The Impact of Artificial Intelligence on Healthcare for Elderly

A Literature Review

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Abstract

Robotics are great achievement of technology. The values they can bring to human are productivity, safety, time and money saving. Since their appearance, their contribution has made robots to become more widespread in various industries, from manufacturing to healthcare. Specifically, in healthcare, robots make a big impact by their participation and usefulness in surgical, disinfection and taking care for elderly. The aim of this literature review was to gather evidence-based information about how impacting robots can be in delivering healthcare for elderly.

The resources used in this thesis were obtained from reliable database, such as CINAHL (EBSCO) and Academic Search Elite which are specializing for healthcare studies. The article search process follows principles of inclusion criteria. Then the relevance of the topic, abstract and ultimately full text of the articles was evaluated leading to eight selected articles in total. After that, content analysis were performed, key findings were summarized in the table.

The study findings show that robotics can benefit elderly by assisting them in mobility, physiological assessment and monitoring, activities of daily living, rehabilitation, navigation, improving care quality for elderly with dementia and providing companionship. The study also shows some limitations on using robotics. However, there are more positive sides than negative ones.

Keywords (subjects)
robotics, healthcare, elderly, benefit

Miscellanous

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1 Introduction

As a discipline, robotics has conventionally been defined as "the science which studies the intelligent connections between perception and actions," though in recent years this has shifted outward, becoming focused on problems related to interacting with real people in the real world. (Siciliano & Khatib, 2008). The use of robots in healthcare represents an exciting opportunity to help a large group of people. Robots can be used to enable people with cognitive, sensory, and motor impairments, help people who are ill or injured, support caregivers, and aid the clinical staff. (Riek, 2017).

According to the World Bank, 2011, an estimated 20% of the world's population experience difficulties with physical, cognitive, or sensory functioning, mental health, or behavioral health. These experiences may be temporary or permanent, acute or chronic, and may change throughout one's lifetime. Of these individuals, 190 million of them experience severe difficulties with activities of daily living tasks (ADL). These include physical tasks (basic ADLs), such as feeding, grooming, and mobility, to cognitive functioning tasks (instrumental ADLs), which include goal-directed tasks such as problem-solving, finance management, and housekeeping. (Graf, 2008).

Shi & Singh, 2014, stated in their study that, there is a substantial healthcare labor shortage i.e. there are far more people who need care than healthcare workers available to provide it. Hence the need to find ways to breach that gap.

There have been several studies of robots in healthcare surroundings including transport robots used to deliver medications and supplies, telemedicine, or telepresence robots used to diagnose and interact with patients, and companion robots designed to provide companionship to older adults in care facilities. Ljungbald et al., 2012, conducted a study to find out staff use and perception of a transport robot in a hospital and found four qualities attributed towards the robot: machine, alien, worker, and work partner. In another study of transport robots in a hospital, Siino & Hinds, 2005 examined the role gender played in how female and male workers made sense of the robot. According to Mariappan et al., 2011, a telemedicine robot can be used by surgeons to diagnose patients remotely. On the other hand, patients and their families who interacted with a telemedicine robot in an intensive care unit were interviewed and found that the use of robots in this situation was viewed favorably (Sucher et al., 2011).

Whereas Chang et al., 2013 used Paro with older adults with dementia and found that with time, participants increased their usage and willingness to use Paro.

2 Roles of Robotics in Healthcare

2.1 Robotics in providing care for Elderly

Technological advancement is a worldwide trend which special effects on human life are significant. Robots are part of the greatest technological progress in recent years. The use of robotics has led to remarkable improvement in human lives. Currently, robots are a permanent part of countless fields including: manufacturing, medical and household services, military activities, and entertainment, according to Yampolskiy, 2013.

The elderly population is increasing world-wide which makes their needs very significant to health providing establishments, caregivers, and family members. These resulted in the introduction of healthcare robots which have an influential role in assisting the elderly to autonomously complete caring tasks. They also help us to compensate for the shortage in caretakers (WHO, 2016). According to Banks et al., 2008, there are a lot of concerns that trusting elderly care to robots could strengthen social isolation, resulting in deception and loss of self-respect, whereas other scholars have pointed to some proof, that confirm the benefits of robot care for the elderly.

There is a thought that because of its impact on the area of care, the technology which is applied in this field should be investigated, this means that care and technology are in conflict. One point of view assumes that caring and technological knowledge are different concepts; that the two are the demonstration of different fields of meaning (Wilson, 2002). In this case, one field embodies images of personal identity and feeling (care) and the other one produces that of objectivity and standard regulation (technology) (Wilson, 2002).

As a result of the recent progress in robotic, robots these days are capable of complex movements, are very skillful and flexible, and also have the ability to mutually learn from and interacting with humans. Based on these improvements, the potential application of robots has greatly expanded (Manyika et al., 2013).

From IFR, 2014, the sales of robots as assistance for the elderly and handicapped people has reach about 6,400 units from 2013-2016, and it is expected to increase considerably within the next 20 years. According to Kartal et al., 2016; Portugal et al., 2015; Veloso et al., 2012, several types of tasks are made possible by making use of the services presented by autonomous service robots. Models are taking care of old people at home or accompanying guests in multi-level buildings (Veloso et al., 2012).

Considering the entity of a care robot, several definitions are currently presented: Carebots are robots that are designed to assist people, support them, or provide the patients, disabled, young, old or vulnerable people with needed care, in different places and situations like homes or hospitals (Vallor, 2011).

It is believed that noble care (appreciated care) is a kind of care that corresponds to the shifting needs of individuals. This is one of the most significant points that the literature of ethics care is concerned with; care is just regarded as "good care" when it is personalized (Tronto, 2010; Vanlaere & Gastmans, 2011).

Cohn & Taylor, 2010, stated that nearly 10,000 Americans turned 65 each day and have become in need of care. This increase will last for an additional 15 years with the same speed. This will increase the levels of Medicare and, subsequently, increase pressure on the workers of primary health care who, due to the shortage in number, cannot cover all the needs at present (Health & Services, 2013). From a demographic studies conducted by Europea, 2014, it is believed that as the average life expectancy over the years increases, the European population is getting older. Recent data released by European authorities shows that, at present, around 17.5% of the total population (88.5 million out of 505.7 million people in 2012) are aged 65+. And Yet, Conrad, 2015; Hendrich et al., 2015, estimated that this percentage will go up to 30% (164 million people) in 2050, and the corresponding projections of the increase for China are 6.9% (88 million people) and 23.9% (400 million people) (Hendrich et al., 2015).

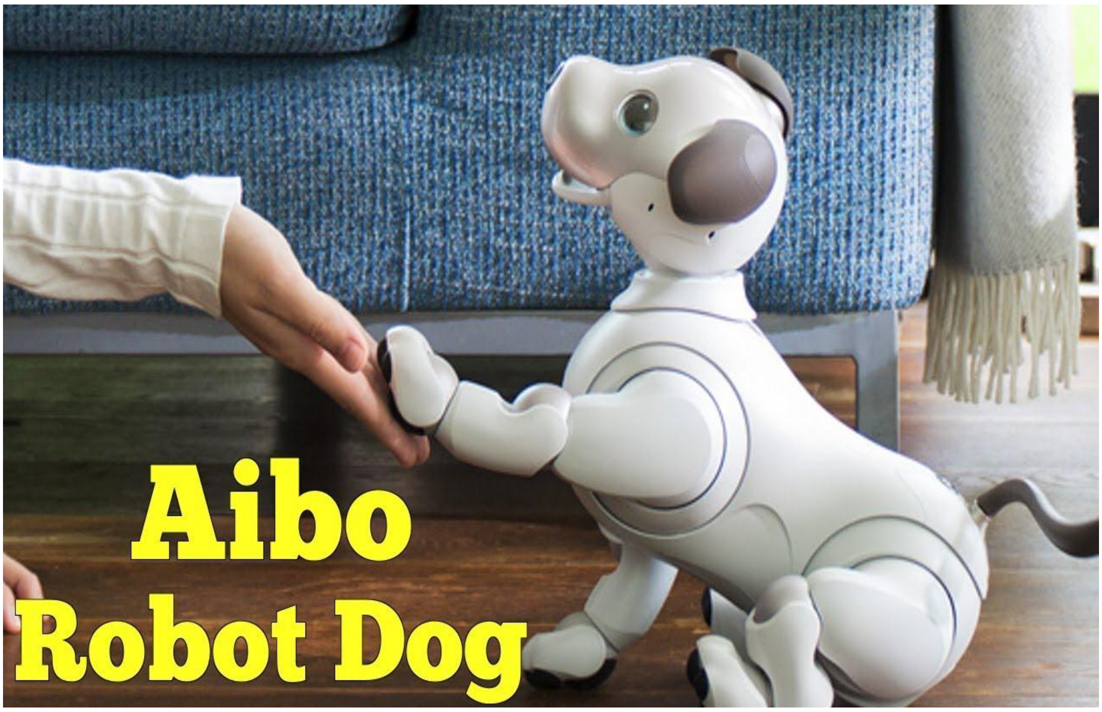
The immobility problems of elderly people also means that they completely depend on others to accomplish their daily life activities at home, and that they are unable to go out for shopping, or visiting people. In addition, some forms of memory loss are expected with increasing age, not to mention dementia as a present day challenge. Beside the physical weakness in performing personal activities, elderly people usually need someone to remind them of the need to complete various actions, or tell them about the positions for, and elements of those activities (Sharkey & Sharkey, 2012). Elderly people are permanently exposed to the risk of falling over or getting sick, or getting confused or lost. They should not be left alone, but be attended to and be offered friendship, love and care.

2.2 Types of care which Robotics provide to Elderly

Sharkey & Sharkey, 2010b, stated that elderly care has three main areas in which robots are considered as useful or essential; these are

- Assisting elderly and/or caregivers to fulfill their works and duties.
- Monitoring health and function.
- Providing companionship.

Assistance robots and elder care:



The world will be soon facing with a situation of rapid elderly population growth. For example, Japan will be having a third of the population that will turn 65 and older in the year 2035. Therefore, the demand for nursing care for the elderly, which is currently high, will become more elevated. The raising question is how to provide sufficient nursing care for a large amount of elderly when the human resources might be understaffed and unable to meet the demand.

It is predicted that other countries with a high population, such as Germany, China and Italy will be having the same problem. To tackle this challenge, Japan has carried out some strategies. Besides attracting more laborers into the nursing field, which also includes foreign laborers, the government has researched and proceeded on robotic projects which help to take care of the elderly. To serve for this purpose, various types of robotic have been appeared to serve for various needs. So far, many examples of the usefulness of robotics have been demonstrated in social media to prove for their positive roles in caring. For example, some robotics like Robot Paro that can simulate pets by gestures, such as crying softly, catching hand, cuddling which can help to befriend with and bring fun to human like dogs and cats. Therefore, it helps to reduce the loneliness of the elderly. Pepper is another robotic model that can accompany the elderly in routine exercises and be able to communicate few words. Cyberdyne is the type that helps nursing workers in lifting and moving people. Resyone bed is an invention by Panasonic which includes two parts: one is a bed and the other can transform into a wheelchair. These inventions do not only benefit the elderly but also keep nursing workers from back injuries (Reuters 2019).

In case people want a partner to dance with, a robot named B.E.N can do this task. Moreover, it can also be good at the role of waking up and comforting human when necessary. To meet more demands from human, more robotics with advanced features have been produced. Who does not love a type of robotics which is called ”affective robotic”, supports human in terms of emotional by being able to respond and react to human's actions beside being able to prepare and deliver meals. The elderly can, therefore, benefit from these robotics by having a "like-friend" accompany besides and a tool which can support in daily living tasks. (Digital Trends 2019).

In rehabilitation, robotic is designed to play a useful role to help improve the condition. Tree is a device that can help in balance support and navigation (Reuter 2019). In addition to people with mobility issues can be helped to be able to move more easily, robotic exoskeleton can also operate light, television and some other equipment in the house. By owning this robotic, elderly patients will be probably more comfortable in living independently (Digital Trends 2019). Loss of mobility is commonly seen in the elderly, especially after a serious disease. In order to assist them in walking, a robotic which is a combination of LSRO and NCCR are designed to help in motion. (Robohub 2019).

According to Time, robotics can play a big role in assisting for eldery in monitoring health and function. When you see how Stevie, Parlo and Paro robotic remind the elderly to take the medicine at the right time, you will start to believe more on how much convenient elderly's life can be since the appearance of this robotic generation. (Times 2019).

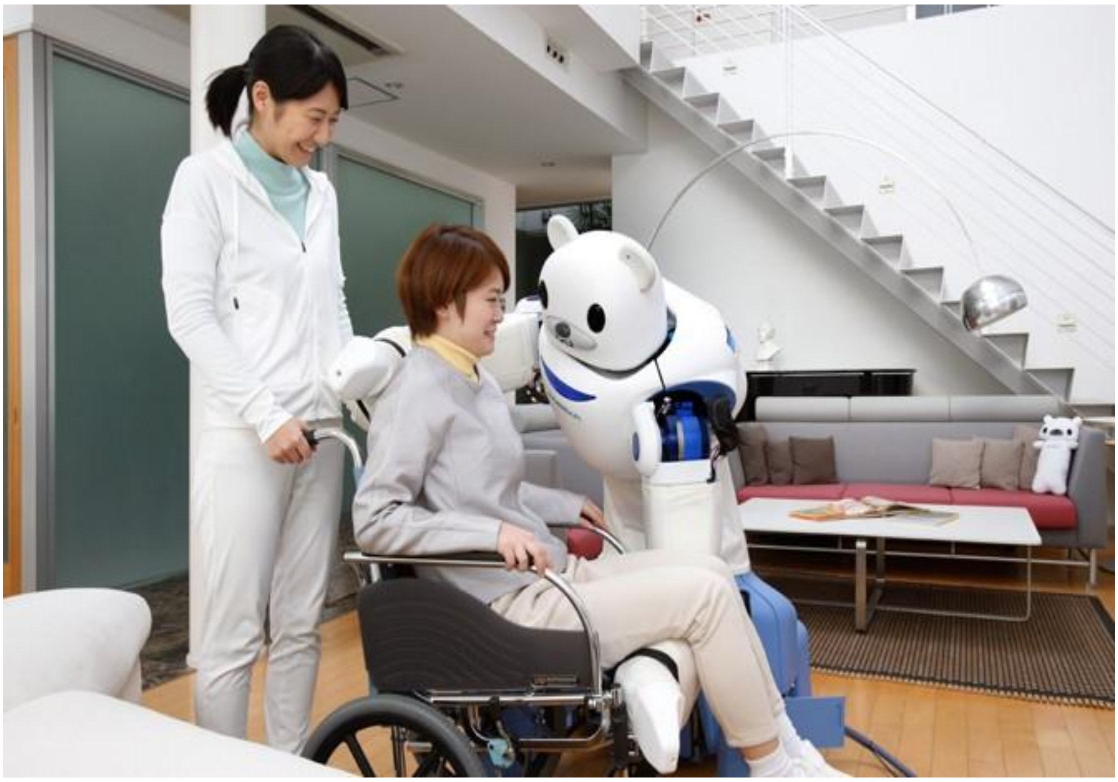
For people with dementia, does robotic be able to help? An invention by American scientists, The Robot Activity Support System, can detect where the elderly are and what they are doing. Therefore, it helps to prevent the elderly with dementia from getting lost and also be able to assist them in directing to places. (Science Daily 2019). Moreover, dementia symptoms can be limited by having interaction with robotic, such as: communication, singing, dancing, playing. (Happy Seniors 2019).

In the UK and Japan, Caresses robotics were brought to live with the elderly in nursing homes to create companionship through interacting and also being tested to see how comfortable they could live together in terms of cultural sensitivity. (Physics Organization 2019).

More projects are expected to be carried out after receiving enough funding to develop advanced functions for robotics. The expected development is robotic that will be able to catch the elderly up after a fall, deliver meals, ensure the medication is taken on time, which is common in life aspects of the elderly. (CNBC 2019).

Aside from helping for the elderly, the robotic can help to release the nursing workers from heavy tasks and saving time. (Reuters 2019).

In total, there have been so far plenty and undeniable benefits which robotic can bring to humanity generally and the elderly specifically.



3 Aims and Purpose

The aim of the thesis was to gather information about the impact of artificial intelligence (robotics) in healthcare for elderly through conducting a literature review based on previous scientific research.

The purpose of the thesis was to provide relevant information that could be utilized within nursing, by analyzing findings from the reviewed literature. allengg

Therefore, the research question is:

What are the benefits of robotics for elderly patients?

4 Methodologies

4.1 Literature Review

A literature review is conducted with a carefully documented process in order to answer the above mentioned research question. Literature review as a methodology is appropriate because it is an all-inclusive study which interprets current literature that relates to this research topic. Literature review aims to inform the readers of current literature on any particular topic and offer sum-ups for the topic. Healthcare workers have the obligation of being up to date with progress and researches concerning their field of practice. Nevertheless, it is quite difficult to read, appraise and process the massive amount of literature that is currently available. This is where literature review becomes, for the most part useful and very essential. Literature review aids physicians to avoid getting misinformed if they only read one article on a particular topic. When a sufficient amount of evidence is reviewed, and presented in an orderly way, an academic conclusion can be viewed as an entirely new and big picture, instead of coming from just one minor piece of published information (Aveyard, 2014, 2-9) and (Bettany-Saltikov, 2012, 11).

A literature review can be used as a portion of a study or as a study on its own. It does not simply present themes from earlier research but also tables down potential problems within the materials and offers criticism. A scholar finds gaps in research; gives recommendations and proof for further studies (Turun yliopisto n.d.). As a research method, a stand-alone literature review is suitable for a beginner in the field of research, since the sources have already been published and are easily accessible. Furthermore, this type of research does not need ethics approval (Aveyard 2014, 15-16.) As a result of that, this study was conducted as a literature review.

According to Niela-Vilén and Hamari, conducting a literature review must be systematic in describing its stages in such a clear way that the readers can assess each stage's implementation and reliability. Hence, the following five stages should be included in a literature review:

1. Defining the aim and the research question
2. Searching for and selecting literature

3. Assessing literature
4. Analyzing and synthesizing literature
5. Reporting results (Niela-Vilén & Hamari 2016, 23).

The literature review in this thesis systematically followed the above-mentioned steps in order to give the research process clarity and transparency.

4.2 Literature Search

An initial search on academic records revealed an ample amount of publications on the topic; the impact of robotics in the healthcare of the elderly. This study provided a summary so that readers can get answers from diverse viewpoints and sources without necessarily going through the vast pool of literatures one after the other.

In order to sustain reliability and decrease bias, a criterion was established before the real search was conducted. Journals used for this study should fall inside the criteria (Table 1).

Articles that are primary research papers on the impact of robotics on the healthcare of the elderly
Articles published in English
Articles published within 2000-2017
Articles available in full text for students

Table 1. Inclusion criteria

Aside to the above mentioned criteria, an additional inclusion criterion called the “hierarchy of evidence” was used. This was implemented by searching for a specific type of research that would give the best proof for the literature review question. (Aveyard 2014, 65.) The question was: What kind of experiences do the elderly get from using robotics? As this question was meant to explore data (experiences) instead of quantifying them, qualitative research design was the ideal choice in selecting the articles for the review. Literature from main sources was also favored since it came directly from the researchers’ work and was therefore less susceptible to the possibility of bias or distortion (Moule et al. 2017, 42). Articles that did not achieve the above inclusion criteria were automatically omitted from the literature review.

Databases that were used to find possibly related studies were: CINAHL and Academic Search Elite. These databases were used because they had reliable and high quality collections of medical research, mostly in nursing, as suggested by many different sources including JAMK's school library (Shields, 2013, 298) and (Bettany-Saltikov, 2012, 10) and (Smith & Dixon, 2009, 70). Although there is a great likelihood of overlapping between records, using several dependable records decrease the chance of missing studies.

The data gathered from the above databases was then sorted according to the inclusion criteria by using PRISMA (preferred reporting items for systematic reviews and meta-analyses) flow diagram as specified:

DATABASE/KEYWORDS robotics OR "robotic therapy" OR robot OR "robot assisted" OR exoskeleton AND elderly OR aged OR older OR elder OR geriatric OR "elderly people" OR "old people" OR senior AND healthcare OR "health care" OR hospital OR "health services" OR "health facilities"	RESULTS AFTER INCLUSION CRITERIA	SELECTED BASED ON TOPIC	SELECTED BASED ON ABSTRACT	SELECTED BASED ON FULL TEXT
CINAHL	39	23	19	4
ACADEMIC SEARCH ELITE	102	20	17	4

Table 2. Data reduction

4.3 Data Analysis

In this thesis, content analysis method is used. Usually, content analysis can be used with either qualitative or quantitative data and includes inductive and deductive way. Inductive content analysis is used in this thesis. The inductive approach is used when there is not enough former knowledge about the phenomenon (Elo & Kyngäs 2008, 109.). The phases of inductive content analysis include: data reduction, data grouping, and formation of the concepts that can be used to answer research question. (Kyngäs, Mikkonen & Kääriäinen 2020, 14).

The purpose of content analysis is to provide knowledge, new insights, and facts by collecting and analyzing present words, concepts, then categorizing similar phenomenon into groups and drawing conclusions to answer the research question. Its aim is to provide a concise and broad description of the phenomenon and the result of the analysis is concepts or categorizes about the phenomenon. (Elo & Kyngäs 2008, 108).

After identifying the articles, the next step is reading, coding and entering findings on a data collection instrument. This step is known as data extraction. The purpose of this step is to determine the trustworthiness of the articles (Rew 2010, 67-68.) Data extraction is also known as an inclusion of data reduction, data display, data comparison, drawing of conclusions and verification. (Garbrah, Välimäki & Palovaara 2016, 3).

After that, quality of extracted data will be evaluated. Based on considering of research design, sample size, data collection protocol, findings and limitations, it can be known how well the data can answer the research question and the trustworthiness of the evidence. In this step, data can also be grouped based on their similarities and differences (Rew 2010, 67-68.) After grouping, the result shows that there are only 4 articles found from Cinahl and another 4 articles found from Academic Search Elite. (Please find information from above table).

Once the literature has been carefully read, data have been extracted and evaluated, they can be interpreted in the next step so that the findings can be found and therefore it can lead to the conclusions. (Rew 2010, 67-68).

The results from all the articles were being summarized to address the research question. The goal was to accumulate diverse studies and produce a new understanding that is more extensive than just reading individual papers separately. The findings will be summarized in the table. (Rew 2010, 68).

5 Findings

Our findings from the articles were classified into three (3) main categories in which robotics benefits the elderly patients:

- Assisting elderly in mobility, physiological assessment and monitoring, activities of daily living, rehabilitation, navigation,
- Improving quality of care for elderly with dementia,
- Providing companionship.

5.1 Benefits of robotics for elderly patients

According to Mesquita and Zamarioli, robotics is found to be the most beneficial to serve for elderly in four main sectors, such as: mobility, physiological assessment and monitoring, assistance in **activities of daily living** and rehabilitation (Mesquita & Zamarioli 2016, 411). They collected data of how robotics was used in healthcare to serve for elderly from some countries, such as: China, Japan, Korea, Taiwan, USA, UK and Spain. Robots can however help in physiological monitoring and evaluation of patients (for example: vital signs) while 8.5% contributes to the use in rehabilitation process. (Mesquita & Zamarioli 2016, 407-410.)

In another research of Carrera and Moreno, ROAD robotics is an invention to help elderly with limited **motor function**. This robotics specializes in assisting sit to stand (STS) activity, balancing and gait (Carrera & Moreno 2011, 1209). ROAD is described as being able to interact with user in same environment between hospital and home and safely for use (Carrera & Moreno 2011, 1204).

Another benefit which robotics can help is improving the **quality of care for elderly** who suffers from dementia. In a research of Chu and Khosla, most elderly with dementia who had interaction with social robots Sophie and Jack gained a very positive engagement (Chu & Khosla 2016, 14). The robotics has features of human-like **communication,** emotion expressions, motions and gestures while being able to play songs, games, stories… They are proved to be able to provide sensory enrichment and social positive engagement to dementia elderly when they are in contact. For example, most of participants are motivated to play bingo with Jack and join other group activities. (Chu & Khosla 2016, 10-14.)

One more benefit of robotics is mentioned in a research performed with elderly who has neuromuscular disorder. The symptom can cause patient to become muscle weakness and then disability. In this case, robotic devices are used as trainers, therapists to provide safe and repetitive trainings and **rehabilitation for patient**. After four weeks of intensive training with exoskeleton robot, the result shows that there is a decreased contraction in elderly patient. (Son & Ryu 2016, 2-4.)

In addition, another type of robotics with intelligent wheelchair system (RIWS) can help elderly in **navigation** functions and avoiding obstacles. A conducted experiment showed that RIWS was able to help the elderly to go to the destination safely by navigating accurately and carrying them, therefore it could also reduce stress for people who could not walk. (Alshraideh & Mahafzah 2015, 471-482). In a research of Frennert and Forsberg, the users expressed a very positive attitude towards telehealthcare systems (GiraffPlus). They are assistive devices to **support for autonomy** of elderly who wants to live independently at home. The users agree that the robotics can bring many possible benefits to support for their independent life at home. (Frennert & Forsberg 2013, 219-234.)

Socially assistive robotics (SAR) is a robotics which provides basic coaching for physical rehabilitation for elderly in retirement home. It was liked by the staff of La Misericordiaod retirement home and they confirmed their satisfaction of using this robotics. (Perez & Zapirain 2015, 351-356.) In addition, users also have certain expectation towards robotics. For example, they expected SAR robotics could be improved for external appearance by adding some kind of clothing or colorful decorations. Screens can be improved bigger by changing to iPad and the robotics needs to be continuously updated with latest technology. (Perez & Zapirain 2015, 356.) For development of robotics for healthcare service, it is necessary to consider about monetary, intellectual investment and cooperation between nurses and professionals from engineering. (Mesquita & Zamarioli 2016, 411-412.)

One of the best well reported literature signifying the usefulness of robots involvement in age related cognitive deterioration, was reported by Tanaka et al., 2012. They reported a trial conducted on 34 healthy Japanese women who lived alone. They realize at the end of the study that participants in the intervention group had lower levels of cortisol-which was measured using their saliva, improved judgment and verbal memory function. This was measured using mini-mental State Examination, and improved night time sleep. Such changes were not seen in the controlled group.

There are other controlled studies that indicate that companion-like robots might have a key role in reducing loneliness and blood pressure. Such a study was conducted by Robinson et al in 2013 at a health Care home in New Zealand with 40 participants. The participants who interacted with Paro had a drastic decrease in loneliness in the course of the trial as compared to their counterparts in the controlled group (Robinson, MacDonald, Kerse, & Broadbent, 2013). An experimental study was conducted by Robinson et al., 2014 at healthcare homes and in the hospital. A total of 21 subjects were made to interact briefly with Paro constantly for a period of time. The blood pressure of the participants was measured before, during and after their interaction with the robot. The outcome indicated a drastic decrease in their systolic and diastolic blood pressure anytime they were with Paro, and a very significant increase in their diastolic blood pressure whenever Paro was taken away from them (Robinson, MacDonald, & Broadbent, 2014) A similar study was conducted to using a pet-like robot called AIBO to determine its effectiveness in reducing loneliness among the elderly in the US. A total of 20 participants were involved in the study and the same conclusion was arrived at. This same outcome was observed in 13 participants in Japan (Banks, Willoughby, & Banks, 2008; Tamura et al., 2004).

6 Discussion

6.1 Discussion of main findings

The aim of this study (based solely on literature review) was to find out the impact of robotics for elderly patients. The outcome of this review can perhaps help to establish researchers' awareness of elderly assistive robots, their usefulness, and countless approaches to measure their effectiveness.

Most of the involved studies suggest that there are positive effects of robotics in elderly care since robotics for the elderly care was designed to improve their wellbeing in the first place.
All the reviews that were included in this study had in one way or another studied the benefits of robotics in elderly care. These benefits include: increase of health status, which is achieved by decreased level of stress, very much improved mood, decreased level of loneliness, improved communication activity with others (Chu, Khosla, Khaksa & Nguyen 2016, 8-16). A lot of the reviewed materials (Koceski & Koceska 2016, 1-6) report positive benefits of robotics in elderly care, although these benefits vary from person to person. As far as mood is concern, companion robots are said to have positive outcome as well, this was determined by evaluating the facial expressions of the elderly people as well as the use of simple questionnaires (Koceski & Koceska 2016, 4-5). Other studies revealed a significant improvement on elderly people with dementia. A similar study indicated that a companion

robot triggered memories from the past that were otherwise forgotten because of the dementia (Chu, Khosla, Khaksa & Nguyen 2016, 15-16).

As stated above, robotics can bring some benefits to elderly and it is proved through research articles. Beside assisting elderly in mobility, physiological assessment and monitoring, activities of daily living, rehabilitation, navigation, improving quality of care for elderly with dementia, robotics also help reduce social isolation and loneliness. Undoubtedly, they can provide some solutions to the challenges of increasing ageing population. As we all know, human get more trust on nursing care for the elderly than robotic. However, the robotic with more development and improvement of technology is hopefully able to create greater contribution in the future. Robotics can be obviously temporary and alternative solutions to provide caring for elderly in case of lacking human resource (Independent UK 2019).

6.2 Limitations

However, most of the studies that were reviewed also had some limitations that may weaken the strengths of the positive benefits of robotics.
Firstly, it is proved that robotics can bring positive impact on rehabilitation progress for disable patients, however, the use of robotics in medical and dentistry fields is not clear and it needs to be considered. Secondly, some professionals hesitate in use of new technologies because they are not sure about its usefullness or how robotics can influence the nursing care practice and patient outcomes. Thirdly, due to financial resources limitation, how nursing area can best use robotics device to maximize their service range should be put into consideration (Mesquita, Zamarioli & Carvolho 2016, 411). The next issue, according to Frennert, Forsberg and Ostlund, their research is conducted based on a small sample size with small number of participants, so the result of the research somehow does not represent populace. Half of the participants did not agree that they needed a telehealthcare system like GiraffPlus. Lastly, during longterm use, telehealthcare system may be used in unpredictable way, therefore it has unpredictable effects and consequences on people using them (Frennert, Forsberg & Ostlund 2013, 233).

In general, before robotics can be fully integrated into providing caring for elderly, public anxiety should be told out and it should be clear that robotics are designed to assist social workers and not replace them. In case we can manage better in regard to finance and risks prevention, robotic is promising to be a possible solution to address the challenges of increasing aging population and human labor shortfall (Independent UK 2019).

7 Ethical Considerations, Validity and Reliability

This thesis is conducted and follows ethical principles of scientific research which are: honesty, objectivity, integrity, carefulness, confidentiality and openness. It provides honest information about the appearance and impact of robotics in healthcare. Robotics can provide any benefits to serve for human in this healthcare, however, their appearance is promising a competition and replacement for human resources who are working in this field. This thesis also complies with the rule of objectivity. It avoids bias in data analysis, data interpretation. It is written with integrity and without negligence. (USA Institute of Environmental Health Sciences 2018).

Our research is conducted in open way. We are willing to share information, data and welcome new ideas. This thesis also respects the rule of confidentiality. All information used is open to public and no information is used or revealed if they belong to group of confidentiality which needs consent and permission of author. Most of information used in this thesis has validation for fifteen years until the current year. So the validity of this thesis is therefore guaranteed. (USA Institute of Environmental Health Sciences 2018).

The topic of this thesis is about robotics and what they have brought to healthcare. Robotics have appeared and their impact has spread recently in healthcare so this topic is a new concept in healthcare and nursing which gets attention, discovery, further discussion and invention. Therefore, it is an up to date and valid topic. (USA Institute of Environmental Health Sciences 2018).

The research articles selected to write this thesis are from databases such as CINAHL and Academic Search Elite. They are generated from database search method of JAMK UAS which is well known and reliable. The articles’ validation is no longer than 15 years, from 2004 to 2018. They are relevant and be able to support to answer the research questions. (USA Institute of Environmental Health Sciences 2018).

8 Conclusion

The population of the elderly is increasing at an alarming rate and the concern to supply them with proper care has become extremely important. In order to address this impending issue, researchers all over the world are working on new ways including technologies such as social robotics to help with the caregiving process for the elderly at home. The significant rising of the elderly population worldwide has intensified the need for robots that deals with personal care, such as for improving movement and aiding independence. It is likely that human being will soon come to appreciate and have a more close relationship with personal care robots than we currently do.

This study focused on the ideas that reflect the benefits of robots in the life of elderly. It is safe to say that virtually all the studies reviewed indicated that robots have a positive impact on the elderly in supporting on activities of daily living, motor and navigation function, physical rehabilitation and as well as keeping company, improving care quality for elderly with dementia. We can therefore conclude that there are a lot of evidence that suggest companion robots have positive impact in healthcare of elderly people with respect to their mood, loneliness and social connections with other people. Despite the positive facts of the use of robots in the everyday life of the elderly for the enhancement of their living conditions, the ethical issues arising from such use of robotics cannot be ignored. It is something that people should consider very carefully because the elderly are in need of real social contact. The study also showed that the elderly people are permanently open to the risk of falling down or getting sick or lost when left uncared for, especially those suffering dementia. They should therefore never be left alone. Using robots might be a little frustrating for the elderly with dementia especially if they do not know how to operate it, as such there is the need to educate them on how to properly use robots in order to achieve positive outcome.

Nevertheless, we believe that it is worth using robotics in elderly care since the positives outweigh the negatives.

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Table 3. Summary of the Selected Articles

NO.	AUTHOR (YEAR), COUNTRY	PURPOSE OF STUDY	KEY FINDINGS
1	Ana Cláudia Mesquita, Cristina Mara Zamarioli, Emilia Campos de Carvalho 2016 Brazil 4	To investigate the invention of robots for use in nursing care.	• Focus on four areas: mobility, physiological assessment/monitoring, assistance in daily activities and rehabilitation. • Monetary, intellectual investment, cooperative work between nurses and professionals from other fields should be taken into account for development of robotics.
2	Saso Koceski, Natasa Koceska 2016 USA 8	To describe the telepresence robot system designed to improve the well-being of elderly by supporting them to do daily activities independently, to facilitate social interaction in order to overcome a sense of social isolation and loneliness as well as to support the professional caregivers in everyday care. To investigate the acceptance of the developed robot system.	• Telepresence robot systems can assist elderly in Activities of Daily Living (ADL), and support professional caregivers in their care to create less burden. • Users have expressed their positive opinions about the robot system, find more benefits than concerns about using this system, and they stated that they are willing to use a developed telepresence system in both social and medical contexts.
3	Mei Tai Chu, Rajiv Khosla, Seyed	To show how social robots can improve care	• Social robots can improve diversion therapy service value to

	Mohammad, Khanh Nguyen 2016 Australia 13	quality for elderly with dementia.	elderly with dementia through sensory enrichment, positive social engagement and entertainment. Life care for the elderly with dementia is developed by using robotics.
4	Isela Carrera, Hector Moreno, Roque Salteren, Carlos Perez, Lisandro Puglisi, Cecilia Garcia 2011 Spain 34	To introduce concept design and analysis of ROAD robot for assistance and rehabilitation of disabled elderly, focusing on assisting with gait, balance and standing up.	• The robot assistant could be of great use for therapist and caregivers, especially for carrying and treating patients. ROAD robot can assist to sit to stand (STS) activity, balancing and gait. It could be installed in a rehabilitation center or at home in order to assist disabled elderly in their ADLs and rehabilitation therapy.
5	PJ Perez, Garcia Zapirain, A Mendez Zorrilla 2015 Spain 5	To design and develop a complete robotic agent, so that it performs physical and mental activities for elderly people to maintain their healthy life habits and, as a final result, improve their quality of life.	• Based on the tests, an easy to use Robot is prepared to deliver basic coaching for physical activities as proposed by the client, the staff of La Misericordia, who confirmed their satisfaction regarding this aspect. • Suggestion to improve external appearance of the agent with some kind of clothing or colorful decorations.
6	Jongsang Son, Jeseong Ryu, Soonjae Ahn, Eun Joo Kim, Jung Ah Lee, Youngho Kim 2016 USA & Korea 14	To investigate the idea that an active-resistive training with an EMG-based exoskeleton robot could be beneficial to muscle strength and antagonist muscle contraction control for	• This study showed that the 4-week intensive active-resistive training with the exoskeleton robot results in the decreased contraction in the elderly people. This study would be valuable for further studies with robotic devices for elderly people,

		elderly after 4-week intensive elbow flexion/extension training.	showing significant changes in the antagonist muscle contraction.
7	Mohammed Alshraideha, Basel A. Mahafzaha, Saleh Al-Sharaeha, Ziad M. Hawamdehb 2014 UK 55	To describe the development and evaluation of a robotic intelligent wheelchair system (RIWS) based on obstacle avoidance and navigation functions that allow elderly patients to navigate to scheduled outpatient appointments in a hospital safely and accurately. Intelligent wheelchairs can be self-controlling of the movement and direction of the wheelchair without patients and older adult's intervention.	• Using the robotics with intelligent wheelchair system (RIWS) enabled participants to automate their movement from their point of arrival to various destination clinics (surgery, orthopedic, radiology and outpatient), which minimizes hospital staff assistance. In addition, patients need not to walk or even find their way that may incur extra stress on them.
8	Susanne Anna Frennert, Anette Forsberg, Brit Ostlund 2013 Sweden 72	To examine the attitude of elderly towards telehealthcare system which supports their independent living at home.	• Users perceived as possible benefits of having such system at home. Assistance of autonomy and customization are considered as the most crucial and meaningful functions for individual.