

Bringing Mobile Technologies in Support of Healthcare Recommendations for a Healthy Beginning and Growth

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Objectives

The objectives of the article are to:

- Briefly outline the potential applications and use of mobile computing and communication technologies (mobile technologies for short) to support and enhance active ageing, independent living, and healthcare in community and institutional settings.
- Review the current status of applications/use of mobile technologies
- Identify problems and challenges facing m-Health (technical, process, management/organisational and people); and
- Provide recommendations to: a) strategy and policy developers b) IT vendors and professionals involved/interested in m-health implementation, and c) care providers

Outline

1. Introduction

- *Briefly introduce the emergence of mobile computing and communication technologies and motivation for using them in healthcare;*
- *Highlight what this paper is going to offer.*

There is international interest in the application of information management and technology (IM&T) to health and aged care. This is driven by increases in the percentage of older people in the populations of developed countries, increases in the incidence of chronic disease, advances in medical technology and pharmaceuticals, increases in the percentage of GDP consumed by health and aged care moves towards extending the independence of older people and encouraging more care to be delivered in the home and in the community. These trends are expected to stimulate the development and application of technologies which will be essential as an enabling infrastructure for these changes.

There is a need for assistance in strategy and policy development and in the practical steps of evaluating new and emerging technology and pathways for successful adoption. A key goal of the *National Strategy for an Ageing Australia* is “A care system that provides integrated and coordinated access, assistance and information for older persons with multiple and significant and diverse care needs”¹. The Strategy states that research and development is vital to “improve the management of patients’ care by improving the flow and linking of individual patient information”. There is a need for the potential benefits of emerging technologies in

[¹]The National Strategy for An Ageing Australia (2001) Department of Health and Ageing, Commonwealth of Australia

providing support for older people to be evaluated^{2, 3}. This potential includes managing activities of daily living, supporting families as carers and advocates through technology such as remote monitoring, improving access to service delivery information, enabling clinicians to share care plans and better coordinate care. There is potential through technology to support ageing in place and delaying or avoiding moves to institutional care. Savings are anticipated from applying technology to foster prevention and early detection of the onset of disease or disability, when treatment is often cheaper and more effective.

Mobile health or m-health concerns the capture and delivery of information through portable or handheld devices. These exchange information either through occasional docking and batch upload and down-load of data, through on-line wireless connections or a mixture of wireless when available and storage of data for docking when wireless is not available.

While wireless and mobile technologies have been around for some time it is only recently that communication speeds have become acceptable for most applications and capacity available for reasonable data transfers. In addition wireless technology is increasingly built into more recent versions of devices such as laptop computers and PDAs. Terms and acronyms associated with wireless and mobile technology includes CDMA, Bluetooth, wi-fi, 802.11 and 3G. A vast amount of technical and general information about each of these can be found through the Internet. There is much interest in wireless and mobile technologies in many industries as there are expected to be applications that better suit the many categories of mobile workers than fixed line communications.

In health and aged care there is also great interest in mobile mobile telecommunications and hand-held technologies. This stems from the promise of a better fit with the mobile workpractices of much of the workforce as well as a key infrastructure for national strategies for ageing and aged care.

M-health is also expected to better assist the capture and delivery of clinical information at the point-of-care. Much of the activity in healthcare is driven by orders from doctors for services to patients. Existing paper or verbal communications incur problems including errors of transcription, productivity and efficiency issues, inability to interact with evidence-based information repositories and barriers to offering decision-support functionality to clinicians. It can be a challenge to expect doctors in particular to use PC located at a ward workstation.

Using a computer system can take longer than writing on paper and most clinicians are pressed for time. Many clinicians are mobile in their work-practices, moving between beds, wards, clinics, other departments; whereas computer systems are easier to use for desk-based workers. Some clinicians may also be called upon to consult or provide care in the patient's own home, community settings, intensive-care unit, hospice or other hospitals and care settings. Hospital doctors are usually pressed for time. To retrieve data from a computer before ward rounds and then to enter orders and other data following or during seeing patients can add rather than reduce time.

The challenges of m-health can be addressed by focusing on three key elements: access, quality and value. The access includes data access from anywhere, any time and any how. The quality issues include offering high level of patient care by establishing integrated

[²]Soar J. (2004) Researching the benefits of technology and innovation in Aged and Community Care: building a national Research Programme, in Conrick M and Soar J (eds) *ACCIC/04 - Proceedings Papers, First Australian Aged and Community Care Informatics Conference, Brisbane Australia, 34 & 25 August 2004*, Health Informatics Society of Australia ISBN 0975101323

[³]Young R, (2004) An industry perspective, in Conrick M and Soar J (eds) *ACCIC/04 - Proceedings Papers, First Australian Aged and Community Care Informatics Conference, Brisbane Australia, 34 & 25 August 2004*, Health Informatics Society of Australia ISBN 0975101323

information repositories. The value includes provision for effective and efficient healthcare delivery. All these three can be achieved by bringing mobile technologies in supporting healthcare.

This paper reviews the potential of m-Health and offers an approach for evaluation and adoption.

2. m-Health: Vision and Potentials

- *Outline current and potential applications of mobile technologies to support various tasks/functions;*
- *Classify and group them under appropriate categories;*
- *Cite real-life examples (could be experimental, prototype, or operational); include actual benefits realised if any.*

There are now new wireless and mobile technologies including user devices, bandwidth at acceptable speeds and a range of other features not available or of limited availability with previous technology.

3G connections enable users to access a wide variety of digital information, including music, video, television, high colour display, video and audio streaming, video-conferencing and electronic payment. 3G Mobile Phone Services are expected to offer voice services, m-Internet service, on-line interactive video, quality images, data service, m-commerce, m-payments m-infotainment and location-based (GIS) services

Access to health information is already a significant component of existing Internet traffic. Mobile access will facilitate remote monitoring, follow up, prevention, remote assistance, diagnostics, m-prescriptions and patient access to their records.

Through this technology caregivers are expected to be able to integrate the information at the bedside or point-of-care with those existing in the system to deliver the best care; simple, flexible, personalized and secure connectivity for doctors, nurses, administrative staff and patients.

By providing timely patient information such as diagnostic services and treatment results to the practitioners through wireless connection at the point of care or wherever else is convenient, it may save practitioners' time and effort spent on reviewing patient records on paper, traveling to fixed terminals or to a healthcare facility to collect information. It is expected to enable faster, more accurate patient assessments and offers more effective and timely delivery of care.

Integrated health care delivery systems are a key enabling infrastructure for patient-centered care, improving clinical efficiency, and supporting evidence-based diagnoses and care delivery. Information must be available on-demand at the point of care wherever that takes place, and clinicians must have access to relevant aspects of the full health record on any computer or wireless equipment on use.

Any vision for m-Health should include a robust IT architecture as this is essential to define the technical communications between stakeholders and to ensure integration of information.. The architecture should be supported by a consideration of wireless technology and there are an increasing range of options available in the market to accomplish this. In order to realize anticipated cost savings or other benefits, organizations must embark on a thorough business case as the mobile infrastructure may require considerable resources to maintain high quality standards to meet the demands of stakeholders. The architecture requires input from policy

frameworks in order to provide high quality services to patients. Anticipated benefits need to be defined in order to meet the dynamic nature of health. While addressing all these, health care service costs should be carefully monitored as 'technology' is cited as the prime reason for the increase in the rising healthcare costs (2005 DoHA report – reference needed here).

3. Challenges of m-Health

- *Present the current status of m-health applications/use (citing surveys, reports, articles, etc., as evidence)*
- *Cover three or more countries if possible.*

There is renewed interest in the application of mobile technology to health and aged care in many countries. Strategy development has anticipated a range of benefits to health from the application of IM&T. Information strategies in health have sometimes been problematic. While many of the technologies that have recently attracted attention emerged some decades ago the barriers to their wide-spread adoption requires further research. Desktop-based systems have not always been well adopted in healthcare and there is an expectation that more recent innovations such as mobile technologies may better suit the work-practices of these and other mobile clinicians.

There is a need for assistance in the practical steps of evaluating technology, development and implementation of information standards, encouraging and enabling adoption of IM&T, and the development of rigorous financial cases for investment incorporating how benefits aims to be realised. There is also a need for the development of specific strategy for information management in aged care. All of these require a stronger research base including the development of methodologies, experimentation and learning through demonstrator projects.

This research in progress paper outlines an active research program for health informatics with a particular focus on aged care that has been developed in collaboration with researchers from Japan, Australia, New Zealand and other countries to support the development, implementation and evaluation of IM&T.

4. The potential of m-Health

- *Then let us identify problems that are being encountered in implementing m-Health*
- *Group them under different categories (maybe Technology, Process, Management/organisational; people) - though there could be some overlap and secondary effects.*
- *Cite surveys, reports, articles, etc., as evidence*

There is skepticism that the wireless technology as applied to healthcare is still in its infancy and not yet robust enough to support clinical applications. Further, many organisations still encounter problems with existing e-business models and a number of issues such as e-signatures are yet to be comprehensively addressed. The greatest advantages organisations can expect to derive from wireless technology include operational efficiency and customer interaction. Even in its current nascent stage, m-Health can be expected to enhance business efficiency by distributing information to the workforce remotely, and offering new channels on which to interact with patients (Kumar and Zahn, 2003). Clarke (2001) provides supporting evidence by stating that industries that are time sensitive, such as health services

and travel, are likely to benefit from applications exploiting this value-added feature of mobile commerce. He further states that ‘The convenience of m-commerce offers tremendous opportunities to expand a client-base by reducing or eliminating some of the customers’ labour of life's activities’. By making services more convenient the customer may actually become more loyal’.

Mobile technology can be expected to enhance the (healthcare) business value by making the activities more convenient and efficient in four related value-adding continuum that are being revolutionized by the Internet. They are Internet—search, evaluation, problem-solving, and transaction (Lumpkin and Dess, 2004). However, to accomplish these four, current healthcare need to transform to m-Health from their current position properly and smoothly (Phan, 2003). A compelling reason to do so includes the potential and growing market creating by mobile users and the huge benefit offered by these mobile customers.

The m-Health transformation framework

If the mobile trend is irresistible, then what are the important issues, and how can healthcare organisations make the adoption process smoother and less painful? As Kalakota and Robinson (2002) declared, when mobile frameworks are developed, it is imperative that mobile solutions build on top of the existing investments. When current models in e-business domain are evaluated, the model provided by Thomas M. Siebel (2001) appear to be providing baseline guidelines for m-Health transformation. This model was developed from hundreds of cases which use Siebel’s e-business system, and gained obvious success in their companies. The steps include :

1. Analyze current situation, create the m-health vision.
2. Design multi-channel strategy for the vision. **Raj – what does this mean?**
3. Action plans development.
4. Introduce and launch m-health system.
5. Evaluate, monitor and trace the m-health strategy.

Further more, there are 8 reference principles to follow in introducing processes associated with the five steps stated above:

- Understand the customers
- Provide multi-channel contact experience
- Give customer personal experience
- Make the best use of each customer’s value
- Focus on the best customer satisfaction
- Develop and maintain a global, customer-centric m-health architecture
- Utilize and expand m-health ecosystem
- Cultivate excellent and innovative business culture

5. Recommendations

- *Our recommendations to:*
 - *IT professionals, vendors, businesses*
 - *Healthcare Organisations/establishments (management)*

- *m-Health Researchers*

The Future:

- *vision*
- *m-technologies to support longevity, active ageing, productive ageing, extended working lives, job flexibility,*
- *m-health – applications for cognitive decline and other age-related conditions,*
- *smart homes*
- *RFID, pervasive computing*
- *The market – who will buy the technology, BBs for themselves, for their elderly parents, BBs using technology to assist their role as carers*

Notes: *Let us:*

- *Include Figures and Tables as appropriate to break continuous text and to present information succinctly.*
- *Provide full citation of the references*
- *For citing a reference in the text let us use name of 'First author and year' format*
- *Use footnotes where that is appropriate (for example some data from a report)*
- *Number of pages: 7 to 8 pages maximum (single spacing), incl figures and tables; 3500 words max*

Graphs:

- *the population – babyboomer hump*
- *healthcare utilisation by age (AIHW)*

The authors consulted with key industries, researchers and other stakeholders in order to establish a scope for future research studies. The consultation resulted in the identification of the following themes:

(1) research and development of **technologies to assist in the delivery of health care into patients' homes**, community care settings and care facilities by direct support of patients and carers, as well as supporting clinicians in these settings;

There are several developments and pilot studies involving a range of available technologies and devices include web-cam and other wireless devices to enable telehealth¹; monitoring devices including those for alerting of falls and tracking movements of elderly patients who may be at risk of wandering.

(2) addressing diversity through applications that focus on **rural and remote** populations, including ethnic minorities and older people in metropolitan areas with limited mobility or

support systems. Technologies are being developed to allow the frail aged to remain in their own homes for longer, to delay or even avoid hospitalization or institutional care. These may reduce the need for travel and the use of inpatient facilities.

Further work is needed on packaging available technologies to facilitate adoption, particularly by the elderly in their homes and by time-constrained clinicians and other carers.

(3) research and development of **clinical decision support technologies**, software intelligent agents such as the digital Personal Care Assistant, and remote communications to link specialist and health care workers in the field. User-interface technologies aims to be linked to international databases to deliver timely evidence-based information;

(4) research and development of **tools and methodologies** to assist the health care industry in adopting a strategy-driven and standards-driven approach to IM&T investment. A standards-driven approach needs to ensure the ease and accuracy of information exchanges in health care, and between aged care and other care sectors such as hospital care and primary care. Information standards are needed to enable devices, software and databases to communicate and needs to impact safety, quality and efficiency;

(5) delivering **educational** products for students, clinicians, consumers and families;

(6) providing support for **national health information strategies**.

The scope specifically covers:

- Nation-wide consultation on priorities for information standards in health care
- Alignment with and contribution to international information standards development
- Development of the key information standards for health care

While efforts are currently underway to develop national health information strategies there is a need to share the experiences and methodologies, particularly where efforts have been successful. A lack of national strategy leaves some countries at risk of making IM&T investment decisions that are not guided by strategy. A planning framework needs to assist in prioritising investment and in directing resources to achieve benefits aligned with strategic directions.

While efforts are currently underway to develop an Australian Aged Care Information Strategyⁱⁱ the current lack of national strategy combined with the “cottage-industry” nature of much of aged and community care leaves the sector at risk of making ICT investment decisions that are not guided by strategy. A planning framework will assist in prioritising investment and in directing resources to achieve benefits aligned with strategic directions.

6. The future – pervasive computing, RFID, smart homes, intelligent agents, monitors, making dumb devices intelligent

m-Health will undertake research to guide information strategic planning and economic analysis to inform investment decisions, requirements engineering, information standards development, integration of existing technologies, evaluation of technologies and the development of products to address gaps in market offerings.

Reasons for the low investment in ICT in aged care aims to be researched including funding, the availability and suitability of products, the need for requirements engineering, and the level of confidence in realizing the anticipated benefits. The m-Health Stream 5: Strategic and

Economic Analysis will research tools, methodologies and templates to assist in strategic investment on ICT in aged care. This will include education and training.

There are a small number of devices emerging that will assist in tracking patients, providing falls alerts and medication reminders. There is a need for research into why the adoption is slow and the need for additional or superior devices to facilitate independent and active living in situations that in the past would have necessitated institutional care. There are increasing numbers of on-line services including on-line patient personal health records, monitoring, consultations, and medication purchasing. Software Personal Care Assistants could link with these and with in-home devices and provider-based health records providing much-needed integration of information. Nevertheless, the deployment of devices is slow. This may be due to doubts about the benefits, the suitability of the devices, the user-interfaces or the integration with other systems. Research stream 3: Innovative Technologies will research these factors, will develop interface engines to better integrate existing technologies and will develop devices to fill gaps. The approach aims to be to use “off-the-shelf” components so as to maximise affordability.

7. Conclusion

References

^[1] Yu P and Soar J, The future for e-health through next generation wireless and mobile connectivity, in Proceedings, *HIC2002 Health Informatics Conference, Melbourne 4-6 Aug 2002* ISBN 0 9585370 9 7

ⁱⁱ Australian Department of Health and Ageing, Aged Care e-Connect, <http://www.health.gov.au/internet/wcms/publishing.nsf/Content/ageing-rescare-econnect.htm>

^{ix} Zikmund, W. (1994). Business research methods (International Ed. ed.). Orlando, FL: The Dryden Press

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