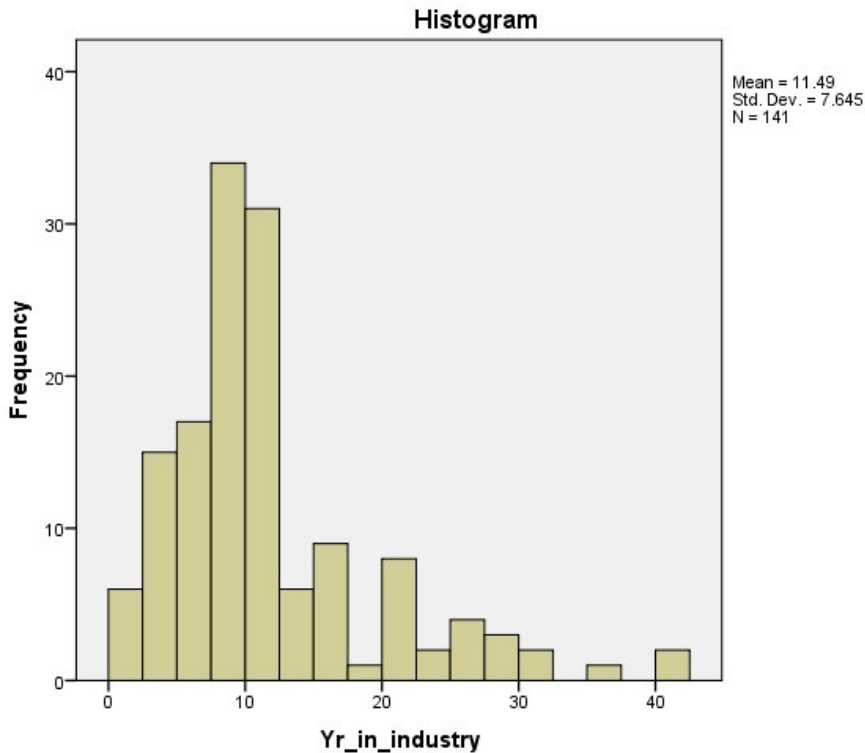
Quantitative variable of 'Yr in industry' having the highest missing value with 3.5% or 5 counts missing. Most of the other variables have only a few missing data which might not be significant in prohibiting effective comparison between group. For this study, serial median technique was used to replace missing data. Using this technique, round figure will be obtained in order to make it as close as possible to the estimated score.

4.1.3 Multivariate outlier

Outlier analysis is only performed for the only quantitative variable with interval scale which is 'Yr in Service'. Outlier is the detection of value which is distinctively different from other observations. It is either extremely high or low value. In this case, the outlier is not considered to be problematic, hence it is still considered within the context of the analysis.

There is an obvious outlier in which a few respondents are much more experience from the rest of the respondents. This is considered to be the normal characteristic of the study population in which senior person might constitute minority of the cohort as the leader of the industry. Using SPSS, the population distribution was characterized by measuring the percentile and the distribution is plotted into histogram which displayed in figure 13. It shows the left skewness of the study population. This phenomenon can be easily explained with the labor intensive healthcare industry with a small group of senior personals leading a large group of young doctors and nurses. For this reason, the outliers are not deleted from the study population.

Figure 13: Outlier for year of experience of participant in healthcare industry



4.1.4 Reliability analysis

Internal consistency of the instrument is measured using Cronbach's alphas. The value of alpha can take any value less than or equal to 1. Higher value of alpha are more desirable and it indicates a more reliable instrument used in the study. In this study, all the items in the instrument used achieve the alpha value of more than 0.9 as shown in Table 3 as on page 59. It means that the test is highly reliable.

4.1.5 Validity analysis

In order to establish the construct validity, convergent validity test is used. It measures the degree to which a measure is correlated with other measures that are predicted that it is correlated with. If the test is highly correlated, it means the scale is

able to measure its intended concept effectively. For the dataset, it passes the validation check without problem.

4.2 Descriptive analysis

Basically, this will be achieved by using descriptive analysis method which include T test. The tests aim to achieve several objectives as below:

- 1) To explore the baseline demographic characteristic of the whole cohort.
- 2) To determine the level of self perceived computer and internet usage competency and internet with cloud computing usage behaviour. This will be compared within different subgroup of medical professionals.
- 3) To assess general perception of cloud based Electronic Medical Record.
- 4) To assess use intention of cloud based medical record and compared it between subgroup of medical professional.

4.2.1 Respondents demographic and baseline statistic

Total participant of this study is 151 persons. A total of 141 of participants are included in the final analysis. Ten participants were excluded because of reason as show in Table 4 below. Most exclusion is because of their status of 'other' profession in which the inclusion criteria of nurse/medical assistant and doctor is not fulfilled.

Table 4: Reason and number of participant excluded from study

Reason of exclusion	Number of participants
Participant with 'Other' profession	7
Missing data of more than 30%	3

Table 5: Age Distribution of respondents

		Frequency	Percent	Cumulative Percent
Age	21-30 years old	39	27.7	27.7
	31-40 years old	70	49.6	77.3
	41-50 years old	21	14.9	92.2
	51-60 years old	9	6.4	98.6
	More than 60 years old	2	1.4	100.0
	Total	141	100.0	

Most of the respondents are middle age with close to 50% of them in 31-40 years old. There is also significant number of respondent (27.7%) in 21-30 years old of age.

Table 6: Age & Job Description Cross tabulation

		Job description												Total
		1	2	3	4	5	6	7	8	9	10	11	12	
Age	21-30	6	22	1	0	0	0	1	0	5	2	0	2	39
	31-40	7	9	0	0	20	1	3	3	9	4	1	13	70
	41-50	0	2	0	1	0	1	5	0	0	3	0	9	21
	51-60	2	1	0	0	0	0	1	0	0	0	0	5	9
	> 60	0	0	0	0	0	0	0	1	0	0	0	1	2
Total		15	34	1	1	20	2	10	4	14	9	1	30	141

1. Nurse/Medical assistant (Public)
2. Nurse/Medical assistant (Private)
3. Nurse/Medical assistant (University)
4. Sister or Matron (Public)
5. Specialist or Consultant (Public, Hospital)
6. Specialist or Consultant (Public, Clinic)
7. Specialist or Consultant (Private, Hospital)
8. Specialist or Consultant (University)
9. Hospital Medical Officer (Public)
10. Hospital Medical Officer (Private)
11. Trainee Lecturer (doctor)
12. General Practitioner (Clinic)

Table 6 shows that, major contributor to the young age of respondents (21-30 years old) is the young nurses in private (22 persons) and public (6 persons) hospitals. Age

group of 31-40 consists of mainly public hospital specialists (20 persons), public medical officers& nurses (9 persons each) and general practitioners (13 persons).

Table 7: Gender

Gender		Frequency	Percent	Valid Percent	Cumulative Percent
Gender	Female	86	61.0	61.4	61.4
	Male	54	38.3	38.6	100.0
	Total	140	99.3	100.0	
Missing	System	1	.7		
Total		141	100.0		

Not surprisingly, there are more female in the whole cohort. This is mainly because, nurses are included in the study and most nurses are female. In this study, there are only 7 male nurses (14%) out of the total 50 nurses. The trend is shown as in the Table 7 above.

Table 8: Job Description and Gender Cross tabulation

		Gender		Total
		Female	Male	
Job description	Nurse/Medical assistant (Public)	11	4	15
	Nurse/Medical assistant (Private)	31	3	34
	Nurse/Medical assistant (University)	1	0	1
	Sister or Matron (Public)	1	0	1
	Specialist or Consultant (Public, Hospital)	5	15	20
	Specialist or Consultant (Public, Clinic)	2	0	2
	Specialist or Consultant (Private, Hospital)	2	7	9
	Specialist or Consultant (University)	2	2	4
	Hospital Medical Officer (Public)	10	4	14
	Hospital Medical Officer (Private)	7	2	9
	Trainee Lecturer (doctor)	1	0	1
	General Practitioner (Clinic)	13	17	30
Total		86	54	140

This female predominant is clearly explained by the Table 8 in which the female gender out number male counterpart. For doctor, the female: male ratio almost equal with 43 lady doctors and 47 male doctors participated in the study. Hence the gender different is basically due to the cohort of nurses in the study.

Table 9: Ethnicity

Race		Frequency	Percent	Valid Percent	Cumulative Percent
Ethnic	Malay	64	45.4	46.0	46.0
	Chinese	46	32.6	33.1	79.1
	Indian	20	14.2	14.4	93.5
	Other	9	6.4	6.5	100.0
	Total	139	98.6	100.0	
Missing	System	2	1.4		
Total		141	100.0		

Table 10: Job Description & Race Cross Tabulation

		Race				Total
		Malay	Chinese	Indian	Others	
Job description	Nurse/Medical assistant (Public)	12	0	0	3	15
	Nurse/Medical assistant (Private)	24	3	6	1	34
	Nurse/Medical assistant (University)	1	0	0	0	1
	Sister or Matron (Public)	0	0	0	1	1
	Specialist or Consultant (Public, Hospital)	3	14	2	0	19
	Specialist or Consultant (Public, Clinic)	2	0	0	0	2
	Specialist or Consultant (Private, Hospital)	1	4	3	2	10
	Specialist or Consultant (University)	0	3	0	0	3
	Hospital Medical Officer (Public)	5	6	2	1	14

	Hospital Medical Officer (Private)	3	3	3	0	9
	Trainee Lecturer (doctor)	1	0	0	0	1
	General Practitioner (Clinic)	12	13	4	1	30
	Total	64	46	20	9	139

The ethnic group distribution of this study mimics the ethnic distribution of Malaysian population. Malay constitutes about 46%, Chinese 33% and Indian 14.4%. However, close look of the distribution as shown in Table 9 & 10 reveals otherwise. It is a norm that nurses' population consists of predominantly Malay and it is shown in the population cohort of this study. Ethnic distribution is almost evenly distributed for subgroup of general practitioner and medical officer. On the other hand, subgroup of specialist is dominated by Chinese. There are 21 Chinese (61.8%) specialists participate in this survey from the total subgroup population of 34 specialists.

Table 11: Job Description

Job description	Frequency	Percent	Cumulative Percent
Nurse/Medical assistant (Public)	15	10.6	10.6
Nurse/Medical assistant (Private)	34	24.1	34.8
Nurse/Medical assistant (University)	1	.7	35.5
Sister or Matron (Public)	1	.7	36.2
Specialist or Consultant (Public, Hospital)	20	14.2	50.4
Specialist or Consultant (Public, Clinic)	2	1.4	51.8
Specialist or Consultant (Private, Hospital)	10	7.1	58.9
Specialist or Consultant (University)	4	2.8	61.7
Hospital Medical Officer (Public)	14	9.9	71.6
Hospital Medical Officer (Private)	9	6.4	78.0
Trainee Lecturer (doctor)	1	.7	78.7
General Practitioner (Clinic)	30	21.3	100.0
Total	141	100.0	

Medical professional from the cohort is mainly from private sector and the trend as shown in Table 11 & figure 14 is observed for both nurses and doctors. Nurses constitute about 36.2% of the total population. However, out of the entire

nurse population, most of them come from private sector (24.1%) and ranked second is nurse from public hospital (10.6%). Only a university nurse/medical assistant and a matron or sister participates in this study. The rest of the population is doctors (63.8%). 25.5% of the total population is specialist and 38.3% of them are non-specialist.

Figure 14: Private and Public distribution

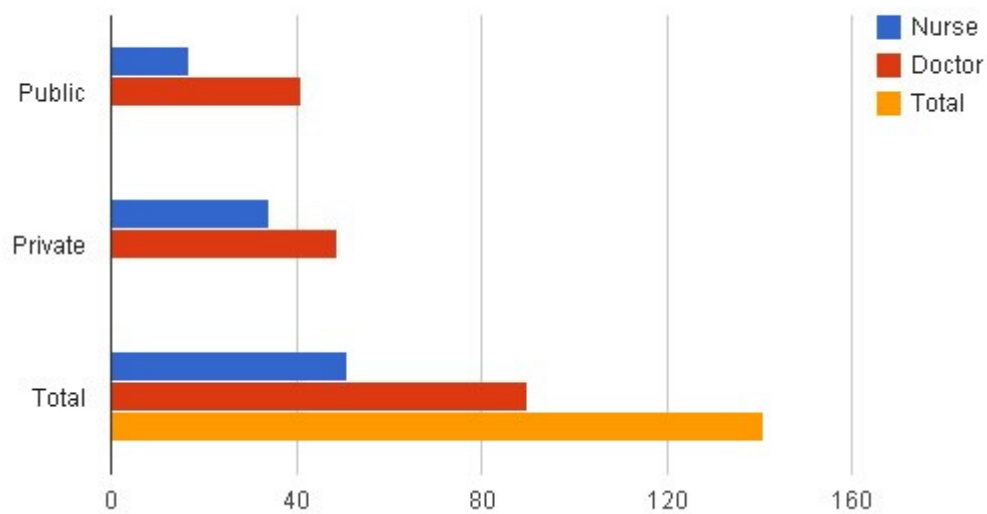


Table 12: Source of participant recruitment

	Frequency	Percent	Cumulative Percent
Facebook	68	48.2	48.2
Via hospital of the participant	39	27.7	75.9
Introduced by friend	29	20.6	96.5
Other websites	4	2.8	99.3
Other channels	1	.7	100.0
Total	141	100.0	

The survey forms are filled via 3 main sources as shown in Table 12. The main source is from Facebook posting. Almost half (48.2%) of the participants acquired using this method. The message of introduction of the study was posting in closed group of primary care doctor and nurses forum. Medical professionals participate on

voluntary basis via this channel. 27.7% of participants were acquired via direct introduction of the study to hospital staffs. The study also introduced to friends of the researcher mainly using emails and Facebook direct massaging. The response was good with 20.6% of participant acquired through this method.

Table 13: Percentage of EMR use at work place

EMR at Work		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	82	58.2	58.6	58.6
	No	55	39.0	39.3	97.9
	Unknown	3	2.1	2.1	100.0
	Total	140	99.3	100.0	
Missing	System	1	.7		
Total		141	100.0		

Table 14: Job description and EMR at work cross tabulation

Job description & EMR at work Cross tabulation		EMR at work			Total
		Yes	No	Unknown	
Job description	Nurse/Medical assistant (Public)	10	5	0	15
	Nurse/Medical assistant (Private)	7	24	3	34
	Nurse/Medical assistant (University)	1	0	0	1
	Sister or Matron (Public)	0	1	0	1
	Specialist or Consultant (Public, Hospital)	14	6	0	20
	Specialist or Consultant (Public, Clinic)	2	0	0	2
	Specialist or Consultant (Private, Hospital)	6	3	0	9
	Specialist or Consultant (University)	4	0	0	4
	Hospital Medical Officer (Public)	8	6	0	14
	Hospital Medical Officer (Private)	5	4	0	9
	Trainee Lecturer (doctor)	0	1	0	1
	General Practitioner (Clinic)	25	5	0	30
	Total		82	55	3

Surprising, Electronic Medical Record (EMR) is used by most of the participant as shown in Table 13 & 14. Up to 58.1% of all participants use this technology in their hospital or clinic. Analysis of EMR usage base on profession revealed that most of the general practitioner use EMR with 25 out of total 30 GP use the technology. For nurses, 30 nurses out of total 48 nurses use the technology. Interestingly, public nurses use the technology more than private nurses. This observation might not be significant as the survey form is distributed at the only private hospital with no EMR facility.

Table 15: Percentage of cloud computing use

Cloud Computing Use	Frequency	Percent	Cumulative Percent
Yes	31	22.0	22.0
No	98	69.5	91.5
Unknown	12	8.5	100.0
Total	141	100.0	

As shown in the Table 15 above, only 22% use cloud computing before the survey. The concept of the cloud computing was introduced in the presentation before the survey. However, we doubt that the participant understand the full range of cloud computing defined in the study. In this study, personal mailing service provided by Yahoo!, Gmail and Hotmail is classified as cloud computing.

Table 16: Internet use frequency

Internet Use Frequency	Frequency	Percent	Cumulative Percent
Don't use at all	3	2.1	2.1
Use once a month	4	2.8	5.0
Use several time a month	3	2.1	7.1
Use once each week	4	2.8	9.9
Use several time a week	14	9.9	19.9
Use about once a day	15	10.6	30.5
Use several time a day	98	69.5	100.0
Total	141	100.0	

Most of the participant use internet frequently and most (69.5%) use several times a day. The trend is shown in the Table 16 above. 10.6% and 9.9% of participants use internet once a day and several time a week respectively. On the other hand, there are 3 (2.1%) medical professionals don't use internet at all.

Table 17: Frequency of computer use

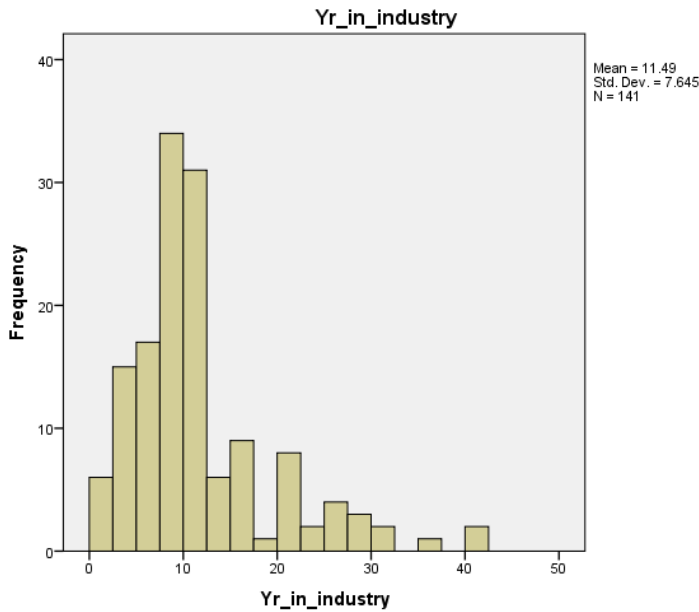
Self Assessment: Computer Use		Frequency	Percent	Cumulative Percent
	Low experience	8	5.7	5.7
	Moderate experience	97	68.8	75.0
	High experience	35	24.8	100.0
	Total	140	99.3	
Missing	System	1	0.7	
Total		141	100.0	

As expected, most medical professional classify themselves as moderate to high experience computer user as shown in the Table 17 above. Only 5.7% of participants claim that they have low experience in using computer.

Table 18: Year of experience in healthcare industry

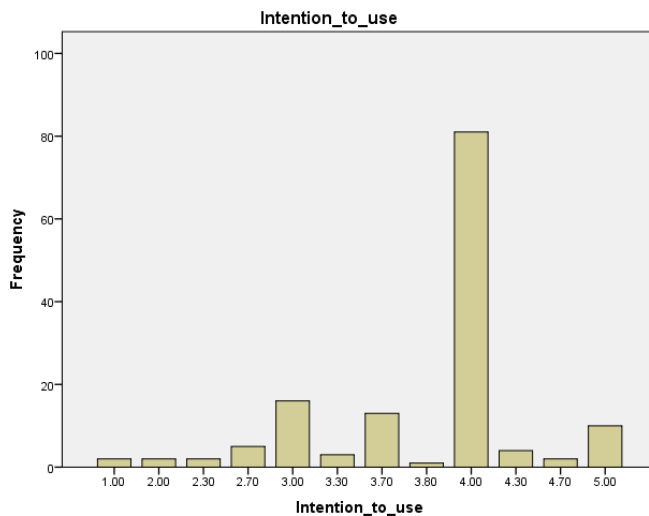
	N	Minimum	Maximum	Mean	Std. Deviation
Yr in industry	141	1	40	11.49	7.645

Figure 15: Year of experience in healthcare industry



The participant's number of year of working experience is left skewed with more participants with experience of less than 15 years. This trend was shown in the Table 18 and figure 15 above. The reason is obvious as most of the staff nurses and doctors are young. However, there is also no lack of senior medical professional in this cohort. The participant's year of experience working in healthcare industry ranges from 1-40 years. The mean duration is 11.5 year.

Figure 16: Intention to use



Majority of patient intent to use cloud base EMR. Up to 80.9% score an average of more than 3.0 and 68.8% of participant agree with the use of cloud base EMR with mean score more or equivalent to 4.0. Only 7.1% of participant strongly agreed with the technology innovation and significant portion (11.3%) of participants still very much sitting on the fence.

Figure 17: Affect toward Cloud based EMR

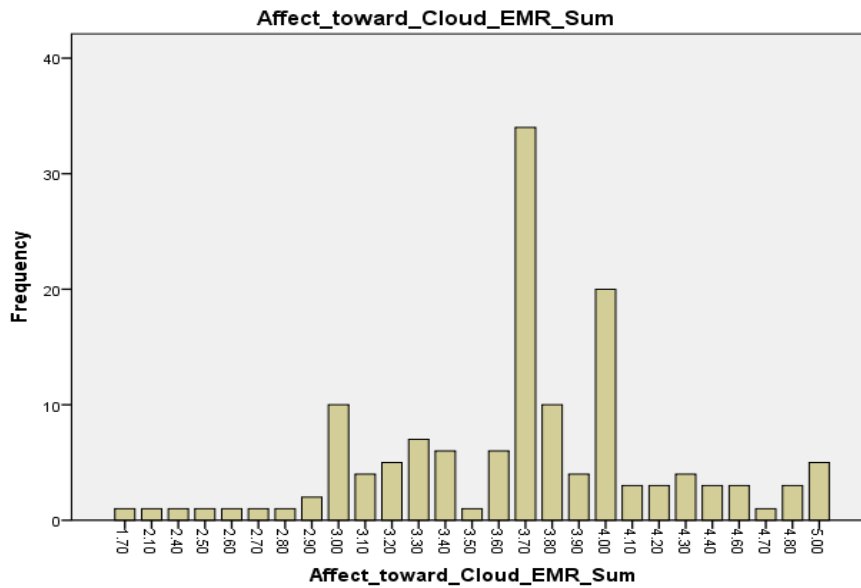


Table 19: Affect toward cloud EMR

Affect Toward Cloud EMR (Sum)		
N	Valid	141
	Missing	0
Mean		3.7035
Median		3.7000
Std. Deviation		.56725

Minimum		1.70
Maximum		5.00
Percentiles	25	3.3500
	50	3.7000
	75	4.0000

The technology also perceived to be more than neutral by more than 75% of participants as shown by Table 19 above. 25% of participant definitely likes the

technology innovation and they score with the mean of more or equivalent to 4.0. The mean score is 3.7 in this study.

4.3 Multivariate normality

The test of normality is needed ensure that the data is compliance with statistical assumption of multivariate techniques. Some of the important assumption of multivariate analysis is assuming multivariate normality. The method assumes that the distribution of dependant variable is normal.

4.31 Multicollinearity

Correlation analysis is conducted to examine the bivariate relationship among variables. According to Field (2005), in order to avoid multicollinearity, the correlation coefficient should be below 0.8. Table 20 shows the correlation coefficients among the independent variables. The correlation coefficients are all below 0.8.

Table 20: Test of multicollinearity

Variables	Perceived usefulness	Job Fit	Relative Advantage	Outcome expectation	Perceived ease of use	Complexity	Ease of Use	Subjective norm	Trust
Perceived usefulness	-								
Job Fit	0.424*								
Relative Advantage	0.593*	0.610*							
Outcome Expectation	0.467*	0.657*	0.752*						
Perceived ease of use	0.575*	0.419*	0.525*	0.471*					
Complexity	-0.344*	-0.131	-0.327*	-0.210*	-0.455*				
Ease of use	0.446*	0.415*	0.568*	0.415*	0.796*	-0.447*			
Subjective norm	0.341*	0.270*	0.423*	0.518*	0.360*	-0.171*	0.402*		
Trust	0.426*	0.344*	0.368*	0.413*	0.397*	-0.098	0.441*	0.473*	-

Note: *correlation is significant at 0.05 level (2 tails)

4.4 Analysis of independent variables

Table 21: Mean score of independent variables

Descriptive Statistics			
	Mean	Std. Deviation	N
Intention to use	3.7908	.67654	141
Perceived Usefulness	3.9099	.77490	141
Job fit	3.8163	.66747	141
Relative Advantage	4.0057	.62801	141
Outcome expectation	3.7553	.58681	141
Performance expectant sum	3.8993	.54162	141
Perceived ease of use	3.8277	.67338	141
Complexity	2.7809	.79435	141
Ease of use	3.8582	.60523	141
Subjective norm	3.4326	.79781	141
Trust	3.4730	.69301	141

There are several variables with high score as shown in Table 21 above. The high score mean that the patient agree with features of the technology and its possible implementation. From the Table above, 'relative advantage' stands out to be the highest scored independent variable. Its mean, most participants agree that cloud computing base EMR possibly better than whatever technology the participants used for medical. In fact, the whole construct of 'performance expectant' and its subgroup which are perceived usefulness, job fit, relative advantage and outcome expectation get a high score.

For 'ease of use' of the technology, the variable also highly scored. Basically, participant gives a reasonable high score to 'perceived ease of use' and 'ease of use'. The construct of 'complexity' received a mix score of only 2.78. This might be due to different perception from different subgroup of medical professional.

'Subjective norm' and 'Trust' received relative lower score. Both of the construct received the mean score of less than 3.5. This observation might be due to medical

professional relative resistant to influence from peer and lower trust to cloud technology in storing patient medical record.

It's a good sign to observe that 'intention to use' received high score of 3.79. With this observation, the administrator of healthcare institution can be reassured that, implementation of cloud base EMR is not going to be unachievable.

4.4.1 Comparison between subgroup

Table 22: Comparison between subgroup: Nurses vs doctor

Group Statistics (T Test)				
Nurses vs Doctors		N	Mean	P Value*
Perceived Usefulness	Nurse	51	3.9059	0.960
	Doctor	90	3.9122	
Job fit	Nurse	51	3.9078	0.143
	Doctor	90	3.7644	
Relative Advantage	Nurse	51	4.0824	0.248
	Doctor	90	3.9622	
Outcome expectation	Nurse	51	3.8980	0.014
	Doctor	90	3.6744	
Performance expectant sum	Nurse	51	3.9392	0.461
	Doctor	90	3.8767	
Perceived ease of use	Nurse	51	3.8196	0.911
	Doctor	90	3.8322	
Complexity	Nurse	51	3.1647	0.000
	Doctor	90	2.5633	
Ease of use	Nurse	51	3.8490	0.885
	Doctor	90	3.8633	
Subjective norm	Nurse	51	3.5588	0.131
	Doctor	90	3.3611	
Trust	Nurse	51	3.7039	0.001
	Doctor	90	3.3422	
Affect toward Cloud EMR Sum	Nurse	51	3.7353	0.591
	Doctor	90	3.6856	
Intention to use	Nurse	51	3.8725	0.258
	Doctor	90	3.7444	

* Equal variances not assumed

There are significant different between doctors and nurses on constructs such as complexity, trust and outcome expectation as shown in the Table 22 above. These three variables show statistical significant different of the mean score with p value smaller than 0.05 with complexity at 0.000, trust at 0.001 and outcome expectation at 0.014.

Nurses subgroup generally, feel that cloud based EMR is more complex, but they expect better outcome from its implementation. Nurses also have more trust toward the technology and its potential vendors.

Doctors group is generally skeptical with the cloud based technology and the mean score of trust of only 3.34 compared to nurses mean score of 3.7. Doctor perceived the technology to be less complex compared to nurses subgroup. In regard to outcome expectation, doctor have less positive expectation compared to nurses.

Table 23: Comparison between subgroup: GP va Doctor Non GP

Group Statistics (T Test)				
GP vs Dr Non GP		N	Mean	P Value*
Perceived Usefulness	GP	30	3.7867	0.393
	Doctor non	60	3.9750	
Job fit	GP	30	3.8933	0,327
	Doctor non	60	3.7000	
Relative Advantage	GP	30	4.0867	0.239
	Doctor non	60	3.9000	
Outcome expectation	GP	30	3.7933	0.283
	Doctor non	60	3.6150	
Performance expectant sum	GP	30	3.9500	0.395
	Doctor non	60	3.8400	
Perceived ease of use	GP	30	3.8333	0.992
	Doctor non	60	3.8317	
Complexity	GP	30	2.6100	0.681
	Doctor non	60	2.5400	
Ease of use	GP	30	3.9133	0.629
	Doctor non	60	3.8383	
Subjective norm	GP	30	3.3667	0.966
	Doctor non	60	3.3583	
Trust	GP	30	3.2767	0.496
	Doctor non	60	3.3750	
Affect toward Cloud EMR Sum	GP	30	3.7300	0.661
	Doctor non	60	3.6633	
Intention to use	GP	30	3.6933	0.602
	Doctor non	60	3.7700	

* Equal variances not assumed

From the Table 23 above, it is clear that there is no different between GP and non-GP. The score of independent and dependant variables are all have no statistically significant different.

Table 24: Pearson Correlation

Independent variable	Correlation coefficient	P value*
Perceived Usefulness	0.620	0.000
Job fit	0.454	0.000
Relative Advantage	0.564	0.000
Outcome expectation	0.469	0.000
Perceived ease of use	0.555	0.000
Complexity	-0.274	0.000
Ease of use	0.502	0.000
Subjective norm	0.431	0.000
Trust	0.657	0.000

* One tail

Pearson correlation is a measure of the strength of the linear relationship between two variables. As established model is used in this study, the independent variables are expected to correlate with the intention to use of the technology. From Table 24 above, all variables are correlated to intention to use and all of them are statistically significant. However, the strength between the correlations might vary. Trust is another important component examined in this study. It was believed to be an important component which predicts intention to use of the cloud computing based EMR.

4.9 Hypothesis test

In this study, all variables are correlated with the intention to use. Perceived usefulness, job fit, relative advantage and outcome expectation which are the sub-component of performance expectancy are all statistically significant in correlating with intention to use. The P values are all less than 0.05. The variables of perceived usefulness and relative advantage are particularly stronger compared to other variables and they have the correlation coefficient of more than 0.50.

Perceived ease of use, complexity and ease of use which are the sub-components of effort expectancy are also all statistically significant in correlating with intention to use. As expected, complexity is negatively correlated with intention to use but it is

not strong and its correlation coefficient is only -0.274. Other 2 components, perceived ease of use and ease of use are also strongly correlated with intention to use.

Subjective norm which is the component of social influence is statistically significantly correlated with intention to use. However, the correlation coefficient is lowest (0.431) among all variables.

In contrast, Trust is the variables with highest correlation coefficient and of course, it is statistically significant. This provides the early evident that it is potentially out-perform other variables to become the main predictor of intention to use cloud based EMR among all medical professionals. This is an important finding as Trust is proven to be more important than other variables in predicting intention to use. Null hypothesis of the following are rejected and alternative hypothesis accepted:

Table 25: Hypothesis acceptance

Hypothesis	Outcome
H1: Performance Expectancy has significant relationship toward intention to use of cloud computing base electronic medical record.	Supported
H2: Effort Expectancy has significant relationship toward intention to use of cloud computing base electronic medical record.	Supported
H3: Social Influence has significant relationship toward intention to use of cloud computing base electronic medical record.	Supported
H4: Trust has significant relationship toward intention to use of cloud computing electronic medical record.	Supported

Table 26: Correlation: Affect

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
	(Constant)	.904	.287				3.151	.002		
1 Affect toward Cloud EMR Sum	.779	.077	.654	10.181	.000	.654	.654	.654	1.000	1.000

a. Dependent Variable: Intention_to_use

The correlation between the affect toward cloud EMR toward intention to use is also statistically significant with the correlation coefficient of 0.654 as shown by Table 26 above.

4.6 General liner model

4.6.1 Analysis of structure model: Whole cohort of study population

With the analysis, general linear model will be built for the whole cohort. Comparison between subgroup of medical professional will be conducted to assess whether the model is consistent between subgroup.

First of all, linear regression analysis is conducted to assess the whole cohort of 141 participants.

Table 27: Analysis of structure model: Subgroup analysis for whole cohort

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change
1	.657 ^a	.431	.427	.51204	.431	105.397
2	.756 ^b	.572	.566	.44565	.141	45.502
3	.777 ^c	.604	.595	.43044	.032	10.927
4	.786 ^d	.617	.606	.42473	.013	4.705

- a. Predictors: (Constant), Trust
- b. Predictors: (Constant), Trust, Perceived Usefulness
- c. Predictors: (Constant), Trust, Perceived Usefulness, Relative Advantage
- d. Predictors: (Constant), Trust, Perceived Usefulness, Relative Advantage, Perceived ease of use
- e. Dependent Variable: Intention to use

‘Trust’ is the major variable which predicts intention to use of cloud based EMR. Trust itself explained 43% of the dependant variable (Intention to use). With the adding of other variables which are ‘perceived usefulness’, ‘relative advantage’ and ‘perceived ease of use’, the model is able to explain 60% of dependant variable.

However, the addition of ‘perceived ease of use’ to the model is very minimal which is only 1.3%. This raises the question, whether it is worthwhile to add ‘perceived ease of use’ into the model. This also highlights that, as long as the technology and the technology provider are trustworthy and the technology is useful and provides advantage to the user, it will be used. ‘Ease of use’ even though is important; it doesn’t seem to be so critical in determining the use intention of cloud based EMR.

4.6.2: Analysis of structure model: subgroup population

Table 28: Analysis of structure model: Nurses vs all doctors

Nurse vs doctor	Model	R	R Square	Adjusted R Square	Change Statistic	
					R Square Change	F Change
Nurse (N=51)	1	.800 ^a	.640	.633	.640	87.228
	2	.854 ^b	.730	.718	.089	15.884
Doctor (N= 90)	1	.673 ^d	.452	.446	.452	72.680
	2	.766 ^e	.587	.578	.135	28.402

- a. Predictors: (Constant), Perceived Usefulness_a
- b. Predictors: (Constant), Perceived Usefulness, Trust_b
- c. Predictors: (Constant), Relative Advantage_d
- d. Predictors: (Constant), Relative Advantage, Trust_e
- Dependent Variable: Intention to use_c

From Table 28, nurse and doctor’s intention to use the cloud based EMR is affected by different variables. For nurse, the variable of ‘perceived usefulness’ alone explains 64% of dependant variables. This is followed by ‘Trust’.

The variables which predict intention of use of cloud based EMR are differ among doctors. ‘Relative advantage’ is the most prominent variable and this is followed by ‘Trust’ in predicting use intention.

The model predicts the intention to use better for nurse than doctor. R square for the model is much higher for nurses (0.718) compared to doctors (0.578).

Table 29: Analysis of structure model: GP vs doctor non GP

Model		R	R Square	Adjusted R Square	Change Statistic	
					R Square Change	F Change
GP(N: 30)	1	.673 ^d	.453	.433	.453	23.191
Doctor Non GP (N: 60)	1	.757 ^e	.572	.565	.572	77.617
	2	.825 ^f	.681	.669	.108	19.336
	3	.853 ^g	.728	.714	.048	9.832

- d. Predictors: (Constant), Trust_d
- e. Predictors: (Constant), Relative_Advantage_e
- f. Predictors: (Constant), Relative_Advantage, Trust_f
- g. Predictors: (Constant), Relative_Advantage, Trust, Perceived_ease_of_use_g
Dependent Variable: Intention_to_use_c

As shown by Table 29 above, the liner model which predicts intention to use of cloud based EMR is different between General Practitioner (GP) and Non GP doctors. For GP, Trust is the most prominent variable and it explains 45.3% of dependant variable. For Non-GP doctors, the model provides better prediction but it consists of 3 variables. Relative advantage is most important and the variable alone predicts 57.2% of Non GP doctor intention to use of cloud based EMR. The model is further strengthened with variables of ‘trust’ and ‘perceived ease of use’. With the addition of

these two variables, the model predicts 71.4% of the intention to use of non GP doctors.

Table 30: Analysis of structure model: Private vs Public or University medical professional

Private vsPublic	Model	R	R Square	Adjusted R Square	R Square Change	F Change
Private (N:98)	1	.716 ^a	.512	.507	.512	100.854
	2	.773 ^b	.597	.589	.085	20.019
Public or university (N:43)	1	.801 ^c	.641	.632	.641	73.158
	2	.858 ^d	.737	.723	.096	14.528
	3	.876 ^e	.768	.750	.032	5.320

- a. Predictors: (Constant), Trust_a
- b. Predictors: (Constant), Trust, Perceived_Usefulness_b
- c. Predictors: (Constant), Relative_Advantage_c
- d. Predictors: (Constant), Relative_Advantage, Trust_d
- e. Predictors: (Constant), Relative_Advantage, Trust, Perceived_ease_of_use_e

The models which able to predict subgroup of private and public or university medical professional is also differ remarkably. The different is shown in the Table 30 above. For private medical professional, ‘trust’ and ‘perceived usefulness’ are prominent. The model which consist of these variables predict 58.9% of intention to use of cloud based EMR among private medical professional.

On the other hand, ‘relative advantage’, ‘trust’ and ‘perceived ease of use’ are more important for public and university medical professional in predicting intention to use of cloud computing based EMR. Prominent variable which is ‘relative advantage’ in this model predict 63.2% of intention to use of cloud based EMR.

Table 31: Comparison of whole cohort and subgroups

Category	performance expectant				Effort expectancy			Social influence	Trust
	PU	JF	RA	OE	PEOU	C	EOU	SN	Trust
Whole cohort	*								*
Nurses vs Doctors	Nurse	*							
	All doctors			*					
GP vs doctor non GP	GP								*
	Doctor non GP			*					
Private vs public/university	Private	*							*
	Public/university			*					

* Most prominent variable in the model

PU = Perceived usefulness

PEOU : Perceived ease of use

JF = Job Fit

C : Complexity

RA : Relative advantage

EOU : Ease of use

OE : Outcome expectation

SN : Subjective norm

From the comparison as illustrated by Table 31, there is a clear different exist between subgroups and between subgroups with the whole cohort. Some of the variables are more prominent in certain groups. Some other variables relatively less important even though it is statistically significant in its correlation with intention to use of cloud computing base EMR.

Table 32 below illustrate some of the prominent trends seen:

Table 32: Exploration of trend seen for all subgroup

Prominent Variable	Subgroup
Trust	All cohort
Relative advantage	All doctors, non GP and public/university medical professional
Perceived usefulness	Nurses

With this prominent trend, the hypothesis 5 as below is not supported:

H5: There is single model of predictors which explain all subgroups of medical professional. The alternative hypothesis to the above would be: There is no single model of predictors which explain all subgroup of medical professional.

Table 33: Possible reasons of resistance toward cloud computing

Reason why some think cloud base medical record is a bad idea	Percentage
Its compromise patient's privacy	28.4
It will be expensive to me	12.1
It will be expensive to patient	13.5
It will be difficult to learn and apply	9.2
It will break the barrier of entry for my business	5.0
It will increase my workload	12.1
It's just the government/conglomerate tactic to disempower medical professional	6.4
Other reason	5

N= 65

A total of 65 medical professionals participated in the exploratory study. The question try to explore why some participants perceived cloud computing based EMR is a bad idea. The concern of patient data privacy and confidentiality top the list as shown in Table 33. 28.4% of participants think that the technology is a bad idea because of the concern of possible patient privacy compromise. Three other contributors of poor perception of the cloud technology applied to EMR are:

- The technology might be expensive for patient,
- The technology will be expensive to the medical professional
- The technology will increase the medical professional's work load.

CHAPTER 5

DISCUSSION

The study was conducted for technology which is not used by most participants before. Even though a presentation was given before questionnaire, perception assessed is only based on concept of the technology and the possible general framework. Depend on how the technology is designed eventually and how it is implemented, the perception might differ.

With the study, at least the researcher will probably have more idea what are the main concerns of potential end user. The concern is important as it might be the potential obstacle of product purchase and adoption. The result of the study is crucial in guiding the design of the technology and its features. It's also important in guiding design of marketing program to promote the usage. The study would expect end user of cloud computing base EMR will at least be less resistant to the initial adoption if some of the basic concerns are addressed. However, subsequent usage and its incorporation into daily work without getting around the technology will be impossible to be predicted with the result of the study. The features of the technology and how it fit into the work flow and cognitive process of medical professionals will be very important. Unlike other technology for example mobile phone and internet

banking, the processes that handled by the technology is simpler and the user is mainly general public. Cloud based EMR technology is different as it is much more complex and the end user is medical professionals.

The study population is well educated and most of them have good knowledge about computer and internet. 97.9% of participants use internet before. Up to 90% of participant use internet at least several time a week. It is surprise to note that there are small minority of the participant (2.9%) never use internet. Up to 93.6% of participants classify themselves as having at least a moderate experience in using computer.

5.1 Low mean score for Trust and Subjective norm

From the analysis, some independent variables received higher score than the others. The whole construct of performance expectant and perceived ease of use received high score. Whereas, the construct of trust and subjective norm received relatively lower score. This trend shows that medical professional still generally skeptical toward cloud computing based technology. This trend is supported by the exploratory question at the end of the questionnaire which aims to discover why some of the participants feel that cloud based EMR is a bad idea.

In the study of E. Myers (2010), significant correlations were found between technology readiness and optimism as well as technology readiness and insecurity/discomfort. No significant relationship was found between technology readiness and innovativeness. Hence, trust is still an important factor which might contribute to the readiness of medical professional in accepting a technology innovation.

The electronic medical record handle a complex service delivered by a powerful and influential user: the clinician. It is obvious that, professional autonomous of end user might not be as susceptible to subjective norm as other users because of their autonomy (Youngberg, Olsen & Hauser, 2009). As feature complexity increase, perceived ease of use will decrease hence lowering the intention to use. Through the

path analysis between TAM variables, path magnitudes were significantly changed by technology features and complexity(Kim, Mannino&Nieschwietz, 2009)

Due to the complexity of the process handled by cloud computing based EMR and the autonomous end user, trust is considered one of the most important factors for successful e-service to reduce uncertainty and complexity in economic and social exchange relationships(Lee &Rao, 2009).Gefen et al. (2003b) argued that trust, conceptualized as a set of specific beliefs, and has a direct positive effect on intention to use an e-vendor by reducing social complexity in the exchange relationship. It has an indirect effect through perceived usefulness by increasing expectation on the future outcome from system use. Empirical study strongly suggests that task complexity may have a profound impact on peoples' online service acceptance decision by moderating not only the usefulness effects, but also a wide range of factors that can influence people's online service usage intentions (Lee al. 2009)

5.2 Correlation

In our study, all independent variables of UTAUT and Trust itself are statistically significant in correlating with intention to use of cloud computing based EMR. This finding confirm the validity of UTAUT to be a useful tool in predicting behavioural intention of cloud computing based EMR used by medical professional in Malaysia. The interesting finding is the construct of Trust which is statistically significant in correlating the behavioural intention with the highest score of correlation coefficient. This raises the question of whether the construct of Trust should be in the technology acceptance model if it involving medical professional. The subgroup might be completely different from general population when come to assessment of technology they need in daily work because of the complexity of task they carried out and the user autonomy.

From the study, it can confirm that medical professional as the user of the technology is heterogenous. Trust, Perceived usefulness and relative advantage are variables which are more important compared to the rest. For example, complexity, subjective

norm, job fit and outcome expectation are less fit into model and relatively less important in predicting behavioural intention.

Table 34: Result of test relationship specified by TAM and related model

Results of tests of relationships specified by TAM and related models.

Relationship tested ^a	Studies reporting that predicted relationship was statistically significant	Studies reporting that predicted relationship was statistically non-significant	Proportion of tests that were significant
BI-USE	[102,110]	[102]	2/3
ATT-BI	[32,98,101,102,105]	[108]	5/6
PEOU-PU	[96,99,100,101,102,103,104,106,107,109]	[32,97]	10/12
PEOU-ATT	[101]	[32]	1/2
PU-ATT	[32,101,105]	—	3/3
PU-BI	[32,96,97,98,99,100,101,102,103,104,105,106,107,108,109,110]	—	16/16
PEOU-BI	[102,103,105,106,107,109,110]	[96,97,99,100,104,108]	7/13
SN-BI	[99,102,105,110]	[49,97,102,108]	4/8
PBC-BI	[49,99,102,105,108]	—	5/5

USE, actual use; BI, behavioral intention; ATT, attitude; PEOU, perceived ease of use; PU, perceived usefulness; SN, subjective norm; PBC, perceived behavioral control.
^a For tests of the Universal Theory of Technology Acceptance and Use (UTAUT), the variables performance expectancy, effort expectancy, and social influence were classified here as PU, PEOU, and SN, respectively.

Source: Holden & Karsh (2010), The technology acceptance model: Its past and its future in health care. *Journal of Biomedical Informatics*, 43 (2010), 1590172.Doi: 10.1016/j.jbi.2009.07.002

From the review article from Holden & Karsh (2010) which focus only in healthcare worker, not all constructs in the standard technology acceptance research is significantly correlated with behavioural intention. The condition is particularly true for perceived ease of use (PEOU) and subjective norm (SN). Only 7/13 of all studies, PEOU was statistical significantly correlated with behavioural intention. For subjective norm, only 4/8 of studies show the statistical significant relationship. This shows that, PEOU and SN are probably a weak predictor of the behavioural intention for healthcare worker.

In contrast, perceived usefulness (PU) exhibits statistically significant relationship in all the studies (16/16). It indicates that, PU is a stronger predictor of behavioural intention of healthcare workers.

In this study, all variables under are statistically significant in correlation to behavioural intention to use cloud base EMR. However, the trend shown by Holden et al. (2008) was seen. Perceived usefulness is the only variable with the correlation coefficient of more than 0.6, just second to the newly added construct of Trust. Ease of use and subjective norm have the correlation coefficient of 0.502 and 0.431

respectively. Hence, the variables at UTAUT should not be weighted equally in the context of healthcare industry.

The relative unimportant ease of use in correlation with behavioural intention of physician had been proven by a study done in Hong Kong (Chau& Hu, 2002). The study involved 400 physicians. The researchers of this study commented that physician appeared to be fairly pragmatic and largely anchoring their acceptance decision in the usefulness of the technology rather than its ease of use. The same study also shows that, physician attached limited weight to peer's opinion about using the technology. This finding is consistent to our current study. For doctor perceived usefulness appeared to be more prominent in predicting behavioural intention rather than ease of use and subjective norm.

Another area which is not consistent with previous finding is the significant correlation of subjective norm with behavioural intention in this study. In the study of Chau&Hu(2002), the researcher revealed a negative finding of subjective norm on correlating with behavioural intention. The different was observed in this study that perceived ease of use was still highly significant even though less so compared to others. It is included to the predictive model which predicts the behavioural intention of whole cohort with limited incremental value.

Chau and Hu study build a model which explain 43% of variance in behavioural intention at most and another model constructed by Yi, Jackson, Park &Probst, (2005), explains 57% of physician's intention to accept an innovation. In our study, the predictive model consists of below four constructs:

1. Trust
2. Perceived usefulness
3. Relative advantage
4. Perceived ease of use

The model explains 60.6% of all variance of dependant variable. The predictive value of the model is relatively high with the addition of trust in the model. However, this is

the definitely not an ideal method to compare just base on the absolute value. The comparison also does not carry a meaningful value as we are comparing study result of different population and assessing different technology. Not to forget, early test of UTAUT model explained an impressive 70% of the variance in behavioural intention (Venkatesh et al. 2003) and recently in the context of healthcare (Han, Mustonen, Seppanen&Kallio, 2005 & Tung et al. 2008).

5.3Performance expectant

Performance expectant is important construct which predict behavioural intention to use the cloud based EMR. Out of 4 constructs, Perceived usefulness and relative advantage appeared to be relatively important compared to other variables.

Perceived usefulness is the extent to which a participant believes that his or her performance will increase with the use of the studied technology. Whereas relative advantage is the degree a participant believe that the studies system is better than the one before. This indicates that, a person need to perceive that a technology is going to increase his or her performance and be sure that the technology is better than the existing one before there is behavioural intention to use the technology.

In the study of Holden et al. (2008), perceived usefulness was showed to have strong evidence to have impact on whether clinician accept the subsequent use of health IT. In the study of Yi, Jackson, Park &Probst, (2005), perceived ease of use was shown to give significant effect on perceived usefulness. The study integrating the related models of technology acceptance research in exploring the PDA acceptance by healthcare professionals. The Yi et al (2005), suggested that, a reduction in effort is a significant component of the utility on professional derives from the use of an innovation. The researcher also found that the perceived behavioural control influences behavioural intention indirectly through perceived ease of use and perceived usefulness. Subjective norm influences perceived usefulness directly and indirectly via image.

5.4 Trust

In this study, some of the variables surfaced as prominent construct in predicting behavioural intention of medical professional. The newly added construct of 'trust' is particularly prominent. This indicates, medical professional needs to trust the technology before adoption is possible. This trend is observed in all subgroups.

Reliability of the technology and its service vendor which contribute to the perception of trust is an important predictor of the early adoption. The construct of trust is more prominent in subgroup of GP and private medical professionals. It is also a main predictor of behavioural intention to adopt cloud based EMR for the whole cohort. It is consistent as a predictor in the predictive model for all subgroups.

It is not difficult to understand the trend. GP and private medical professional are all in private practice. Patient pays for the service and usually demands for superior services and expects most medical care organised in good order. Missing a medical record is a big issue to a practitioner and healthcare institution in term of reputation. This wrong doing might invite litigation problem and potentially affect the career of medical professional significantly.

According to Mayer, Davis, and Schoorman (1995), trust and risk perception are very strongly interrelated. In the study of Mark, Margôt& Jan(2007), trust in e-government is negatively correlated to risk perception of e-service. In the study, the relationship was showed to be statistically significant at 0.001 level. According to the results, worry about e-government service is predicted by trust in e-government, which in turn depends on the trust in governmental organisations and risk perception.

Another study conducted by Zhiping& Melissa (2008), shows that perceived threat to professional autonomy has a significant, negative direct influence on perceived usefulness of an IT and on intention to use the IT technology. The researcher added that, perceived threat to professional autonomy is largely for clinical decision support systems than for electronic medical records systems. Perceived threat also had been proposed to be a predictor of resistance, perceived compatibility as predictor

of perceived usefulness, and related knowledge as predictor of perceived ease of use. Perceptions of institutional trust exerted strong direct effects on physicians' perceived usefulness, perceived ease of use, and attitude towards the use of Electronic Healthcare Record systems (José & María, 2011).

The study design of this research is unable to clearly define what component of the technology and system is more important in need of trustworthiness. Below are some components which might possibly need extra attention in trust building:

- The trustworthiness of the service provider. This will include reputation, its business practice, its business supporting system and after sale service.
- Trustworthiness of hospital administration in securing patient data
- The security of the installed hardware and software
- The security of the remote storage system

5.5 Perceived ease of use

Another important variable which contribute to the behavioural intention is perceived ease of use. This is the perception that a participant believes that using the technology will be relatively effortless. This variable is particularly prominent in the subgroup of doctor who are not GP and public or university medical professional. These two subgroups of medical professional work in an environment which typically more demanding and complex compared to other subgroups. Hence, this probably the main reason why the perception of usefulness is important as the participant need to be assured that using the technology will increase their performance and efficiency of their current job. Thus, doctors who are not GP and public/university medical professionals might not use a technology voluntarily if they perceived that it is not easy to learn and master as it will burden their job.

In the research of technology acceptance in healthcare, perceived ease of use appears to be a more prominent contributor to behaviour intention. Day, Demiris, Oliver, Courtney and Hensel (2007), conducted a qualitative study of the use of videophone

technology. The study shows that ease of use to be a more prominent predictor of behavioural intention and the videophone technology was perceived to be useful but not easy to use. However, the study was conducted with subjects consist of mainly hospice providers like nurse care manager, social worker, administrator and management staffs. The number of participant also limited in this study with total number of 17 persons. It might not reflex the true condition for medical professional.

In the review article of Richard et al. (2008) also show that whether the IT is perceived to be easy to use may not be directly affect the subsequent usage but it might influence the perceived usefulness of the technology. It perhaps reflects that a technology which is not easy to use will not be perceived to be useful.

Study of Wu, Wang and Lin (2007) with participants that consist of 123 doctors, nurses and medical technician working in the hospital at Taiwan show that perceived usefulness and perceived ease of use to be statically significant in predicting behavioural intention. In contrast, the impact of perceived usefulness was shown to be moderate. This study has the total population of almost similar with this current study. The major different is nurse and medical technician outnumber the physician population. Non physician population make up of 75.6% of total number compared to 36.2% of non physician population of current study.

5.6Other variables

Even though all variable of UTAUT-Trust model significantly correlated with behavioural intention of cloud base EMR use, there are several constructs which are less important compared to the others. The following 2 variables under the category of performance expectant might be less important.

- 1) Job fit- the extent that a participant believes that using the technology can enhance the performance of the job.
- 2) Outcome expectation- the believe that adoption of a system will lead to more favorable condition

Complexity also shown to be less important even though it's correlation with behavioural intentions is statistically significant. Not only this, subjective norm also not so prominent in predicting behavioural intention. This indicates that medical professional is less likely influenced by important others when deciding what technology in their practice. Definitely, it can be assumed that participants are free to decide whether they want to use the technology.

Above four constructs are not included in any of the general predictive model of the whole cohort and subgroups.

5.7 Inter-profession different

Even though there are researches done in the area of technology acceptance for healthcare workers with different profession (Chen, Wu & Candall, 2007, Liang, Xue & Byrd, 2003) the research specifically looking into the different between professions is limited.

In the research by Christos, Leonidas, Anastasia & Vassilis (2011), testing of different between medical specialties was conducted. The study found an initial evident for the moderating effect of physician specialty in PEOU-PU and ICT feature demand-PU relationship. They found that surgeon required the information system to be easy to use before the system is considered to be useful. This trend is more prominent in surgeon compared to pathologist. Hence, different perception between professions might exist in healthcare workers. If the different exist between doctors with different specialties, the different most probably also exist between nurses and doctors. Limited research study that looking into this area proposed that there is significant different among various non-physician healthcare workers when compared to physicians or information technologies professions (Karen, 2008).

In this study, we discovered that nurses and doctors have different perception about cloud based EMR. Nurse perceived the technology to be more complex but expect to gain benefit from the technology if it is implemented. Doctors group is more skeptical about the technology as the trust score is much lower. Doctor group perceived the

technology to be less complex. Surprisingly, the comparison between GP and non-GP revealed no difference in perception. Comparison between subgroups shows that the intention to use of cloud based EMR was observed to be no different.

In terms of correlation, the analysis revealed certain constructs to be more predictive for certain subgroups. For nurses, perceived usefulness seems to be most important. For all doctors, doctor non-GP and public/university medical professional subgroups, relative advantage was dominant as a primary predictor of behavioural intention. Hence, performance expectancy is a more dominant predictor for doctors and public medical professionals. For risk-averse medical professionals in private practice, trust seems to be the primary consideration before adoption is possible. The construct of trust is a consistent predictor for all subgroups and this trend makes trust as a primary predictor of behavioural intention when the whole cohort is considered together.

This observation suggests that technology acceptance research for healthcare workers probably should be profession specific. The subgroups of healthcare workers come from different backgrounds and handle different complex processes of the healthcare workflow and perceive the technology differently. The observed differences in predictive models for each profession also suggest that technology usage intention probably correlates differently with different constructs of technology acceptance research for different healthcare professions.

5.8 Limitation of the study

This study utilises the 'adding variables' approach to test the UTAUT model in a healthcare setting. This practice is common in the research of technology acceptance and its related models (Venkatesh et al, 2003, Moore & Benbasat, 1991). This particular approach is advocated to further the research of technology acceptance as some of the constructs which might not have been included in the past, will now be a strong determinant in some of the healthcare relationships. The utilisation of cloud

computing like what had happened to banking industry is expected to face the issues of customer data privacy and confidentiality, the construct of trust is added to test its validity.

There is almost definite that, the user of technology in other studies which is usually general public will be very different from medical professionals. There is also different perception of usefulness from the view point of general public and the study population. A physician might perceive the technology innovation to be useful when patient safety can be guaranteed while the feature of technology just acceptable. On the other hand, when the technology has excellent features but might impose potential risk to patient privacy, then the technology will definitely not be acceptable by medical community.

There may be other constructs which is not included in this study. These constructs might be the more important determinants of cloud computing EMR utilisation. There may be precedence for trust which will predict the intention to use the EMR and cloud technology.

Majority of data is collected via invitation using Facebook and emails. Researcher believes nurses and doctor are well educated and ones can hardly find a nurse or doctor without experience of using Internet and have no email account. With the high Facebook penetration rate of Internet user in Malaysia, we probably can safely assume that Facebook penetration for medical practitioner should be at par if not higher (>70%) than normal population. Base on this assumption, email and Facebook message postings were used to collect data for this study. However, the reader should apply caution in interpreting the result as fundamental different between groups participated from invitation via email and Facebook via hospital might also exist. There might also be differences in participants and non-participants in term of IT knowledge and experience.

However taking into consideration that, limited number of participant will make the generalisation of the study's conclusion to the whole medical community less

accurate, the researcher considers that the benefits of using the current data collection alternative outweigh the risk.

The study is carried out at the pre-implementation stage hence participants might not be familiar with the technology. Moreover, cloud computing is a relatively new concept. Even with power point presentation and video clip, researcher is unable to be sure that all participants have a sufficient understanding. However, we expect the impact to the study's result arises from the insufficient knowledge before filling in the questionnaire to be minor. This is because; the study is testing perception and its relation of use intention and not perception alone. The limitation arises because the model of cloud computing application in healthcare is still not established yet. Hence, it is not possible to test a well developed model at the time of study.

As the study is testing the pre-implementation stage, it might only be relevant for designer of the technology and marketer in order to encourage the usage of cloud computing technology and EMR. It is probably less likely to predict regular use.

Study sample size is the other limitation of the study. Relative to the whole population of doctor and nurses in Malaysia, the sample population of this study is small. The conclusion drawn from this study will probably miss out data from certain sub-groups of medical practitioner like those who are not information technology (IT) savvy or who really hate IT.

The respondents of the survey are all voluntary; hence it is subject to self selection bias as well. It means those who are interested with the topic or technology will more likely to respond to the survey, compared to those who were not.

Most of the studies use the antecedent of behavioural Intention (BI) as the surrogate marker of the actual usage. This is mainly because the data of actual usage is difficult to obtain. Hence BI is sometime the only measured outcome in technology acceptance research (Chau & Hu, 2001). From the review article, the study constructs seem sufficient to predict the initial acceptance of the technology. For prediction of

long term adoption and continuous use, rigorous and data driven approach is still needed to further investigate the concern.

Research on technology acceptance has shown that the relationship in the model might change over the life of the new technology. Ease of use and perceived usefulness might be critical for initial adoption but might not be relevant after the adoption (Han et al, 2005, Venkateshet al, 2003). Hence, technology and the process fit still important to ensure full utilisation of the innovation. This is especially true for healthcare in view of complicated clinical processes and immensely different demand from each specialty. For example, general practitioner and surgeon will probably perceive a Computerised Physician Order Entry (CPOE) completely differently.

The model is base on the past. Hence its predictive value for future development and behavioural pattern might not be relevant. This is particularly true in healthcare whereby the change of the stakeholder relationship, regulation and other medical technology happen so fast and dynamic.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

The study opens several avenues for future research. The research and observation is done for single study and it is profession specific. It shows that all constructs under the model of UTAUT are significantly correlated with behavioural intention. This finding suggests that UTAUT is an applicable model in Malaysian healthcare setting. However, the model alone might not be enough in assessing medical professional. This is because; our study shows that, the added construct of trust is a strong variable which correlated with behavioural intention to use cloud based Electronic Medical Record (EMR). UTAUT-Trust model might be a more appropriate model for future research when study is done for healthcare related technology which handles confidential patient information.

There is also evident to show that, perception of nurses and doctors is different toward the use of cloud based EMR. Nurses perceive the technology to be complex

but expect to derive benefit from applying the technology. Nurses also have a higher perception of trust toward cloud based EMR compared to doctor subgroup. There was no statistical significant different between GP vs doctor non GP group in term of perceptionof the cloud computing based EMR technology. All subgroups namely nurses, GP and doctor non GP have no statistical significant different toward intention to use of cloud computing based EMR.

As far as the different of subgroup is concern, the different is obvious in perception between nurses and doctors. Analysis of intergroup different for doctor subgroup (GP vs nonGP) shows no statistical different. In term of best predictive model for each subgroup, not surprisingly, there is obvious different as well. The general predictive models for subgroups are all different.

Trust appears to be a consistent construct which predict the behavioural intention. It is proven to be significant across the whole cohort and all subgroups. It is the most dominant construct for the whole cohort, GP and private medical professional. Relative advantage is a more prominent construct for doctors who are not GP, public/university medical professionals and all doctors. However, perceived usefulness is a most dominant variable for the subgroup of nurses in predicting the behavioural intention to use cloud computing based EMR.

Even though it make sense to say that:

- The construct of trust is more prominent for risk averse private medical doctors and nurses.
- Relative advantage is more important for busy doctor in public hospital or non-GP
- Perceived usefulness is more important for nurses as they would choose technology which is more relevant to their job as a burden avoidance behaviour.

The above remain an exploratory finding. The validity of the result need to be confirmed with larger research study designed specifically to analyse the problem.

At this point, it can be concluded that there is a difference between medical professionals, namely nurses and doctors. There is probably a need to study nurses and doctors separately as we would expect the predictive model to be not the same.

Patient privacy issues top the list of all contributors of reason why some participants perceived the technology to be not a good idea. In order to get around the condition, the designer of the technology needs to make sure that the technologies are designed without compromising the security of data. The added features which ensure the safety of the data need to be communicated with the end user in order to reduce the resistance and encourage initial adoption.

The effort should not be only limited to technology designer and it should include service vendor only. Healthcare administrators also play an essential role in gaining trust from the user. Some of the essential aspects of the cloud computing based technology in healthcare need to be modified and packaged before the technology is adopted and launched for use. Without a proper regulatory framework, crime which involves the breach of data and hacking of medical databases will not be handled efficiently. Cyber law which protects the security of the data should be tabulated and approved.

Other than the law, a strong management team with suitable expertise and sufficient resource allocation should be in place in order to orchestrate the use, distribution and maintenance of the technology and database efficiently. Hence, hospital administrators need to have properly planned policies and protocols. Well designed check and balance mechanisms are also essential in order to let end users feel secure in using the technology in managing their patients.

Without this, the database will be at risk of poor management and the end user will be hesitating to adopt the technology. The user might just get around the technology innovation. Not to forget, medical doctors and nurses have major influence in determining the technology they wish to use in their practice.

This research had important implication. The study has produced insights into factors that influence technology acceptance by healthcare professionals. It's also extending the existing literature by proposing the need to adding trust to the technology acceptance research when cloud computing based EMR is the subject of the study. Further study in differences between nurses and doctors is warranted and development of technology model should probably be profession specific. Further study should also be conducted in assessing the antecedents' relationship of trust and UTAUT model as it has been proven to play a critical role for technology acceptance in cloud computing based EMR.

Table 35: Answer to research questions

Research questions	Result
1. What are the perception and intention of Malaysian medical professionals in using the cloud computing based medical record at work place?	Medical professionals have a good perception toward cloud computing based medical record. The intention to use the technology is high.
2. What is the validity of UTAUT in predicting the use of cloud computing based medical record among Malaysian medical professionals?	UTAUT is a valid tool to measure the use intention of cloud computing based electronic medical record among Malaysian medical professionals.
3. Is trust an important construct in predicting intention to use of cloud computing based medical record compared to the established contrasts of UTAUT?	Trust is an important construct in predicting intention to use of cloud computing based electronic medical record.

4. What are the reasons of resistance toward cloud computing based medical record among medical professionals in Malaysia?	Patient privacy and data confidentiality are the main reason why some participants perceived the technology to be not a good idea.
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APPENDICES 1

Questionnaire: Application of Cloud Computing Technology in Malaysia Healthcare Institution

Purpose of the study: To assess the variables which affect the decision of medical professional in accepting cloud computing and Electronic Medical Record (EMR). The researcher will then analyse the differences between nurses/medical assistant, MOs/GPs and Consultants.

Confidentiality: The identity of the participant will not be collected. The data which you provided will be used solely for the research study and will not be shared or used for other purposes. All participant will remain anonymous and no one other than the researcher will know the data that belong to an individual participant.

Payment: The participation of the survey will be voluntary (sukarela) and no payment will be made.

Benefits: Participant will not be benefited directly from the survey. However, the result of the survey will guide the authorities to design suitable program to encourage the use of cloud computing in healthcare for different group of medical professionals.

Procedure: Participant of this study will need to read 15 slides at a power point followed by 5.5 minutes of video clip if needed. These materials introduce the concept of cloud computing in healthcare. After this, participant will need to answer 27 questions at Google Form which will take roughly 4-5 minutes.

Researcher: Dr Shew Yee Siang MBBS (Malaya), FRCR part 2A (Clinical Oncology), MBA student (UTAR) with special interest in Application of Information Technology in Knowledge Management.

Withdrawal and rights of research subjects: The participants of this study can elect to withdraw from the study at any time without any consequences. The researcher reserves the right to remove data of subjects from the data if circumstances arise which in the opinion of researcher warrants doing so.

Identification of the researcher: If you have any question about the study, please feel free to email me at yeesiangs@yahoo.com

***Required**

Consent *

I would like to participate in this study. I understand that i need to fill in 27 questions below and agree to release all information collected to the researcher of this study. Furthermore, i accept the procedure and condition explained above.

- Yes, I agree
- No, i don't agree

Have you read the power point presentation or video presentation of cloud computing in healthcare institution *

- Yes, i do.
- No

I am a practicing Medical Professional (perkerja perubatan terlatih) *

Doctor, Nurse or Medical Assistant

- Yes
- No

Demographic

Your Age

Year

- 21-30
- 31-40
- 41-50
- 51-60
- More than 60 years old

Gender

- Female
- Male

Race

- Malay
- Chinese
- Indian
- other

Job Description *

- Nurse/Medical assistant (Public)
- Nurse/Medical assistant (Private)
- Nurse/Medical assistant (University)
- Sister or Matron (Public)
- Sister or Matron (Private)
- Sister or Matron (University)
- Specialist or consultant (Public, hospital)
- Specialist or consultant (Public, Clinic)
- Specialist or consultant (Private, Hospital)
- Specialist or consultant (Private, Clinic)
- Specialist or Consultant (University)
- Hospital Medical officer (Public)
- Hospital Medical Officer (Private)
- Trainee lecturer (doctor)
- General practitioner (Clinic)
- Others

How do you get to know about this questionnaire/ study?

- Facebook
- Via hospital that you are working
- Introduced by friend
- Other website
- Other channel

How many years have you been working in healthcare industry ?

Have you ever use electronic medical record at your work place?

- Yes
- No
- Unknown

Have you ever use cloud computing services from any service provider?

- Yes
- No

Unknown

At Present how frequent do you use internet?

- Don't use at all
- Use once a month
- Use several time a month
- Use once each week
- Use several time a week
- Use about once a day
- Use several time a day
- Unknown

What is your self assessment about using the computer?

- Low experience
- Moderate experience
- High experience

What is your self assessment about using the internet?

self assessment= penilaian sendiri

- Low experience
- Moderate experience
- High experience

Performance expectant: Please check the answer you feel best fits each statement

Perceived Usefulness

Using electronic medical record with cloud computing in my job:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
would enable me to accomplish tasks (menghabiskan Kerja) more quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
would improve my job performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
would increase my productivity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
would enhance my effectiveness on the	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

job.					
would make it easier to do my job.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would find electronic medical record with cloud computing useful in my job.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Job Fit

Use of electronic medical record with cloud computing:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
will have no effect on the performance of my job (reverse scored)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
can decrease the time needed for my important job responsibilities.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
can significantly increase the quality of output on my job.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
can increase the effectiveness of performing job tasks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
can increase the quantity of output for the same amount of effort.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Relative Advantage

By using electronic medical record with cloud computing, i expect it to::

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
enables me to accomplish tasks more quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
improves the quality of the work I do.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
makes it easier to do my job.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

enhances my effectiveness on the job.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
increases my productivity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Outcome Expectations

By using electronic medical record with cloud computing, it might :

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
increase my effectiveness on the job.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
spend less time on routine job tasks (urusan rutin).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
increase the quality of output of my job.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
lead to increase the quantity of output for the same amount of effort.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
my coworkers (rakan sekerja)/business partner will perceive (melihat) me as competent (kompeten).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
increase my chances of obtaining a promotion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
increase my chances of getting a raise (naik pangkat) or bring the business to next level	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Effort Expectancy

Perceived Ease of Use

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strong Agree
Learning to operate electronic medical					

record with cloud computing would be easy for me.

I would find it easy to get electronic medical record with cloud computing to do what I want it to do.

My interaction with electronic medical record with cloud computing would be clear and understandable.

I would find electronic medical record with cloud computing to be flexible to interact with.

It would be easy for me to become skillful at using electronic medical record with cloud computing.

I would find electronic medical record with cloud computing easy to use.

Complexity

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strong Agree

Using electronic medical record with cloud computing takes too much time from my normal duties (tugas).

Working with electronic medical record with cloud computing is so complicated; it will be difficult to understand

what is going on.

Using electronic medical record with cloud computing will involves too much time doing mechanical (kerja mekanikal) operations (e.g. data input).



It will takes too long to learn how to use electronic medical record with cloud computing to make it worth the effort (berbaloi).



Ease of Use

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strong Agree

I believe that it is easy to get electronic medical record with cloud computing to do what I want it to do.



Overall, I believe that electronic medical record with cloud computing is easy to use.



Learning to operate electronic medical record with cloud computing will be easy for me.



Social Influence

Subjective Norm

Strongly Disagree Disagree Neither Agree or Disagree Agree Strong Agree

People who influence my behavior (mempengaruhi perlakuan saya) will think that I should use electronic medical record with cloud computing.

People who are important to me will think that I should use electronic medical record with cloud computing.

Attitude Toward Using Technology

Using electronic medical record with cloud computing is a bad/good idea.

- Bad
- Good

Using electronic medical record with cloud computing is a foolish/wise idea.

- Foolish (bodoh)
- Wise

I dislike/like the idea of using electronic medical record with cloud computing.

- Dislike
- Like

Using electronic medical record with cloud computing will be unpleasant/pleasant.

- Unpleasant (tidak menyenangkan)
- Pleasant (menyenangkan)

Intrinsic Motivation

Strongly Disagree Disagree Neither Disagree nor Agree Agree Strong Agree

I find that using electronic medical record with cloud computing should be enjoyable.

I will expect (jangkakan) the actual process (process sebenar) of using electronic medical record with cloud computing is pleasant (menyenangkan).

I will have fun using electronic medical record with cloud computing

Affect Toward Use

	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strong Agree
Electronic medical record with cloud computing will makes work more interesting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Working with electronic medical record with cloud computing will be fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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I will like working with electronic medical record with cloud computing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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Affect

	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strong Agree
I look forward (mengharapkan) to those aspects of my job that require me to use electronic medical record with cloud computing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Using electronic medical record with cloud computing will	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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be frustrating
(menyebabkan
kemurungan) for me.

Trust (kepercayaan)

I believe the electronic medical record with cloud computing company will :

	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strong Agree
keep the best interest (menjaga kepentingan) of hospital and patient in their mind.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
keep the promises made to hospital	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electronic medical record with cloud computing is totally trustworthy (amanah, boleh dipercayai).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe in the information provided by electronic medical record & cloud computing provider.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My tendency to trust the cloud computing is high	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trusting in the cloud computing not difficult.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel secure putting patient information at the computer server with cloud computing capability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
have good security feature (ciri-ciri keselamatan) to protect users.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I trust the electronic medical record with cloud computing system even though I have little knowledge of it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I trust the electronic medical record with cloud computing system at the hospital to do the right job

Intention to Use

Strongly Disagree Disagree Neither Disagree nor Agree Agree Strong Agree

I intend (berhasrat) to use the electronic medical record with cloud computing to carry out routine job.

As much as is possible, I will use electronic medical record with cloud computing on a regular basis.

I will strongly recommend others to use electronic medical record with cloud computing

If you think application of Cloud Computing in healthcare in general is bad idea, please tell us the reason

- It compromises patient privacy
- Will be expensive to me
- Will be expensive to patient
- Will be difficult to learn and apply
- Will break the barrier of entry for my personal business
- Will add to my workload
- Just the government/conglomerate (Syarikat besar) tactic to disempower (melemahkan) medical professional
- Other reason

Other reason or other remarks

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