Foreword

The Ontario Telemedicine Network believes that Telehomecare answers the challenge presented by three converging pressures in health care.

Offering home-based remote monitoring and self-management training for chronically ill patients, Telehomecare has the potential to fulfill the needs of an aging population and the demands of new technologies and empowered patients.

The first challenge facing the health care system is the changing face of the Ontario population. In 1981, only about 9.5 per cent of our population was over 65. In 2011, it was 14.8 per cent. By 2036, it is expected that seniors will comprise 25 per cent of our population.

That changing demographic has many implications for society but amongst the most significant of these is the healthcare burden of chronic illness. About 89 per cent of Ontarians over 65 have at least one chronic condition. The economic impact of chronic disease is estimated to be 55 per cent of total direct and indirect healthcare costs.

The second challenge is information technology. With scientific and technological advance comes the welcome but challenging responsibility of changing the way we do things – to put to work the new tools that will allow us to deliver health care better, faster, cheaper. We are compelled by logic and economics – and by human nature – to use advancements in technology. But we are also charged with the responsibility of using these tools in a way that actually contributes to our overall well-being. Health care must not change for the sake of change.

The third challenge is an expectation – even a demand – among patients and their families: they no longer wish to be passive recipients of health care. They expect to understand their situation, exercise their options and participate in their care plan. Not surprisingly, it is, at least in part, the information age itself that has contributed to creating this “new” patient. As William H. Frist has written in Health Affairs, “the newly empowered consumer (is) equipped for the first time with actionable knowledge that can affect his or her health.” More, as Frist writes, “People know that making appointments, receiving routine test results and filling prescriptions should be as simple as online banking, buying an airline ticket, or reserving a table for dinner.” The implications are profound for most healthcare providers who must not only shake off their skepticism about self-management but also welcome the patient – and the family – to the healthcare team.

Telehomecare answers all three challenges within the framework of a healthcare system struggling with sustainability.
Telehomecare in Ontario

In Ontario, Telehomecare is a free program that allows the patient to learn the skill and confidence to manage chronic conditions in their own home with the support of a registered clinician. A specially-trained clinician – registered nurse or respiratory therapist – remotely monitors vital signs, provides health coaching and sends reports to the patient’s primary healthcare provider on an agreed schedule.2

Telehomecare currently addresses Chronic Obstructive Pulmonary Disease (COPD) and Chronic Heart Failure (CHF). A pilot is currently in place for Diabetes Mellitus (DM).

OTN’s Telehomecare has been shown to reduce hospital stays and ER visits while helping the patient enjoy the best possible quality of life.34–6

Telehomecare is co-funded by the Ministry of Health and Long-Term Care (MoHLTC) and Canada Health Infoway (CHI). Local Health Integration Networks (LHINs) lead the program in each of their regions. The LHINs each select host organizations to deliver the nursing services and provide the patient equipment. Host organizations may be hospitals, Community Care Access Centres (CCAC) or Family Health Teams (FHT).

The Ontario Telemedicine Network (OTN) provides program design and oversight as well as implementation and support services, manages the technology, maintains an expert clinical advisory committee and certifies clinicians to deliver Telehomecare. As an integral part of Ontario’s Chronic Disease Management Framework, Telehomecare aligns with and supports other provincial health strategies including Health Links.

Clinical Effectiveness of Telehomecare Programs for Chronic Disease Management: a literature and evidence survey

A summary of findings is presented for telehomecare patient care models where treatment was offered to patients with CHF, COPD or DM and the treatment program includes components similar to OTN Telehomecare, i.e. 1) individual patient interaction with a specially-trained telehomecare nurse who updates the primary care provider; 2) self-management training and health coaching; 3) remote monitoring of physiological parameters (weight, pulse-oximetry, blood pressure and blood glucose levels).

Methodology

The following keyword search was used to obtain the initial body of literature from PubMed accessed on Nov. 18, 2013:

(telenursing OR telehealth OR telehomecare OR telemedicine OR telecare OR telemonitoring OR “home monitoring”) AND (COPD OR COAD OR “heart failure” OR “cardiac failure” OR “diabetes mellitus” OR (diabetes mellitus[MeSH Terms]) OR “chronic disease” OR “chronic condition” OR “chronic illness”) AND English[Language]

The resulting 1,791 abstracts were manually reviewed to identify meta-analysis and review publications (limited to 2003-2013) and individual research studies addressing telehomecare intervention with chronic disease (e.g. diabetes, heart failure, COPD) patients’ care.

Google Scholar citation index was used as a guide to identify publications impact in the field.

Additional literature and evidence was obtained from telehomecare program web sites2,11,12, and through consultation with expert clinicians.
Discussion
Telehomecare programs for chronic disease patient care and management have been prioritized by policy makers in many jurisdictions due to the prevalence of these conditions worldwide, the potential in improving patient care and satisfaction and the potential cost avoidance in health care. This policy is supported by individual studies and meta-analyses that report the clinical and economic benefits from telehomecare interventions.

- **Telehomecare programs are being endorsed and implemented worldwide**
  While telehomecare and telemedicine are relatively new treatment approaches, clinicians and policy makers worldwide have recognized the potential benefit from implementing such plans to improve chronic patient care.

  In the case of COPD, the Canadian Lung Association highlights the importance of change in lifestyle and participation in rehabilitation programs\(^1\). For CHF, the Canadian Cardiovascular Society (CCS) and the Heart Failure Society of America have endorsed telehomecare type interventions in their 2010 guidelines, recommending their integration into existing practice\(^14,15\).

  For DM, the Canadian Diabetes Association (CDA) and other organizations worldwide have endorsed telecare, self-management and practical education plans\(^16\).

  Furthermore, based on successful small-scale studies and more recent large studies both the UK department of health and the Veterans Health Administration in the US have implemented telehomecare interventions, the WSD and CCTH, respectively. These programs are now being expanded\(^5,17-20\).

- **There are clinical and economic benefits from telehomecare programs**
  Telehomecare programs report improvements in:
  - Patient self-management\(^31,32\).
  - Quality of life\(^4,6,33\).
  - Acceptability of the intervention\(^22\).
  As well, substantial clinical and economic benefits from telehomecare programs for chronic disease patients include:
  - Reduction in all-cause mortality rates\(^17,21-24\).
  - Reduction in hospitalization rates or number of patients hospitalized\(^5,6,17,25-29\).
  - Reduction in emergency department visits\(^6,17,21\).
  - Reduction in the number of patient bed days\(^17\).
  - Reduction in admission or overall healthcare costs\(^30,31\).
  - Reduction in the number of exacerbations in the case of COPD\(^3,5\).

Conclusion
Universally accepted, conclusively definitive meta-analyses of telehomecare programs and their efficacy in the management of chronic disease do not exist because telehomecare programs tend to be small and widely varied and results are not easily synthesized\(^34,35\).

In spite of this, data from a few large trials have led to the integration of telehomecare into large-scale health systems, demonstrating widespread confidence in remote monitoring and health coaching as a significant contributor to patient health, satisfaction and reduced or avoided healthcare costs in the management of chronic disease.
1. **British Columbia, Canada**

Two pilot telehomecare projects offered to HF patients were launched in 2006 and in 2009 in two British Columbia communities. The projects were expanded in 2008 and 2010, respectively. Both used remote monitoring devices and daily contact with a specialized nurse for follow-up. Patients were satisfied with the level of care provided by the telehomecare programs. The interventions in both communities:

- reduced hospital readmissions.
- reduced ER visits.
- reduced average length of hospital stay.
- reduced HF hospitalization costs.

2. **United Kingdom (UK)**

The Whole System Demonstrator (WSD) project, funded by the UK Department of Health, is a large randomized trial (6,191 patients and 238 general practitioners) testing the benefits of integrated care supported by telehealth and telecare intervention vs. usual care.

- The program is offered to patients with the following conditions: HF, COPD, DM.
- The intervention model is based on telemonitoring transmitted to monitoring centres staffed by specialist nurses who communicate data to care providers and provide patients with care management and education.

- Steventon et al. (2012) report the following results in a cohort of 3,154 patients (from 179 GP practices) randomized to either usual care control group (n=1,584) or telehealth intervention group (n=1,570) over the 12-month trial period:
  - 45% reduction in mortality rates.
  - 11% reduction in inpatient admissions.
  - 20% reduction in emergency admissions.
  - 15% reduction in emergency department visits.
  - 14% reduction in the number of patient bed days.
  - 14% reduction in elective admissions.
  - 8% reduction in tariff costs.

- Since results show that these services can substantially reduce mortality, reduce the need for admissions to hospital, lower the number of bed days spent in hospital and reduce the time spent in A&E (ER), telehealth and telecare interventions are being incorporated in the 3 million Lives campaign.

3. **United States (US)**

Veterans Health Administration (VHA) is a large integrated healthcare system committed to the care of over 8.3 million US Veteran patients annually.

- In 2003, VHA implemented a national care coordination/home telehealth (CCHT) program providing non-institutional care (NIC) to patients with any of the chronic conditions: diabetes mellitus (DM), congestive heart failure (CHF), hypertension (HTN), posttraumatic stress disorder (PTSD), chronic obstructive pulmonary disease (COPD), and depression.

- The program’s model is case manager-based; the patient’s coordinator assigns the patient to the appropriate telehealth technology, provides training, reviews telehealth monitoring data, and provides active care or case management which includes communication with the patient’s physician.

- In 2008 Darkins et al. reported the benefits from VHA’s CCHT program for a cohort of 17,025 patients (12% COPD patients) showing 25% reduction in bed days of care and 19% reduction in hospital admissions. Moreover, 90% of patients accept enrolment into the program and 86% are satisfied with it.

- The cost of CCHT intervention is $1,600 per patient per annum, substantially less than other non-institutional care programs and nursing home care offered by the VHA.

VHA has expanded its CCHT program into large telehealth networks that provided care to 497,342 patients (in fiscal year 2012).

4. **Denmark**

In Denmark, the TELEKAT program offers telehomecare rehabilitation to COPD patients. The study included severe and very severe COPD patients. Participants were monitored for lung function, weight, oxygen level and pulse. Data was transmitted to healthcare providers who follow up and provide consultation. Evaluation of 57 patients participating in the program suggests that the intervention improves the condition of the patient by lowering the blood pressure, the number of prescribed antibiotics and steroids, and the number of clinical consultations. Moreover, in a randomized controlled trial of 105 COPD patients who were block-randomized into a telehomecare group (57 patients) and a control group (48 patients), a cost-utility analysis found that the THC program was more cost-effective than the conventional rehabilitation.
Early results, Ontario Telehomecare

OTN’s Telehomecare represents the largest program nationally. It is offered for six months to eligible chronic disease patients who are diagnosed with COPD or CHF and have had emergency room visits or hospital admissions associated with their condition. Patients are offered monitoring of weight, blood pressure and blood oximetry using electronic equipment connecting them via the Internet with a program nurse available five days/week. In addition, the nurse provides coaching and education and liaisons with the primary healthcare provider who is provided with periodic reports.\(^{2,45}\)

**Pilot**

A pilot study conducted in 2007 showed ER visits were reduced by 73% and hospital admissions were reduced by 65%.

**Expansion**

Ontario Telehomecare was implemented in early adopter LHINs in 2012 with additional LHINs coming onstream in 2013 and 2014.

- Hospital utilization data from William Osler Health System, which delivers the Central West LHIN Telehomecare program, indicates a 70 per cent reduction in hospital admissions and a 53 per cent reduction in ED visits among Telehomecare patients six months after discharge compared to pre-Telehomecare rates.

- Southlake Regional Health Centre, which delivers Telehomecare in the Central Region, reports reduced system usage of 57 per cent for hospital admissions and 48 per cent for ED visits.

- Toronto Central Community Care Access Centre, which delivers Telehomecare in the Toronto Central LHIN, reports hospital admissions reduced by 44 per cent and ED visits reduced by 48 per cent compared with pre-Telehomecare rates.

**Evaluation**

A formal evaluation by Toronto Health Economics and Technology Assessment Collaborative is underway.

---

**Ontario Telehomecare AT A GLANCE**

- Supports patients with COPD or CHF through health coaching and remote monitoring.
- Patients are referred to the program in a simple, one-step process.
- Patients use home-based technology to monitor vital signs and answer simple questions.
- Specially-trained team of local nurses and respiratory therapists monitor results and alert primary care provider if there has been an exacerbation.
- Process and protocols are based on Best Practice guidelines of leading healthcare organizations.
- In place in seven LHINs and soon to be introduced across the province.
- Co-funded by the Ministry of Health and Long-Term Care and Canada Health Infoway.
- A program of the Ontario Telemedicine Network.
A Note on the Limits of Telehomecare Literature Reviews and Meta-Analyses

As one literature review indicates, during the last 20 years, more than 1,300 Medline papers have been published concerning the use of telemedicine. Only one in 10 of these studies have been formal randomized trials. A wide range of outcomes has been reported. As a result, a conventional meta-analysis cannot yet provide a robust summary of this very heterogeneous field.

As one example of the difficulty, telehomecare programs use a variety of remote monitoring methodologies to follow-up on patients’ symptoms and provide accessible communication with healthcare providers. Methodologies range from simple to complex and typically fall into one of several approaches.

A simple approach would include a structured telephone conversation where patients report their symptoms and weight to a health professional, often as part of a more formal chronic disease management care plan.

A more complex approach may include remote monitoring equipment where physiologic data and symptoms are transmitted to a healthcare professional via phone line or broadband internet from the patient’s home allowing the healthcare professional to review the patient’s data and respond accordingly.

Implanted monitoring devices represent further monitoring complexity providing wireless data transmission from the patient to a monitoring unit where a healthcare professional can respond to the information as needed.
Moreover, and perhaps most importantly, patient selection criteria vary widely. The potential for improved outcomes, therefore, also varies widely. As an example, a reduction in hospital admissions amongst end-stage COPD patients might be considered a desirable outcome whereas, for newly diagnosed, early-stage patients, only complete avoidance of hospital admissions would be a cost-effective outcome.

All of these treatment models have been the subject of studies evaluating telehomecare efficacy. Yet these studies cannot be synthesized because, as discussed, the programs differ in significant aspects including:

- The specific type of technology used
- Involvement of a case manager or specialized nurse in the follow-up process
- The nature of interaction between the clinician and the patient (face-to-face, via video teleconferencing, or via an automated response system)
- The duration of the follow-up time and measured outcomes
- Patient selection criteria

Studies also differ in the size of cohort and type of study design, that is, randomized control trial or retrospective analysis.

As the saying goes, absence of evidence does not imply evidence of absence. Or, as Dr. Ed Brown, CEO of OTN, says of Telehomecare's impact on hospital utilization at William Osler Health System - a reduction of 71 per cent in hospital admissions amongst the first 130 Osler Telehomecare patients - “If you found a new drug with that kind of track record, you'd jump at it.”

“If you found a new drug with that kind of track record, you’d jump at it.”

Dr. Ed Brown, CEO of OTN


