International Journal of Technology Research and Management
ISSN (Online): 2348-9006
Vol 2 Issue 10 October 2015

The impact of ICT & M2M on healthcare industry

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Abstract: *M2M can play an important role in improving significantly the quality, access and efficacy of healthcare. Usage of M2M in health is still in initial stage. Many of the approaches being used are still at a relatively new stage of implementation, with insufficient studies to establish their relevance, applicability or cost effectiveness. M2M has enormous potential as tools to increase information flows and the dissemination of evidence-based knowledge, and to empower citizens and major impacts in improving the health and well being of poor and marginalized populations, combating poverty, and encouraging sustainable development and governance.. However, despite all its potential, a major challenge is that ICTs & M2M have not been widely used as tools that advance equitable healthcare access.*

Keywords: *Uttam Kumar, m2m in healthcare, telemedicine, ICT in healthcare, KN Modi university*

1. Introduction

Healthcare is one of the world's biggest economic challenges. Global spending on healthcare is estimated to be USD 6.6 Billion 2017.

Over 200 million people in the America and Eeastern Europe suffer from one or more chronic diseases like cardiac arrhythmia, hypertension, sleep disorder, diabetes, hyperlipidemia, asthma and chronic obstructive pulmonary disease (COPD). These conditions cause substantial costs and reduces both life expectancy and quality of life.

The going population will place further strain on healthcare systems. In 2010, there were 207 million people over 75 years of age worldwide. This figure will rise to 265 million by 2020. As healthcare system demands increase in pace with the aging population, a significantly higher burden is being placed on healthcare systems. Increasing, these solutions should be "value for money" and within healthcare budgets. With the aging population wanting to continue living independently, at home, they are looking to assisted living solutions for help for self and elders.

With a growing aging population and the prevalence of chronic diseases across the world, there is an urgent need to find new ways to improve patient outcomes, increase access to care, and reduce the cost so that all segment of the society can afford a medical care. With the advancements in sensor technology & M2M, the ubiquitous availability of cellular technology like 3g & 4g, and falling costs of communication devices are opening up new channels for improving patient care and quality of life. Using seamless, continuous remote patient health monitoring, healthcare providers, insurance payors, and the government are looking to significantly alter how care is provided to patients, while reducing cost of care at the same time.

Healthcare ICT represents a market with great opportunity for of ICT solutions. The healthcare ICT market is one of the fastest growing ICT verticals with spending growing at 7-10% CAGR. As an industry, healthcare is in the early stages of technological evolution and has not yet taken full advantage of the efficiencies that can be gained through strategic implementation of ICT solutions. This late adopter market has produced many single application solutions within organizational silos that are not suited for today's information requirements.

Machine to machine (M2M) is a broad label that can be used to describe any technology that enables networked devices to exchange information and perform actions without the manual assistance of humans. M2M communication is often used for remote monitoring. Key components of an M2M system include sensors, RFID, a Wi-Fi or cellular communications link and autonomic computing software programmed to help a networked device interpret data and make decisions.

The most well-known type of M2M communication is telemetry, which has been used since the early part of the last century to transmit operational data. Pioneers in telemetrics first used telephone lines -- and later, on radio waves -- to transmit performance measurements gathered from monitoring instruments in remote locations. The Internet and improved standards for wireless technology have expanded the role of telemetry from pure science, engineering and manufacturing to healthcare.

In the coming years these areas expand to include personalized medicine as well as better point-of-care tools with real-time individualized patient risk predictors and actionable care metrics. However, the technology that is getting the majority of attention from the industry is electronic healthcare records (EHR). EHR projects are large scale transformational projects that aim to simplify the complex and disparate nature of medical record keeping. EHR projects are considered to be the most complicated, expensive and politically charged currently being deployed in the industry. According to Gartner, through 2017, annual spending on medical informatics needed for EHR optimization will trend toward five times the initial informatics costs.

VCE offers specific industry based solutions that are geared to solving the most critical issues faced in Healthcare IT departments today. Extreme application focused systems deliver VDI solutions to provide a foundation for building out the latest healthcare services such as Telehealth, and mobility capabilities that can securely connect the clinician with the patient records, irrespective of device or location.

High end systems provide the perfect solution to the problem faced by IT in healthcare as they scramble to implement EHR projects. With the large amount of storage, processing and network to support an EHR, we understand that IT will require scalable and high performance systems that can expand to support the rapidly increasing amounts of data being pushed through.

According to WHO, the use of ICTs in health is not merely about technology, but a means to reach a series of desired outcomes:

- health workers making better treatment decisions
- hospitals providing higher quality and safer care
- people making informed choices about their own health
- governments becoming more responsive to health needs
- national and local information systems supporting the development of effective, efficient and equitable health systems
- policy makers and the public aware of health risks
- people having better access to the information and knowledge they need for better health.

2. Improving healthcare by use of M2M

Much interest is being placed in mobile and wireless technologies given that most healthcare workers are not desk bound and that immediate access to information is critical. Despite this interest, much of the investment into ICT is still dominated with the needs for basic infrastructure and platform systems (with Electronic Health Records among the top priorities).

The market is changing. Governments and Health Management organizations are placing greater emphasis, and greater resources, on technology as an improvement tool. In practice, the use of ICTs in the health sector has tended to focus on three broad categories that incorporate these pillars:

There are a number of interesting market dynamics for Healthcare ICT. These dynamics include a number of powerful drivers as well as a number of challenging barriers to adoption. The business drivers for Healthcare ICT can be summarized simply as a need for increased productivity, decreased costs and better utilization of capital. The medical drivers are focused on improved patient care. These drivers include fewer medical errors, less variation in care, consumer-centered care, portability of information (medical information moves with consumers), and improved interoperability and

connectivity of systems. As well, there is an overriding need for protection of information.

The adoption of technological solutions in the healthcare industry faces a number of obstacles. Limited funding allocation for ICT projects and a lack of sufficient financial incentives to encourage technology adoption has often meant inadequate solutions. Until recently technology has been used as only a mechanism for improvement in care delivery rather than as a tool for process efficiency. The complexity of the healthcare business, where there are multiple management layers, multiple operational silos, and multi-organzation business processes, represents the biggest challenge for technology adoption.

In healthcare specifically, M2M applications have the potential to:
(1) Reduce healthcare costs by allowing clinical staff to remotely work together and instantly access patient data.
(2) Serve a growing population of patients with chronic illnesses by allowing physicians to remotely monitor the patient's long—term health.
(3) Improve diagnoses by bringing together data from disparate devices (e.g. monitors, images, therapeutic devices) over time to form a complete picture of a single patient's health status.

2.1 Use of M2M for improved out- of-hospital care & monitoring

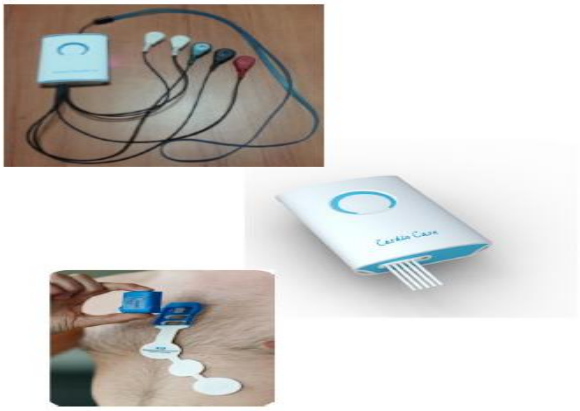
The healthcare industry relies on an endless variety of medical devices to assess patient wellbeing – weight scales, thermometers, blood pressure devices, heart rate monitors, glucometers and oxygen monitors just to name a few. These devices work as individual units, measuring only one aspect of patient health and caregivers piece together data to get a complete picture of overall health. Modern healthcare IT systems have improved and simplified this task by aggregating, visualizing and managing patient data on web-based medical platforms. M2M technology and the expanding Internet of Things (IoT) are taking this one step further by leveraging mobile technology and enabling devices to automatically send real time data to back end IT systems via wireless networks. Known as mHealth solutions, this technology is transforming the medical industry enabling new services, improved care and significant time and cost efficiencies

Figure 1: Next Generation Pregnancy Care solutions

Remote patient monitoring and telehealth applications are changing healthcare. For many conditions, healthcare provider office visits are being replaced by home monitoring, thanks to wireless technologies.

Figure 2: Post Intervention Cardiac care solutions

The technology market intelligence firm ABI Research agrees and predicts that by 2017, there will be nearly 170 million health and fitness wearable wireless devices worldwide on the market, more than half of which will be specifically designed to improve healthcare through home and remote patient monitoring. Although the remote patient monitoring market still must resolve questions



about potential privacy and security issues, the immense demand for quality care coupled with patients' willingness to connect to real-time network communication systems will drive major growth in the years to come.

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2.2 M2M for Medical Equipment Functionality and Maintenance

Using sensors, Smart IVs can monitor what dosage a patient is being given and detect any mistakes automatically before he or she is harmed. Not only does the technology improve health and safety, it also allows nurses and doctors more time to focus on interpersonal dealings with patients. Another example of M2M-based medical equipment are newly developed pacemakers that pace only when rhythm disturbances occur. These devices can reduce the risk of permanent abnormal heart rhythms in people with a slow heart rate

Figure 4: GlowCaps Pill Bottle

Lower data transmission and hardware costs make it possible to add M2M technology to smaller-scale consumer products. GlowCaps, a smart pill bottle cap designed by Vitality, Inc., is a good example of this. The caps are programmed to remind patients to take their medication at regular intervals. The device's M2M features include calling and texting users when it is time to take their medication, emailing usage reports to the patient and clinician, and automatically ordering prescription refi lls. Before M2M technology became cheaper, it would not have been possible to sell this product at a competitive price. Today, the product retails for $10 to $15 per month with a service plan.

PositiveID Corporation's iGlucose smart device is an example of medical technology that transmits diagnostic data. Diabetes patients are often encouraged to keep daily records of their glucose levels for their physician to monitor. Unfortunately patients often forget or neglect to keep reliable records. The iGlucose automates this process by periodically gathering, storing, and transmitting blood glucose levels. The readings are sent to a data management portal that generates reports sent to the patient, the patients family, and clinical staff .

CareFusion, a subsidiary of Cardinal Health, is a good example of a company using remote monitoring to improve their business. Carefusion manufactures a range of healthcare products that include medication dispensing equipment, infusion ventilators, respiratory diagnostic instruments, and surgical instruments. By using an M2M application to remotely detect equipment faults and service repairs, the company has reduced their field tech visits by over 30%. Remote firmware upgrades have also allowed the company to save over $2 million for every new software release. In addition to cost savings, the company has seen an increase in revenue – renewal of their Service Level Agreement contracts have increased by 10% since they have begun their remote diagnostics program.

Connected devices can also help healthcare providers track their assets in the field and reduce the risk of theft. M2M-enabled devices can:
• Protect drug deliveries. Ensuring packages are not tampered with and that logistics partners are storing them in appropriate conditions.
• Track vehicles on the road. Monitoring the location of delivery vehicles and on-call staff to plan patient care and streamline logistics.
• Monitor equipment. Using live performance data to spot early signs that maintenance is required, avoiding downtime caused by equipment failure.

Connected devices can also be used to:
• Check whether patients are taking their medication at the right time and the right dosage, and remind them to do so.
• Monitor long-term trends in patients' conditions, including evaluating progress towards agreed patient goals.
• Verify whether any medical equipment in the patient's home requires maintenance.

For the clinicians, these sensors and monitoring devices provide an unrivalled source of detailed patient

information. Data is available at their fingertips, so they can respond rapidly to any change in patients' condition. And by saving time on appointments, clinicians can effectively treat more patients, without compromising standards of care.

2.3 Improving functioning of healthcare systems by information sharing

With M2M, electronic records can be automatically shared in real-time between patients, clinical records systems and caregivers, providing timely access to medical care based on up-to-date, accurate information. One example of how this can work is a patient and caregiver can know within hours or days, rather than weeks or months, whether a treatment is effective or not. Not only will the anxiety of waiting be eliminated, but ineffective treatments can be halted and replaced with an alternative regimen.

Healthcare systems that respond immediately and automatically to patient needs improve the user experience for both the patient and the clinical staff . In addition, automatically generated therapy logs improve long-term healthcare for patients with chronic conditions. Of course sending and storing patient related data can introduce HIPAA concerns, so it is important to keep security considerations in mind when designing such systems.

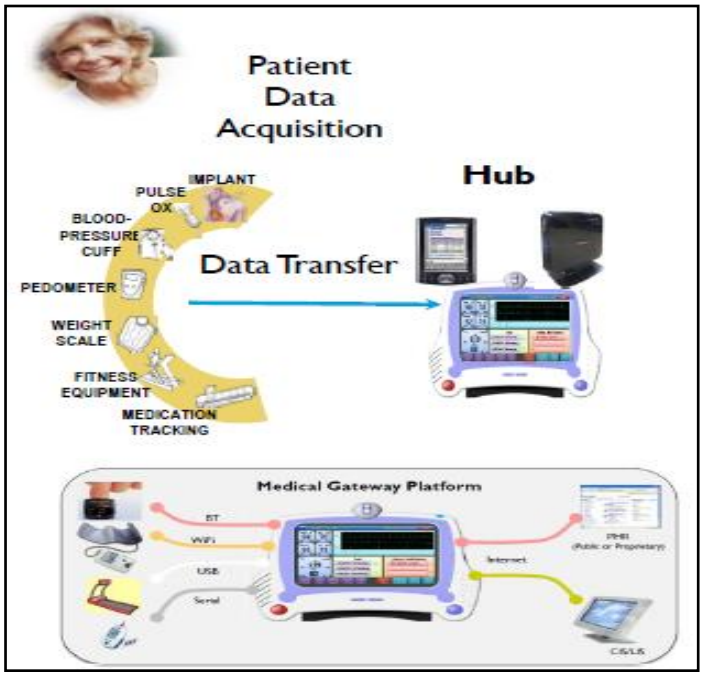

Figure 4: Patient Data Acquisition

Healthcare can be further improved by improving the management of information and access to that information, including

- Management of logistics of patient care
- Administrative systems
- Patient records
- Ordering and billing systems

Through better diagnosis, better mapping of public health threats, better training and sharing of knowledge among health workers, and supporting health workers in primary health care, particularly rural health care, including:

- Biomedical literature search and retrieval
- Continuing professional development of health workers
- Telemedicine and remote diagnostic support
- Diagnostic imaging
- Critical decision support systems
- Quality assurance systems
- Disease surveillance and epidemiology

2.4 Improving communication about health

ICT & M2M can help in improving information flows among health workers and the general public, better opportunities for health promotion and health communication and improved feedback on the impact of health services and interventions, including:

- Patient information
- Interactive communication
- Media approaches
- Health research
- Advocacy to improve services

3. Conclusions

The application of M2M enabled information management systems to healthcare is challenging. The healthcare sector's fragmented constituencies and complex transactions present a major challenge. It is too early to right-off the potential impact of M2M as mere hype, but it is clear that progress is slow and there are many barriers to overcome. Consequently, at the system level, the impacts of ICTs are likely to be in overall management and cost control, and in influencing decisions at the point of care. In terms of care, the impacts are likely to be in such areas as quality control, patient

safety and general improvements in outcomes and performance.

Most medical devices today work as individual units, monitoring one aspect of health for a specific purpose. Doctors and nurses spend precious time piecing together and analyzing disparate data for a complete picture of patient well-being. The healthcare industry has realized the promise of wireless machine-to-machine (M2M) communications to streamline monitoring and reporting to improve patient care.

New mobile health (mHealth) and telemetry monitoring solutions use cellular M2M technology and web-based platforms to connect medical devices, aggregate health data and provide a true comprehensive look at patients' well being. These new mHealth systems allow greater transparency and quick and easy access to medical data while maintaining very stringent requirements for security, safety, and patient-doctor confidentiality and privacy. M2M is poised to transform the healthcare industry.

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