Information Communication Technology-Enabled Health Care at Home

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The delivery of health care to people at home using information and communication technologies, often termed telecare, telehealth, or telehomecare, is set for rapid expansion. This article provides a brief overview of the applications and the evidence supporting its implementation. Relevant national policies in England and Canada are discussed, along with prominent examples of services and deployments. Finally, the links between research evidence, government policies, and service changes in primary care in the two countries are discussed.

Key words: telecare, telehealth, eHealth, telehomecare

Introduction

During recent years, there has been significant technological innovation in secondary care, in both diagnostic and therapeutic practices—for example, the introduction of new imaging techniques. Yet, the speed of technology innovation in primary care, especially home care, has been noticeably slower. Often termed telecare, telehealth, telehomecare, or eHealth, the use of information and communication technologies (ICTs) to support health and care delivery to people in their own homes is growing in prominence. The clinical architect for the UK National Health Service’s Connecting for Health has stated that, “health and social care services have five years to develop the telehealth and telecare services they will need to cope with an aging population.”

The emphasis on home, rather than hospital-centred, care may still be debated by some; yet in 2002, the World Health Organization (WHO) commented that “as long as the acute care model dominates health care systems, health care expenditures will continue to escalate, but improvements in populations’ health status will not.” With aging societies, increasing demands on health care, and a diminishing workforce capacity to meet growing patient needs, the emphasis on technology innovation may be set to change from secondary to primary care.

Overview

Telecare may be defined as “the remote or enhanced delivery of health and social care services to people in their own home by means of telecommunications and computer-based systems.” This definition is equally descriptive of telehomecare.

Arguably the first mainstream use of telecare was the community alarm or personal emergency response system. It was introduced in the UK during 1948 and has not changed substantially since then, with most systems still requiring the user to pull a cord or press a radio trigger to call for assistance. This simple system has benefited many and is used by approximately 11% of people over the age of 65 who live independently.

While developments such as automatic fall detection, bed occupancy alerts, and the detection of changing behaviour patterns through lifestyle monitoring fall within the broad definition of telecare, perhaps the most important development to achieve the WHO’s goal of translating resources from secondary to primary care has been the monitoring of health at home, especially for long-term conditions. A typical system enables users to record their own physiological measurements and symptoms at home on a daily basis. These data are uploaded and automatically analyzed so that areas of concern can be highlighted to medical practitioners and responded to accordingly. In 2003, the Veterans Health Administration in the US introduced such systems, and now more than 43,000 patients have used them. Technology development is likely to continue at pace, increasing the appropriateness and effectiveness of these systems, propelled by initiatives such as those launched by the Technology Strategy Board in England. In terms of the potential beneficiaries, it has been suggested that from 2006 to 2016, there will be a worldwide increase in use of 72%, to some 55.5 million potential users.

Evidence for Deployment

The application of ICTs to deliver health care to people in their own homes is an emerging discipline. At present, the evidence base to support decision making could be regarded as inconclusive. Some systematic reviews, such as that by Hersh et al., suggest strong evidence for telehealth in a handful of clinical specialties, whereas Garcia-Lizana et al. reported no improvement in clinical outcomes. Barlow et al. concur with this mixed outlook, indicating that about half of the...
studies suggest clinical benefits, while the other half find no effect.

Some of the inconsistency of results may be due to methodological oversights in study design and measurement of outcomes, together with difficulties in implementation or the system itself. Delivering a new health care programme takes time, infrastructure, and workforce development, appropriate project management, and a supportive workplace environment. As highlighted by the Veterans Association in December 2008, if these and other building blocks are put in place, then substantial benefits can be observed. Indeed, in Darkins et al.’s research with 17,025 users, they reported a 25% reduction in bed days of care; a 19% reduction in hospital admissions; an 86% satisfaction rate from participants; and significant cost savings (i.e., $2,060 per patient per annum for telecare compared with $16,905 for home-based care services and $100,168 for nursing home care). (All costs cited in this article are presented as Canadian dollars.)

### Information and Communication Technologies in England and Canada

England and Canada have been active in the application of ICTs to support people at home for many years and are chosen to highlight current activity levels and strategies. Neither is presented as a “gold standard” and, therefore, comparison between countries would not be appropriate. However, Table 1 identifies some of the key policy statements supporting developments, leading on from the policy context, Table 2 highlights some of the practical examples of actual deployments in the countries under consideration.

### Table 1: Major Policy Initiatives and Guidance Supporting ICT Delivery of Health Care at Home

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<th>Year</th>
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<td>2005</td>
<td>$145M investment to encourage deployment</td>
<td>2000</td>
<td>$80M under the Canada Health Infrastructre Partnership Program</td>
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<td>2007</td>
<td>“Telecare to be viewed as integral not marginal”</td>
<td>2001</td>
<td>Romanow Commission was established “to ensure long-term sustainability of a universal accessible, publicly funded health system”; of the 47 recommendations of this commission, 7 related to telehealth</td>
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<td>2008</td>
<td>“Person centred planning … with individuals having choice and control over how best to meet their needs, including through routine access to telecare”</td>
<td>2003</td>
<td>National Initiative for Telehealth Framework of Guidelines were published to provide structure for telehealth policy, procedures, and standards</td>
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<td>2008</td>
<td>Benefits of telecare to carers highlighted</td>
<td>2006</td>
<td>“Establishment of accreditation criteria specific to Telehealth by [CCHSA]. The accreditation criteria developed by the CCHSA assume that Telehealth is a mode of health care delivery integrated into the full complement of service delivery, not an entity unto itself”</td>
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<td>2008</td>
<td>IT infrastructure Healthspace detailed to deliver mainstream telecare and self-care</td>
<td>2007</td>
<td>Business case backing telehomecare for management of chronic disease in Canada was formalized</td>
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<td>2009</td>
<td>Maintain a “watching brief over the emerging evidence base on assistive technology and telecare to support the needs of people with dementia and their carers”</td>
<td>2008</td>
<td>eHealth Ontario was created to coordinate a $2.133 billion eHealth Strategy from 2009 to 2011 in this province</td>
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CCHSA = Canadian Council on Health Services Accreditation; ICT = information and communication technology; IT = information technology.
conditions are quite different applications, but both fall within the broad definitions and related policy documents found in telecare, telehealth, eHealth, digital inclusion, and telehomecare. Without agreed terms and definitions, the establishment of an evidence base is compromised and the sharing of knowledge between interested parties difficult.

Nevertheless, England and Canada share many of the same motivations for implementing telecare programs to address rising medical expenditures, a diminishing health care workforce, a rapidly aging population, and the increasing emphasis on primary care. Delivering appropriate health care and support to people in their own homes through ICTs is seen by many as part of a sustainable strategy. However, although national policies in both England and Canada can be seen to be supportive, the realization of policies into practice is occurring at a relatively slow pace in both countries. That is, large-scale mainstream services are not current practice.

In the past decade, Canadian efforts have focused largely on building infrastructure and practices for remote consultations and videoconferencing to address its vast geographical and seasonal barriers to accessible health care. Widespread adoption of telecare hinges partially on the ability to overcome policy barriers including standards for reimbursement across territories and provinces, licensing, privacy, liability, consent, and adversity to change. Presently in Canada, the state of telecare with hand-held units for long-term conditions is in the stages of community pilot studies, with sample sizes in the order of 100 users. Conversely, in England, there are few examples of home-based video consultations. Instead, efforts seem to have focused more on low bandwidth applications, specific clinical applications for hand-held devices for long-term conditions, and the establishment of an evidence base with respect to this approach. Infrastructure, in terms of high bandwidth communications, seems to be less well developed in England than in Canada, which perhaps explains the different emphasis taken in the two countries.

Deployment in both countries is hindered by a relatively weak evidence base. Internationally in 2005, only 4.7% of telehealth publications were classified as clinical trials. This number is

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**Table 2: Major Activity in the Support of ICT Delivery of Health Care at Home**

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<th>England</th>
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<td>Whole System Demonstrator, a $56M investment with 6,000 participants as part of a randomized controlled trial, is established to understand system level components and establish an evidence base. This involves disseminating the lessons throughout the study.</td>
<td>9 of 13 jurisdictions have 24-hour, 7-day-a-week health support telephone lines. For example, “[OTN] annually provides over 38,000 remote consultations. More than 2,000 health care professionals deliver care using OTN.”</td>
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<td>From the $145M investment in 2005, more than 160,000 additional people have been supported with telecare systems.</td>
<td>Numerous small scale programmes are under way; for example, Vancouver Island Health Authority is introducing up to 100 telecare systems for people with heart failure.</td>
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<td>Over 65 of the 150 local authorities are actively engaged in pilot studies, with deployments ranging from a few units to several hundred (Mike Clark, personal communication).</td>
<td>1,300 videoconferencing units are in operation across Canada, particularly to address the health needs of rural areas, First Nation and Inuit communities, and the northern territories.</td>
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<td>Birmingham has 2,000 people who have telephone support, with home monitoring being introduced. It plans to increase deployment to 27,000 people.</td>
<td>Telehomecare pilot studies and programs have been introduced across Canada to build the evidence base on which to formulate policy.</td>
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<td>Met Office system is to support self-care when there is an elevated risk due to weather conditions. Over 8,500 patients who have COPD are on the system.</td>
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COPD = chronic obstructive pulmonary disease; ICT = information and communication technology; OTN = Ontario Telemedicine Network.

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**Figure 1: A Typical Telecare System in Use**

![A Typical Telecare System in Use](image)
likely to have increased a little over recent years but is almost certainly still a low proportion, especially when compared with the 72% observed in surgical journals. In 2007, Whitten et al. suggested that even in studies defined as a clinical trial, randomized subject allocations were only present in 11% of patient studies and the majority of studies involved sample sizes of less than 100. More evidence on clinical and cost effectiveness using robust research designs is needed to support the translation of telecare policy to practice. Results of large-scale initiatives such as the English Whole System Demonstrator, which will study 6,000 participants using hand-held units for long-term conditions in a randomized controlled trial, should be of great assistance in developing the necessary evidence base.

Yet despite the lack of well-established evidence, there is growing political will and investment in telecare in response to present and envisaged service pressures. This situation aligns with Pawson’s observation that the “policy cycle revolves more quickly than the research cycle, with the result that real time evaluations often have little influence on policy making.” Establishing evidence-based policy is difficult, and it is widely accepted that health policies do not reflect research evidence to the extent that, in theory, they could.

**Probable Impacts on Primary Care Delivery**

The growing momentum in the shifting of resources from secondary to primary care and the anticipated increase in telecare delivery will inevitably impact on primary care delivery models and primary care physicians’ working routines, especially in the support of people with long-term conditions. Expenditure on such conditions can consume as much as 75% of national health care budgets, and telecare has been proposed as being able to enhance patient outcomes while reducing health care expenditure. Patients monitoring their own conditions at home with abnormalities being automatically highlighted for analysis by health care practitioners would lead to a greater emphasis on prevention and more timely interventions, but also require GP practices to embrace such approaches with the following structural changes required. That is, GPs would be required to offer more consultations remotely, either by telephone or video conference, supported by data obtained by telecare systems. This should yield reductions in travel for patient and GP alike, while also offering a more personalised and timely service.

Such a change in working practices also impacts the “balance of power” between the patient and GP. Empowering patients to take greater control over their own conditions through the completion of daily question sets and physiological measurements often increases their knowledge and abilities to manage their own conditions. As such, the patient can move from being a recipient of knowledge from the GP to a position of more shared responsibility for medical interventions. Consequently user satisfaction levels for telecare are often reported as high. However, shifting the “balance of power” impacts upon both patient and provider.

A further anticipated impact on GP service delivery models is that less support should be required for out of hours services. Evidently telecare systems can help triage more appropriately through the availability of reliable lifestyle and physiological patient data obtained from the home. Yet there can also be a reduction in demand as the anxiety of patients is often reduced as they have become better at managing their own condition and also because they know that if outside of pre-defined parameters the telecare sys-

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**Key Points**

Due to current and anticipated service pressures, the use of ICTs to support health care delivery to people in their own homes is prominent in the national policies of both England and Canada.

The reality of mainstream telecare services is noticeably different from the supportive policy environment.

Developments in England tend to focus on the establishment of an evidence base for hand-held devices targeted at long-term conditions, whereas in Canada, the emphasis on remote consultations is greater.

The evidence base to support mainstream deployments is sparse; as a result, widespread adoption of telecare has been slow.

The potential of telecare to mitigate rising medical expenditures and to improve quality of life justifies focused, rigorous study. At the same time, governments continue to be supportive and invest noticeable sums on the assumption that evidence will ultimately be supportive.

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**Clinical Pearls**

Clinical and cost outcomes could be enhanced by the adoption of telecare, but it requires system re-engineering to be effective.

Patient satisfaction of telecare systems is often high and can empower individuals to take greater control over their own lives.
tem would have instigated interaction with the GP. While currently it may be advisable to ensure that telecare systems are not relied upon as a consequence of the automatic decision support systems not being as robust as some might hope for, patients knowing that they are “not alone” can be helpful in managing service demand.

Conclusion
It seems inevitable that telecare will ultimately play a large part in service delivery in primary care. Service pressures are increasing, deployment is increasing, further investment is being made in new technologies, and policymakers are increasingly supportive. The missing elements are the evidence base to support investment and a toolkit to ensure safe and successful deployment. If, or when, these are available, there could be dramatic changes observed in primary care.

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