The Royal Academy of Engineering

mHealth – mobile phones and healthcare

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Introduction

Developments in the past few years have made mobile phone networks and handsets key technologies in the delivery of healthcare worldwide. The technologies are fundamental in opening up the potential for remote health monitoring and self-management of health by people with long-term conditions.

Background

It is only 25 years since the UK cellular telephony service, as it was called then, was launched. As recently as 10 years ago, the link between mobile phones and health was seen in an entirely negative light. Exposure to electromagnetic radiation close to the brain, through the use of a mobile phone, was perceived as giving rise to an increased risk of developing a brain tumour, and all mobile phones had to be switched off inside hospitals because of "possible interference with medical equipment".

What changed between 2000 and 2010? A number of studies, for example the report from Professor Sir William Stewart in 2000 as well as two reports from the World Health Organisation (WHO) and a paper in the British Medical Journal in 2006, showed that there were minimal health risks associated with mobile phone use, although children under the age of 16 are still advised to limit the time they spend on calls.

In addition, the introduction in 2002 of GPRS (General Packet Radio Service), sometimes known as 2.5G, transformed the landscape. Today, mobile telephony, which includes voice, text messaging (SMS) and data services, has become the most widespread communication infrastructure in the world, with 80% of the world's population living within range of a cellular network. GPRS and now 3G allow two-way, real-time transfer of data to and from a remote computer server. The mobile phone is both a data entry device with a keyboard and a data review device with a colour screen.

Mobile phones are now seen as tools to facilitate the delivery of healthcare services, leading to a new term: 'mHealth', the use of mobile devices in health solutions.

The important issues

A 2010 report from McKinsey (mHealth: A new vision for healthcare) warned that, on current trends, spending on healthcare will consume an unsustainable proportion of the wealth of developed nations, up to 25% of gross domestic product (GDP), with the management of long-term conditions such as diabetes or asthma accounting for 80% of the growth in costs.

Innovative methods are required to address this challenge, and mHealth is highlighted as having the potential to achieve significant reductions in the cost burden of long-term conditions.

In the UK there are 17.5 million people with a long-term condition or chronic illness (the terms are interchangeable). Some 12 million of these suffer from diabetes, hypertension, asthma or chronic obstructive pulmonary disease – COPD.

In the United States, long-term conditions affect 130 million people, generating healthcare costs of approximately $1.4 trillion a year overall. Around 80% of GP consultations relate to long-term conditions and patients with these conditions or their complications use over 60% of hospital days. Type 2 diabetes is the fastest growing disease in the developed world as a result of poor diet and obesity, and the World Health Organisation (WHO) has predicted that long-term conditions will be the leading cause of disability by 2020.

Improved self-management, coupled with regular education and support, is seen as the best means of slowing the inexorable rise of healthcare spending on long-term conditions, through a reduction in the number of hospital admissions, emergency visits to the GP surgery or days off work.

How engineering is helping

The challenge today is to create sustainable, large-scale programmes that can support self-management of long-term conditions without being a drain on healthcare resources.

Patients with a mild or moderate form of a long-term condition expect to lead a normal life and do not want to change their routine or be confined to one location for self-monitoring. The mobile phone can be used not only to transmit self-monitoring data and patient diaries to a remote server but also to provide real-time feedback, which increases compliance. Algorithms running on a secure server can prioritise patients for telehealth nurses to review and call on their mobile phone, whenever appropriate, without the costs of frequent visits to the patient's home.

Telehealth services (or "remote health monitoring") are focused mainly on two types of populations, with different

economic cases. One type targets patients with COPD or chronic heart failure, for example, those who have a high risk of experiencing an expensive care episode, such as an unplanned hospital admission. The second type is more concerned with the long-term benefits of self-management for conditions such as diabetes. Here the target population is more likely to be younger, more active and early adopters of new technology.

The concept of mHealth can benefit both groups, although it has so far been mostly deployed among the second group. One of the main barriers to the adoption of mHealth by the first group has been the small and difficult-to-use keyboards of today's mobile phones, but this is being eroded by the introduction of a new generation of smart phones (such as the iPhone) with large icons on touch-sensitive screens.

Other applications of mHealth

Other mHealth services are also being developed in many markets outside the management of long-term conditions. For example, the automatic sending of text messages to remind patients of appointments is widespread within the National Health Service. Similarly, SMS reminders can help promote adherence to medication regimens, by prompting individuals to take their medication and encouraging them to complete their treatments.

There are now several thousand healthcare applications for the iPhone. The Pill Phone, a medication reminder application from a US company, tells patients when they should take their medicine. Medication Tracker, MedsLog and Pillbox are among the most popular medication trackers in the iPhone App store. Text messaging has also been used to improve success rates in smoking cessation programmes.

Recently mHealth has begun to have an impact in the developing world, albeit mostly through pilot projects at this stage. Three quarters of mobile phone users are in developing countries.

Making sure that there is the right amount of malaria drugs at the hospital or the health centre where they are dispensed is a hard logistical problem in sub-Saharan countries, which mobile phone technology is helping to solve.

Mobile phone applications have also been developed to empower community health workers, allowing them to record medical information in patients' homes and uploading it to a basic electronic health record.

Future work

Whenever any new drug or medical device is to be introduced, evidence is required of its safety and efficacy. Because mHealth is a technology based on self-monitoring, there are no safety implications if it is accepted that the use of a mobile phone carries no health risks.

But the sustained use of mobile phones (including smart phones) for healthcare will depend on evidence gathered in clinical studies or trials demonstrating improved patient outcomes, for example an increase in the long-term control of blood glucose levels in people with diabetes or fewer exacerbations in people with respiratory conditions such as asthma or COPD.

The spread of mHealth technology will also underpin the growth of personalised medicine, for example by providing the means to monitor the variance in drug dose response within a patient population.

Conclusion

Engineering has a vital, underpinning role in improving care and support of patients through mobile health. The Royal Academy of Engineering is active in the field of biomedical engineering through the UK Focus for Biomedical Engineering. The group produces policy papers, organises briefing seminars and engages with the policy community to promote awareness of new technologies, their applications and implications for the delivery of healthcare.

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