Telehomecare Technologies for the Elderly: Milestones and challenges

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Introduction

- The need for healthcare increases with age, e.g. four times as many elderly people of 85+ need daily care compared to those aged 65-74.
- It is unlikely that in the near future there will be enough:
  - nurses to support them adequately and
  - facilities to accommodate them.

  This international trend has been described as a 'crisis in care'.

  → **Telehomecare** (or home telecare) seems to be the **best** solution.

  - It was first developed for patients with chronic diseases (HF, diabetes, asthma, COPD). It has the potential:

  (1)to increase independence and QoL for elderly people (**diseased or not**) who prefer to live in their own homes and

  (2)realize cost savings for the health care system.

Why telehomecare?

- **For the elderly patients** who wish to spend their old age in their own home it is possible to:
  - provide frequent access to their care from different groups (caring personnel, family and friends)
  - obtain cost-effective results, including time-savings for service providers and shorter treatment periods
  - detect health abnormalities at an early stage through the frequent monitoring of physiological data.
- **For the healthcare providers** who wish to offer elders more:
  - education and counselling
  - social support
  - disease monitoring and management

  compared to a short hospital visit.

Restrictions

- Not all chronic diseases are suitable for telehomecare, e.g. those requiring the permanent presence of healthcare personnel or life critical monitoring equipment.
- Telehomecare-enabling diseases include ‘stable’ chronic diseases such as COPD, asthma, cardiovascular diseases, diabetes, dementia and mobility impairments.
- Telehomecare systems for the elderly (and not only) should fulfil the following requirements:
  - they must be simple to use and user-friendly
  - they must be stable, interoperate without interruption and provide reliable monitored values
  - computer security and data confidentiality must be ensured
  - the service should be continuously available (in many cases).

Technologies – Asthma & COPD

Portable spirometer, transmitting values to a remote monitoring centre, e.g. Medical International Research Company – Spirolab III supports USB, Bluetooth & RS232 connectivity.

Asthmatic and COPD patients often need long-term oxygen therapy and use supportive devices at home:

- HELiOS oxygen system (Tyco Healthcare), apart from the liquid oxygen storage vessel, is equipped with a built-in remote oxygen content telemonitoring option. By utilizing such facilities it is possible to trace the patient's reactions to the treatment.

Technologies – Diabetes

There is a range of technologies for diabetes care at home:

- In earlier studies, invasive glucose meters were connected to a telephone system to communicate data and even provide patients with feedback in some cases.
- Non-invasive glucose meters (that measure the glucose value without penetrating the skin), e.g. GlucoWatch (Animas Technologies)
- Low-invasive meters with real-time continuous glucose monitoring, e.g.
  - MiniMed Paradigm REAL-Time System (Medtronic Minimed Inc) that integrates an insulin low-invasive pump or
  - GlucoDay (Menarini) that offers online glucose values during sensor recording.

Technologies – Other equipment

- GPS locators for people with dementia
- Health watches measure blood pressure, pulse, temperature and skin moisture; then transmit them to the closest healthcare centre.
- Homelab devices that perform point-of-care testing at home on blood, urine or even stool samples, e.g. i-STAT device (Abbott Laboratories) , ‘smart’ toilets (Matsushita Electric Industrial Co).
- Sensors at home, e.g. fall sensors
- Sensors in clothing: a variety of sensors can embedded in clothes for close monitoring of the patient, e.g. LifeShirt System (VivoMetrics Inc), SmartShirt (Sensatext)
- Medication control: intelligent pillboxes may be useful to warn against or prevent intake of incompatible medication

Future Technologies

- Simple supervision tasks may be handed over to robots:

  - 'Wakamaru' robot (Mitsubishi Heavy Industries) equipped with cameras and can be controlled by voice and collected pictures can be transferred to mobile phones and computers.
  - 'Asimo' (Honda Motor Co) an advanced humanoid robot that can respond to voice control messages.
  - 'Dr Robot' (InTouch Health Inc., Santa Barbara, California, USA), operated by a doctor, that can conduct a ward round and check up on patients
- Through the body implantation of miniature electronic devices (MEMS – Micro Electro-Mechanical Systems), it will be possible to observe various biological functions

- Radio Frequency Identification (RFID) tags for marking various items (food, clothes) that a person uses at home and both read and write data to the tag on the move

Establishing Telehomecare

The main problems in establishing telehomecare systems, especially for elderly, could be summarized to the lack of:

- standards to combine incompatible information systems
- an evaluation framework considering legal, ethical, organizational, economical, clinical, usability, quality and technical aspects
- guidelines for practical implementation of potential telehomecare solutions
- scientific evidence base demonstrating the effectiveness of telehomecare solutions.

Issue 1: Usability

- Usability is an issue for telehomecare applications that require operation by the patient and/or their family members.
- Designers of telehomecare systems for the elderly should:
  - aim to increase the system's functional accessibility
  - address the needs of their end users and
  - follow guidelines for the implementation of IT applications
- Several telehomecare initiatives demonstrate the potential of the technology in the home setting for older adults but:
  - most studies are pilot or feasibility studies with a relatively small sample size
  - there are few large scale clinical trials exploring the use of telehomecare for older patients.

Issue 2: Legal & Ethical

Should there be a special legal frame for telehomecare?

- The characteristics, limitations and permissions in telehomecare for elderly patients should be stated clearly including issues of: licensure, accreditation and accountability.
- Other legal risks associated with the use of telehomecare, such as liability for malfunctioning or failing equipment need to be addressed.
- It is also important to explore the possible ethical problems such systems may introduce; e.g., can equipment replace the nurse's touch?

Issue 3: Reimbursement strategies

- The absence of consistent reimbursement policies is a barrier to the greater integration of telehomecare services into daily practice
- In order to confront this problem, some countries have already established the appropriate procedures:
  - Norway (August 1996) became the first country to implement an official telemedicine fee schedule making (some) telemedicine services reimbursable by the National Health Service.
  - Partial reimbursement was authorized in the United States in 1997 as well.

Conclusions

- Telehomecare systems for elderly should:
  - include validated, reliable and accurate devices and
  - be tested properly for their completeness.
- The target population is elderly with major or minor disabilities, chronically diseased or not = aged consumers
- Organizational and societal changes (cost reduction policies, aging population) are the main driving forces for the development of telehomecare, especially for elderly patients.
- There is a lack of a holistic model for scientific evaluation from different perspectives (clinical, legal, technical, etc.).
- More research on telehomecare and its impacts needs to be conducted.