

University of Southern Queensland

**EVALUATING THE ACCEPTANCE OF MOBILE
TECHNOLOGY IN HEALTHCARE: DEVELOPMENT
OF A PROTOTYPE MOBILE ECG DECISION
SUPPORT SYSTEM FOR MONITORING CARDIAC
PATIENTS REMOTELY**

A dissertation submitted by

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Abstract

This research focuses on managing cardiovascular disease (CVD) using mobile technologies and a decision support system (DSS). Evidence from this study indicates that this development can benefit health professionals in medical diagnoses of CVD, which is the most prevalent cause of death in Australia. Capturing cardiac data early when infarction is suspected has the potential to save lives and reduce health costs. This research is built upon a mobile ECG decision support system (M-ECG DSS), which allows remote monitoring of patients. It provides real-time data for specialists, GPs, hospitals and emergency service without the need for hospital admission or travel. The research combines web browser and native applications with DSS together for the first time to give health professionals a non-delay access and fast interpretation to support diagnosis on a mobile device (with synthetic ECG data being used). The mobile ECG decision support system (M-ECG DSS) is expected to improve overall referral processes and diagnoses of CVD patients remotely located from physicians by eliminating or minimising unpredictable elements such as delays in diagnosis time and speed.

The primary research aim is to identify ECG functional and DSS system characteristics to arrive at possible solutions for mobile ECG implementations. The research also evaluates the acceptance of the M-ECG DSS system that has been developed. The scientific merit of the research lies in the innovative development of a prototype system that displays the relevant information graphically and in real-time. This research adapts the Technology Acceptance Model (TAM) and Information System Success Model (ISSM) to increase actual use of the application; furthermore, it investigates attitudes toward intention to use the technology and explores the associations between medical system services and acceptance by individual healthcare staff.

This research focuses on the quality of distributing a patient's detail to clinicians. Data collection methods employed in this research encompass interviews and surveys. Qualitative data was gathered from a group of users as an effective means

of soliciting views of acceptance of M-ECG DSS from cardiologists, doctors and nurses and to identify attitudes, opinions and acceptance of using this system. In this research, quantitative descriptive statistics are also used to triangulate the results. Eighteen participants from regional hospitals took part in the research - 12 in Taiwan and 6 in Australia. Participants consisted of cardiologists, doctors and nurses who have knowledge on remote medical treatment and pre-hospital (medical treatment before arriving at hospital) services.

The research findings clearly identify the need for this type of application for disease management and patient care. A M-ECG DSS should contain not only ECG functional characteristics but also DSS system characteristics in order to be able to monitor a CVD patient remotely. In addition, the platform developed can be articulated to other disease diagnoses and to pre-screen outpatients. Doctors can save time as all necessary vitals have been taken and available in a patient's record before they present for consultation. This is a challenge, given the variety of mobile devices available to health professionals. Studies have shown that unless such a system is reliable and intuitive to use, its uptake will be limited.

A combination of mobile web browser and native apps has created a new experience for health professionals for CVD diagnosis, and speeding up decision-making. Findings establish that a mobile device has the ability to present more comprehensive details than a paper-based ECG presentation. The research also shows that a DSS in a mobile device should not only provide decision-making information but also increase system resources availability. There is strongly agreement amongst health professionals that a digital measurement tool is a necessary inclusion in mobile DSSs. It can help clinicians to interpret patient data easily, with minimal errors. The research finds that health professionals will realise benefits from monitoring suspect and actual heart disease, and monitoring in real-time patients' activity patterns. Future research may be conducted for constructing a more complete mobile health system as well as a DSS for decision-making. This current research will allow health professionals in hospitals and clinics to monitor patients with minimum human intervention.

Certification of Dissertation

I certify that the ideas, developments, experimental works, results, analyses, and conclusions reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award.

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List of Acronyms and Abbreviations

3G	3d generation mobile telecommunications
AUI	Adaptive user interface
API	Application programming interface
APP	Application on mobile
ASP.Net	Active server pages developed by Microsoft
CSS	Cascading style sheets
CVD	Cardiovascular disease
DICOM	Digital imaging and communications in medicine
DSS	Decision support system
DBMS	Database management system
DOA	Dead on arrival
ECG	Electrocardiography
EH	Event handler
EHR	Electronic health record
EMR	Electronic medical record
EMS	Emergency medical services
GPRS	General packet radio service
GSM	Global system for mobile communications
GPS	Global positioning system
HF	Heart failure
HIT	Health information technology
HSDPA	High-speed downlink packet access
HTML	HyperText markup language
IT	Information technology
IS	Information system
ICU	Intensive care unit
MTP	Multi-touch processing
M-ECG	Mobile ECG
MS-SQL	Microsoft structured query language
MVC	Model View Controller
OS	Operating system
PDA	Personal digital assistant
REST	Representational state transfer
TAM	Technology Acceptance Model
TSA	The signal algorithm
UMS	User menu system
URL	Uniform resource locator
UI	User interface
XHTML	eXtensible hypertext markup language

Publications Related to This Study

Meng-Kuan, L, Joseph, M, Gururajan, R & John, WL 2011, 'Development of a prototype multi-touch ECG diagnostic decision support system using mobile technology for monitoring cardiac patients at a distance', paper presented to 15th Pacific Asia Conference on Information Systems (PACIS2011), Brisbane, Australia, 11-13 July.

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