Telecare Technology for an Ageing Society in Europe

Current State and Future Developments

Summary

Background

Ageing societies in western countries lead to more people with chronic health conditions and in need of care. Recent developments in technology have led to more devices supporting elderly people. They provide health care and enable elderly people to maintain their autonomy and allow them to live independently for a longer period of time. These technologies are subsumed under the term “telecare”. Trials have shown that hospital admissions and mortality can be reduced by such devices. Telecare may therefore unburden the health care system and serve at the patients’ best interest in allowing them to live for a longer period of time independently and increase quality of live.

Telecare includes technical devices and assistive technology as well as professional health care services to assist, monitor and care for people from a distance. Telecare includes a variety of services such as communication, monitoring, consultation, diagnostics and training.

Goals

The main goal of this study is to give an overview of existing telecare technologies for the elderly and future developments and tendencies in this field in Europe. The study results will be used for a scenario workshop within the PACITA (Parliaments and Civil Society in Technology Assessment) Project. The project has the goal to provide insight and experience in technology assessments for stakeholders from European countries that currently don’t have parliamentary technology assessment institutions.

Methods

A literature review was conducted on current telecare technologies and future trends. The search was conducted in five databases: Ageline, CINAHL, Abstracts in Social Gerontology, Medline und Ageline. In accordance with the mandate of the literature review, articles not concerning Europe or dealing with ethical or societal issues of telecare were filtered out in a second step.

Furthermore, 61 experts from the fields of research, gerontology, engineering and from technology assessment institutions from the following European countries: Austria, Belgium, Bulgaria, Hungary, Ireland, Norway, Spain and Switzerland were invited to participate in a survey conducted by TA-SWISS through e-mail. Experts were asked to give their insight on current developments and future trends in telecare and provide further information about regional differences in the use of telecare.

A summary was compiled from the results of the literature review and the expert interviews.

Results

A vast amount of 635 articles were identified in the literature review. However, after selecting only articles with a European focus and a focus on elderly people only 77 articles remained for review. Another 15 articles recommended by the experts were taken into account for the review.

17 experts participated in the survey and answered the six questions in regard of telecare in Europe.

For the current state of telecare a great variety of devices and health care services delivered over distance through technology were found. Services included: Monitoring, consultations, diagnostics, prescriptions filling, disease management, support through communication and interventions, such as training of motor functions or surgeries. Devices belong for the most part to the following categories: Sensors and monitoring devices, detectors, alarm systems, communication devices, video or imaging devices, smart phone apps and specialized medical devices connected with the internet. More advanced devices often use more than one technology and have more than one function. Technologies described in the literature were either made for home use, clinical use or increasingly also for mobile use.

Experts pointed out that many devices belonging to the first generation of telecare, such as alarm buttons or sensors, are in use. However, market penetration varies greatly from country to country. Newer and more complex devices, which encompass some form of ICT, are not yet in wide use.

For future trends in telecare demographic, social, political and technological trends have to be taken into account for predictions of future developments in the use of telecare. As telecare is continuously developing, it is difficult to pinpoint specific products or technologies, which may be wide spread in the future in Europe. Telecare technology is expected to grow in Europe and become a part of healthcare delivery. Reasons are a growing population in retirement age, changing family structures with low birth rates, more mobility and more women in the professional work force and therefore less private care givers. At the same time, there is a lack of care professionals that could step in and economic pressure on the health care systems of European countries. These developments on the level of society are currently stimulating the development of telecare solutions. However, ethical, legal and provision issues have to be addressed in order for telecare to further grow in Europe.

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1. Background, Objectives and Research Questions

1.1 Background

The European Commission describes ageing as one of the greatest social and economic challenges of the 21st century for European societies. By 2025 more than 20% of Europeans will be 65 or over, with a particularly rapid increase in numbers of over 80 year old persons (European Commission, 2013). Due to an ageing of European societyies the number of people who live with long term chronic health conditions is increasing (McLean et al., 2011). Therefore the number of people dependent on care and assistance is rising in Western countries (OECD, 2011). Also the demand of medical services due to medical advancements and societal changes increases and leads to rising health care costs. At the same time many Western countries experience a shortage of qualified health professionals (Simones et al., 2005). Solutions for these challenges in health care provisions need to be tackled soon. The rapid progress in communication technologies and digital electronics may provide solutions in health care provision (McLean et al., 2011).

The range of telecare technologies is increasing significantly as their market potential has been recognized. The new technologies to support care and security are increasingly applied in the assistance of elderly people and people with chronic diseases. The technologies enable patients to maintain their autonomy and allow them to live independently for a longer period of time. Telecare can reduce hospital admissions without increasing mortality (McLean et al., 2011). Telecare may therefore unburden the health care system and serve the patient's interest in living for a longer period of time independently. Living at home is moreover often mentioned to provide higher quality of live.

Telecare provides opportunities that have been recognized by governments and administrations, such as the US or the European Union. In the European Union telecare is regarded as a legitimate medical act (McLean et al., 2011). It is therefore in some of the member statesbeing reimbursable by health insurers. The European Commission as well as governments in the European Union, foremost in the UK, (Department of Health, 2005) have started to actively promote telecare and support or initiate research projects with telecare as a focus. (See http://www.ict-ageing.eu/?page_id=529 for country details)

Studies have shown that most patients see telecare as a positive development, as it improves access to care (Finkelstein & Friedman, 2000). Especially the aspects of feeling safer and "looked after" at home were described. Some patients experienced feelings of empowerment and freedom in contrast to being under surveillance while in hospital (Mair & Whitten, 2000). However the autors also point out that despite a large body of literature on patients' satisfaction with telecare, the research lacked depth. Therefore the largely positive findings have to be interpreted with caution (Mair & Whitten, 2000). Mort et al. concluded after panel discussions with patients and their perspectives on telecare that telecare could not take the place of a face to face interac-

tion. They resume that a combination of face to face interaction and telecare consultations would be optimal.

Field trials have shown promising results in the use of telecare. The UK's Department of Health's Whole System Demonstrator (WSD) showed in a large trial with over 3200 participants in Newham, Kent and Cornwall that mortality could be reduced by 45% and emergency admissions by 20% (Steventon, 2012).

1.2 Study Goals

The main goal of this study assigned by TA-SWISS is to give an overview of:

1. Existing telecare technology and devices in Europe
2. Future developments and tendencies of telecare technology and devices in Europe.

The overview of telecare technology and devices and future developments serve TA-SWISS as a part of the project PACITA. PACITA is a collaborative project on mobilization and mutual learning actions in European parliamentary technology assessment (PTA). The work package 6, EU stakeholder involvement on Ageing Society, aims at serving as an example of a technology assessment and involve countries that currently don't have PTA institutions in order to gain experience (see PACITA Handbook: Hebakova et al., 2011). This report serves as a basis for a stakeholder workshop to be held in October 2013.

1.3 Definition of Telecare

Telecare is an umbrella term and describes a large amount of applications and devices, with new ones constantly released on the market. The definition of telecare is not quite clear, as telecare is often synonymously used with tele-healthcare, tele-monitoring and tele-medicine (Barlow et al, 2006). Barlow et al. (2006) and Denz (2002) both emphasize the aspect of overcoming distance with help of technology for services in health care. McLean et al. (2011) describe three components of telecare: 1. The patient is providing data, such as video, electrocardiography or oxygen saturation that gives information about the health status, 2. Information is transferred electronically to a health care professional at a second location, 3. The health care professional uses clinical skills and judgment to provide personalized feedback to the individual.

In the literature telecare is often distinguished from telemedicine by way of who is using the technology: McLean et al. (2011) describe telemedicine as "technology shared over a distance between healthcare providers". As the technology might be the same, irrespective of its user group, we like to define telecare as follows:

Telecare includes electronic devices combined with "Information and Communication Technology" (ICT) and professional practices applied to assist and care for people from a distance. Telecare includes services such as monitoring, assistance, information, consultation and communication.

For telecare, one of the main technologies in use is ICT. ICT can take on many different forms, such as store-and-forward, real-time video transmission or simply a doctor's consultation via telephone, video-conferencing or IP-telephone software on computers or tablets (e.g. Skype). Furthermore, ICT plays an important role in keeping people connected and reducing a person's feeling of isolation and loneliness. ICT is mostly applied in the form of computer cameras/microphones and the correspondent software. Mobile phones and tables also serve as ICT devices.

For this project telecare devices for elderly and chronically ill people were considered. However, some devices may be used by any number of patient or age group.

2. Methods

The methodology of this study consists of two parts: First, 18 expert interviews concerning telecare technologies in Europe were conducted through an e-mail survey. These interviews were then compared and summarized to highlight the current status and future trends in telecare in Europe. Second, a literature review was carried out to analyse available literature on telecare technology in Europe. Finally, the findings of the questionnaires and the literature review were summarized to illustrate the current status and future trends of telecare technology and devices in Europe.

2.1. Literature Review

The literature review was carried out in five data bases: Medline/EBSCO, CINAHL, Cochrane, Ageline and Abstracts in Social Gerontology. The following search terms were used: “telecare”, “telehealth”, “telemedicine”, “monitoring technology/telemonitoring”, “E-care”, “E-health”, “E-medicine” in combination with: “elderly”, “aged”, “senior” “older adults”, “ageing”, “care”, “nursing”, “health care”, “health care delivery”, “trend”, “outlook”, “forecast” and “future” (see Table 1). The articles had to be published from 2003 onwards and had to be written in English. No regional limitation was set at first in order to capture future trends and developments. (For detailed search strategy and findings see appendix A)

Table 1: Overview of search strategy for the literature review

Data Bases	Search Terms
Medline/EBSCO CINAHL Cochrane Ageline Abstracts in Social Gerontology	Telecare Telehealth Telemedicine Monitoring technology/Telemonitoring E-care E-health E-medicine **In combination with:** Elderly/aged/senior/older adults Ageing Care/nursing Health care/health care delivery Trend/outlook/forecast/future

These queries resulted in 635 articles and scientific contributions. This amount of articles was too extensive for a thorough evaluation. Therefore, the articles were screened for contributions only concerning Europe or from European authors as the focus for the study was Europe. 488 articles could be excluded mostly concerning the USA, Canada and Asia. 192 articles from European authors or concerning the European market remained to be evaluated.

Table 2: Overview of search strategy for the literature review

Database	**Time span**	**References found**	**References after de-duplication**
Medline	2003 onwards	307	306
Cochrane	2003 onwards	46	22
CINAHL	2003 onwards	233	199
Ageline	2003 onwards	101	95
Abstracts in Social Gerontology	2003 onwards	26	13
Pool		**713**	**635**

In a second step, the remaining articles were further narrowed down to contributions only concerning current telecare technologies and future developments in accordance with the mandate by screening through all abstracts. Some 115 articles were excluded from the literature review, as they dealt with aspects around telecare, but not telecare devices itself, such as ethical issues or cost effectiveness of telecare or articles concerning the health care systems or other patient groups such as children.

Finally, 77 articles from the literature review remained and were considered relevant to this study and therefore taken into account. The list of articles can be found in appendix B.

In addition to the literature found in the data bases, the 52 articles recommended by the experts in the interviews were considered. 15 articles were included in the literature review. The remaining 37 articles mentioned by the experts could not be taken into account for this study because they either were not in English, French or German or focused on ethical issues, policies or other issues related to telecare, but not telecare products itself. In total, 92 articles were analysed: 77 were selected from the literature review, 15 were recommended by experts.

2.2. Expert Interviews

TA-SWISS was responsible for conducting the expert interviews. A short questionnaire was therefore compiled by TA-SWISS (see appendix C). It consisted of the following six questions:

1. *Status quo: Which telecare technologies are, to your knowledge, already used in your country in elderly care today? (e.g. smart houses, sensors, tracking devices, communication technologies, robotics)*

2. *In your opinion, how can telecare technology positively impact on the needs of an ageing society?*

3. *Where could telecare-technology impact negatively on the elderly, their care networks and society as a whole?*

4. *Are there discussions under way in your country to address the ethical and legal issues arising through the use of telecare? If yes, which subjects are brought up?*

5. *Which technological development do you expect in the next 10 to 15 years in this domain and what will be the main drivers?*

6. *Specialized literature: Please indicate four titles you consider particularly relevant to the topic*.

TA-SWISS contacted 61 experts from the fields of technology, engineering, science, geriatrics and health care from the following countries: Austria, Belgium (Wallonia), Bulgaria, Hungary, Ireland, Norway and Switzerland. In addition, Fundacio Catalana per a la Recerca (FCR) contacted five experts from Spain (Catalonia) to participate. In total 66 experts were addressed and invited to fill out the questionnaire. The survey was conducted from June to August 2013.

Out of the 66 contacted experts, 17 submitted their answers via email to TA-SWISS. This results in a participation rate of 26 % (see appendix D).

3. Results

The results of the literature review and the expert interviews are presented and then summarized concisely.

3.1. Results of Literature Review

The analysed literature either concerned products currently available or in development or in trial phase. Only few articles found in the search described future trends in telecare. From the articles alone it was at times difficult to judge, which products are currently available on the market and which are still in development. The current status therefore, describes to our best knowledge devices and technologies which are currently in use or which were successfully tested and expected to have been released on the market.

Future trends developments describe macro trends in the field for the coming 10 to 15 years.

3.1.1 Current Status

As the amount and variety of devices in telecare is constantly growing, a large amount of literature can be found on the subject. We encountered articles with a variety of different perspectives, for example article discussing technological aspects or articles that represent a specific field within medicine in which telecare is now used. A large amount of articles were dedicated to pilot trials of telecare devices, either in a specific geographic area or for a specific group of patients.

The analysis of the literature showed that elderly people are one of the main target groups for telecare technologies, as many devices are for people with chronic health conditions or made for people with limited mobility. The devices allow elderly to maintain their autonomy through a better management of their condition or to have easier access to health care. This and also monitoring functions of devices lead to more independence of the elderly instead of being dependent on care takers or have to live in care facilities.

However, telecare devices are also of great use for (younger) patients suffering from chronic diseases, for example diabetes, cancer or Chronic Obstructive Pulmonary Disease (COPD). A further field of use is before and after hospital admission for monitoring purposes available for all ages and patient groups. For all age groups are also telecare devices, which are used solely amongst healthcare professionals such as devices for remote diagnostics or pathology.

The literature review showed three main areas of application of telecare use (for details see appendix B):

1. home use
2. clinical use (mainly in hospitals) and
3. mobile use

Whereas home use devices are often permanently in the home installed sensors, detectors, alarm- or monitoring systems, mobile devices can be carried around and can be used at any location. Devices for clinical use are often specialized medical devices linked to the internet for consultations amongst specialists or for second opinions in diagnosis over distance.

Home use of telecare devices are of particular interest to elderly people, as products are often made for this specific age group or for patients with dementia. The devices allow elderly people to live for a longer period of time independently, instead of relocating to a nursing home or care facility.

A wide variety of devices and technologies combined with care services were found in the literature. Some higher advanced devices combine several technologies and/or serve multiple functions. Telecare devices therefore are often classified as “first”, “second” or “third generation” depending on their complexity:

The first generation telecare: Are equipment and user-activated devices found most often in community alarm services such as push button, pendant or pull-cord alarms. The device must be activated by the user and it then raises alarm. These are typically responded to by a call handler who will trigger a response, usually from a relative, friend or informal care giver. (Fisk, 2003, Simpson & Siotia, 2008)

The second generation telecare: Refers to enhanced and more “proactive” and “intelligent” equipment, which has evolved from the introduction of basic community alarm services, and sensors such as smoke alarms and flood detectors. This includes sensors which can monitor the home environment, vital signs, physiological measures, and lifestyle. These sensors can collect and transmit information continuously about door opening, bath water running, the use of electrical appliances, and movement both within and out with the home. Sensors are activated qutomatically when the patient falls and help is alerted. Thus, second-generation alarms rely on the event and not on the user to initiate the alarm. (Aberdeen City Council, 2008; Simpson & Siotia, 2008)

The third generation telecare: Refers to the improving and increasing availability of broadband, wireless and audio-visual technology, which offers potential for virtual or tele-consultation between the service user, their doctors, nurse and or support workers, reducing the need for home visits or hospital appointments (Aberdeen City Council, 2008). It also refers to systems currently being conceptualised and developed (Simpson & Siotia, 2008).

Devices found in the literature review belonged to the third generation of telecare technology. As the first and second generation telecare devices were developed before 2003 and are therefore not discussed in the literature any longer but reached market penetration.

Telecare devices can be further categorized by technology they mainly use:

- Sensors and monitoring devices which monitor patients' health status such as sensing patches, wearable health systems or body sensors.
- Detectors and alarm systems detect for example falls and alarm care givers or can localize patients.
- Communication devices ensure the contact to the healthcare professionals and are often combined with video or imaging devices or specialized medical devices.
- Video or imaging devices (also teleconferencing) support communication or allow consultations and diagnostics over distance.
- Smart Phone Apps help to manage chronic health conditions or provide support through reminder functions or prompts etc.
- Specialized medical devices connected with the internet for measuring health condition and forward data to health care professionals.

Often devices are connected to a database where health information is compared and stored. In some cases data is even recorded in the patient record. Therefore data management and recording of health condition is made easier.

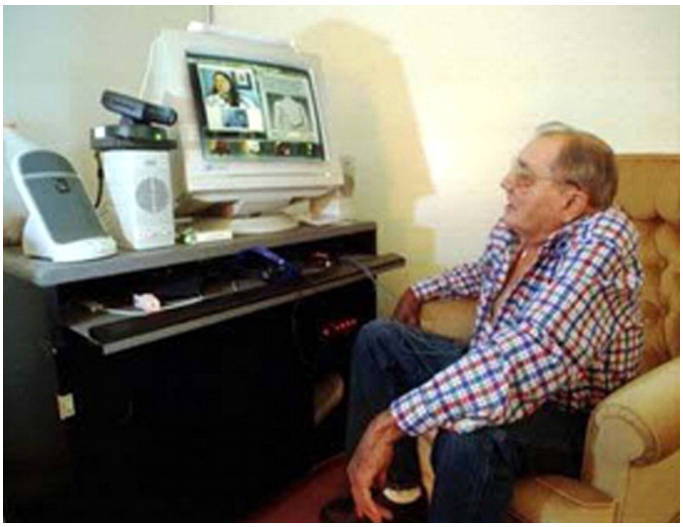
The following classification is based on functions telecare devices fulfill. As some devices have more than one function however, some devices could fit into more than one category.

Consultation and Communication

A major part of the articles described systems for remote patient-physician or expert communication or consultation. Articles often describe telecare consultations over video conferencing or audio communication for patients with chronic health conditions such as chronic obstructive pulmonary disease (COPD) (e.g. Jensen et al., 2012), hypertension (e.g. Verberk et al., 2011) or diabetes (e.g. Martínez-Sarriegui et al., 2011). Telecare systems predominantly used for consultation and communication are made to avoid (re-) admission to hospital.

Furthermore, Norman (2006) found in her literature review that psychiatric or psychological consultations over videoconferencing are promising. She believes that psychiatric services delivered over video conferencing may enhance psychiatric services especially for patients in rural areas.

Figure 1: Telecare through video conferencing for a patient with COPD



Source: http://www.bmj.com/content/342/bmj.d120?ath_user=nhsmcook002&ath_ttok=%253CTUrgsKMr%252FjmTqhso2Q%253E, site viewd 20.8.2013

Disease Management and Monitoring

Telecare devices are frequently used for disease management and monitoring of patients and their health status. Disease management and monitoring is, for example, frequently applied in patients suffering from chronic diseases such as diabetes (e.g. Rodríguez-Idígoras et al., 2009) or hypertension (e.g. Becker et al., 2012) and allows keeping track of a person's blood glucose level or blood pressure. Whereas some devices allow the patient to monitor his/her own health in an easier or better manner, other devices forward data to health care professionals for monitoring purposes or supervision.

Overall, many of the analysed articles dealt with devices for diabetics, and it appears that there are a rising number of devices, which are used to support people with this disease. Levin et al. (2013) present a web-based quality-monitoring diabetes data base, where patients may record their condition. Such data bases are also in use with obese people who need to follow a strict diet (e.g. Castelnuovo et al., 2010). Prato et al. (2012) describe a system for patients initiating insulin therapy. Blood glucose monitoring is done with the help of a device that measures blood glucose and transmits the levels by phone from the patient's home to a centralized server. The results are made available to a health care professional who then can transmit information (e.g. dose titration) to the centralized server. Information is then returned to the patient by phone.

Also mobile phone apps are used for a better and easier (self-) management of chronic health conditions, such as diabetes or hypertension. Rossi et al. (2009), for example, describe an interactive diary for diabetes patients to support their decision making process and another application for mobile phones for diet management (Rossi et al. 2010). Becker et al. (2012) describe the possibilities for better hypertension management with mobile applications.

Monitoring includes multiple types of (wireless) sensors, including wearable sensors and ambient sensors. Wearable micro sensors can, for example, be integrated in clothing or worn on the wrist and allow the surveillance of bodily functions such as heart rate or unusual activity such as falls (e.g. Korhonen et al., 2003). In contrast, ambient sensors are installed at home to ensure security in case of accidents in the household (e.g. Boulos et al., 2007). In case of a fall, accidents or unusual behavior care personnel is alarmed and can act accordingly. This again is important for elderly people living alone.

Figure 2: Blood pressure measuring device

Source: http://www.bmj.com/content/342/bmj.d120?ath_user=nhsmcook002&ath_ttok=%253CTUrgsKMr%252FjmTqhso2Q%253E site viewed 20.8.2013

Follow up and Rehabilitation

Telecare is applied for follow-up and rehabilitation purposes to help a patient recover after hospital release or an ambulant surgery. While some systems are made to monitor the recovery process (e.g. Martínez-Ramos et al., 2009) others have further functions and patients may receive tasks via internet to support their recovery. For example motor task exercises after a stroke. Piron et al. (2009) describe an experimental treatment for rehabilitation for stroke patients. The treatment was based on a virtual reality system delivered via the Internet, which provided motor tasks to the patients from a remote rehabilitation facility.

Other telecare recovery devices are similar to ICT and monitoring technologies, where patients are able to upload and transmit health information, for example of their home spirometry (pulmonary function test), via Bluetooth (e.g. Sengpiel et al., 2010).

Diagnostics

Several articles found in the literature review dealt with diagnostics over distance. The range of services is broad most of which use some form of remote imaging e.g. foot ulcer scan devices (e.g. Ladyzynski et al., 2011). Some devices are made for mobile or home use such a blood glu-

coses measure devices (e.g. Azar & Gabbay, 2009). However, the bulk part of articles dealt with diagnostics done in hospitals or clinics. Examples were cancer genetics (Mackay & Taylor, 2006), dermoscopy (e.g. Browns et al., 2006), tele-cardiology (Gherardi, 2010), tele-echocardiography (e.g. Giansanti & Morelli, 2009), anatomic pathology (e.g. Garcia Rojo, 2012) and video examination for acute stroke patients (e.g. Handschu et al., 2003). The latter mentioned devices and technologies can also be classified as telemedicine.

Meade et al. (2003) describe a case report of a device for pre-hospital use. The device is a laptop-sized portable videoconferencing system with a satellite phone especially built for emergencies. The remote emergency clinician can have a real time view on a patient (e.g. pupils) and mechanisms of the injuries (e.g. fractures) already before the patient arrives in hospital.

Figure 3: Videoconferencing device for pre-hospital use

Source: Meade et al. 2012

Benger et al. (2004) describe telemedical consultations over videoconferencing for minor injuries for patients recruited at the emergency unit of a hospital. They found that diagnostics through videoconferencing resulted in the same outcome as an on-site general practitioner or emergency medicine specialist.

Surgeries and –interventions

Telesurgery and –intervention technologies were not predominant in the literature review of this study but nonetheless, appeared as “telecare” is used as an umbrella term. In telesurgery physicians are able to actively perform an intervention on a patient without being in the same room, as for example with the da Vinci surgical robot for prostatectomies, and increasingly for cardiac valve repairs. An example for remote interventions for stroke patients is intravenous thrombolysis via

videoconferencing described by Johnsson et al. (2011). Another example is the remote activation of a cochlear implant described by Ramos et al. (2009).

Prescriptions of Medication

Prescription filling can be made using telecare, for example, via web-based systems or teleconsultations as argued in Casteltons (2006) article. Prescription services are not only useful for home use, as described by Castelton (2006), but could be especially beneficial for nursing homes, in which professional care taker are available but no medical doctor is regularly present. The prescription process can be made faster, safer and more efficient.

Compliance

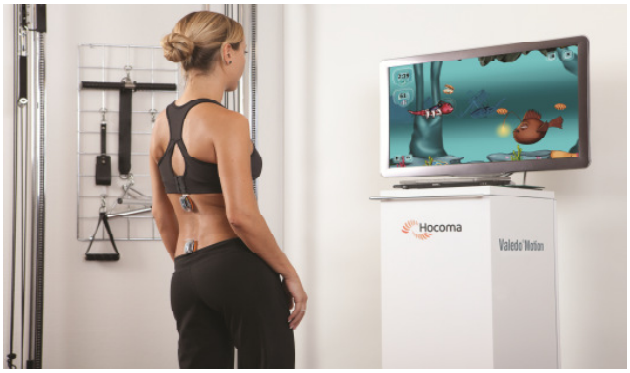
Many people using telecare suffer from chronic diseases and need to take medication regularly. There are telecare devices currently in use who remind the patient when measurements or medication intake is due, and provide information about dosage of the medication (e.g. for diabetes Rodríguez-Idígoras et al., 2009). Furthermore, as devices are interactive between patient and caregiver, compliance with dietary regimes or medication intake can be improved and are reported in trials to be high (Clifford & Clifton, 2012). Rossi et al. (2009), for example, conducted a pilot study with a mobile phone application, the "Diabetes Interactive Diary", which allows people to transfer their blood glucose values via mobile phones and supports them in keeping a consequent nutrition.

Training, Proctoring and Mentoring

Gambadauro & Torrejón (2013) describe in their article remote training for surgeons through "tele"-devices. Training of physicians, such as surgical training, can be made available through videoconferencing. The authors argue that not only training is possible, but also common teaching methods, such as mentoring and proctoring can be done from a distance through telecare.

Other devices are on the market for training with patients, such as the "ValedoMotion" for home training and (re-)learning of motor functions. Remote teaching and supervision is possible.

Figure 4: Training device for (re-)learning or motor functions



Source: Hocoma

3.1.2 Future Trends

Only a small part of articles found in the literature search dealt with future trends. As telecare is continuously developing, it is difficult to pinpoint specific products or technologies which may be wide spread in the future in Europe. In the articles about specific products, it is often not clear whether a product is already available on the market or still in trial use or development. Furthermore, demographic and societal trends have to be taken into account for predictions of future developments in the use of telecare. For future trends additional literature therefore was consulted and taken into account.

Societal Trends

As the proportion of elderly people between 65 and 79 is expected to increase in European countries (EU 27) from just above 15% in 2010 to almost 25% in 2035, an increased demand on long term care services is very likely (OECD, 2011). Furthermore, more and more females participate in the formal labor market and are likely to contribute to the decline in the availability of family career givers leading to an increase demand for paid care. The demand for long term care workers is expected to double by 2050 (OECD, 2011). At the same time many European countries are dealing with a shortage of trained healthcare professionals (e.g. Jaccard Ruedin & Waver, 2009). A further societal change is that people demand more patient-oriented care. Patients become more involved in their treatments and in medical decision taking. The OECD (2011) therefore expects an upward pressure on the demand for long-term care services.

Telecare might fill an opening gap between the demand of healthcare services and supply (While & Dewsbury, 2011). Devices for support, security, health monitoring and assistance therefore are expected to become increasingly popular. Also health care services such as consultations, diagnostics, coaching and filling of prescriptions over distance are likely to become increasingly popular especially in remoter areas or financially strained health care systems.

Technological Trends

The following trends in the field of telecare are expected:

1. Increasing use of mobile health. Mobile health is gaining more and more importance with the steady rise of smart phones, tablets, wireless technology and the interaction of different (medical) devices with mobile technology. Mobile health makes use of web-based systems or Bluetooth, as they allow the quick transmission of data. The internet is available to nearly 90% of the world population and more than 5 billion people have a cell phone (Hampton, 2012). Mobile health as a cheap and easy way to spread health information is promoted by the United Nations, governments, nongovernmental organizations and academic institutions (Hampton, 2012).

2. Increasing use of personal digital assistants, monitoring devices or applications. Personal digital assistants (PDA) help to keep track of a person's condition and will gain importance in the future. There seems to be a trend towards PDA, allowing patients not only to monitor their health status but also to communicate it to health professionals and seek assistance if needed. Also alarm functions are already integrated in the devices if assistance is needed. Furthermore, PDA will in the future be even more mobile than now already.

3. Increased interaction between existing devices and more functions in one device. It is expected that interaction between existing products is made easier through accessible interfaces. The combination of data will provide better data and even more detailed information on the patient's health status. This means that it will no longer be necessary to install several different devices, but one device or system that is capable of several functions.

4. Devices are expected to become more user-friendly and economic. The devices can be expected to become smaller and less expensive, in order to be applied all around the home and enhance smart living. Moreover, the devices will be generally improved and become more user-friendly. As more and more people use such devices, production costs can be reduced and prices of devices will decrease. This, with the reservation that prices for raw material remain stable and recycling solutions are found.

5. Devices will be used for prediction and prevention. Instead of treating already existing conditions, the goal is to be able to prevent diseases altogether or manage them in an early state to prevent aggravation. Furthermore, as nearly every person owns a mobile phone, health information may be easily spread to target groups. Also with an increasing use of smart phones apps for tracking of his or her health status, healthy living may become more and more popular and important for prevention. Preventive, perhaps implantable technologies are also possible to emerge in the future (Sandler, 2008).

6. Extended use of telehealth into other fields of use. Currently many devices are made for home use. In the future it is expected that mobile devices, tele-diagnostics and other tele-services will be also used within and between health care providers. Devices that are currently only applied for one specific patient group may be adapted for people with different diseases in the future.

Other Influences

Other influences that have an effect on future trends in telecare in Europe are the governments and the European Commission. An active policy with funding and active dissemination of telecare products, providers and support for smooth integration of services in current health care structures, could boost the use of telecare within the next 10 to 15 years. Administrations, such as the UK or the European Commission are promoting products and services in the area of telecare. Such as the following:

- The Ambient Assisted Living project from the European Commission to enable suppliers of eHealth tools to build a strong base from which they can compete in the global market. The EU's therefore is funding advanced research and development of electronic health tools. (See: http://www.aal-europe.eu/ site visited 5.12.2013).

- The EU's eHealth policy, covers areas as diverse as patient rights in cross-border healthcare, is funding advanced research and development, and ensures that electronic health record systems are compatible internationally. (See: http://ec.europa.eu/digital-agenda/en/life-and-work/health-and-ageing site visited 5.12.2013)

- The Europe 2020 Initiative: The Strategic Implementation Plan foresees a first set of specific actions to be launched in 2012: 1. Innovative ways to ensure patients follow their prescriptions – a concerted action in at least 30 European regions; 2. Innovative solutions to prevent falls and support early diagnosis for older people; 3. Co-operation to help prevent functional decline and frailty, with a particular focus on malnutrition; 4. Spread and promote successful innovative integrated care models for chronic diseases amongst older patients, such as through remote monitoring. Action should be taken in a number of the EU's regions; 5. Improve the uptake of interoperable ICT independent living solutions through global standards to help older people stay independent, mobile and active for longer. 6. In addition, networking and knowledge sharing on innovation for age-friendly buildings, cities and environments will be pursued. (see: http://ec.europa.eu/research/ innovation-union/index_en.cfm?section=active-healthy-ageing&pg=implementation-plan site visited 5.12.2013)

However, if governments remain in a passive state the dissemination could be scarce. Moreover, for future trends, private actors have to be considered as well. If private funding is put into devel-

opment and marketing of telecare products or private firms enter the market and offer care services over ICT market, penetration could develop faster.

3.2. Results of Expert Interviews

In this section the answers given in the expert interviews are summarized and presented below.

1. Status quo: Which telecare technologies are, to your knowledge, already used in your country in elderly care today?

The answers to the first question show that alarm systems, belonging to the first generation of telecare devices, currently make up a major part of telecare applications across Europe. The application of some form of alarm system was mentioned by at least one expert of every country included in the study.

In Belgium as well as in Norway, various telecare technologies are already in use, including communication technologies, surveillance and security systems, sensors and tracking devices. In Norway, "the pendent alarm" is already installed by 77'000 users.

A similar status quo is observable in Ireland, where alarm systems remain the most frequent application but other technologies are on the rise. The telecare products currently in use can be divided into three generations, whereupon pendent alarms belong to the first generation and are applied in the homes of 13 to 15 percent of elderly people, age 65 and over (Interview Dr. Aoife Callan from Ireland). The costs for installing these technologies are covered by public sources. However, "telecare provision is not currently linked to the mainstream health and social care services in Ireland" (Interview Dr. Aoife Callan from Ireland). The second and third generation include more advanced technologies such as automatic detectors, sensors, door openers and pressure mats. These are not yet as numerous as the devices from the first generation, but the number is definitely increasing. At present, there are various projects in Ireland, which aim to provide a wider range of home telecare technologies, including fall detectors and other monitoring sensors. One of these projects is a collaboration of the Alzheimer Society of Ireland and Emergence Response and focuses on elderly people suffering from dementia.

The range of telecare technologies is wide in Spain as well, where, according to Francesc Moya from TiCSalut in Spain, a number of sensors for abnormal behaviour – of the environment, but also of a person's health status – are in use. Furthermore, telemonitoring is applied for patients with chronic diseases and allows the observation of blood pressure and the testing of symptoms. Francesc Moya further mentions communication systems, which serve, for example, as reminders for appointments or medication intakes. A telecare device which was mentioned by Spanish experts and covers the emotional aspect of the patients is the mood detector.

In Bulgaria, some of the telecare technology that is currently in use was initially designed as aiding tools in health monitoring and health care servicing, for example in military missions. Due to its limited use in such a context transfer into mainstream application was sought, though its proliferation continues to be limited. (Interview Prof. Georgi Sotirov from Bulgaria).

2. In your opinion, how can telecare technology positively impact on the needs of an ageing society?

When asked about the positive impact of telecare on the needs of an ageing society, the experts share fairly similar opinions. An important benefit of telecare is that it offers older people the possibility to live on their own for a longer amount of time and thus improve their quality of life. Elderly people who make use of telecare devices are more independent and more active than in care facilities or hospitals.

Another advantage of telecare technology is the heightened security, which is ensured because of the quick transmission of data. Thus, in case of an emergency, elderly people will receive help much faster with telecare.

Furthermore, telecare simplifies communication and can reduce the patient's feeling of loneliness: „Telecare technology will never replace human contacts, but it may increase security (or feeling of security) and promote "tele" contacts" (Interview Eric Salmon from Belgium).

Several experts state that with telecare, caretakers are relieved of routine tasks and may focus on the personal care of their patients.

Lastly, as some devices are used for diagnostics and disease management the management of chronic health conditions will be made easier and hospital (re)admissions can be reduced.

3. Where could telecare-technology impact negatively on the elderly, their care networks and society as a whole?

The third question discusses the negative impacts of telecare technologies. Many experts agree that telecare could lead to isolation and loneliness if it completely replaces human contact, which should therefore be avoided. Should companies only see telecare as a way to make profit, the quality of life of elder people would suffer. Rather, telecare devices should enhance the already existing health care system and be applied in collaboration with human contact.

Another concern with telecare is that older people might have problems understanding and operating the devices. The professors Georgi Sotirov and Peter Gezov from the Bulgarian Academy of Sciences emphasise that telecare devices should require minimal intervention by the patient to ensure his or her comfort.

Moreover, several experts mentioned the aspect of costs in connection with telecare devices. The technologies should be available to everyone, but as the electronic systems may be expensive and public funding is not ensured, this might be difficult to put into practice.

Dr. Aoife Callan from Ireland writes that health professionals who mistrust technology might disapprove of telecare technologies and adds:

"This can negatively impact upon uptake and support of telecare within its role in the community care model and hinder the usefulness of telecare in supporting care networks. This is also coupled with an Irish health and social care sector that has been relatively slow in the utilisation of ICT tools, resulting in a significant lack of state support" (Interview Dr. Aoife Callan from Ireland).

The integration of telecare into already existing health care systems thus seems to be a serious issue. Francesc Moya from Spain states a similar concern, namely that the public health system of Spain may not recognize the new model of care and hence not cover its costs.

Furthermore, the intrusion of privacy is seen as possibly having a negative impact on society. This concern is shown in more detail in question 4.

4. Are there discussions under way in your country to address the ethical and legal issues arising through the use of telecare? If yes, which subjects are brought up?

In many countries ethical questions concerning telecare are discussed. Daniel Lopez from UOC Spain writes that they are part of an EU project regarding these concerns and highlights some questions that were discussed, such as "What normative visions and programs do these technologies carry?" and "How do the norms [...] of telecare, their design, policy documents and investment programs relate to actual care practices?" The ethical framework of telecare systems was another key subject in the discussion of the said EU project.

Other concerns revolve around privacy issues and data confidentiality in connection with telecare technologies. An essential question is the acceptance level of surveillance, and at what point it could intrude upon a person's privacy. Diarmuid Cahalane from Ireland emphasises that "this raises questions about the perception of telehealth and telemedicine being perceived as a monitoring solution rather than a life enhancing one". Experts of several countries, such as Austria, Ireland, Belgium and Bulgaria mention ethical concerns in connection with privacy.

When asked about legal concerns, Dr. Rostislava Dimitrova from Bulgaria mentions liability issues and the question of responsibility in case of malfunctioning of telecare devices. Steinar Pedersen from Norway speaks about the legal issues with tracking devices, which are used to locate patients who suffer from dementia.

These discussions are, however, not equally loud in all countries – the dialogue on ethics and telecare in Bulgaria, for example, is only held "within teaching and academic settings" (Interview

Assist. Prof. Dr. Polina Mihova from Bulgaria). The expert's answers give reason to assume that there is a need for a louder discussion of ethical concerns with telecare technologies and in a further step also regulations.

5. Which technological development do you expect in the next 10 to 15 years in this domain and what will be the main drivers?

Many experts state that devices for remote monitoring and diagnosis will be developed in the near future. Diarmuid Cahalane from Ireland emphasises the need to develop devices that are able to predict and prevent diseases with what he calls 'digital biomarkers': "Current trends are geared towards monitoring patients, I believe that we should work with researchers in geriatric medicine to identify how we can use technologies to treat and prevent age related illnesses rather than merely use technologies to monitor and react to these conditions."

Assist. Prof. Polina Mihova from Bulgaria supports this prediction and writes that in the next 10 to 15 years, the focus will lie on "prevention and early diagnosing of non-contagious diseases like diabetes and cancer". She further points out changes in the health conditions of people due to eating habits, which is why she sees new opportunities within m-health (mobile health), such as healthcare advice and recommendations and emergency response systems. M-health seems especially promising because it allows the transmission of information via voice messages, text messages and the combination of GPS and mobile technologies. Andreu Català from UPC Spain highlights m-health applications for smart phones and tables, which will very likely emerge in the next few years.

Dr. Aoife Callan from Ireland expects the rise of telecare communication technologies, especially because people nowadays are already used to communicating via Internet and programs like Skype. This tendency gives reason to assume that telecare communication devices are likely to be accepted and are thought to "reduce loneliness and isolation".

Dr. Particia Kearney from Ireland points out that the demand for health care services will continue to rise with the increasing ageing population, which is why telecare has major potential, especially for the management of chronic diseases. Another driver is the sustainability of the health system and the fact that patients want to be more active (Interview Francesc Moya from Spain).

Expert Markus Nufer from Switzerland does not predict any telecare development in Switzerland, as "we are deadlocked through our structure and the political indignation to change our Healthcare System into the future."

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4. Summary

In succession the results from the literature review and expert interviews are summarized, the two research questions are answered and limitations of this study are outlined.

4.1. Current State of Telecare Technology in Europe

The literature review showed that there are a great many publications to the topic of telecare published in the last 10 years. The vast amount of articles found in the literature search however, was from abroad not concerning Europe directly. More than one hundred articles from European authors or concerning Europe were taken into account for the analysis.

A great variety of devices and health care services delivered over distance through technology were found. Services were all from the "third generation" of telecare technology and included: Monitoring, consultations, diagnostics, prescriptions filling, disease management, support through communication and interventions such as training of motor functions or surgeries. Devices belonged for the most part to the following categories: Sensors and monitoring devices, detectors, alarm systems, communication devices, video or imaging devices, smart phone apps and specialized medical devices connected with the internet. More advanced devices often use more than one technology and have more than one function. Technologies described in the literature were either made for home use, clinical use or increasingly for mobile use.

Many devices were made for a special patient group such as patients with COPD, hypertension or diabetes and address not only elderly people but also patients with chronic conditions at younger ages. Most devices described in the literature are not made specifically for elderly people. However, as chronic health conditions are often occurring in elderly patients, devices can support and assist elderly to stay independent for a longer amount of time. No specific devices were found for people suffering from dementia.

The expert interviews showed that telecare products of the "first or second generation" such as alarm buttons, detectors and tracking devices are available and in use in all countries across Europe. Currently in use are also sensors and tracking devices and different communication and alarm solutions. Described were also medical services available for a fist consultation on the telephone. The dissemination and market penetration across Europe however, varies greatly depending on family and society structure, health care system, financing, affordability and governmental support. Also in some specific parts of society such as the military more advances telemedicine or telecare is already in use but not available for all members of society.

Products mentioned by the experts belonged mostly to the group of "first generation" or "second generation" telecare products. Products described in the articles however, belonged to the "third generation" of telecare products. The second and third generation are more advanced in tech-

nology than the first generation and have penetrated the marked in most European Countries. The “third generation of telecare products” are more specific in their function (such as for the management of certain disease) and combine several functions (reminding, measuring, communication or alarm function etc.). They are made not only for elderly people, but for people with chronic health conditions or for hospital use. Many of the described products or technologies were not made for the use by patients or for the use of patients and care providers, but for the use in hospitals, clinics or ambulances between health care professionals. The “third generation” products are still in development or trial phase and only start to be available on the market.

4.2. Future Developments and Trends of Telecare Technology in Europe

The field of telecare is rapidly emerging. It is therefore difficult to pinpoint specific telecare devices or services which may be in wide use across Europe in the next 10 to 15 years. Not only technological advances and inventions have to be taken into account but also developments in society, politics and the health care system.

Telecare technology is expected to grow in Europe and become a part of healthcare delivery. Reasons are a growing population in retirement age, changing family structures with low birth rates, more mobility and more women in the professional work force and therefore less informal care givers. At the same time there is a lack of care professionals that could step in and economic pressure on the health care systems of European countries. These developments on the level of society are currently stimulating the development of telecare solutions.

On the side of technology the following trends could be made out: 1. There will be an increasing use of mobile health through the steady rise of smart phones, tablets, wireless technology and the interaction of different (medical) devices with mobile technology. More and more elderly people who use smart phones, tablets and computers and therefore possible good acceptance of services delivered over such devices 2. Also the use of personal digital assistants, monitoring devices or apps for monitoring health status and to communicate it to health professionals and seek assistance if needed, will increase. 3. Interaction between existing devices and more functions in one device will increase. 4. Devices become more user-friendly and less expensive as production costs can be reduced, as more and more people are using those devices. 5. Devices will be used for prediction and prevention to prevent diseases or manage them in an early state to prevent aggravation. 6. There will be an extended use of telehealth into other fields of use such as other patient groups or functions within hospitals or clinics.

As the expert interviews showed there are ethical issues that have to be addressed. Other unresolved issues around the use of telecare might negatively influence development, dissemination and further investment in telecare technologies. They can be grouped as follows:

1. Unsolved cost provision issues. In many countries, it has yet to be established which telecare services by which providers are paid through health insurers. Advancements in service delivery could therefore be slowed down if cost assumption is not regulated in a timely manner, or such services will be accessible only for people who can afford the expenses.

2. Changes in care provision. Many authors and also experts point out that health service delivery has to be thought over for the coming decades. The ways services in health care are provided, have to be amended with a shift towards telecare and telehealth. Furthermore, health care professionals have to be trained for the new tasks and ways of health care delivery (see point 5).

3. Data protection issues and lack of legislation. Data concerning health status or medical records are considered as very sensitive. As more data is transferred from a device to service provider, insecure systems could cause great damage. Data storage or servers are often outside of the country of data generation, therefore data protection laws in a specific country may not apply to others. Data protection therefore has to be given high priority in the development and use of services in telecare. Also liability issues have to be clarified.

4. Ethical issues and fears of declining health services. Ethical issues such as limitation of personal freedom, fear of losing personal human contact through telecare, fear of being under observation through telecare devices, fear of declining quality in care are issued that have to be addressed to ensure that telecare is used in a positive way and to minimize negative outcomes. Furthermore, justice in access of telecare services has to be ensured.

5. User training and education. As telecare devices become more popular, healthcare professionals need to be constantly educated about the newest products. They also need to be trained for the usage of the devices and for the new way healthcare is delivered. Also training has to encompass issues of responsibility, liability and ethics. An expert stated, that physicians need to be better trained as direct contact is not possible though telecare. Also patients need to be informed of the purpose of telecare and need to be trained for a secure and safe use of the devices.

Other aspects that influence the development of telecare is: 1. if governments actively support and fund the development and dissemination of telecare projects, as for example done by the European Commission and their AAL (Ambient Assisted Living) project; and 2. if market potentials are more and more recognized and private firms and investors boost the development of devices and services in telecare, market penetration could develop faster.

4.3. Limitations

The currents study gives only a broad overview of the current state of telecare products and future trends in Europe. As the timeframe was short and resources limited, not all articles could be retrieved and read thoroughly. Furthermore, no freehand research or in depth analysis of the current market penetration of the various products could be conducted. Also no product research was conducted on the side of companies producing telecare devices. The devices and technologies described in this study are therefore not exhaustive, but only reflect the current state in the academic literature.

Also more detailed research on the side of market potential, socio-demographic developments, societal aspects such as technology acceptance and policies in the European countries would have been fruitful to better predict future trends and future dissemination of telecare.

Furthermore, the literature review was limited to articles concerning Europe or by European authors. The USA, Canada, Australia and Asia however, are also important regions for the development and use of telecare. Therefore, trends and innovative products developed outside of Europe may not have been captured in this study. Devices developed outside of Europe may greatly influence also the European market, the uptake of telecare and the acceptance of telecare services in Europe.

5. Literature

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Appendix

Appendix A: Search Strategy and Results for Literature Review

Appendix B: List of Articles Considered for the Literature Review

Appendix C: Questionnaire of Expert Interviews

Appendix D: List of Experts

Appendix A: Search Strategy and Results for Literature Review

EBSCOhost: Print Search History

Friday, July 19, 2013 6:10:23 AM

#	Query	Limiters/Expanders	Last Run Via	Results
S19	S10 AND S17	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	14
S18	S10 OR S17	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	233
S17	S13 OR S16	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	34
S16	S3 AND S14	Limiters - Search Only Pre-CINAHL Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	2
S15	S3 AND S14	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	178
S14	TI trend* OR forecast OR outlook OR future	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	88,285
S13	S5 AND S12	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	32
S12	(MM "Telemedicine+/TD")	Limiters - Published Date from: 20030101-20131231 Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	87
S11	(MM "Telemedicine+/TD")	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	169
S10	S6 OR S9	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	213
S9	S3 AND S7	Limiters - Search Only Pre-CINAHL Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	4
S8	S3 AND S7	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	476
S7	TX elder* OR aged OR senior	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	660,382
S6	S4 AND S5	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	209
S5	(MH "Technology+") OR TX"technology"	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	169,161
S4	S2 AND S3	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	965
S3	TI telemedicine OR telecare OR telehealth OR e-care OR "e care" OR e-medicine OR "e medicine" OR e-health OR "e health"	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	2,103
S2	(MM "Telemedicine+")	Limiters - Published Date from: 20030101-20131231 Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	1,688
S1	(MM "Telemedicine+")	Search modes - Find all my search terms	Interface - EBSCOhost	2,475

http://web.ebscohost.com/...c4-9ab3-16c4393c132f%40sessionmgr111&vid=34&hid=113&theSearchHistoryIds=S1,S2,S3,S4,S5,S6,S7,S8,S9,S10,S11,S12,S13,S14,S15,S16,S17,S18,S19,[19.07.2013 12:10:19]

Friday, July 19, 2013 9:18:45 AM

#	Query	Limiters/Expanders	Last Run Via	Results
S13	S9 OR S12	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	101
S12	S4 AND S10 AND S11	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	25
S11	S1 OR S7	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	207
S10	TX trend* OR forecast OR outlook OR future	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	15,581
S9	S5 OR S8	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	90
S8	S7 AND S6 AND S4	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	27
S7	TI telemedicine OR telecare OR telehealth OR e-care OR "e care" OR e-medicine OR "e medicine" OR e-health OR "e health"	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	130
S6	TX elder* OR aged OR senior	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	66,913
S5	S3 AND S4	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	73
S4	(DE "Technology+") OR TX "technology"	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	2,898
S3	S1 AND S2	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	110
S2	DE "Older Adults" OR DE "60 " OR DE "65 " OR DE "70 " OR DE "75 " OR DE "80 " OR DE "85 " OR DE "90 " OR DE "95 "	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	107,606
S1	DE "Telemedicine"	Limiters - Publication Year from: 2003-2013 Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - AgeLine	142

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#	Query	Limiters/Expanders	Last Run Via	Results
S13	S9 AND S11	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	7
S12	S9 OR S11	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	26
S11	S5 AND S10 AND S8	Limiters - Publication Date from: 20030101-20131231 Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	8
S10	TX trend* OR forecast OR outlook OR future	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	6,162
S9	S7 AND S8	Limiters - Publication Date from: 20030101-20131231 Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	25
S8	TX "technology"	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	1,726
S7	S5 AND S6	Limiters - Publication Date from: 20030101-20131231 Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	59
S6	S3 OR S4	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	36,820
S5	S1 OR S2	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	130
S4	TX elder* OR aged OR senior	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	36,597
S3	DE "Older Adults"	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	914
S2	TI (telemedicine OR telecare OR telehealth OR e-care OR "e care" OR e-medicine OR "e medicine" OR e-health OR "e health") OR AB (telemedicine OR telecare OR telehealth OR e-care OR "e care" OR e-medicine OR "e medicine" OR e-health OR "e health") OR KW (telemedicine OR telecare OR telehealth OR e-care OR "e care" OR e-medicine OR "e medicine" OR e-health OR "e health")	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	130
S1	((ZW "telemedicine") or (ZW "telemonitoring")) or ((ZW "e-health"))	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - Abstracts in Social Gerontology	20

Friday, July 19, 2013 5:55:38 AM

#	Query	Limiters/Expanders	Last Run Via	Results
S19	S10 AND S17	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	4
S18	S10 OR S17	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	307
S17	S13 OR S16	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	195
S16	S3 AND S14	Limiters - Journal & Citation Subset: In Process Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	32
S15	S3 AND S14	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	468
S14	TI trend* OR forecast OR outlook OR future	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	447,114
S13	S5 AND S12	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	163
S12	(MM "Telemedicine+/TD")	Limiters - Date of Publication from: 20030101-20131231; Language: English, German Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	404
S11	(MM "Telemedicine+/TD")	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	945
S10	S6 OR S9	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	116
S9	S3 AND S7	Limiters - Journal & Citation Subset: In Process Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	13
S8	S3 AND S7	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	838
S7	TX elder* OR aged OR senior	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	3,867,177
S6	S4 AND S5	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	103
S5	(MH "Technology+") OR "technology"	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	725,873
S4	S2 AND S3	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	379
S3	TI telemedicine OR telecare OR telehealth OR e-care OR "e care" OR e-medicine OR "e medicine" OR e-health OR "e health"	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	5,256
S2	(MM "Telemedicine+")	Limiters - Date of Publication from: 20030101-20131231; Age Related: Aged: 65+ years, Aged, 80 and over; Language: English, German	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	1,215

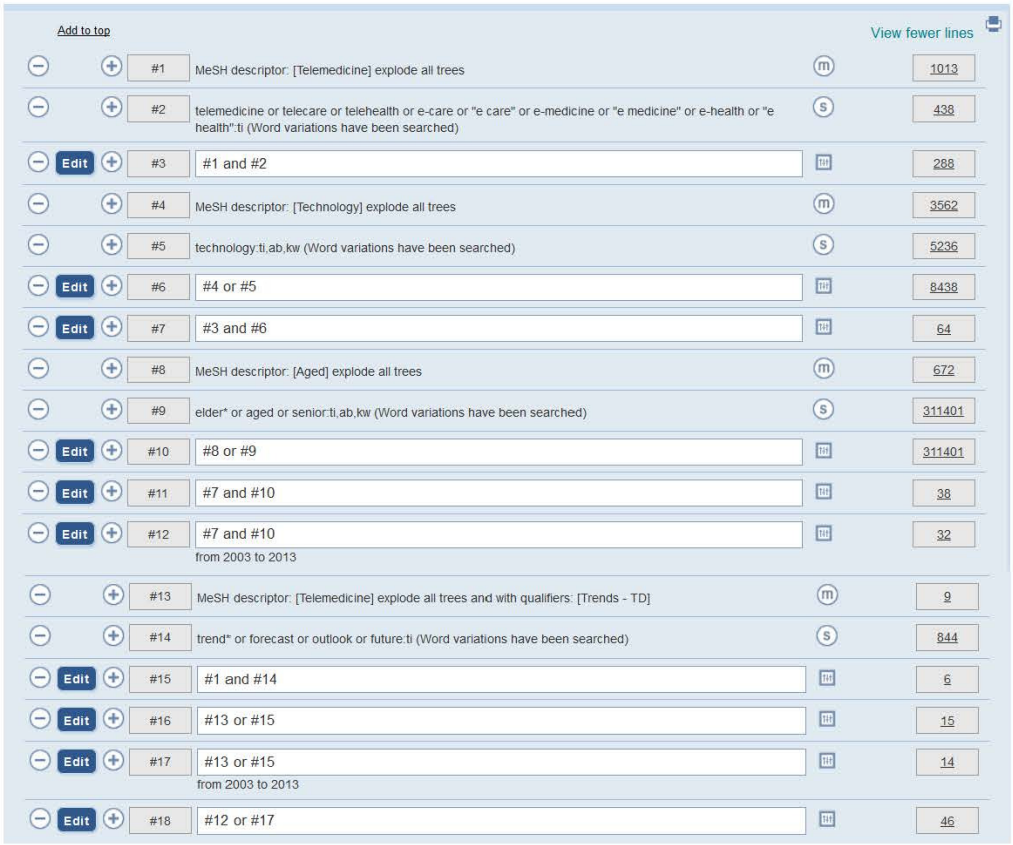
		Search modes - Find all my search terms		
S1	(MM "Telemedicine+")	Search modes - Find all my search terms	Interface - EBSCOhost Search Screen - Advanced Search Database - MEDLINE	11,972

Search Name: Meidert Telemedicine 2013

Last Saved: 19/07/2013 14:23:15.512

Description: ZHAW

ID	Search
#1	MeSH descriptor: [Telemedicine] explode all trees
#2	telemedicine or telecare or telehealth or e-care or "e care" or e-medicine or "e medicine" or e-health or "e health":ti (Word variations have been searched)
#3	#1 and #2
#4	MeSH descriptor: [Technology] explode all trees
#5	technology:ti,ab,kw (Word variations have been searched)
#6	#4 or #5
#7	#3 and #6
#8	MeSH descriptor: [Aged] explode all trees
#9	elder* or aged or senior:ti,ab,kw (Word variations have been searched)
#10	#8 or #9
#11	#7 and #10
#12	#7 and #10 from 2003 to 2013
#13	MeSH descriptor: [Telemedicine] explode all trees and with qualifiers: [Trends - TD]
#14	trend* or forecast or outlook or future:ti (Word variations have been searched)
#15	#1 and #14
#16	#13 or #15
#17	#13 or #15 from 2003 to 2013
#18	#12 or #17



Add to top View fewer lines

#1	MeSH descriptor: [Telemedicine] explode all trees	(m)	1013
#2	telemedicine or telecare or telehealth or e-care or "e care" or e-medicine or "e medicine" or e-health or "e health":ti (Word variations have been searched)	(s)	438
Edit #3	#1 and #2		288
#4	MeSH descriptor: [Technology] explode all trees	(m)	3562
#5	technology:ti,ab,kw (Word variations have been searched)	(s)	5236
Edit #6	#4 or #5		8438
Edit #7	#3 and #6		64
#8	MeSH descriptor: [Aged] explode all trees	(m)	672
#9	elder* or aged or senior:ti,ab,kw (Word variations have been searched)	(s)	311401
Edit #10	#8 or #9		311401
Edit #11	#7 and #10		38
Edit #12	#7 and #10 from 2003 to 2013		32
#13	MeSH descriptor: [Telemedicine] explode all trees and with qualifiers: [Trends - TD]	(m)	9
#14	trend* or forecast or outlook or future:ti (Word variations have been searched)	(s)	844
Edit #15	#1 and #14		6
Edit #16	#13 or #15		15
Edit #17	#13 or #15 from 2003 to 2013		14
Edit #18	#12 or #17		46

Appendix B: List of Articles Considered for the Literature Review

Nr.	Study Titel	Zitation	Study Typ	Technology, Function	Environment of use	In use	In devel-op-	Comment
1	Current state of remote imaging in France and future developments	L'Agence Nationale d'Accreditation d'Evaluation en Sante (ANAES). Current state of remote imaging in France and future developments. Paris: L'Agence Nationale d'Accreditation d'Evaluation en Sante (ANAES) 2003: 95	Review	Remote imaging for tele-consultation	Clinical use, home use	X		
2	Web-based management of diabetes through glucose uploads: has the time come for telemedicine?	Azar, M. and R. Gabbay (2009). "Web-based management of diabetes through glucose uploads: has the time come for telemedicine?" Diabetes Research & Clinical Practice 83(1): 9- 17.	Review article	Web-based systems allowing patient-initiated glucometer uploads	Home use	X		
3	From computers to ubiquitous computing by 2010: health care	Aziz, O., et al. (2008). "From computers to ubiquitous computing by 2010: health care." Philosophical Transactions. Series A, Mathematical, Physical, And Engineering Sciences 366(1881): 3805-3811.	Descriptive Article	Body sensor network' (BSN) platforms composed of tiny integrated microsensors with on-board processing and wireless data transfer capability.	Everywhere	n.a.		
4	Teleradiology: evolution and concepts	Barneveld Binkhuysen, F. H. and E. R. Ranschaert (2011). "Teleradiology: evolution and concepts." European Journal Of Radiology	Descriptive Article	Teleradiology	Clinic	X	X	
5	Mobile applications and management of hypertension: possibilities, problems and perspectives	Becker, S., et al. (2012). "Mobile applications and management of hypertension: possibilities, problems and perspectives." Herz 37(7): 742-745.	Descriptive Article	Internet and smartphones ("Apps") to meet needs of patients suffering from hypertension.	Everywhere	X	X	
6	The safety and effectiveness of minor injuries telemedi-	Benger, J. R., et al. (2004). "The safety and effectiveness of minor injuries telemedicine." Emergency Medicine Journal 21(4): 438-445.	Comparative Study	Minor injuries telemedicine, telemedicine consultation	Hospital/ Clinic	X		

7	Health information systems--technology and acceptance. Findings from the section on health information systems	Bott, O. J. (2007). "Health information systems--technology and acceptance. Findings from the section on health information systems." Yearbook Of Medical Informatics: 61-65.	5 studies presented in a yearbook	Five articles representing research on new user interfaces for mobile data entry, smart card based approaches for national eHealth projects, generic system architectures for telemedicine services, new approaches for electronic prescriptions based on ubiquitous computing, and telemedical systems for chronic care in COPD	Various	X	X	
8	CAALYX: a new generation of location- based services in healthcare.	Boulos, M. N. K., et al. (2007). "CAALYX: a new generation of location-based services in healthcare." International Journal Of Health Geographics 6: 9-9.	Pilot Study	Complete Ambient Assisted Living Experiment: measuring specific vital signs of the elderly, detecting falls and location, and communicating automatically in real-time with his/her care provide	Home & outside	X		
9	Telemedicine in dermatology: a randomised controlled trial	Browns, I. R., et al. (2006). "Telemedicine in dermatology: a randomised controlled trial." Health Technology Assessment 10(43): iii.	Comparative Study	Store-and-forward (SF) teledermatology, digital photography and dermoscopy	Clinic	X		
10	Liverpool Telecare Pilot: telecare as an information tool	Buckland, M., et al. (2006). "Liverpool Telecare Pilot: telecare as an information tool." Informatics In Primary Care 14(3): 191-196.	Pilot study	Telecare systems collecting data to produce visual daily behavioural profiles and present these to carers (social workers, occupational therapists and relatives of the service users)	Home	X		
11	The Telemedical Information Society: doctors' playground or a contribution to the evolution of healthcare?	Burg, G. and M. Denz (2003). "The Telemedical Information Society: doctors' playground or a contribution to the evolution of healthcare?" Current Problems In Dermatology 32: 2-5.	Overview book	Various	n.a.	X	X	
12	TECNOB: study design of a randomized controlled trial of a multidisciplinary telecare intervention for obese patients with type-2 diabetes.	Castelnuovo, G., et al. (2010). "TECNOB: study design of a randomized controlled trial of a multidisciplinary telecare intervention for obese patients with type-2 diabetes." BMC Public Health 10: 204-204.	Randomised Trial	TECNOB (TEChnology for OBesity) program enhanced by telemedicine for obese people seeking weight loss. Technology: information and communication technologies (ICT) such as internet and mobile phones.	Everywhere	X		

13	From pilot to practice: mainstreaming telecare	Castleton, B. (2006). "From pilot to practice: mainstreaming telecare." Primary Health Care 16(9): 19-20.	Pilot Study	Telecare prescriptions	Home	X		
14	Telemedicine fighting acute coro-nary syn-	Clemmensen, P., et al. (2010). "Telemedi-cine fighting acute coronary syndromes." Journal Of Electrocardiology 43(6): 615-618.	Pilot Study	Teletransmitted ECG	Prehospital medical care	X	But also in develop-ment	
15	Wireless technology in disease management and medicine	Clifford, G. D. and D. Clifton (2012). "Wireless technology in disease management and medi-cine." Annual Review Of Medicine 63: 479- 492.	Descriptive Article	Current wireless technology used for patient monitoring and disease management	n.a.	X	X	
16	Services de proximité et nouvelles technologies: une union prometteuse pour l'économie plu-	Cools, F. (2012). Services de proximité et nouvelles technologies: une union promet-teuse pour l'économie plurielle, Pour la Solida-rité.	Comparative Study	Overview of new technologies in the european context: TIC; E-Health, E-Inclusion, fall detectors…	Mostly home	X		Article provided by expert
17	Research on the provision of Assistive Technology in Ireland and other coun-tries to support inde-pendent living across the life cycle	Cullen, McAnaney et al. (2012). Research on the provision of Assistive Technology in Ireland and other countries to support independent living across the life cycle. National Disability Authority report, Dublin.	Research	Assistive Technology	Home/community/eve ryday life, em-ployment and education	X		Article provided by expert
18	The value proposition in the widespread use of telehealth	Cusack, C.M., Pan. E., Hook, J.M. et al. (2008). The value proposition in the widespread use of telehealth. J Telemed Telecare.	Simulation based on literature, cost analysis	Store-and-forward, real-time video and hybrid systems for telehealth encounters	Home and clinic	X		Article provided by expert
19	Concept and modular telemedicine platform for measuring of vital signs, ADL and behavioral pat-terns of elderly in home settings	Czabke, A., et al. (2011). "Concept and modular telemedicine platform for measuring of vital signs, ADL and behavioral patterns of elderly in home settings." Conference Proceedings: ... Annual International Conference Of The IEEE Engineering In Medicine And Biology Society. IEEE Engineering In Medicine And Biology So-ciety. Conference 2011: 3164-3167.	Intervention Study	Computer with functions for measuring of vital signs, ADL and behavioral patterns wich collect also data from every med-ical device that can be connected to the platform.	Home	X		

20	Using preventive home monitoring to reduce hospital admission rates and reduce costs: a case study of telehealth among chronic obstructive pulmonary disease patients	Dinesen, B., et al. (2012). "Using preventive home monitoring to reduce hospital admission rates and reduce costs: a case study of telehealth among chronic obstructive pulmonary disease patients." Journal Of Telemedicine And Telecare 18(4): 221-225.	Intervention Study	Home monitoring of patients with COPD with tele-rehabilitation with a telehealth monitoring device installed in their home	Home	X		
21	Effectiveness of telemedicine: a systematic review	Ekeland, A. G., Bowes, A., & Flottorp, S. (2010). Effectiveness of telemedicine: a systematic review of reviews. International journal of medical informatics, 79(11), 736-771.	Review	E-health interventions, information and communication technologies for health care, Internet based interventions for diagnosis and treatments, and care	n.a.	X		Article provided by expert
22	This process is just beginning': connecting mobile medical devices	Facchinetti, T., et al. (2012). "'This process is just beginning': connecting mobile medical devices." Biomedical Instrumentation & Technology / Association For The Advancement Of Medical Instrumentation Suppl: 19-25.						
23	Assessment and analysis of territorial experiences in digital tele- echocardiography	Frumento, E., et al. (2009). "Assessment and analysis of territorial experiences in digital tele-echocardiography." Annali Dell'istituto Superiore Di Sanità 45(4): 363-371.	Pilot Studies	Echocardiography for specialists by means of second opinion and telemedicine services.	Hospital/Clinic	X	X	
24	The "tele" factor in surgery today and tomorrow: implications for surgical training and education	Gambadauro, P. and R. Torrejón (2013). "The "tele" factor in surgery today and tomorrow: implications for surgical training and education." Surgery Today 43(2): 115-122.	Review article	Telementoring, teleproctoring and robotic telesurgery	Hospital, Clinic, Home	X	X	
25	State of the art and trends for digital pathology	García Rojo, M. (2012). "State of the art and trends for digital pathology." Studies In Health Technology And Informatics 179: 15-28.	Despcriptive article	Anatomic pathology through Digital Imaging and Communications in Medicine	Hospital/Clinic	X	X	
26	Telemedicine: a practice-based approach to technology	Gherardi, S. (2010). "Telemedicine: a practice-based approach to technology." Human Relations 63(4): 501-524.	Analysis	Telecardiological consultancy	Hospital/Clinic	X		
27	Digital tele-echocardiography: a look inside	Giansanti, D. and S. Morelli (2009). "Digital tele-echocardiography: a look inside." Annali Dell'istituto Superiore Di Sanità 45(4): 357-362.	Literature review	Digital tele-echocardiography (T-E)	n.a.		X	

28	E-health self-care interventions for persons with chronic illnesses: review and future directions	Glueckauf, R. L. and M. L. Lustria (2009) E-health self-care interventions for persons with chronic illnesses: review and future directions (Structured abstract). Database of Abstracts of Reviews of Effects 151-242.	Review. Structured Abstract	Web-based and telephone-based self-management interventions	Home use	X		
29	Using Personal Handheld Computing Devices for Personalizing Healthcare. A Contribution from the IMIA Working Group on Telehealth	Gogia, S. B., et al. (2012). "Using Personal Handheld Computing Devices for Personalizing Healthcare. A Contribution from the IMIA Working Group on Telehealth." Yearbook Of Medical Informatics 7(1): 74-78.	Review article	Personal handheld computing devices for personalizing healthcare,	Everywhere	X		
30	E-Health: are there expert patients out there?	Gortzis, L. G. (2009). "e-Health: are there expert patients out there?" Health Sociology Review 18(2): 173-181.	Comparative Study	Information communication technologies. Portable biosignal device (PBD)	Home use	X		
31	Recent advances in mobile technology benefit global health, research, and care	Hampton, T. (2012). "Recent advances in mobile technology benefit global health, research, and care." JAMA: The Journal Of The American Medical Association 307(19): 2013-2014.						Global focus
32	Telemedicine in emergency evaluation of acute stroke: interrater agreement in remote video examination with a novel multimedia system	Handschu, R., et al. (2003). "Telemedicine in emergency evaluation of acute stroke: interrater agreement in remote video examination with a novel multimedia system." Stroke; A Journal Of Cerebral Circulation 34(12): 2842-2846.	Intervention Study	remote video examination is feasible and reliable when applied in emergency stroke care	Hospital	X		
33	Telemedicine in dermatology 2003: a review	Hasse, U., et al. (2004). "Telemedicine in dermatology 2003: a review." Journal Der Deutschen Dermatologischen Gesellschaft = Journal Of The German Society Of Dermatology: JDDG 2(4): 294-300.	Review article					
34	The modern technique of electronic data transmission	Hitzenberger, G. (2011). "The modern technique of electronic data transmission." Wiener Medizinische Wochenschrift (1946) 161(13-14): 333-333.						

35	The use of telemedicine in combination with a new stroke-code-box significantly increases t- PA use in rural communities	Ickenstein, G. W., et al. (2005). "The use of telemedicine in combination with a new stroke-code-box significantly increases t-PA use in rural communities." Neurocritical Care 3(1): 27-32.	Intervention Study	Telemedicine network system to increase the use of acute stroke thrombolysis	Hospital			
36	Hypertension home telemonitoring: current evidence and recommendations for future studies	Jaana, M., et al. (2007) Hypertension home telemonitoring: current evidence and recommendations for future studies (Provisional abstract). Disease Management and Health Outcomes 15, 19-31.	Systematic review	Hypertension home telemonitoring	Home use	X		
37	Moving prediction of exacerbation in chronic obstructive pulmonary disease for patients in telecare	Jensen, M. H., et al. (2012). "Moving prediction of exacerbation in chronic obstructive pulmonary disease for patients in telecare." Journal Of Telemedicine And Telecare 18(2): 99-103.	Intervention Study	Home measurements, tele-rehabilitation COPD	Home use			
38	Telemedicine in acute stroke care: the TESSA model.	Johansson, T., et al. (2011). "Telemedicine in acute stroke care: the TESSA model." Journal Of Telemedicine And Telecare 17(5): 268-272.	Intervention Study	Intravenous thrombolysis via videoconferencing	Hospital	X		
39	UK telehealth initiatives in palliative care: a review	Johnston, B. (2011). "UK telehealth initiatives in palliative care: a review." International Journal Of Palliative Nursing 17(6): 301-308.	Review article	Telehealth in palliative and end-of-life care	n.a.	X	X	
40	Telemedicine in wound healing	Jones, S. M., et al. (2004). "Telemedicine in wound healing." International Wound Journal 1(4): 225-230.	Review	Development of a suitable telemedical system for wound healing	Home use		X	
41	Mobile Health: m-Health, mHealth, or Mobile Health – which on is correct?	Jordanova, M. (2011). Mobile Health: m-Health, mHealth, or Mobile Health – which on is correct? QUESTION 14-2/2: Telecommuncations for e-Health, ITU, Geneva. 1-6.	Review	Mobile Health	Everywhere	X		Article provided by expert
42	The use of telemedicine to assess and advise patients regarding dietary treatment of hyperphosphataemia	Kariyawasam, D. (2005). "The use of telemedicine to assess and advise patients regarding dietary treatment of hyperphosphataemia." EDTNA/ERCA Journal of Renal Care 31(4): 215-218.	Study	Telemedicine to communicate dietary information	Home use/Clinic	X		
43	Health informatics and the delivery of care to older people	Koch, S. and M. Hägglund (2009). "Health informatics and the delivery of care to older people." Maturitas 63(3): 195-199.	Review article			X		

44	Telemedicine in heart failure: pre-specified and exploratory subgroup analyses from the TIM-HF trial	Koehler, F., et al. (2012). "Telemedicine in heart failure: pre-specified and exploratory subgroup analyses from the TIM-HF trial." International Journal Of Cardiology 161(3): 143-150.	Intervention Study	Telemedicine exact device not applicable	Home use	X		
45	The research project of the German Federal Ministry of Econom-ics and Technology: 'Partnership for the Heart' - - a new approach in tele-	Köhler, F., et al. (2006). "The research project of the German Federal Ministry of Economics and Technology: 'Partnership for the Heart' -- a new approach in telemedicine." Disease Manage-ment & Health Outcomes 14: 37-41.	Research Project	Telemedical homecare monitoring system	Home use	X		
46	Telemedicine seeks to empower patients to manage their care	Kohler, M. (2008). "Telemedicine seeks to empower patients to manage their care." Brit-ish Journal of Community Nursing 13(3): 135-137.	Review article	Telemedicine exact device not applicable			X	
47	Health monitoring in the home of the future	Korhonen, I., et al. (2003). "Health monitoring in the home of the future." IEEE Engineering In Medicine And Biology Magazine: The Quarterly Magazine Of The Engineering In Medicine & Biol-ogy Society 22(3): 66-73.	Descriptive Article	Wearable sensors and ambient sensorsor for health monitoring	Home and everyday environment		X	
48	Network collaborative environment supporting 3D medicine	Krsek, P., et al. (2009). "Network collaborative environment supporting 3D medicine." Confer-ence Proceedings: ... Annual International Con-ference Of The IEEE Engineering In Medicine And Biology Society. IEEE Engineering In Medi-cine And Biology Society. Conference 2009: 2164-2167.	Descriptive Article	3D geometrical modelling applications in the field of clinical human medicine	Hospital & Clinic		X	
49	Kubitshcke, L., Gareis, K. et al. (2008). ICT & Age-ing: European Study on Users, Markets and	Kubitshcke, L., Gareis, K. et al. (2008). ICT & Ageing: European Study on Users, Markets and Technologies. Preliminary Findings.		ICT		X		Article provided by expert
50	Information and communication technolo-gy. New ways to strengthen health compe-tence	Kubli, C., et al. (2011). "Information and communication technology. New ways to strengthen health competence." Krankenpflege. Soins Infirmiers 104(11): 15-17.						

51	Patient-physician interaction over the internet	Kummervold, P. E., et al. (2004) Patient-physician interaction over the internet. Tidsskrift for den Norske lægeforening : tidsskrift for praktisk medicin, ny række 124, 2633-2636.		Web-based system for patient-physician communication	Home use	X		
52	Area of the diabetic ulcers estimated applying a foot scanner-based home telecare system and three reference methods	Ladyzynski, P., et al. (2011). "Area of the diabetic ulcers estimated applying a foot scanner-based home telecare system and three reference methods." Diabetes Technology & Therapeutics 13(11): 1101-1107.	Experiment	Diabetic foot ulcer scans transmitted to the physician from a patient's home.	Home use/cilnic	X		
53	La télémédecine et les technologies d'assistance pour la prise en charge des personnes âgées fragiles à domi-cile et en institution: modélisation du besoin, de la prescrip-tion et du suivi	Laila, M. (2009). La télémédecine et les technologies d'assistance pour la prise en charge des personnes âgées fragiles à domicile et en institution : modélisation du besoin, de la prescrip-tion et du suivi, thèse de doctorat.	Doctorate Thesis	Technologies against isolation, medical technologies, technologies for everyday life		X		Article provided by expert
54	Detection of falls using accelerometers and mobile phone technology	Lee, R. Y. W. and A. J. Carlisle (2011). "Detection of falls using accelerometers and mobile phone technology." Age and Ageing 40(6): 690-696.	Study	Accelerometers and mobile phone technology	Home use	X		
55	Telemedicine diabetes consultations are cost-effective, and effects on essential diabetes treatment parameters are similar to conventional treatment: 7-year results from the svendborg telemedicine diabetes project	Levin, K., et al. (2013). "Telemedicine diabetes consultations are cost-effective, and effects on essential diabetes treatment parameters are similar to conventional treatment: 7-year results from the svendborg telemedicine diabetes project." Journal Of Diabetes Science And Technology 7(3): 587-595.	Intervention	Expert diabetes care using teleconsulta-tions with audiovisual contact, supported by an electronic patient record and a Web-based quality-monitoring diabetes database.	Home use	X		
56	International developments in telecare and telehealth showcased at conference	Lewis, J. (2009). "International developments in telecare and telehealth showcased at conference." Equipment Services: 18-19.	Commentary on a conference	Telemedicine -- Equipment and Supplies	various	X		

57	Be wary of signing costly deals for telehealth technologies, NHS told	Limb, M. (2012). "Be wary of signing costly deals for telehealth technologies, NHS told." BMJ: British Medical Journal (Overseas &	Commentary		n.a.			
58	Possibilities of telemedicine	Linke, K. (2007). "Possibilities of telemedicine." Klinische Monatsblätter Für Augenheilkunde 224(4): 229-230.						
59	The future: biomarkers, biosensors, neuroinformatics, and e- neuropsychiatry	Lowe, C. R. (2011). "The future: biomarkers, biosensors, neuroinformatics, and e- neuropsychiatry." International Review Of Neurobiology 101: 375-400.	Descriptive study, Trends	Application of mobile communications technology and grid computing to support data-, computation- and knowledge- based tasks will assist disease prediction, diagnosis, progno-sis, and compliance monitoring.	Everywhere		X	
60	Health information systems for home telehealth services - a nomenclature for sensor-enhanced transinstitutional information system architectures	Ludwig, W., et al. (2010). "Health information systems for home telehealth services - a nomenclature for sensor-enhanced transinstitutional information system architectures." Informatics for Health & Social Care 35(3-4): 211-225.	Literature Review	ICT. Sensor-enhanced transinstitutional health information system architectures	Home use	X		
61	Converging micro-nano-bio technologies towards integrated biomedical systems: state of the art and future perspectives under the EU-information & communication technologies program	Lymberis, A. (2008). "Converging micro-nano-bio technologies towards integrated biomedical systems: state of the art and future perspectives under the EU-information & communication technologies program." Conference Proceedings: ... Annual International Conference Of The IEEE Engineering In Medicine And Biology Society. IEEE Engineering In Medicine And Biology Society. Conference 2008: 6-8.	Descriptive study, Trends	Micro-Nano-Bio Convergence Systems, "so-called" MNBS, systems that use a vast array of technologies to integrate between the micro-nano-bio, and info worlds, enabling a wide range of applications from health care to food quality monitoring	n.a.		X	
62	Advanced wearable health systems and applications.	Lymberis, A. and A. Dittmar (2007). "Advanced wearable health systems and applications." IEEE Engineering In Medicine And Biology Magazine: The Quarterly Magazine Of The Engineering In Medicine & Biology Society 26(3): 29-33.	Descriptive study, Trends	Sensor technology, bio-sensing patches and wearable (nontextile) health systems	Everywhere		X	

63	Wearable health systems: from smart technologies to real applications	Lymberis, A. and L. Gatzoulis (2006). "Wearable health systems: from smart technologies to real applications." Conference Proceedings: ... Annual International Conference Of The IEEE Engineering In Medicine And Biology Society. IEEE Engineering In Medicine And Biology Society. Conference Suppl: 6789-6792.	Descriptive study	Wearable health systems (WHS) which monitor patients over extensive periods of time outside the hospital	Everywhere		X	
64	Moving genetics into clinical cancer care: examples from BRCA gene testing and telemedicine	Mackay, J. and A. Taylor (2006). "Moving genetics into clinical cancer care: examples from BRCA gene testing and telemedicine." Breast (Edinburgh, Scotland) 15 Suppl 2: S65-S70.	Descriptive study	Remote cancer genetics service, which uses live, real time teleconferencing technology	n.a.	X		
65	e-Care integration: To meet the demographic challenge	Manning, B. R. M. and M. McKeon Stosuy (2006). "e-Care integration: To meet the demographic challenge." Studies In Health Technology And Informatics 121: 138-150.	Descriptive study	IPTV based approach of integrated assistive technology systems with medical and status monitoring; extended care-watch and service co-ordination	Home use	X		
66	Active ageing: independence through technology assisted health optimisation	Manning, B. R. M., et al. (2008). "Active ageing: independence through technology assisted health optimisation." Studies In Health Technology And Informatics 137: 257-262.	Descriptive study	Smart environment with physiological monitoring, communications and computing with leading-edge textile technologies, which uses a multi- layered, multi-functional clothing system as a mobile and extended variant of a smart home IP hub.	Everywhere			
67	Mobile phone-based telemedicine system for the home follow-up of patients undergoing ambulatory surgery	Martínez-Ramos, C., et al. (2009). "Mobile phone-based telemedicine system for the home follow-up of patients undergoing ambulatory surgery." Telemedicine Journal And E-Health: The Official Journal Of The American Telemedicine Association 15(6): 531-537.	Pilot Study	General Packet Radio Service mobile phone-based telemedicine system used to improve follow-up after ambulatory surgery	Everywhere		X	
68	How continuous monitoring changes the interaction of patients with a mobile telemedicine system	Martínez-Sarriegui, I., et al. (2011) How continuous monitoring changes the interaction of patients with a mobile telemedicine system. Journal of diabetes science and technology 5, 5-12	Study	Mobile smart assistant. Combination of telemedicine systems integrating mobile technologies with the use of continuous glucose moni-	Everywhere	X		

69	Is telemedicine effective?	McGarry, J. and S. Nairn (2005). "Is telemedicine effective?" Primary Health Care 15(2): 21-23.	Review	ICT, Sensors, Monitoring Devices	Home use	X		
70	Telehealthcare for long term conditions	McLean, S., Protti, D., & Sheikh, A. (2011). Telehealthcare for long term conditions. BMJ, 342.	Overview article	Telemedicine exact device not applicable		X		Article provided by expert
71	Right technology, right situation -- a case report on prehospital telemedi-cine	Meade, B., et al. (2003). "Right technology, right situation -- a case report on prehospital tele-medicine." Journal of Emergency Primary Health Care 1(1/2): 3p.	Pilot Project	Low-cost videophone system. Combination of Satellite integrat-ed Services Digital Network (ISDN) and videophone terminals	Can be used outside e.g. on scenes of accidents, before admis-sion to the hos-		X	
72	The use of telemedicine in psychiatry	Norman, S. (2006). "The use of telemedicine in psychiatry." Journal of Psychiatric & Mental Health Nursing 13(6): 771-777.	Literature Review	Video-conferencing	Home use, especially for patiens who live in rural areas	X		
73	Un système de télémédecine pour les seniors	Nourizadeh, S., Song, Y. Q. et al. (2009). Un système de télémédecine pour les seniors. In 1er congrès de la Société Française des Technolo-gies pour l'Autonomie et de Gérontechnologie-SFTAG09.	Concept	Smart house	Home use	X		Article provided by expert
74	Telecare for an ageing population?	Parker, S. G. and M. S. Hawley (2013). "Telecare for an ageing population?" Age & Ageing 42(4): 424-425.	Review					
75	Telecare Provides Comparable Efficacy to Conventional Self- Moni-tored Blood Glucose in Patients with Type 2 Diabetes Titrating One Injection of Insulin Glulis-ine-the ELEONOR Study	Prato, S. D., et al. (2012). "Telecare Provides Comparable Efficacy to Conventional Self- Moni-tored Blood Glucose in Patients with Type 2 Diabetes Titrating One Injection of Insulin Glulis-ine-the ELEONOR Study." Diabetes Technology & Therapeutics 14(2): 175-182.	Parallel-group study	Telecare monitoring of blood glucose levels	Home use	X		
76	Main-streaming telecare	Preece, M. (2005). "Main-streaming telecare." Working with Older People: Community Care Policy & Practice 9(2): 26-29.	Pilot Project	Telecare products such as falls detectors	Home use		X	

77	Use of telemedicine in the remote programming of cochlear implants	Ramos, A., et al. (2009). "Use of telemedicine in the remote programming of cochlear implants." Acta Oto-Laryngologica 129(5): 533-540.	Research	Remote cochlear implant (CI) programming	Via Internet, a remote expert can program the cochlear implant of a patient at a CI centre.	X		
78	Using Telehealth to Avoid Urgent Care and Hospitalization	Rhonda, C. (2008). "Using Telehealth to Avoid Urgent Care and Hospitalization." Home Health Care Management & Practice 20(2): 154-160.	Review	Telehealth and technology. Not specified	Home use		X	
79	Calling for care: Disembodied work, teleoperators and older people líving at home	Roberts, C., Mort, M. And Milligan, C. (2012). Calling for care: Disembodied work, teleoperators and older people líving at home, Sociology (46)3: 490-506.	Study	Teleoperators	?	X		Article provided by expert
80	Telemedicine influence on the follow-up of type 2 diabetes patients	Rodríguez-Idígoras, M. I., et al. (2009). "Telemedicine influence on the follow-up of type 2 diabetes patients." Diabetes Technology & Therapeutics 11(7): 431-437.	Study	teleassistance system using real-time transmission of blood glucose results, with immediate reply when necessary, and telephone consultations	Home use	X		
81	Interactive Diary for Diabetes: A Useful and Easy-to-Use New Telemedicine System to Support the Decision- Making Process in Type 1 Diabetes	Rossi, M. C., et al. (2009). "Interactive Diary for Diabetes: A Useful and Easy-to-Use New Telemedicine System to Support the Decision- Making Process in Type 1 Diabetes." Diabetes Technology & Therapeutics 11(1): 19-24.	Pilot Study	Diabetes Interactive Diary (DID), set up on patients' mobile phones	Home use		X	
82	An Interactive Diary for Diet Management (DAI): A New Telemedicine System Able to Promote Body Weight Reduction, Nutritional Education, and Consumption of Fresh Local Produce	Rossi, M. C., et al. (2010). "An Interactive Diary for Diet Management (DAI): A New Telemedicine System Able to Promote Body Weight Reduction, Nutritional Education, and Consumption of Fresh Local Produce." Diabetes Technology & Therapeutics 12(8): 641-647.	Study	Software for mobile phones to support patients following a specific dietetic program.	Home use	X		

83	Detection of activities of daily living impairment in Alzheimer's disease and mild cognitive impairment using information and communication technology	Sacco, G., Joumier, V. et al (2012). Detection of activities of daily living impairment in Alzheimer's disease and mild cognitive impairment using information and communication technology. Clin Interv Aging.	Study	Information and communication technology (ICT), particularly techniques involving imaging and video processing	"smart home"	X		Article provided by expert
84	Tomorrow's world: telecare	Sadler, S. (2008). "Tomorrow's world: telecare." British Journal of Healthcare Management 14(7): 294-295.	Overview article	Overview of various telecare technologies				
85	eHealth and telemedicine: current situation and future challenges	Saner, H. (2013). eHealth and telemedicine: current situation and future challenges. European journal of preventive cardiology, 20(2 suppl), 1-2.	Overview article	Various applications in healthcare		X	X	Article provided by expert
86	Use of telehealth technology for home spirometry after lung transplantation: a randomized controlled trial	Sengpiel, J., et al. (2010) Use of telehealth technology for home spirometry after lung transplantation: a randomized controlled trial. Progress in transplantation (Aliso Viejo, Calif.) 20, 310-317	Pilot Study	Bluetooth-equipped cell phones facilitate data transfer from home spirometry	Home use		X	
87	Effect of telehealth on use of secondary care and mortality: findings from the Whole System Demonstrator cluster randomised trial.	Steventon, A., Bardsley, M. et al. (2012). Effect of telehealth on use of secondary care and mortality: findings from the Whole System Demonstrator cluster randomised trial. BMJ: British Medical Journal, 344.	Randomised Trial	Telehealth involved remote exchange of data between patients and healthcare professionals as part of patients' diagnosis and management.	Home	X		Article provided by expert
88	Using handheld pocket computers in a wireless telemedicine sys-	Tachakra, S., et al. (2006). "Using handheld pocket computers in a wireless telemedicine system." Emergency Nurse 14(5): 20-23.		Personal Digital Assistants (PDA). Handheld pocket computers	Everywhere	X		
89	Telecare is a valuable tool for hypertension management, a systematic review and meta-analysis	Verberk, W. J., et al. (2011). "Telecare is a valuable tool for hypertension management, a systematic review and meta-analysis." Blood Pressure Monitoring 16(3): 149-155.	Review	Telecare system for blood pressure measurement	Everywhere	X		

90	Disease management for heart failure patients: role of wireless technologies for telemedicine. The ICAROS project	Villani, A., et al. (2007) [Disease management for heart failure patients: role of wireless technologies for telemedicine. The ICAROS project]. Giornale italiano di cardiologia (2006) 8, 107-114	Descriptive study	Advanced wireless telecommunication technology. Portable computer	Ambulatory Care, Hospital	X		
91	Telemedicine: supporting normality in midwife-led community units	Warriner, S. and A. Martinez (2005). "Telemedicine: supporting normality in midwife-led community units." British Journal of Midwifery 13(10): 654-658.	Intervention Study	Telemedicine to communicate dietary information	Home use/cilic			
92	Long-running telemedicine networks delivering humanitarian services: experience, perform-ance and scientific output	Wootton, R., et al. (2012). "Long-running telemedicine networks delivering human-itarian services: experience, performance and scientific output." Bulletin of the World Health Organization 90(5): 341-351.		Clinical tele-consultations for humanitarian purposes using store-and-forward methods	Hospital/clinic	X		

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Name:

PACITA "EU Stakeholder Involvement on Ageing Society"

Work Package 6.2

Expert survey on telecare technology and home-based telemedicine in Europe

1. Status quo: Which telecare technologies are, to your knowledge, already used in your country in elderly care today? (e.g. smart houses, sensors, tracking devices, communication technologies, robotics)

2. In your opinion, how can telecare technology positively impact on the needs of an ageing society?

3. Where could telecare-technology impact negatively on the elderly, their care networks and society as a whole?

4. Are there discussions under way in your country to address the ethical and legal issues arising through the use of telecare? If yes, which subjects are brought up?

5. Which technological development do you expect in the next 10 to 15 years in this domain and what will be the main drivers?

6. Specialized literature: Please indicate four titles you consider particularly relevant to the topic.

Appendix D: List of Experts

EU Stakeholder Involvement on Ageing Society, PACITA WP 6.2

List of technology experts in Austria, Belgium (Wallonia), Bulgaria, Ireland, Norway, Spain (Catalonia), and Switzerland who responded to the questionnaire (see appendix C)

	Name	Institution	Area of Interest	Suggested by
1	Assoc. Prof. Georgi Sotirov / Prof. Peter Gezov	Bulgarian Academy of Sciences, Institute for Space Research and Technologies, Sofia		ARC Fund; Sofia
2	Dr. Rostislava Dimitrova	European Commission, DG Health and Consumers	e-healthcare, health policy, healthcare in cohesion policy	ARC Fund; Sofia
3	Assistant Prof. Polina Mihova	New Bulgarian University, Sofia	telemedicine, medical informatics, e-health	ARC Fund; Sofia
4	Eva Beloso	FENIN – National organization of suppliers of healthcare technologies	innovation & technology transfer	Fundació Catalana per a la Recerca
5	Andreu Català	Technical Research Centre for Dependency Care and Autonomous Living	engineering	Fundació Catalana per a la Recerca
6	Daniel Lopez	Psychology and Educational Sciences Department, Universitat Oberta de Catalunya	implementation of new technologies in care settings	Fundació Catalana per a la Recerca
7	Francesco Moya	TicSalut – Public entity responsible for the implementation of telecare & telemedicine	technology	Fundació Catalana per a la Recerca
8	Martì Martinez	Creu Roja (Red Cross)	telecare	Fundació Catalana per a la Recerca
9	Prof. Dipl.-Ing. Dr. Wolfgang Zagler	Vienna University of Technology	applied assistive technologies	ITA Austria
10	Markus Nufer	Nufer Consulting AG and SATW topical platform health technologies	healthcare solutions, telemedicine	TA-SWISS
11	Steinar Pedersen	Tromsø Telemedicine Consult		Teknologiradet Norway
12	Valérie Flohimont	FUNDP (Basic Rights and Social Cohesion Interdisciplinary Centre)	social law, ageing, mental health, discriminations	Université de Liège / SPIRAL

Appendix D: List of Experts

13	Jean Petermans	ULg-CHU (geriatrics)	immunosenescence	Université de Liège / SPIRAL
14	Eric Salmon	ULg/CHU (neurology)	adaptation of simple technologies for Alzheimer or dementia patients	Université de Liège / SPIRAL
15	Diarmuid Cahalane	Open Innovation Partners, University College Cork	founder of Open Innovation Partners, focused on developing emerging technologies from university research	University College Cork / UCC
16	Dr Aoife Callan	Irish Centre for Social Gerontology, National University of Galway, Ireland	PhD in social gerontology and ICT and has published extensively in the area	University College Cork / UCC
17	Dr Patricia Kearney	Epidemiology & Public Health; University College Cork	Irish longitudinal study of ageing	University College Cork / UCC