ACCEPTANCE AND BARRIERS TO PHARMACISTS' ADOPTION OF SMARTPHONE MEDICAL APPS

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FACULTY OF MEDICINE AND HEALTH SCIENCES
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2015

DECLARATION

I hereby acknowledge that I have stated the source of each extraction, summary and reference in this study and that this thesis comprises no material available elsewhere or extracted in whole or partially from others theses presented for any universities degree or diploma programs.

In addition, I also declare that I have never submitted this thesis for the award of any degree or diploma in any other tertiary institutions.

12 October 2015

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ABSTRACT

With the recent blooming and revolutionizing effect of mobile technologies and its related applications (apps), it is not uncommon that medical apps have seen to play a role in decision support within the health system including pharmacy practice. It is of great importance to learn about healthcare professionals' views towards the adoption of this new health information technology (HIT) in their practices prior to any mandatory implementation of the system. The goal of this study is to investigate pharmacists' perception towards mobile medical apps use in pharmacy practice and to explore the enabling and inhibiting factors that govern the adoption of this HIT. This study has undertaken a mixed-mode research methodology, combining focus group and survey questionnaire studies to examine the relationships between key constructs in the proposed model. Multinational pharmacists from various fields of practice have participated in the studies. Survey data was analyzed using partial least squares (PLS) modeling statistical technique. The findings provided strong empirical support for six positive (i.e. perceived usefulness, perceived ease of use, result demonstrability, subjective norm, compatibility, facilitating conditions) and two negative determinants (i.e. security, resistance to change) of intention to use medical apps. Predictive relevance of the proposed model was evaluated and was found promising in generalizing actual medical apps usage. Results of this study are able to assist healthcare administrators or managers in their decision making during early stage of medical apps use implementation. In short, contribution and implications of this study are noteworthy both theoretically and practically, and serves as the baseline for future studies.

ABSTRAK

FAKTOR KEBOLEHAN DAN HALANGAN PENERIMAAN APLIKASI MOBIL PERUBATAN OLEH PEGAWAI FARMASI

Dengan perkembangan terkini dan kesan revolusi teknologi mobil dan aplikasi yang berkaitandengannya, ia satu kebiasaan yang mana aplikasi perubatan dilihat memainkan peranan dalam menyokong keputusan di dalam sistem kesihatan termasuklah perkhidmatan farmasi. Ia satu kepentingan besar untuk mengkaji tentang pandangan para pakar penjagaan kesihatan terhadap penerimaan Teknologi Maklumat Kesihatan (TMK) yang baru ke dalam perkhidmatan mereka sebelum sebarang mandatori sistem diimplimentasikan. Matlamat kajian ini adalah untuk mengkaji persepsi pegawai farmasi terhadap penggunaan aplikasi mobil perubatan dalam perkhidmatan farmasi dan untuk meneroka faktor kebolehan dan halangan yang mempengaruhi penerimaan itu dalam Teknologi Maklumat Kesihatan. Kajian ini telah melalui metodologi penyelidikan secara mod-campuran menggabungkan kumpulan sasaran dan kajian soalan tinjauan untuk memeriksa hubungan antara faktor utama dalam model penyelidikan yang dicadangkan. Pegawai farmasi dari pelbagai bidang praktis dan negara telah mengambil bahagian dalam kajian ini. Data kualitatif telah dianalisis dengan menggunakan teknik partial least squares. Hasil penemuan menunjukkan sokongan empirikal yang kuat bagi enam penanda positif (perceived usefulness, perceived ease of use, result demonstrability, subjective norm, compatibility, facilitating conditions) dan dua penanda negatif (security, resistance to change) untuk menggunakan aplikasi perubatan. Ramalan relevan model yang dicadangkan telah dinilai dan mendapati cerah dalam menentuluar TMK sebenar. Hasil kajian ini dapat membantu pentadbir dan pengurus farmasi dalam process membuat keputusan tentang pelaksanaan awal aplikasi perubatan. Kesimpulannya, sumbangan dan implikasi kajian ini perlu diberi perhatian secara teori dan praktikal, seterusnya menjadi garis panduan untuk kajian pada masa akan datang.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ADR	-	Adverse Drug Reaction
apps	-	applications
CPOE	-	Computerized Prescriber Order Entry
EHR	-	Electronic Health Record
EMR	-	Electronic Medical Records
FDA	-	US Food and Drug Administration
HIS	-	Health Information System
HIT	-	Health Information Technology
ICT	-	Information and Communications Technology
IDT	-	Innovation Diffusion Theory
IT	-	Information Technology
LHR	-	Lifetime Health Record
mHealth	-	mobile health
OS	-	Operating System
PEOU	-	Perceived Ease of Use
PLS	-	Partial Lease Squares
PU	-	Perceived Usefulness
SEM	-	Structural Equation Modeling
SPSS	-	Statistical Package for Social Sciences
TAM	-	Technology Acceptance Model
TPB	-	Theory of Planned Behaviour
TRA	-	Theory of Reasoned Action
UTAUT	-	Unified Theory of Acceptance and Use of Technology
WHO	-	World Health Organization

LIST OF APPENDIX

CHAPTER 1

INTRODUCTION

1.1 Overview

Mobile technology has proliferated into every single corner on earth and it is nothing less than astonishing. The utilization and adoption of mobile technology by end users has quietly transformed many fields such as communications, entertainment, finance, commerce and whatnot. Now this technology has reached its hand in healthcare environment to alter delivery of health services, quality of health services to patients as well as cost of healthcare.

Matching the rapid growth in mobile technology advancement is the explosion of mobile health (mHealth) initiatives around the world following a global survey undertaken by World Health Organization (Figure 1.1) (WHO, 2011). The growth of new generation of mHealth is substantiated due to the synergistic effect of combined smart device value-added abilities such as camera, GPS, video chat, Bluetooth connectivity to medical or home devices together with creative software applications. The value of medical applications (apps) as mHealth tools is undeniable and its development and adoption poise a great deal in various healthcare fields. Four characteristics of mobile devices has attributed to the development of quality medical apps: personal, ubiquitous, connected and increasingly intelligent (Modani & Eldrasi, 2012).

This chapter provides insights into the importance of pharmacists as main potential health information technology adopters. It is essential to note the impact of medical apps penetration within healthcare industry and its roles in the delivery of quality healthcare services. Hence, it is of great interests and benefits to

investigate the attitude of pharmacists towards the adoption of medical applications in their practice.

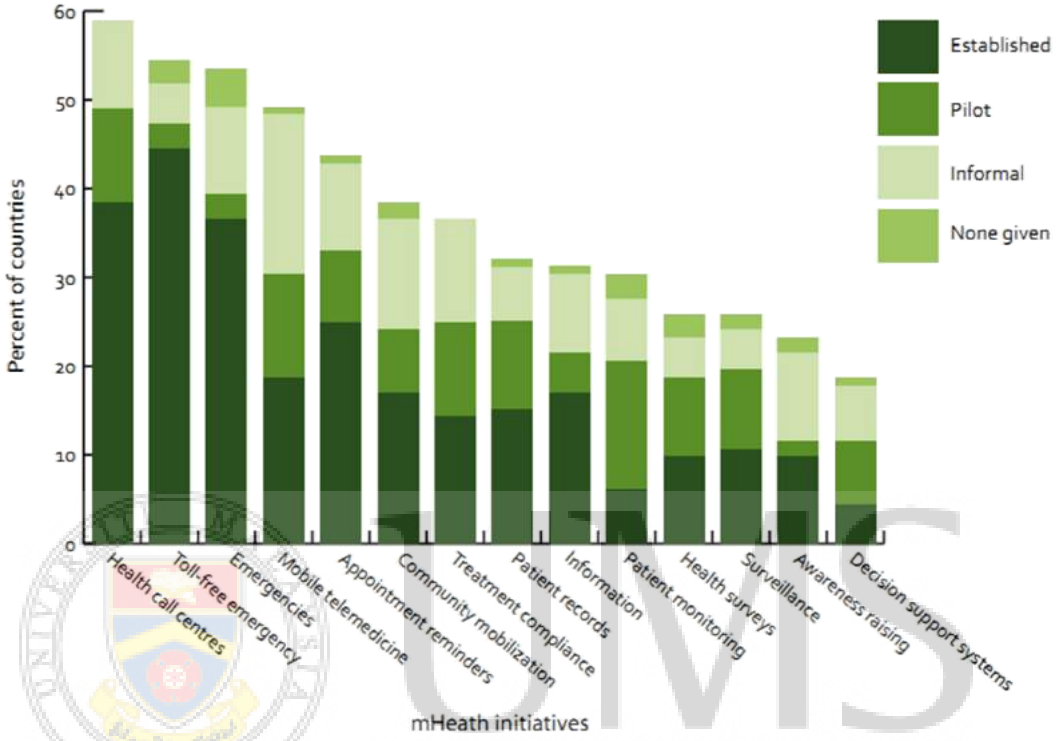

Figure 1.1: Global adoption of mHealth initiatives in 2011.
Source : WHO, 2011.

1.2 Study Impetus and Rationale

1.2.1 Background of The Study

Mobile phone is the single most pervasive technology ever invented – this statement is not over exaggerated at all. International Telecommunication Union has reported that there are now nearly 5 billion mobile phone subscriptions worldwide, with more than 85% of the population are now covered by at least a commercial wireless signal (WHO, 2011). Mobile technology is reshaping consumer spending pattern, be it in the housing, healthcare, entertainment and travel, or in the food, drinks, communication and transportation (Sharma, 2012). It is therefore anticipated that there will definitely be more changes in the next 10 years than in the previous 100 years on the effect of mobile technology innovations in our lives.

In a recent report released, unit sales as well as revenue of mobile devices and handheld computers are now exceeding traditional personal computers, with an expected total global mobile subscription to exceed 7 billion in early 2013 (Sharma, 2012). The growth is the most prominent in Asian countries such as China and India, hitting the record of 1 billion and 950 million subscription respectively. Consequently, it is not a surprise to see the development and sales of mobile applications (mobile apps) to surge exponentially boosted by expanding spread of smartphones and related devices such as tablets. It is forecasted that the mobile apps download (all kind) clicks across all devices will reach 50 billion by 2012, which is a tremendous increase from 7 million in 2009 (Na, 2011) (see Figure 1.2).

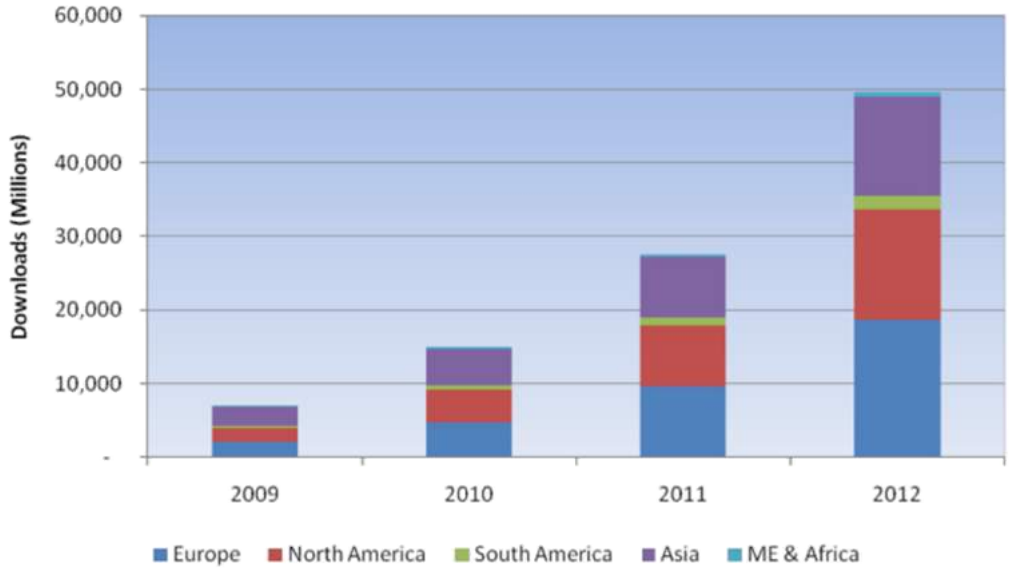

Figure 1.2: Global Mobile Apps Download (all kind).
Source : Chetan Sharma Consulting, 2010.

A mobile app is a software application designed to run on smartphones, tablet computers and other mobile computing devices. These devices allow users to self-install and use the application based on their own need and interests. The applications are classified into a full wide range of category from gaming, education, entertainment, lifestyle, utility tools, and book to finance, weather, sports and travel, as well as medical apps, and the list goes on (see Figure 1.3). The average healthcare app costs about US$15, which is above the average costs of general app, and the apps are being developed mainly for health education, health management, data management, and other health workflow processes. These healthcare apps make up about 1%-2% of the entire market for apps, and is expected to grow 25% annually over the next 5 years (Anderson, 2012).

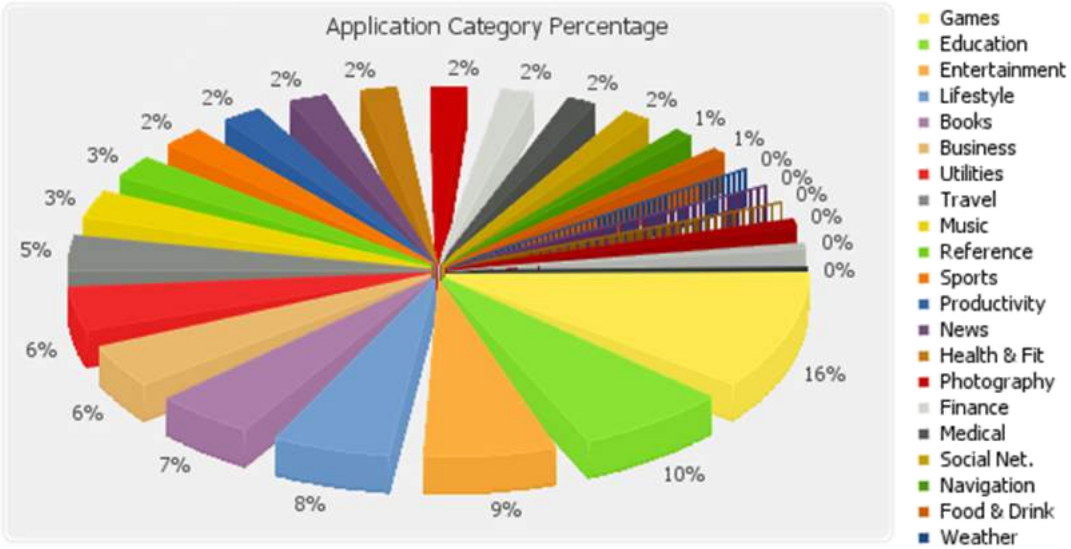

Figure 1.3: Active Application Count by Category 2013.
Source : App Store Metrics, 148apps.biz.

Being one of the major categories in the apps market, medical apps have made up about 2% of the total apps, consisting of about 16 thousands apps, and the number is increasing steadily by days. There are essentially two major types of mobile medical apps: applications that are integrated with/without medical devices to monitor patients' physiological functions and applications that deliver information and feedback between healthcare providers and patients. Example of medical apps which are designated specifically for healthcare professionals use include: Disease Diagnosis Applications (for example 5-Minute Clinical Consult, Johns Hopkins Antibiotic Guide), Drug Reference Applications (for example Skyscape's Rx Drugs, Medscape, Epocrates), Medical Calculator Applications (for example Body mass index, body surface area, MedMath), Literature Search Applications (for example PUBMED, Mdot), Clinical Communication Applications (for example Amcom Mobile Connect, mVisum),HIS Client Applications (for example Meditech EMR), General Healthcare Applications (for example H1N1 Swine Flu Update, WISER, Boborleta) and Medical Training Applications (for example iCPR, iResus, CME) (Mosa, Yoo, & Sheets, 2012). These apps are able to support healthcare professionals more efficiently as these apps complement a more personalized medication and treatment.

Just as the internet sparked the rise of e-health, so as the smartphone's popularity is revolutionizing healthcare industry. According to Savit *et al.* (2012), the five ways in which mobile apps will transform healthcare include: improved access to care, improved patient engagement, new provider business models, reduced Medicare fraud and improved patient safety. In this context, healthcare delivery is moving rapidly from a world of patient influx to a world of data influx, transforming how the patients are engaged by the healthcare system. One should not underestimate the impact of these new capabilities as to the way consumers practice and react on health information through the use of apps. For most healthcare organizations nowadays, the question is no longer whether they should involve but rather how quick they can become part of the market. Example of organizational innovations in taking the central in using medical apps to improve healthcare include: eVisits for patients, PineApp for patients, medication or patient care app for nurses, and mobile drug referencing tools for physicians and pharmacists (Jeni, 2012). Mobile technology holds a potential for more efficient and sustainable, more competent and cost effective in healthcare processes, pharmacy practice included.

Year 2011 has seen a huge leap forward in healthcare mobile computing industry when the US Food and Drug Administration (FDA) announced and issued a draft guidance document (FDA, 2013) in an attempt to regulate mobile medical apps to protect consumers from associated risks. The move did not surprise everyone because it has well been advocated that the use of mobile medical apps on smartphones and other mobile computing devices is revolutionizing delivery of healthcare from the point of care giver to another end of care receiver.

The extraordinary spread and penetration of mobile technologies, as well as encroachment in their innovative applications to address health precedency has evolved into a new era of e-health which is known as mHealth. Mobile health is fundamentally the practice of medicine and public health which are supported by mobile devices, including more specifically the apps-sophisticated programs. The use of mobile apps offers a highly accessible and cost-effective means of

implementing motivational and self-management programs, and hence delivering high quality healthcare that is going to benefit and empower the patients at the end of the day (Handel, 2011). It is believed that healthcare providers, as well as pharmaceutical industry, will supplant mobile phone industry as the primary distributors for mHealth apps (Larkin, 2011). The mHealth tools advocated do not intend to replace healthcare providers but rather is an important supportive tool for the provision of high quality healthcare services. As such, it is a common understanding that the effective implementation and adoption of information technology (IT) within mHealth entity enables the industry to overcome its three most pressing concerns: increasing medical errors, climbing costs, and the shattering of care delivery (DePhillips III, 2007).

Information systems have developed substantially over the years to support the infrastructure of medicine such as education, clinical decision making, communication and many other facets of health professional activities (Greenes & Shortliffe, 1990). These are now collectively known as Health Information Technology (HIT). Three distinctive types of HIT that are prominent and significant in day-to-day provision of healthcare services include: electronic health record (EHR), personal health record (PHR), and clinical data exchanges.

On the other hand, medical informatics or health informatics is now emerging as a distinctive academic entity. It can be regarded as an umbrella for medical informatics, bioinformatics, and pharmacoinformatics, reflecting that informatics plays a significant role in all parts of healthcare (Åstrand, 2007). In parallel with the rise of information technology over the years, the role of pharmacists has changed considerably. Despite the fact that pharmacists are no longer compounders of medicines, pharmacists are still responsible to ensure delivery of quality, effective and safe pharmaceutical care to patients. Pharmacy informatics focuses on the use, management and integration of data, related knowledge, information, and various technologies associated to medication use processes in order to improve pharmaceutical outcomes (M. Siska, 2007). Table below (Table 1.1) depicts some examples of emerging pharmacist activities