The use of assistive technology to support selfcare of elderly people at home

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Abstract

Background: The rapid increase of ageing population is raising concern in many developed countries, especially in Northern Europe where declined fertility rates after baby boomers caused a demographic structure dominated by people aged 65 and above. Ageing comes with functional and cognitive declines. Therefore, in the coming decades, the need for elderly care is expected to grow significantly which creates a gap between care demand and supply.

Aim: The aim of the study is to explore the option of assistive technology to support elderly people's self-care ability and reduce burden on home care providers by facilitating organized way of care service delivery. Based on prior studies done, the research questions investigated (1) What is the role of assistive technology in supporting self-care of the elderly? (2) What kind of assistive technology is currently available for use by the elderly? **Method:** Systematic literature review was conducted by selecting 11 scientific articles written on the subject. **Theory:** This study was done guided by a nursing theory of self-care by Dorothea Orem. **Results:** The study found out that application of technology plays important role in maintaining physical and cognitive functioning of the elderly and empowers them to live independently and safely. It also showed that assistive technology contributes a lot in improving quality of life of elderly people living at home and reduce burden of care givers as well as health care cost. The findings of currently available assistive technology for elderly people fetched variety of assistive technology products and services that are known and widely used at this time. **Conclusion** Application of assistive technology is advantageous for the elderly, the health care professionals and the health care system. However, further studies need to be conducted from nursing perspective and awareness raising activities need to be done among home care nurses.

Keywords:	Assistive technology, elderly, self-care, ageing, independent living
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LIST OF ABBRIVATIONS

AT- Assistive technology

ICT- Information and communication technology

EC-European commision

WHO- World health organization

PWD- people with dementia

FOREWORD

Let me begin by saying ‘Glory to God!’ , for he has been my strength throughout everything from the beginning to the end.

I would like to thank ARCADA university of applied sciences for giving me the opportunity to study and for the support throughout the academic years. And specific to this thesis work, I would like to express my gratitude for my supervisor for her continuous support and motivation and her extra effort to encourage me to do my best.

My special thanks goes to my employer **Ulla Pohjankyrö** for giving me the opportunity to work and develop my finish language skill which made my practical studies attainable. I am beyond words great full for her kindness and all the support from my colleagues in Varpula.

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1. INTRODUCTION

The aging population is increasing significantly in developed countries where living standard is high. Life expectancy is getting higher as the awareness for healthy living grows, together with the advancement of medicine. Aging comes with the inevitable decline in physical and cognitive function which makes living independently difficult in many ways. Consequently, older people need help from others to manage basic routines in their daily life (Ahanathapillai et al., 2015).

The baby boomers (people born post world war II 1945) will turn 80 years old and above in the coming few decades. The succeeding generation will be burdened to provide all the care and support needed. Economic situations currently limited availability of time and human resources. Thus, although older people wish to remain at home and be supported by family members, the economic situation which is making time and human resource scarce will make their demand difficult to meet (Redfoot et al.,2013).

Home health care services aimed to provide all the necessary help and support while encouraging older people to live independent and dignified life (Ellenbecker et al., 2008). However, the gap between the aged population at home and the limited amount of home care service providers will impact the quality of care. In order to keep the quality of care uncompromised, implementation of assistive technology is believed to contribute a lot to enhance the self-care ability of elderly and eases the workload of nurses (Kachouie et al 2014).

There have been many studies done about the contribution of technology to elderly care in institutions and at home as most of the developed world leaning towards keeping the elderly people to live independently at home as long as possible. Most of the European projects have already included use of safety alarms, smart sensors and remotely monitored devices to increase safety and security of elderly people living at home (Molin et al 2007).

This study looks through various scientific studies that were done about development of assistive technology and its current application for supporting elderly people to cope at home, with little or no help from formal and informal care givers.

In addition to that in this study the role of assistive technology for maintaining self-care and keeping quality of life despite the physical and cognitive decline of elderly people due to aging and disability will be discussed briefly.

2. BACKGROUND

2.1 Demographic changes in Europe

There have been significant changes on the share of old age group in the populations of most countries in Europe. Currently the ratio of working age population to old dependent population below 4 to 1 and in 2050, it is projected to be 2 to 1. Population growth has been stagnant considerably in Finland, Baltic States, Germany, France and Portugal between the years 2000 and 2014. Economic recession and lower growth rates are suspected to be the major reasons that contribute to population shrinkage at the regional level (Gløersen et al 2016).

According to a research by European commission, life expectancy of Europeans has increased and people are living longer and healthier. On the other hand, fertility rates are below replacement level and that is causing a decline in population growth, as the post-war baby boomers age in the coming decades. It is predicted that the low fertility rate in the long run will create a gap in working force as the aged population retires without enough replacement (European Commission 2014)

In Finland, life expectancies had risen to 77 years for men and 84 years for women which makes it to be among one of the countries with highest life expectancies. The infant mortality rate is one of the lowest in the world. The total fertility rate shows that only 1.75 children are born for a woman and the population growth rate is 0.38% (statistics Finland 2016).

Demographic studies predicted that in the coming decades, Finland's population would be dominated by the age group of 65-years old and above. Hence, the working population will also decrease. Labour 2025 report shows, it is estimated that after the retirement of the baby boomers, there will not be enough labour force to replace them. Therefore, as an option it is suggested to employ elderly, unemployed, disabled and immigrants (Heikkilä 2012).

2.2 Increasing demand for long term care

Long term care is defined as nursing and personal care provided for long period of time in residential institutions, day-care centers or at home to help people facing various problems physically or mentally and are unable to perform their day to day routines. (Muiser & Carrin, 2007).

Professionally, long term care is provided by paid care givers who are trained to provide different kind of care required by people with a reduced physical or cognitive functions. The type of care demanded by these people vary from support for basic activities to specific medical services such as wound dressing, pain management, medication, health monitoring, prevention, rehabilitation or services of palliative care (Fujisawa & Colombo, 2009).

There is a growing concern among many European countries about increasing demand for long-term care along with the growing number of care dependent aging population (Peeters et al 2012).

In order to narrow the supply and demand gap for long term care, EU countries are getting ready in various ways. Since domestic labour market for health care professionals is not sufficient, skilled labour migration is recommended as a solution even though it has its own side effects from integration and language barriers. Regarding informal care givers such as family, friends, neighbours and volunteers, counties with developed welfare scheme are already providing benefits in cash and in kind for frail older people to be taken care of at home (Lamura et al. 2013)
In Finland, in 2008, 20.3 % people in the age group of 65-74 years old reported severe limitations in daily activities (Johansson 2010). This rapid growth of aging population and the corresponding increase in long-term care demand, tends to be key challenge to municipalities' financial management over the coming decades.

For example, the number of 85 years old forecast is expected to rise from the current 136, 000 to 360, 000 people, or 2.6-times or more by 2040. From this age group, 22.1 % were already in regular home care by the end of 2013(Kauppi et al, 2015)

Currently, the shortage of health care workers is not a critical concern. According to Finnish local authorities report on 2013, there was only 3.2% deficit of practical nurses and 2.8% deficit of registered nurses. Significant deficits were recorded in the professional groups of social workers, psychologists and speech therapists that is higher than the industry average. However, the fast-growing ageing population in the country is expected to increase the need for health care professionals and it is estimated that there needs to be 247 200 employees in health care services, which is 24% higher than the number of employed persons in 2015, to meet the demand of professional care service in 2030 (Kirkonpelto & Vallimies-Patomäki, 2016)

2.3 Independent living and self-care

The concept of self-care includes the ability to care for oneself and the performance of activities necessary to achieve, maintain, or promote optimal health. Different healthcare disciplines share the idea that self-care is conditional and influenced by culture and situations. The effort individuals make towards achieving optimal health depends on individual's capacity and personal characteristics such as amount control over own life, skills, personal values and level of literacy. Selfcare concept may be vary from managing health fully independently to relaying completely on medical care (Richard et al. 2011). Self-care can contribute for human structural integrity and human development in many ways, if it is executed successfully (Söderhamn 2013).

In the developed countries where high life expectancy is evidenced, there have been significant increases in third age dependency ratios (Arif et al. 2014). For many older people, independence is the core component to measure the quality of life(Demiris & Hensel, 2008). The main characteristic of positive ageing is how independent individuals are and how much control they have over their own lives (Brownie & Horstmanshof, 2012)

Self-management and self-monitoring are concepts that have related meaning with self-care. However, self-management refers specifically to managing the impacts and potential impacts of chronic disease and self-monitoring is recognizing symptoms of chronic diseases on body and following up physiological and cognitive measurements and readings (Richard & Shea, 2011).

Richard and Shea identified five concepts related to the role of individuals in managing their healthcare; self-care, self-management, self-monitoring, symptom management and self-efficiency. The relation of these five concepts is demonstrated in the diagram, self-care as a general concept which comprises specific qualities of self-management and self-monitoring that led to symptom management that goes beyond the self-care domain to include care provided by healthcare professionals. Self-efficacy then shown in the model as a mediator due to its impact on the other four concepts (Richard & Shea, 2011).

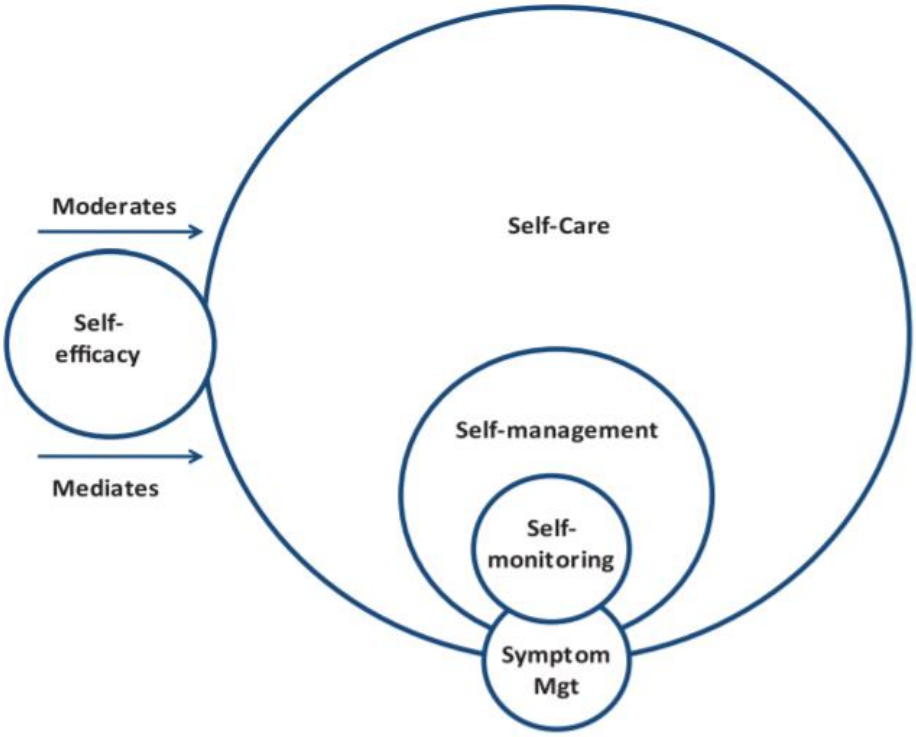


Figure 1. Conceptual model of self-care (Richard & Shea, 2011 p261)

As the physical and cognitive function of elderly adults declines with aging and diseases that come along with senescence, living independently and managing and following up chronic diseases becomes difficult (Beswick et al. 2008). In addition, some older adults are not capable to take preventive actions to protect themselves from situations that adversely affect health and safety. This will lead eventually to home or institutional long-term care (Burnett et al. 2011).

The option of institutional care, has a negative impact on active aging process and well-being of elders. According to older people reflections on a study done about successful ageing process, ‘‘*Older people have identified health; social resources; personal values and belief systems; autonomy and independence; and the capacity to engage in challenging, meaningful, and purposeful activities as factors that moderate the quality of the ageing experience’’ (Brownie & Horstmanshof, 2012).*

Living in care facilities have a tendency to create feeling of isolation, boredom and uselessness among older people. Their quality of life will be compromised and most of them feel as if they are just sitting and waiting do die which diminishes their desire to live. *(*Brownie & Horstmanshof, 2012).

Self-care ability develops motivated by communication, healthy life style and active social interaction. Successful selfcare is defined by active involvement with in the health care system, being physically and mentally active, keeping healthy and mindful lifestyle, keeping active participation in family and social life, being able to stay positive and hopeful as well as well as being satisfied (Söderhamn 2013).

Nowadays, living independently is being valued more and more by most of older population living in the developed society. Social security benefits that enabled older adults to be economically independent, are also among the many factors that encourages independent living (Mutchler et al. 2015)

2.4 Assistive technology for older people

The term ‘‘assistive technology’’ refers to equipment and services that support and maintain the declined physical and cognitive functions due to age and disability. (Reisinger & Ripat, 2014). *‘‘Using a conservative assumption of 20% of the population aged 60 and older being in need of two assistive devices (AD), each lead to a global estimate of at least 800 million items being in use by older people in the year 2050’’* (Garçon et al. 2016).

Among the most commonly used assistive technology devices; custom made kitchen devices, Bathroom aids, location devices, medication devices, fire and smoke alarms and monitoring and surveillance devices are few examples (Seiler 2007). Furthermore, 'Smart homes' that are equipped with assistive devices and systems, that enable frail elderly people to coup with health-related difficulties such as falls, sensory impairment, diminished mobility, medication management and other issues related to diminished cognitive function are being designed and implemented (Demiris & Hensel, 2008).

Assistive technology uses as an umbrella term to define devices and services that enable people with limitation, to cope with their day to day life. The term is widely used currently by most national information systems in Europe and by the European Assistive Technology Information Network. Another term that is mentioned in relation to Assistive technology is 'Ambient Assisted Living'. It is also an umbrella term that indicates the use of information and communication technologies to make the living environment adaptable for people with disability (Andrich et al. 2013)

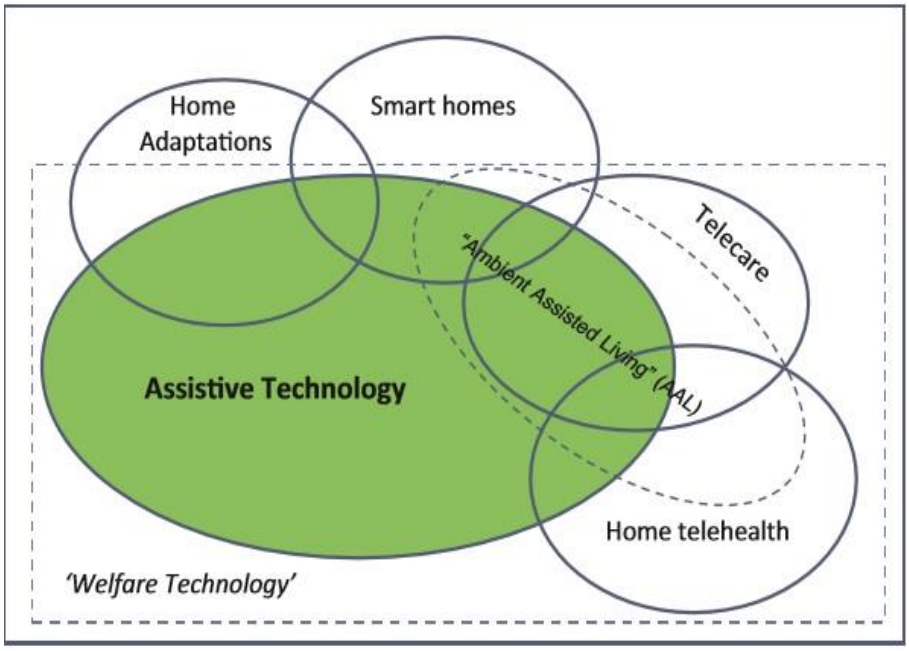


Fig. 2 Assistive technology (Andrich et al. 2013 p131)

The design and mode of smart homes has been under constant improvement since the first smart homes were developed. The improvements are aimed to attain the most effective system of health monitoring, security and comfort for frail elderly people. Health monitoring systems evaluate the general condition such as body weight, heart rate, activity using physiological sensors, movement detector, videos and other sensors. Security systems detect and alert hazardous situations such as fall, smoke, intrusion and other potential dangers that can harm specially the elderly living alone. Comfort systems are intended to ease managing home appliances in daily life. Mainly, comfort systems are focus on environmental modifications such as automatic doors and lights, custom made furniture and equipment and home set up that eases movement with disability aids (Portet et al. 2011)

The technological development towards assistive devices and systems for the elderly became the main focus of researches as the aged population increases alarmingly. The prevalence of long-term conditions increases as people age. As a result, aged people need frequent follow up of their health status. Telecare services are being more and more familiar to help elderly people maintain their independence and continue living in their own homes (Bujnowska-Fedak & Grata-Borkowska, 2015). Telemedicine and telehealth services are exchange of health information between a client and health care provider using ICT technology to monitor health and wellbeing of people living at home. This technology is convenient for both care provider and client. It supports the health care service providers to manage their time more effectively by reducing the need for actual home visits to distant locations. At the same time, it minimizes inconvenience from frequent trip to health care centres for the elderly (Paul & McDaniel, 2016).

In general, aged people are vulnerable to hospitalization and the presence of chronic diseases will increase the frequency of hospitalization. About 20% of older adults which are discharged from hospital get readmitted within a month or less. Telehealth services are expected to reduce hospitalization of older adults through constant monitoring of symptoms of individuals receiving health care from home care agencies, improve communication with primary care providers, and deliver evidence based treatments (Gellis et al. 2014).

Technology advancement in health care also offered social robots to support the process of caregiving. Personal robots that are designed with ability to interact with human are being developed to become part of day to day life (Kachouie et al. 2014).

In Finland, the application of assistive robots for elderly care is under empirical research. An assistive robot named 'Zora' is introduced in to the elderly care service in the city of Lahti. The preliminary finding showed many positive feedbacks from the elderly and their close relatives. Most of them expressed Zora as a good entertainer, funny and interesting due to its childlike characters. There were also some negative feedbacks with a perception of fear, irritation and unacceptance towards the robot. Robot technology is new in the care service however, as the awareness of people grows, it is believed that it can assist physical and cognitive rehabilitation of older people (Melkas et al. 2016).

Studies confirmed that Elderly people fear losing their independence more than they fear death. Assistive technologies could promote independence and, consecutively create positive mood and behaviours, and increase quality of life (Kerssens et al. 2015)

In addition to delivering independence and improve quality of aged life, assistive technologies are also aim to minimize cost of long term care (Harrefors et al. 2010). Western European countries are leaning more towards the idea of keeping elderly at home as long as possible (Peeters et al 2012). In Finland, local authorities are already reducing long term institutional care and shifting care services to home care and home hospitals (Kauppi et al, 2015)

3. THEORETICAL FRAMEWORK

3.1 Self care nursing theory

The theoretical framework is a basic element of a research that provides a connection with an already existing study and guides the hypotheses and choice of research methods within a certain theoretical assumption. It makes a study stronger by allowing the researcher to investigate a phenomenon from different angles and identify key variables that critically affects the phenomena under different circumstances (Swanson, 2013)

The selected nursing theory for this specific study is Dorothea Orem's theory of self-care. Orem presented her theory as a composure of three interrelated theories; Theory of self-care, Theory of self-care deficit and Theory of nursing systems. Self-care theory emphasizes that individuals have to take care of themselves and when they failed to provide needed care due to disabilities and other health problems, nursing care is required (Masters, 2015).

According to Orem, naturally all humans can care for themselves and the focus of nursing should be identifying factors that hinders people from that and support in overcoming the limitations and enable people to attain self-care. when individuals need care that is greater than their current ability, self care disability occurs (O'Shaughnessy, 2014)

Health care professionals, informal caregivers, family, and friends play vital role in supporting self care of older individuals. Care givers needs to provide psycological and physical support to motivate older people to have initiation for self-care and be able to actualize self-care activity.Older people with illnesses and diseases may easily lose their motivation to provide self care. They need support from care givers to identify and prevent self-deception (Söderhamn, 2013).

Orem identified ten factors that affect the value of therapeutic self care demand of an individual. These are age, gender, developmental state, health state, pattern of living , health care system factors, family system factors, sociocultural factors, availability of resourses and external enviromental factors(Masters, 2015).

Nurses responsibilities in supporting self-care includes assessing abilities of patients to provide caring for own selves and identifying limitations that affects self-care abilities. Nurses also involve in selecting assistive technology services and devices that supports individuals in their disabilities and help them to attain self-care (Masters, 2015).

Human beings should be active and communicative among their society and environment to stay alive and remain functional. The ability to take actions when needed and making sound judgments, indicates maturity to care for oneself and for others. Matured humans with structured relationships understand their duties in their social group and take responsibilities to give care when needed. The interaction between self- care, therapeutic self-care demand, and nursing agency is demonstrated in social, contractual, and legal dimensions in the below diagram (Tylor & Renpenning, 2011).

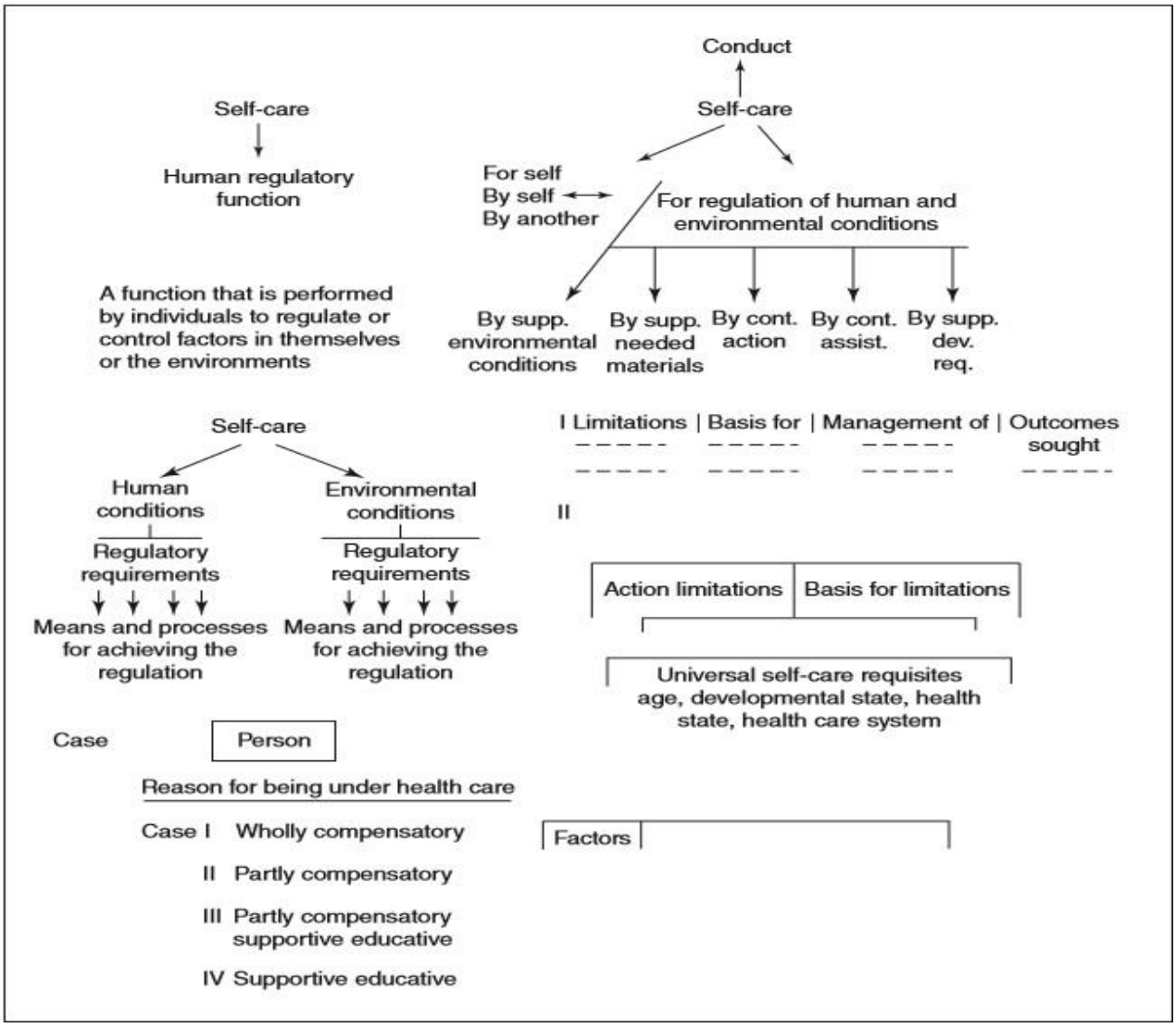


Fig 3. The science of self-care (Tylor & Renpenning, 2011 p22)

4. AIMS AND RESEARCH QUESTION

This study is aimed to explore the option of assistive technology to support elderly people's self-care. As the world's population sharply ages, there would not be enough care work force that can meet the demanded amount of long term care. Enabling the elderly people to care for themselves and stay at home as long as possible contributes a lot for positive ageing and quality of life.

Nurses play important role in supporting elderly people to attain self-care. Hence, having adequate knowledge about the existing assistive technology devices and services helps them to educate their clients and select a suitable technology support that elderly people can use at home.

The research question in this study are:

1. What is the role of assistive technology in supporting self-care of the elderly?

2. What kind of assistive technology is currently available for use by the elderly?

5. METHODOLOGY

This study is a qualitative literature review based on previous scientific studies done on the subject. According to Randolph, a literature review is a means of incorporating studies of the influential researchers and research groups in a particular field to present the writers knowledge about a certain phenomenon or subject matter. Conducting literature review involves recognizing a researchable problem and investigating based on a ground theory to gain insight on what has been done so far on the subject and identifying recommendations for further research (Randolph, 2009).

5.1 Data collection

The data for this study is collected mainly from Arcada's library portal (Libguides) which provides accesses to academic data bases and articles in nursing. The data bases EBESCO, SCIENCE DIRECT, SAGE and PUBMED were used as a source of secondary data for this literature review. In addition to that GOOGLE SCHOLAR and GOOGLE search engines and the web pages of World health organization(WHO), European commission(EC) and Statistics Finland were also explored seeking for statistics and other relevant data.

In order to retrieve the most relevant data from the Academic data bases, the writer used advanced search method of applying 'AND' to conjugate key words 'Assistive technology', 'self-care', 'elderly', 'ageing' and 'independent living'. As the study topic is quite a new issue, available articles written in the area appear while applying the key word 'assistive technology'. However, most of these search results were related to a specific assistive technology for a particular chronic disease management. Therefore, the writer combined the key word 'assistive technology' with one or more other key words.

Different data bases have different interpretation of the keywords. For example, some databases provide more relevant articles with the keyword 'aging' while others have better results with 'elderly'. The same principle applied for key words 'self-care' and 'independent living'. Therefore, different words with similar meanings were used in different data bases to get more articles out of each data base.

Data from search engines and the webpages were retrieved using title search such as ‘Assistive technology for elderly’, ‘assistive devices’, ‘ageing and functional decline’, ‘shortage of long-term care providers’ and by combining two or more key words. In the table below, the inclusion and exclusion criteria is briefly summarized.

Inclusion criteria	Exclusion criteria
Articles published 2007-2017	Articles published before 2007
Articles relevant to research question	Articles irrelevant to research question
Peer reviewed scientific articles	Non-academic publications
Full text and accessible free of charge	Abstract only and fee requiring articles
Articles written in English language	Articles written in any other language

Table 2. Summary of inclusion and exclusion criteria

Although the time limit for search of articles was set to articles published between 2007-2017, the writer selected as much as possible recent articles to get the most updated insight on the subject.

Two searches were done in EBESCO by combining the key word Assistive technology with elderly at first and with self-care. Prior to that the writer carried out several searches that have not resulted any relevant article to the subject. The key words ‘Assistive technology’, ‘elderly’ and ‘Ageing’ resulted the most relevant articles during the searching process. The relevance of the articles was measured first, based on the titles of the articles and the writer went through the abstracts to pick the most relevant ones to the subject.

After selecting the 11 articles, the writer noted out core concepts and key phrases and summarized them in a mind map to clarify the answers for the two research questions.

Below is a table that shows data search and retrieval process briefly.

Table 1. Summary of data retrieval process

Data source	Keywords	Time range	№ of hits	Relevant articles	Selected articles
EBESCO	Assistive Technology AND elderly	2007-2017	56	21	6
	Assistive technology AND Self-care	2007-2017	12	2	1
SCIENCE DIRECT	Assistive technology AND Age-ing	2007-2017	889	4	1
	Assistive technology AND El-derly	2007-2017	48	8	1
SAGE	Assistive technology AND Ageing	2007-2017	9	2	1
PUB MED	Assistive technology AND inde-pendent living AND elderly	2007-2017	15	5	1
Total			1029	42	11

From the gathered relevant articles, those which provide answers for the research ques-tions of this study were selected. Due to limited availability of studies done in the area, data searches resulted narrow output. All articles used in this literature review are listed together with summary of the main conclusion of the article, as follows:

1. Siegel & Dorner, 2017: Information technology for active and assisted living-influences to the quality of life of an ageing society, International Journal of medical informatics. Summary: *The study was done to explore the impact of ICT use on quality of life and subjective health of the elderly. The findings showed that use ICT as a means of assistance improves quality of life by empowering the elderly to have control over their health problems as well as increase their safety regardless of their cognitive and functional decline.*

2. Khosravi & Ghapanchi, 2016: Investigating the effectiveness of technologies applied to assist seniors, International Journal of medical informatics. Summary: *The study investigated the role of assistive technology to assist mobility, provide social connection, decrease depression and reduce hospitalization for elderly people living at home. It identified that use of assistive technology such as ICT, robotics, telemedicine, sensor technology, medication management applications and video games are effectively assisted elderly people to live independently safely and actively.*

3. Kerssens, 2015: Personalized Technology to Support Older Adults with and without Cognitive Impairment Living at Home, American journal of Alzheimer's disease and other dementias. Summary: *The focus of this study was a personalized touch screen technology called 'Companion', which delivers psychosocial, nondrug interventions to people living with dementia in their home. This technology is found to be easy to use, significantly facilitated independence living and reduced work load of care givers.*

4. Kachouie et al. 2014: Socially Assistive Robots in Elderly Care: A Mixed-Method Systematic Literature Review, International Journal of Human–Computer interaction. Summary: *The study examined and identified that the socially assistive robots have positive impact on well-being elderly people living at home. It also concludes that SAR have a potential to improve older adult's quality of life and decrease health care cost.*

5. Lexis et al. 2013: Activity monitoring technology to support homecare delivery to frail and psychogeriatric elderly persons living at home alone, Technology and disability Journal. Summary: *The study was done about an activity monitoring device called 'QuietCare system' and concluded that it can support frail older people to live independently at home.*

6. Andrich et al. 2013: Service delivery systems for assistive technology in Europe, Technology and disability Journal. Summary: *The finding of this study showed that use of AT and personalised environmental modifications to support autonomy of people with disabilities.*

7. Agree & Freedman, 2011: A Quality-of-Life Scale for Assistive Technology: Results of a Pilot Study of Aging and Technology, Physical therapy journal. Summary: *This study surveyed and reported that assistive technology plays significant role for increasing independence and facilitating physical rehabilitation. Thus, improves quality of life for elderly people.*

8. Harrefors et al. 2010: Using assistive technology services at differing levels of care: healthy older couples' perceptions, Journal of advanced Nursing. Summary: *The study surveyed older couple's perception about assistive technology and found out that it facilitates home based care for the elderly and supports independent living.*

9. Mirza & Hammel, 2009: Consumer-Directed Goal Planning in the Delivery of Assistive Technology Services for People who are Ageing with Intellectual Disabilities, Journal of Applied Research in Intellectual Disabilities. Summary: *This study concluded that assistive technology and environmental modification supports people aging with intellectual disability to coup living at home and involve in their self-care.*

10. Carswella et al. 2009: A review of the role of assistive technology for people with dementia in the hours of darkness. Journal of technology and health care. Summary*: This study showed that Assistive technology can increase safety of older people living with dementia and face problem of wandering around at night.*

11. Molin et al. 2007: Living at home with acquired cognitive impairment – Can assistive technology help? Technology and disability Journal. Summary: *The study explored the potential of assistive technology to support people with cognitive impairment to continue living at home and recommended that it is advantageous to develop and implement assistive technology for care of elderly people living at home*

5.2 Data Analysis

In this literature review data was analysed using inductive approach. Both inductive and deductive data analysis methods involve preparation, organization and reporting result phases. Preparation phase in inductive approach includes collecting suitable data for content analysis, making sense of the data, and selecting the unit of analysis.

And the organization phase includes open coding, creating categories, and abstraction (Elo et al. 2014) Inductive approach of analysing data uses the actual data itself to derive the structure of analysis instead of using a predetermined framework. This approach is the most commonly used approach to analyse qualitative data (Burnard et al. 2008).

The content of the collected data was evaluated by its relevance to the research questions and the aim of the study. Selected articles were then organized by using open coding process. Guided by the research questions, the selected 11 articles were sorted in to two categories. The first category was for articles that contains details about 'the role of assistive technology in supporting self-care of the elderly', the second category contains articles which describes 'current use of assistive technology by the elderly'. Two articles were used to answer both questions since they contain relevant concepts for both research questions.

In order to ease understanding of the concepts, key phrases were selected from the articles and illustrated in a mind map diagram at the results session of this study under each research question.

5.3 Ethical considerations

The most common challenges in conducting qualitative studies arise from dilemmas such as maintaining confidentiality, establishing honest and open interactions, and avoiding misrepresentations. It is very important to take into consideration anonymity, confidentiality and informed consent while carrying out qualitative research (sanjari et al. 2014)

All of the 11 articles used in the literature review were retrieved from an official academic data bases that all students of Arcada University of Applied Science have access to. The details of sources of data and the retrieval is clearly presented and original ideas of authors are maintained while paraphrasing. Ideas that are taken directly word by word are put into quotations to avoid plagiarism.

In general, in this literature review ARCADA's principles of ethical conduct is implemented by giving proper credits for the authors and by clearly mentioning all sources of information as a reference.

6. RESULTS

This part of the study aim to provide answers for the two research questions according to the information contained in the selected 11 articles. Basically 6 articles are used to provide answers for each question but in some instances an article that is used to answer question 1 is used again for question 2 since the content is relevant for both questions.

6.1 Role of assistive technology to support self care

Ageing people deal with social issues such as interpersonal relationships and social recreative activities, in addition to unavoidable age-related physical and cognitive declines. As the intellectual ability of older people declines, there comes the need for assistive technology that is designed to support their intellectual disability and increases the opportunities to have community and social participation and options for leisure activities. Prior studies by Hammel et al. in 1998, 2000 and 2002, have confirmed that Assistive technology plays a significant role in supporting older people with intellectual disability to maintain or improve a cognitive function and to support their community living and participation (Mirza & Hammel, 2009).

Non-drug psychosocial interventions delivered using computer technology have provided support for neuropsychiatric symptoms for elderly people who has declined cognitive function due to dementia at late life. A study done by Kerssens et al. 2015 to investigate feasibility and adoption of a touch screen technology named ‘‘The Companion’’, which delivers psychosocial, nondrug interventions to elders with dementia living in their home, received positive feedbacks from the elders and their care givers who tested the product. The respondents stated that it contributes for quality of life and improving wellness by easing chronic disease management (Kerssens et al. 2015)

Elders going under physical therapy due to functional decline, take more time to rehabilitate since their body responds very slowly to physical exercise. However, assistive technology is proved to have a positive impact on rehabilitation process and gaining physical independence. In most cases, assistive technology users have shown delays in functional decline and experience less and less difficulties than people relying only on personal assistance (Agree & Freedman 2011).

In addition to this, assistive technology supports psychological well-being as it provides elders with the ability to choose the type of activity, time to do the activity and ways to carry out. For aged people, being able to live in their own houses rather than long term care facility, is the core component of quality of life (Agree & Freedman 2011).

Dementia, chronic diseases, depression and risk of fall are known to affect quality of life and independence of older adults and eventually lead them towards institutional care. In order to make frail elders continue living at home safely, there have been many researches done about application of Information Communication Technology(ICT) and sensor technology as an aid. A study done by Khosravi and Ghapanchi identified that assistive technology products and services such as assistive robots, medication dispensers, telemedicine and sensory technology helped safe medication intake, preventing and detecting falls, minimizing depression and supporting independent living and self-care (Khosravi& Ghapanchi, 2015).

Elder people living with dementia face confusion and nervousness usually in the late afternoon or early evening that can be expressed as day-night reversal. This disturbed pattern of sleep often increases the risk of falling and injury at night time. Assistive technology offers environmental modifications such as grab bars to help them safely move to use toilets, walk in and out of doors and entry and exit of showers. Also, monitoring alerting technology called Accelerometers in smart homes, measures loss of balance and falling. In the incident of fall or any other call for help, microphone arrays installed in the houses can help to facilitate communication and get external assistance timely (Carswell et al.2009).

Assistive technology benefits older adults by providing them a chance to stay at home safely and besides that, it eliminates burden of care givers and nurses. Harrefors et al. 2010 confirmed that Nurses can have better use of their time to help fully care dependent patients. As a result, there would be better use of time and human resource and reduction of healthcare cost (Harrefors et al. 2010)

Summary of role of assistive technology for self- care

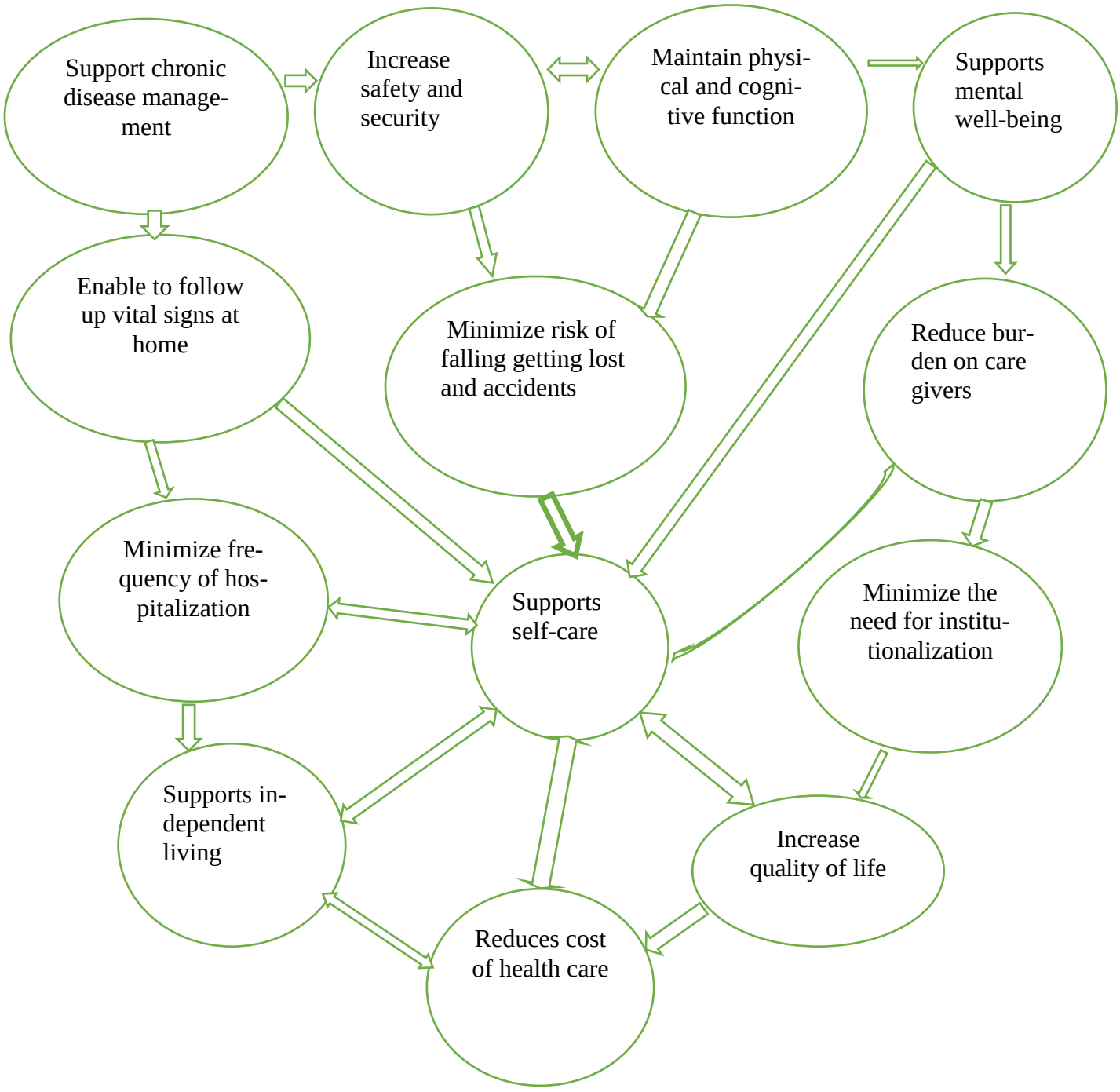


Figure 4. Illustration of role of assistive technology to self-care

6.2 Currently available assistive technology for the elderly

Information and communication technologies (ICT) are believed to fill the gap in demand for caring professions without compromising the quality of care. The contribution of technology to elderly care in institutions and at home is under continuous research and development. There are many large European projects about facilitating independent living at home. Currently, assistive technology products such as safety alarms, smart sensors and remotely monitored device are being developed, installed and investigated among other things (Molin et al. 2007).

In Europe, Assistive technology service provision became an important part of each country's healthcare and social support policy. The system and the extent of delivery vary from country to country. In some systems, it includes personalized environmental adaptation such as modifications to bathroom, kitchen and general areas. While in others it is limited to products such as prosthetics, wheelchairs, orthotics, hearing aids and foot ware which helps to maintain functional capacity than environmental modifications (Andrich et al 2013). The variety and availability of technologies and supportive living environments is showing encouraging developments for people with disabilities to live independently and participate in daily activities (Agree & Freedman, 2011).

There has been many researches done about use of Assistive technology for elders however, the awareness is limited about the diversity and effectiveness of assistive technologies (Khosravi& Ghapanchi, 2015). Among many assistive technology products and services that are already in use currently, but not known widely, few are listed as follows

> **Activity monitoring technology**- in Netherlands an activity monitory system called 'QuiteCare' is being used for older people living alone at home. This technology gathers information about the client's activity using infrared motion sensor technology that are installed different strategic places with in the house. The sensors analyse room temperature, the frequency and duration of movements in the room and generate activity pattern of the client in the first two weeks. The system then detects when there is abnormal activity, that might be potentially harmful or dangerous to the client (Lexis et al. 2013).

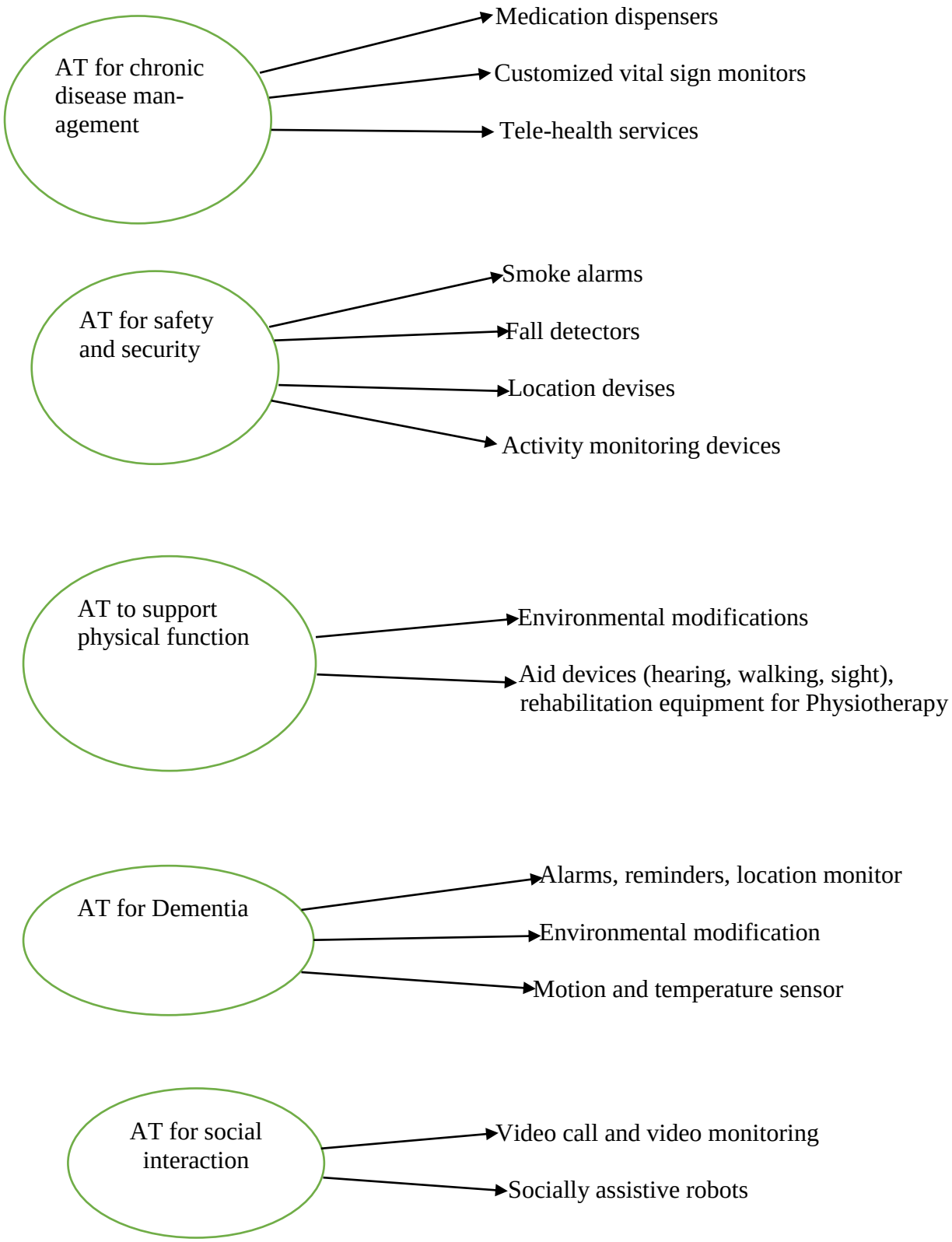
It generates yellow or red light depending on how much the detected motion deviates from the predetermined activity pattern. Yellow-light emergency alerts sent to care givers or registered incise of emergency person while the red-light alert will transfer to 24/7 emergency centre for immediate action (Lexis et al. 2013).

- **ICT Solutions (Smart homes and Tele-health applications)** – there are variety of ICT solutions already put in use to increase quality of life of the elderly living at home. Smart homes that are designed with assurance systems (fall detectors, vital data analysis, behavior monitoring) and modified environmental settings are getting higher acceptance for keeping the elders safe, secured and comfortable in their own homes. According to a literature review done by Siegel and Dorner, ICT solutions are integrating monitoring and tele-health solutions to address physiological needs, social relationships and safety and security issues. Tele-health services empower older people to participate in their own health care by facilitating communication with care professionals and providing wide access to health and well-being information (Siegel & Dorner, 2017).

- **Socially assistive Robots –** there are several socially assistive robots developed for the purpose of use in elderly care work. Although their function and outer look varies, mainly they are made with camera, touch sensors, bumper sensors, microphones, speech synthesis system and software communication system with several web services to retrieve and update information. The robots are also able to interact with human, show facial expressions and emotions, talk, dance, sing and ask and answer different questions. The use of these Robots is already implemented in Japan, Australia, New Zealand, USA, Netherland and Italy at home and public health care services. The response from the elderly was mostly positive and the robots contributed in minimizing boredom, loneliness and depression and improving well-being (Kachouie et al. 2014).

In the diagram below different assistive technology products and services are listed according to the support they provide for elderly people living at home.

Figure 5. Summary of currently available assistive technology devices and their use



7. DISCUSSION

The fast-growing ageing population, the upcoming shortage of nurses and other care givers and raising concern about ways of supporting self-care and independent living of elderly were the main factors that initiated the writer to conduct this study.

In the attempt to decrease the gap between care demand and supply, shifting from total dependence on human assistance to technology is presumed to be the wisest and most effective solution (Khosravi & Ghapanchi, 2016). This transition is expected to reduce cost of health care significantly and allow older people to age actively and independently (Agree & Freedman, 2011).

According to the information gathered from articles used in this study, ageing comes with problems such as functional decline, disability, cognitive decline, dementia, chronic diseases, social isolation, loneliness, depression and etc (Mirza & Hammel, 2009). All of these problems require care and support from formal and informal care givers. However, the available health care work force will not be sufficient to satisfy the demanded amount of care (Khosravi & Ghapanchi, 2016). Relaying on informal care givers is not an option due to low fertility rate which limited succeeding generation and difficult economic conditions (Harrefors et al. 2010).

Assistive technology plays important role in maintaining physical function, preventing functional decline and enabling older people with disability to cope up with their day to day life routines (Andrich et al. 2013). For older people living with Dementia and other cognitive problems, assistive solutions and environmental modifications have a potential to provide an opportunity to live safely in their own homes without depending fully on caregivers. This also benefits nurses and informal care givers by reducing their burden (Kerssens, 2015).

Independence is a core component of quality of life for the elderly people. Studies confirmed that elderly people value living in their own house and being able to care for themselves more than anything (Kerssens et al. 2015). Supporting elderly people to maintain their self-care ability is nowadays a popular approach among many European countries, where share of aging population is high. (Agree & Freedman, 2011).

Therefore, several kinds of assistive technology products and services are being developed and put in to use to create comfortable and safe living environment for the elderly (Harrefors et al. 2010)

Technology has provided variety of products and services to facilitate good quality nursing care and to empower the elderly to maintain self-care ability despite their physical and cognitive limitation due to ageing (Molin et al. 2007) Self-care ability is defined by the extent of control that individuals have over their life. It comprises different aspects of healthy living and well-being such as proper nutrition, mobility, disease management and social activity (Mirza & Hammel, 2009). Although functional and cognitive status of the elderly limits the extent of control that they have over their lives, assistive technology is proven to have a great potential for maintaining quality of life and minimizing negative impacts of aging (Agree & Freedman, 2011).

There has been concerns about the level of readiness of elderly people to shift from human assistance to technology assistance and related risk of minimized actual human contact (Kachouie et al. 2014). In addition to that there was a great concern about privacy specifically on technology products and services that involve video monitoring devices (Siegel & Dorner, 2017). Readiness of older people is expected to progress with time, awareness and experience. However, implementation of technology solutions need constant control and evaluation of the elderly people's perception (Agree & Freedman, 2011). Nurses in home care services play important role in evaluating the effectiveness of assistive technology applied and notice when there comes a need to change or modify the system in use. Alternative solutions can be proposed in accordance with the specific issues arise (Harrefors et al. 2010).

Although the potential of assistive technology is high in supporting self-care of the elderly, the implementation is limited to mainly disability aids and different kinds of alarms. Low level of awareness is not only among elderly people and but also among nurses providing home care services. For example, in this study the writer had an initial plan to include nurse's role in the care provision assisted by technology and nursing perspective of assistive technology implementation. However, most of the studies were done from medical technology aspect and there were not studies conducted from the nursing perspective available in English language in data bases accessed.

Relating results of the study with theoretical frame work

Dorothea Orem's self-care theory that is used for this study states that people should be able to perform actions in order to protect themselves from threats and to maintain optimal health and well-being. This ability is what we call self-care ability. When self-care ability is not enough to meet the required amount of care demand due to ageing, diseases and other factors, self-care deficit exists (Tylor & Renpenning, 2011).

In the occurrence of self-care deficit individuals need assistance from others to function in their day today life. Unfortunately, the demographic changes that resulted high number of aged population and scarce amount of care givers, thrived the need for technological interventions (Kachouie et al 2014).

Assistive technology empowers people to take actions on their own behalf regarding their health and well-being (Agree & Freedman 2011). Orem highlighted that Nurses have knowledge and skills that can benefit people with declined ability to provide continuous self-care due to health and other physiological conditions. However, people need to maintain their self-case ability as long as possible, in order to regulate their human functioning development (Tylor & Renpenning, 2011).

According self-care deficit theory, nurses support self-care ability of their clients by educating, guiding, providing physical and psychological support and by providing and maintaining an environment that supports personal development (Masters 2015). Connecting this theory directly to this study, assistive technology includes information communication technology that facilitates tele-health services. These services provide an opportunity for the nurses to have frequent communication with clients and educate as well as provide psychological support, directly from the health care center. It also saves time and resource by reducing the need to make actual visits to client's home.

8. Conclusion

Demographic and economic changes are affecting health care provision system. In order to allocate scarce human and financial recourse efficiently for quality care service, assistive technology plays vital role in equipping elderly with self-care ability and facilitating home care service delivery.

The beneficiaries of Assistive technology can be classified in three categories. The first category includes older people living at home. For this group, assistive technology facilitates independent yet safe living, prevent the need to be under institutional care, reduce depression, increase well-being and quality of life. Another category who benefits from assistive technology is health care professionals. Effective implementation of assistive technology facilitates better use of time for care givers. It reduces overload of work and resulting burnout. This minimizes medical mistakes, maintain quality of care and enable organized and well-structured flow of work. The health care system also benefits from use of assistive technology. It advances care service provision and helps to establish more organized and effective system which satisfies the elderly and motivate health care work force.

8.1 Strength and limitations

This study attempted to explore the impact of assistive technology on self-care of the elderly. Several studies were conducted aiming to develop the most effective way of keeping elderly people at home. However, there have not been much done in increasing awareness of nurses on the variety of available technology solutions. The writer intends to create this awareness by introducing the available products and services with the potential benefit they have for supporting self-care.

Initially the writer had a plan to conduct a quantitative study to researches the current use of assistive technology in home care service for the elderly and its impact on supporting self-care, focusing in home care services in Helsinki metropolitan area. However, the scope of the study was too wide for a bachelor's degree thesis. Therefore, literature review was conducted instead, to be used as a base for master’s degree dissertation.

Limitations of this study mainly arise from lack of enough information in the area of study. Technology aided care provision is an issue that recently gain enormous amount of attention due to abrupt demographic changes. Although the writer tried to put together several concepts from medical technology areas in to a nursing aspect, the study still could not demonstrate concretely nurse's responsibility in implementation of assistive technology.

8.2 Recommendation for further study

Assistive technology implementation affects home care service and nurse's role in many ways. However, there are not enough studies done from the nursing perspective. More studies need to be done to create awareness among nurses and to include some aspects of medical technology in to nursing education.

Furthermore, future researches have to put in to consideration strategies for a smooth transition to technology assisted care provision.

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