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Benefits and Impacts of Assistive Technology in Elderly Home Care

A Literature Review

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Description

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Abstract

The aging population is increasing, and this will increase the cost of caring for them as the elderly tend to lose basic functionality and capacity hence depend on nurses and caregivers. However, using assistive technology to care for the elderly has been associated with various the benefits and advantages.

The study adopted literature review method to explore the benefits and impacts of assistive technologies in the elderly home care. The authors used PICOS criteria as the inclusion and exclusion criteria for articles used in the study and each author ended up with 9 articles. The process of data analysis followed an integrative method that provides summary that is appropriate for compilation and aggression. The analysis of the data followed the method of content analysis.

The results indicated that assistive technologies provide benefits and positively impact the elderly home care. These benefits and impacts under social benefits entails enhancing the elderly independence and mobility, bring back elderly dignity and autonomy, help to maintain the quality of life and well-being of the elderly, reduce the burden on caregivers and assist elderly with everyday living; health benefits that include improve the physical and emotional functioning of elderly and improve safety and coping ability of elderly; economic benefits and impacts including reduce the healthcare costs. This implies that these technologies are not only positively impacting and beneficial to the elderly but are also beneficial to the caregivers.

The authors concluded that there is a need to conduct proper training for both the elderly and the caregivers when adopting these technologies and the need to increase the accessibility of these technologies.

Keywords/tags (subjects)

Assistive technology, elderly care, home nursing/

Miscellaneous (Confidential information)

None

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1 Introduction

The aging population is increasing, and governments worldwide, especially in developed economies, are concerned that the world is getting older. The concern has been fueled by regular reports released by the United Nations warning of the rapidly increasing aging population. The reports estimated that approximately 703 million persons of the world population were aged 65 years and above by the end of 2019. In addition, it is predicted that the aging population is likely to double, reaching 1.5 billion by 2050 (United Nations, 2019). It is common knowledge that older adults tend to lose basic functionality and capacity, implying that they lose their independence (Su et al., 2020). This often creates a problem for their families, who cannot look after them regularly, forcing them to hire outside help such as caregivers and nurses, which can be costly in the long term. Accordingly, Barnay and Juin (2016) note that the concept of an elderly home was created to help elderly adults maintain a quality life and remain productive while enjoying the company of other older adults instead of being isolated in their homes.

Creating or developing elderly home care was done with the goal of dealing with the challenges and opportunities experienced by the aging population. For instance, independence is one of the challenges faced by the aging population because older adults cannot carry out most of their daily activities by themselves. In that regard, Su et al. (2020) elderly home care is essential for the aging population because they have lost independence due to sensory impairment, immobility, and other body failures. Similarly, Barnay and Juin (2016) pointed out that elderly homes are needed to help maintain a high quality of life for the older adults and remain active members of the society. Further, the concept of elderly homes became relevant because of the need to bring dignity to the aging generation. In other words, losing most of body functions or inability undertake daily activities often rob old people their dignity and receiving care in elderly homes help bring back that dignity and autonomy. Although some older adults can afford to hire professionals to provide the care at the comfort of their homes, majority of them choose to live in retirement or elderly homes.

Elderly homes adopt various types of technologies, from robotics to communication technologies, which form part of assistive technologies. Accordingly, Saborowski and Kollak (2015) report that

assistive technologies are widely used in elderly homes to improve the quality of life and well-being of elderly adults. Besides offering safe and efficient care to the residents of elderly homes, assistive technologies also help improve the physical and emotional well-being of elderly adults. For instance, assistive technologies such as information and communication technologies (ICTs) help them interact with their families and the rest of the world. The high rate of technology adoption in elderly homes is mostly due to the benefits and advantages associated with them in helping older adults live a normal or easy life by regaining some of their physical and cognitive functions.

In addition, technology not only help the elderly adults but also make it easy for caregivers and nurses to offer the best care that ensure quality life and improved wellbeing for the elderly. Therefore, it is vital to understand the benefits and impacts of assistive technologies in the context of elderly home care. Thus, the aim of this study is to explore the benefits and impacts of assistive technology in elderly home care.

2 Background

2.1 Elder and Elder Care

An elder is a person who is advanced in terms of age, and it is usually used for people who have lived for many years, usually 65 years and above. According to Cao (2019), the concept of elder care is a broad and is sometimes referred to as senior care or elderly care. Elder can be described as a specialized care designed to meet the requirements and needs of older people in various stages of their lives. However, aging alone does not qualify one for elder care but rather the accompanying diseases and declining physical or cognitive capacity that prompt or necessitate the need for elder care (Dahl, 2017). Based on these assertions, defining elder care or senior care is difficult since it encompasses a broad range of services and categories. Nevertheless, any type of care in this context is aimed at assisting individuals who are unable to undertake daily activities independently. Elderly care has become a necessity in the society, with the need to offer quality living, amore valued concern in the society today (Boland et al., 2017). Person-fit environments are a significant way of increasing the quality of life for the elderly, as they age.

Senior/elderly care take on many different options based on what is available, and what is needed as well. Some of the options available include independent living communities, assisted living communities, nursing homes, respite care, home care, residential care, and hospice care (Sayegh, 2018). Independent and assisted living communities refers to living in care homes, where arrangements have been made, for the elderly to be taken care of. The two are however different in that independent living serve more as retirement homes, with the elderly taking care of themselves, while in assisted living communities, the elderly are helped, and these serve as personal care homes. Respite/adult day care is a care facility that serves elders for short periods of time, say a few days, or a month at most (Dahl, 2017).

Hospice care is a form of care, not necessarily reserved for the elderly, where the individuals in their final stages of life, are offered quality service, which is often family focused, for a period, to enable them find relief with their condition (Sayegh, 2018). Home care companies, refer to the form of care where the nursing services are offered at the individual's home, with the home being modified to be more accommodative of their current needs and situations (Dahl, 2017).

2.2 Home Nursing

Home nursing or home care is a type of health care that leans toward actualizing a new form of care whereby health professionals offer their expertise and service at the patient's home or outside the confines of hospitals. Home nursing is considered an alternative to hospitalization that works to reduce the length of stay and demand for the hospital admission. Furthermore, home has been recognized as a suitable environment for unique and innovative care, offering the potential to provide care focused on the needs and demands of the patients (Cronfalk et al., 2015). Thus, it can be argued that home nursing is a healthcare intervention that needs the services of qualified professionals.

Home nursing requires qualified health professionals with vast competencies, including interpersonal skills, because they need to develop relationships with patients, family members, and other professional teams. Home nursing can entail specific complexities and many actions requiring qualified and experienced health professionals. Most studies focusing on home nursing or care

tend to consider it an administrative aspect whereby the health professionals or nurses offering the service must provide direct care and managerial services. Home nursing is offered to individuals who need health care because of their health conditions without necessarily being hospitalized (Andrade et al., 2017).

Home nursing can include various services and procedures performed in the comfort of the patient's home (Cronfalk et al., 2015). Home nursing is prevalent in primary care or when providing care to individuals suffering from chronic conditions. Other than chronic conditions, frailty that can result in rapid health deterioration and result in fatal health outcomes, which often requires intensified surveillance have created need for multi-professional follow up, and hence the use of home nursing services. Home nursing can also be offered to patients discharged from a family health center, hospital, or care institution (Andrade et al., 2017). Part of the services offered by home nursing facilities, is quality of care afforded to the patients, who are highly dependent on competent health care services for their survival (Naess et al., 2017). The existence and use of this technology has been necessitated by the need for quality healthcare that is readily available to patients that cannot take care of themselves.

2.3 Assistive Technology

Assistive technologies are increasingly becoming popular in nursing homes and among private residents of elderly adults. The term "assistive technology" refers to the services and devices or equipment used to maintain and support declining cognitive and physical functions because of old age (Reisinger & Ripat, 2014). Another term often used synonymously with assistive technology is "ambient assisted living" (Calvaresi et al., 2017).

Similarly, ambient assisted living, which is also falls under an umbrella term that refers to the utilization of various communication and information technologies to help make the homes and residents of old or disabled people adaptable to their conditions (Calvaresi et al., 2017). Therefore, assistive technology can be summed up as any device or system that helps older people regain and maintain their physical and cognitive capabilities while improving the life quality and health of older people.

Some of the most common assistive technologies adopted in elderly home care include, bathroom aids, robotic wheelchairs, bathroom wheelchairs, communication devices, bed motion sensors, and medication devices, among others (Saborowski & Kollak, 2015). Furthermore, some assistive devices help older adults cope with challenges related to health like sensory impairment, medication management, reduced mobility, and other declining cognitive functions. Thus, AT is an umbrella term covering all the devices, systems, and services that allow older adults with limited cognitive and physical functionality to cope with their daily routines and life (Reisinger & Ripat, 2014).

It is usually used in the context of nursing and elderly home care. Since the aged population is increasing at an alarming rate, there has been an increased focus on developing technologies that result in assistive systems and devices. According to Yusif et al. (2016), the growth of the aging population has increased investment in research and development (R&D) aimed at developing better assistive technologies capable of helping elderly adults not regain but also maintain their independence as well as continue living quality life. The adoption of assistive technology in elderly care helps provide essential assistive functions to the older adults by ensuring they are comfortable, and their wellbeing is improved. In addition, the inadequate number of healthcare professionals and nursing staff has also made the adoption of assistive technology a necessity instead of an option since the technologies help fill the gap (Barnay & Juin, 2016).

3 Aim, purpose and research question

Aim of this research is to investigate the benefits and impacts of assistive technology in elderly home care.

Purpose of the research is to enhance the quality of elderly home care by adopting assistive technology.

Research question: what are the benefits and impacts of assistive technology in elderly home care?

4 Methodology

4.1 Literature review

In its simplest form literature review refers to the description of what other people done or published in a summary form. However, a more complete review of literature should take the form of literature insights, critical discussion and awareness of diverging theories, approaches, and arguments. Thus, it should be an analysis and synthesis of relevant work published, linked all the time to the own research rationale and purpose (Mudavanhu, 2017). Supporting the definition, Snyder (2019) defines literature review as a comprehensive review of available literature for any given research aim or question. It is an analysis, summary and evaluation of the available literature and an explanation of the research that has been done already for a research area. In this case, the writer synthesizes and extracts the issues, main points, research methods and findings that emerge from a critical review of the articles read to build a coherent argument that results in the description of the proposed research (Danson & Arshad, 2014).

Snyder (2019) asserts that a well-conducted and effective review as a research method has several benefits as it generates a firm foundation of advancing knowledge and facilitating theory development of. Through findings and perspectives integration from different empirical findings, review of literature can address study questions with a power that cannot be found in any single study. Also, it can assist in providing an overview of areas in which the study is interdisciplinary and disparate. Additionally, a review of literature provides an outstanding way to synthesize the research findings to indicate a meta-level evidence and uncovering areas that require more research, which is a key component to build the conceptual models and create theoretical frameworks (Snyder, 2019).

Accordingly, Efron and Ravid (2018) describe the process to writing literature review. First step is choosing a topic that can take a research question form, thinking of the search terms that can be linked to it including the synonyms and any alternative spellings that can aid in searching for the topic. Second step entails formulating a search strategy. This includes making notes of the phrases ad words to be searched for, looking at the available sources and deciding the ones that are most appropriate for the research needs, starting the search process and keeping records of the searches to check the quantity of the results generated under the search. If the researcher is not

getting enough information, then the researcher should consider the research question from a differing angle or try to expand the research area to include certain areas that nay have been excluded originally as only being outlying to the study. Finally, the last step entails ascertaining the materials found whether they are suitable to answer the research question. This process entails identifying materials to be included in the final work as the researcher takes notes on these articles when checking them.

4.2 Literature search

Author 1: the author included studies from three databases in this review including CINAHL, EBSCO and PubMed. Boolean operators “OR” and “AND” were utilized, and key words “benefits of assistive technology” “impacts of assistive technology” “elderly home care” as well as synonyms and abbreviations for these key terms were also utilized. To ascertain materials for use in analysis of the study, the inclusion criteria applied included studies published in English language, have full texts available, published between ten years range (2012 to 2022), and relate to the research question or answer the research question. The criteria to exclude articles were those articles published before 2012, not relevant to the research or not answering research, not available in full texts, and not in English language. Accordingly, the author used PICOS to conduct initial research as shown below:

Table 1. PICOS Criteria for Author 1

P: Population	Elderly or older people
I: Phenomenon of interest	Benefits and impacts of assistive technology
Co: Context	Home care offered in elderly homes or home care institutions
S: Types of studies	English language, full text available and published between 2012 and 2022

The author applied a step-by-step process to choose studies that were included in the review and assigned Hawker scores to the studies. As demonstrated in figure 1 below, the search from the three databases (PubMed, CANHAL, EBSCO) using the key words and Boolean operators generated a total of 312 articles. 42 articles were found as duplicates and were therefore removed. Then the author screened the remaining 270 articles according to abstracts and titles, which yielded 27 articles, taking into consideration the articles relevance to the subject of research. Finally, the author selected 9 articles based on the answers to the study questions. The critical appraisal of the articles included was based on Hawker score that assessed each article based on abstract and title, aims and introduction, ethics and bias, methods and data, data analysis, sampling, results, generalizability/ transferability, and usefulness and implications (Appendix 1).

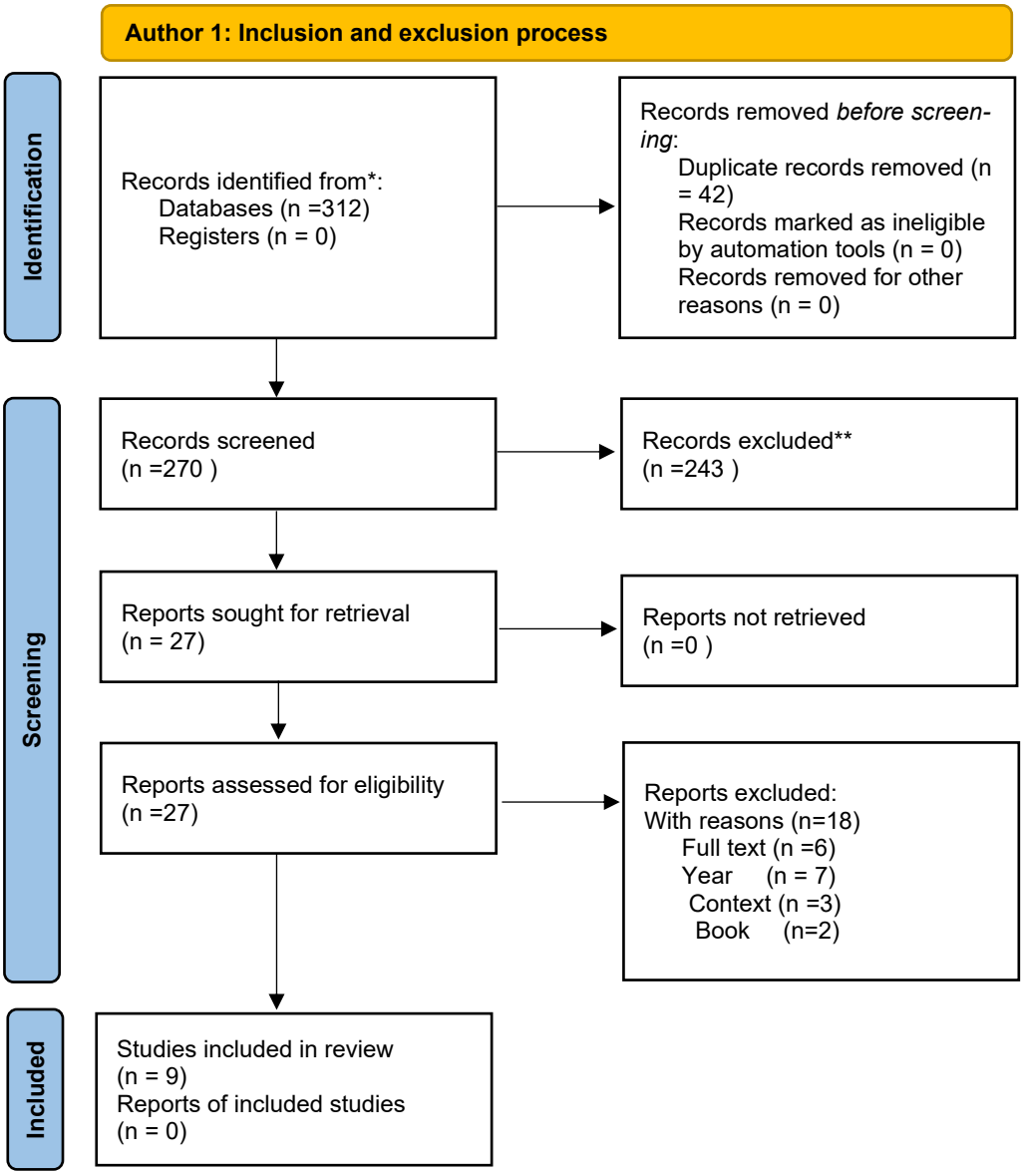

Figure 1: Author 1 inclusion and exclusion process

Author 2: the included studies in this review were derived from three databases including EMBASE, CINAHL and PubMed. The author used the terms Boolean phrase “AND” and “OR” as well as the keywords “benefits”, “impacts”, “assistive technology”, “elderly care”, “elderly home care”, “home care setting.” The synonyms for these terms were also used in the search process. The criteria for screening included full text accessible, published in English language and between 2012 and 2022, and answer or relate to the study questions. The articles that were excluded are those that could not be accessed in full, articles not published in English, articles published before 2012 and does not answer or relate to the study question. The table 2 below shows PICOS used to conduct the preliminary search.

Table 2: PICOS Criteria for Author 2

P: Population	Older people or elderly
I: Phenomenon of interest	Benefits, impacts of assistive technology
Co: Context	Home care offered in elderly homes or home care institutions
S: Types of studies	English language, publication done between 2012 and 2022, and available in full text

Applying the step-by-step process to choose the studies or articles to include in the review, the author searched the three databases (EMBASE, PubMed and CINAHL) using the key words and Boolean operators generated a total of 312 articles that generated 420 articles as shown in the figure 2 below. Among the 420 articles, a total of 80 were deleted after initial screening as 63 were duplicates and 17 did not meet study standard. Using abstracts and titles of the articles, screening of the remaining 340 articles was done, and this resulted in selection of 16 articles. Finally, due to relevance and non-availability of full text of articles, the author selected 9 articles that were used for analysis in the study. The critical appraisal of the studies included was based on Hawker score with each article assessed each article based on title and abstract, sampling, introduction and aims, data and methods, data analysis, ethics and bias, results, generalizability/ transferability, and usefulness and implications (Appendix 3).

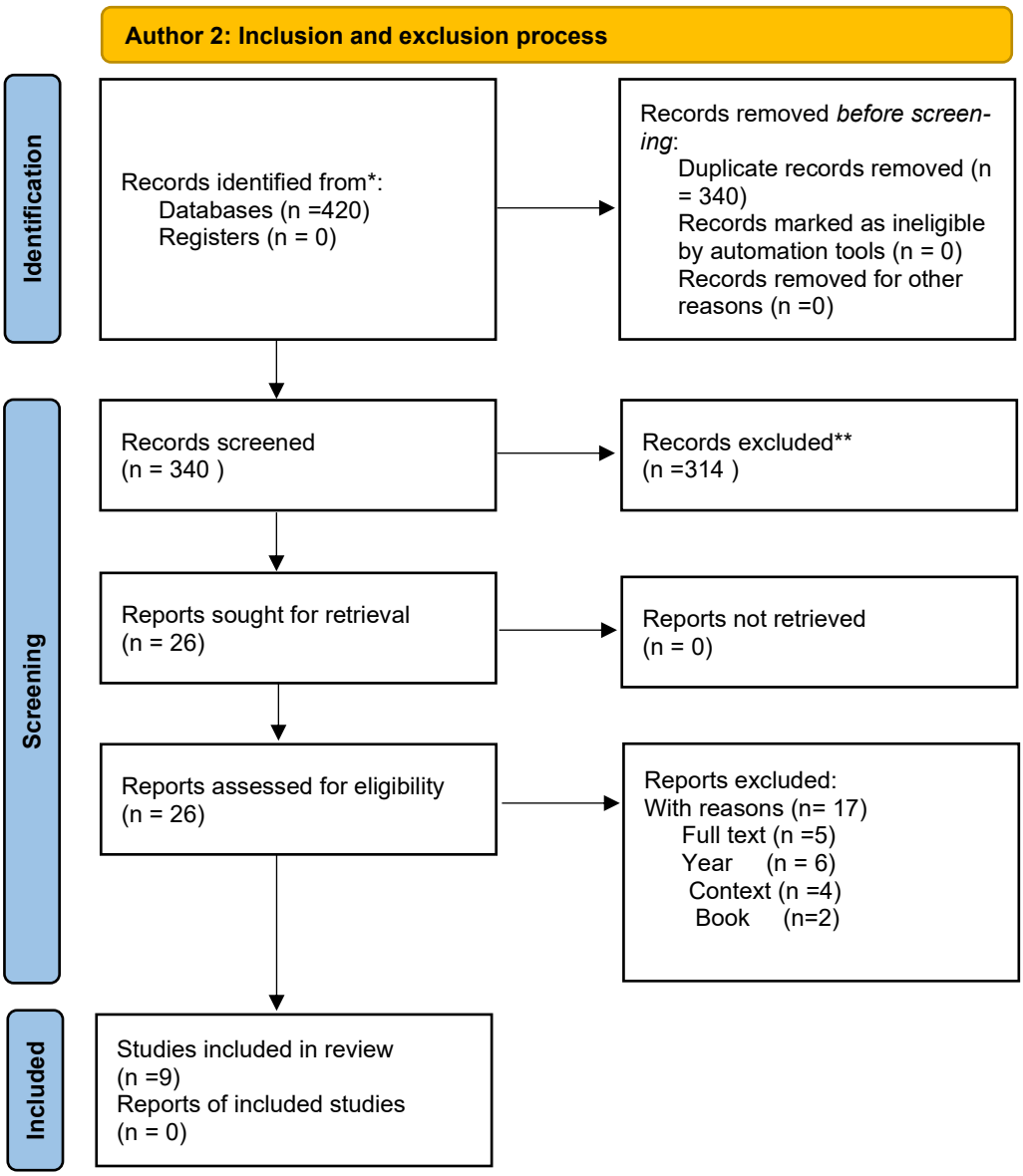

Figure 2: Author 2 Inclusion and exclusion process

4.3 Data analysis

The process of data analysis followed an integrative method that provides summary that is appropriate for compilation and aggression. Since the concepts from the review are defined well and there is consistency of their contents with other articles, the review focused on using this existing literature derived from the search process to extract, describe and summarize the information from various articles (Boland et al., 2017). The analysis of the data followed the method of content analysis. Content analysis means the content of the selected material, opened and verbally and creating a clear description of the phenomenon under investigation. Content analysis is used to organize the selected material in such a way that its informativeness becomes apparent despite its

conciseness and clarity. Qualitative content analysis was chosen for this study because it makes the material clearer, which facilitates reliable and clear conclusions about the phenomenon (Tuomi & Sarajärvi, 2018).

Data-driven qualitative content analysis used in this review was divided into three topics: material reduction, grouping, and the creation of theoretical concepts. In the first step, reduction, all the things in the data that are irrelevant to the research were eliminated. Reduction can be accomplished in several ways, e.g., by presenting expressions from the material that correspond to research questions and underlining the original expressions in one single file. In the second stage, the grouping of the material, the reduced expressions extracted in the previous stage were reviewed and combined into their own groups based on the phenomenon they describe. This generated subcategories that were named after their contents. The grouping of the material continued from there, the subcategories were formed into upper categories, the upper categories are formed into main categories and, lastly, connecting categories that were related to the research problem. In the last step, the categories were combined if it is the knowledge of the analysis based on which the theoretical concepts were formed. Combining theoretical concepts provides answers to research questions. (Tuomi & Sarajärvi, 2018).

Author 1: The author first read all the articles that were sampled for analysis. After reading all the articles, the author openly coded the extracted data in sentence form that utilized in the description of content aspects. Thereafter, higher level headings were derived from the codes. Then the author clustered same sub-categories into categories that were then put in the main categories. This process is demonstrated in the below example in figure 3.

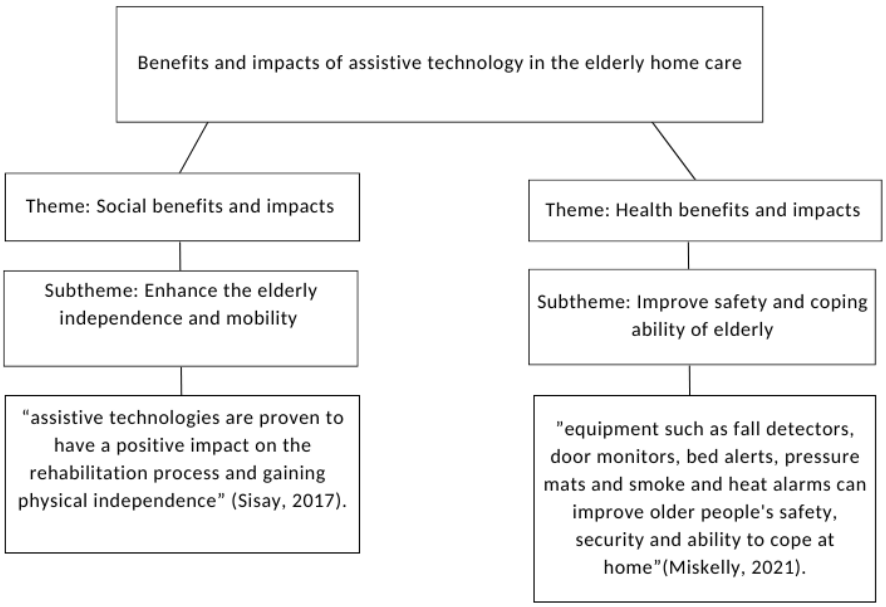

Figure 3. Author 1 Data analysis process

Author 2: after the author read the articles, the extracted data was openly coded in sentence form that utilized in the description of content aspects. These codes were then categorized into higher level headings. After that, same sub-categories were clustered into categories that were then put in the main categories. This process is shown in the below example in figure 2.

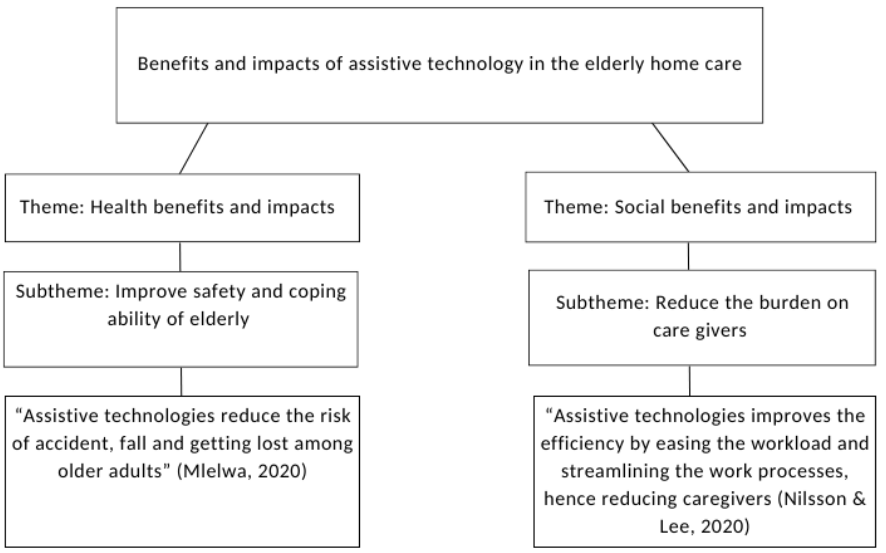

Figure 4. Author 2 Data analysis process

5 Results

Author 1 and 2 each selected nine articles with five duplicates removed. This resulted in a total of 13 articles selected, which were combined and used to analyze the results. From the combined analysis of author 1 and 2, the authors derived five themes on the benefits and impacts of assistive technologies for elderly home care. These themes include social benefits and impacts, health benefits, impacts and economic benefits and impacts. These themes represent the benefits and impacts of assistive technologies in the elderly home care including their homes and institutional home cares.

Table 3: The benefits and impacts of assistive technologies in the elderly home care

Theme	Subthemes
Social benefits and impacts	• Enhance the elderly independence and mobility • Bring back elderly dignity and autonomy • Help to maintain life quality and well-being of elderly • Reduce the burden on care givers • Assist elderly with everyday living
Health benefits and impacts	• Improve the physical and emotional functioning of elderly • Improve safety and coping ability of elderly
Economic benefits and impacts	• Reduce the healthcare costs

5.1 Analysis of the benefits and impacts of assistive technologies in the elderly home care

5.1.1 Social benefits and impacts

Enhance the elderly independence and mobility

The study by Demers et al. (2016) reported that assistive technologies are effective in enhancing the mobility of older adults, increasing their independence as they rely less on family caregivers to

perform their day-to-day activities. Mlelwa's (2020) findings also reveal that since the elderly require more support on needs related to the house, assistive technologies adoption has a direct impact on the physical environment of the house and promotes the elderly functioning, which in turn, indirectly improves the attitude, social perception, and belief of independent living. For instance, the robots can support the independent living of the elderly through monitoring, assist in offering household maintenance, mobility and social function, and maintenance of safety. The robot care can be provided by it working on itself or through interaction with it either by the elderly or care provider.

Sisay's (2017) study findings agree that the elderly undergo physical therapy because of functional decline. However, assistive technologies have been proven to have a positive effect on the process of rehabilitation and attaining physical independence. In many cases, the elderly who use assistive technology have shown functional decline delays and have experienced fewer difficulties than people who rely on personal assistance. Vichitvanichphong et al. (2013) study further found that the adoption of assistive technologies in elderly care enhances their independent living and daily active life.

Bring back elderly dignity and autonomy

According to Walsh (2014), old age is associated with reduced functionality that leads the elderly to depend on other people to perform other activities such as visiting family and friends, showering, and dressing; they have reduced control over their lives at this age. However, the findings of Walsh's (2014) study revealed that using assistive technologies helps to improve the elderly functionality and makes it possible for them to have some control over their lives. For instance, assistive technologies such as bathing devices and hearing aids positively impact on participation likelihood in several activities that brings increased health and social capital benefits. Thus, older adults continue to be active and gain control of their lives hence bringing back their autonomy and dignity.

Help to maintain the quality of life and well-being of the elderly

Dratsiou et al. (2022) study findings showed that assistive technologies help to maintain the quality of life and well-being of the elderly to enable them to remain active members of society. Dratsiou et al. finding revealed that the use of digital technologies such as cognitive and physical training software, face recognition and emotion software, motion detection devices, a social robot, and chatbots promote the cognitive and physical function of older adults with focus given to psychosocial functioning as well as supporting the elderly suffering from early-stage dementia through personalized cognitive activities. The use of ARI robots – the social and collaborative robots, increases older adults' acceptability and enriches their interaction level since this technology has a set of multi-modal behavioral capabilities such as speech interaction for supporting multiple languages and a combination of animated, expressive eyes and head movement to enhance gaze behavior.

Fotteler et al. (2022) findings further showed that a system that consists of a tablet computer connected to a scale of a patient is effective in improving the health-related life quality and self-care behaviors among participants who are slightly impaired or prefrail with heart failure; hence improving their well-being to remain active members in their families and community. The primary endpoint results indicated an improvement among the intervention group participants after a 90-day trial, indicating the positive impact of such technologies on the elderly.

Reduce the burden on caregivers

Sisay (2017) study found that the utilization of assistive technologies by the elderly having disabilities minimize the informal care given, hence reducing the burden of caregivers. The findings further found that assistive technologies for outdoor or indoor mobility, bathing, and bed transfer are substitutes for personal assistant services, while assistive technologies for toileting and bed transfer can complement the formal personal assistance services use.

In line with these findings, Nilsson and Lee's (2020) study concurs that assistive technologies are valuable and vital for caregivers. In this case, assistive technologies enhance efficiency by streamlining the work processes and easing the workload, reducing the burden caregivers have to bear

when caring for the elderly without using assistive technologies. For instance, both active and passive alarm systems, such as the motion sensor, were vital as they helped professionals or caregivers to get essential information from elderly patients; digital locks that help to ensure that elderly patient homes are always accessible for giving care when required; and Digital Medical Record Systems that has helped ease the work of caregivers by eliminating much paperwork and made accessible more information.

The findings by Mlelwa (2020) revealed that using assistive technologies helps to reduce the burden of caregivers through supporting chronic disease management of the elderly, thus, minimizing caregivers' stress level of caring for the elderly. According to the findings, assistive technologies such as Home Telemonitoring are good as they provide support to patients with chronic conditions through offering remote monitoring of patient's clinical signs and symptoms while at home, while Ambient Assistive Living (AAL) assists caregivers with the utilization of actuators and sensors to give support to elderly patients from a distant.

Prajapati and Sharmila's (2020) found that assistive technologies and modifications around home can offer the elderly caregiver’s instant relief, minimize their stress levels, and assist them in providing care to the elderly at home more safely and efficiently. Mlelwa (2020) revealed that using assistive technologies helps to reduce the burden of caregivers. This is achieved as these technologies support chronic disease management of the elderly, hence, minimizing caregivers' stress level of caring for the elderly. For instance, assistive technologies such as Home Telemonitoring are good as they provide support to patients with chronic conditions through offering remote monitoring of patient's clinical signs and symptoms while at home.

Sisay (2017) study found that using assistive technologies by the elderly with disabilities decrease the amount of informal care given, which in turn, minimize the burden of caregivers. For instance, assistive technologies for outdoor or indoor mobility, bathing, and bed transfer are substitutes for personal assistant services. Similarly, assistive technologies for toileting and bed transfer was shown to complement the formal personal assistance services use. Nilsson and Lee's (2020) study

concurs that assistive technologies are valuable and vital for health professionals such as the elderly caregivers/nurses. This is because assistive technologies enhance efficiency by streamlining the work processes and easing the workload, reducing the burden caregivers have to bear when caring for the elderly without using assistive technologies. Saborowski and Kollak's (2015) findings demonstrated that utilizing assistive technologies decreased the burden of caregivers when caring for the elderly. However, caregivers experience some difficulties when using certain technologies

Assist elderly with everyday living

Benefits to the elderly entail assistive technology helping the elderly to manage and improve their health and physical wellbeing, assisting them manage their everyday living and helping them to save money they spend on healthcare. These has been revealed by many studies from the review. The findings of Prajapati and Sharmila (2020) indicated that assistive technologies such as walkers, canes, and crutches help to increase elderly patients' base support, enhancing their balance, increasing their activity as well as functional independence. When using these technologies, the elderly functionality is enhanced, enabling their freedom of living alone and developing those activities for deriving their pleasure despite having social, mental, or physical limitations. Miskelly's (2021) study showed a similar finding, indicating that assistive technologies such as video-monitoring, electronic equipment, remote health monitoring, bed alerts and sensors like door monitors, fall detectors, pressure mats, heat and smoke alarms enhance the elderly security and safety, as well as their capability to cope well at home.

In line with this, Mlelwa's (2020) findings found that since the elderly require more support on needs related to the house, when they use assistive technologies, it directly improve the physical environment of the house and promotes the elderly functioning. This in turn, indirectly improves the social perception, attitude, and belief of independent living.

Loi et al. (2018) study same up with similar findings. The authors noted that there is a positive correlation between a TV-based assistive system and older adults' activation levels concerning health self-management. Their findings showed that using a TV-based assistive system positively impacts older adults' health self-management as the technologies activate them to perform self-care. This in turn, improve their health and helping them to maintain the quality of their lives. Demers et al.

(2016) reported that when assistive technologies are adopted in the elderly care at home, it helps in effective enhancement of the mobility of older adults. This assists to increase their independence as they rely less on family caregivers to perform their day-to-day activities. Dratsiou et al. (2022) study findings also demonstrated that assistive technologies help to maintain wellbeing and life quality of the elderly to enable them to remain active members of society.

5.1.2 Health benefits and impacts

Improve the physical and emotional functioning of elderly

Mlelwa (2020) study found that aging leads to an unavoidable reduction in physical and cognitive functions, and the use of assistive technologies helps to restore and enhance older people's functioning. For instance, the utilization of wearable sensors, which can predict fall risk results in the improvement of the elderly quality of life and physical activities. The study also revealed that aging comes with some unavoidable reduction in physical and cognitive functions. However, when the elderly use assistive technologies, it helps in restoring and improving the function of the elderly. This can take the example of using wearable sensors that can predict fall risk, which results in the improvement of the elderly quality of life and physical activities.

Additionally, mobile technology offers the elderly mobile games and programmed puzzles that increase their semantic memory performance. Sisay (2017) study found that assistive technology is essential in assisting the elderly with intellectual disabilities to improve or maintain their cognitive functioning and supporting their living as well as participation in the community.

Improve safety and coping ability of elderly

Fotteler et al. (2022) study revealed that assistive technologies such as personal disease management apps effectively improve and maintain elderly health. From the study, four out of five trials of personal illness management indicated a substantial enhancement in monitoring and self-care of disease-or-health-related pointers, effectively impacting the elderly safety and autonomy in certain circumstances. One study that the authors included for review showed mobile health apps' effectiveness in managing blood pressure among the elderly. However, the assistive technologies

did not indicate significant effectiveness with severely impaired or frail older people. For instance, only one out of five individual illness management device trials from the study demonstrated some substantial improvement, and the other four did not. The findings highlight that frail elderly may encounter specific certain challenging while utilizing assistive technologies that could impact how such technologies perform. Notably, the authors add that the success of and willingness for assistive technologies supported self-management may depend on the illness and is a factor that should be considered in future studies (Fotteler et al., 2022).

Miskelly's (2021) study revealed a similar finding, indicating that assistive technologies such as remote health monitoring, video-monitoring, electronic equipment, and sensors like pressure mats, door monitors, fall detectors, bed alerts, heat and smoke alarms improve the elderly security and safety, as well as their ability of coping at home. Mlelwa's (2020) study also found that assistive technologies help to minimize the risk of accident, fall, and getting lost among the elderly. According to the findings, wearable sensors, accelerometers, and ambient sensors that can be placed out door and indoors help in the detection of actions, human presence, movement, and even heart rate to help minimize accidents and falling risks among older people.

In Sisay's (2017) study, the author asserts that depression, dementia, risk of falls, and chronic illnesses impact the elderly independence and quality of health, which finally leads them to institutional care. However, the findings of this study revealed that the use of sensor technology and ICT act as an aid to help to detect and prevent falls and support self-care among the elderly, which enhances their safety living in their homes. Furthermore, the elderly risk falling and injury at night due to sleep disturbance. However, assistive technologies provide modifications in the environment, like grab bars that assist the elderly to safely move to around the house to visit the toilets, exit and entry of showers, and walk out and in of doors (Sisay, 2017).

5.1.3 Economic benefits and impacts

Reduce the healthcare costs

Fotteler et al. (2022) study found that the protection system of medical alert for the elderly staying alone can effectively reduce the length of hospital admission stay with a slight reduction in the many times the elderly could be hospitalized and emergency department visits. This, in turn, reduces the healthcare costs used in treating the elderly with chronic conditions due to a reduction in lengthy hospital stays and frequent emergency visits.

Supporting the findings, Mlelwa's (2020) findings reveal that assistive technologies such as social assistive robots (SAR) reduce healthcare costs and support independent living among the elderly. Through the automation of some caring tasks, the efficiency of caregivers is promoted, reducing the cost by eliminating the need for more nurses to provide care for the elderly. Also, reduction in healthcare costs is achieved through using robot technology, which contributes to increasing the efficiency and productivity in care through providing support to older people to perform self-care by taking many of the responsibilities by themselves.

Similarly, Sisay (2017)’s findings also arrived at the same conclusion that assistive technologies adoption in elderly home care helps to reduce the healthcare costs associated with caring for them by helping them. The reduction of healthcare costs is achieved when nurses can better utilize their resources and time when caring for dependent elderly patients who use assistive devices.

Also, Saborowski and Kollak's (2015) study found that when the elderly use assistive technologies, they minimize the money spent on healthcare costs associated with caring for them. This happens because assistive technologies help them to monitor their health at home instead of long stays in the hospitals. E-Health applications and assistive devices through the internet can help the elderly self-manage their health through connection to health care.

6 Discussion

Through the literature review and summary of the information derived from the literature, this systematic review has found that the use assistive technology is beneficial and positively impacts elderly home car. Accordingly, the review has identified three main benefits and impacts of assistive technology in elderly home care including social, health, and economic benefits. These benefits and impacts under social benefits entails enhancing the elderly independence and mobility, bring back elderly dignity and autonomy, help to maintain the quality of life and well-being of the elderly, reduce the burden on caregivers and assist elderly with everyday living; health benefits that include improve the physical and emotional functioning of elderly and improve safety and coping ability of elderly; economic benefits and impacts including reduce the healthcare costs.

6.1 Discussion of results

The authors of this thesis found that the use of assistive technologies in elderly home care is associated with social benefits and impacts such as improving the independence and mobility of the elderly, reducing the burden of caregivers by minimizing their stress level and increasing their productivity; help to bring back the dignity and autonomy of the elderly; and help to maintain quality of life and health of older people to remain active members of the society. These findings concur with a previous study by Madara Marasinghe (2016), which found that assistive technologies contribute to minimizing the burden of older adults' caregivers by reducing the assistance levels, energy and time put towards caregiving, reducing their fear and anxiety, safety risk and task difficulty, especially for activities that require increasing users' independence and physical assistance.

Also, another finding that supports this thesis view that assistive technologies help to bring back the dignity and autonomy of the elderly is from Garçon et al. (2016) study, where the authors found that assistive medical and health technologies help to ensure the autonomy and dignity of older people as the technologies assist them in performing some of their daily routines without depending on other people or caregivers. Further concurring with this thesis's findings that assistive technologies help to maintain the quality of life and well-being of the elderly to remain active

members of society is Olufokunbi (2018) study. The author found that assistive technology systems and devices catering for older adults can enhance sound health and graceful aging to solve the issue of elderly living fulfilled, long and productive lives through being active.

Similarly, Hubner et al. (2022) study found that the utilization of assistive technologies among older adults helps support their goals and improve autonomy, control, self-awareness, and pleasure. However, the author further note that there are barriers to adoption, which include technology familiarity and complexity, which needs to be addressed to facilitate the adoption of these technologies in elderly care. Additionally, Nelson et al. (2004) support this thesis's findings that assistive technologies help improve the independence and mobility of the elderly. The authors found that assistive technologies such as floor-based lifts, powered standing lift improvements, new ceiling-mounted patient lifts innovations, novel patient transport technology, and novel friction-minimizing devices help enhance mobility and prevent patient handling injuries.

A study by Khosravi and Ghapanchi (2016) further supports this study finding, revealing that using assistive technologies such as robotics, ICT, telemedicine, video games, sensor technology, and medication management applications effectively helps the elderly living at home to live an independent life, actively and safely. A study by Paul and McDaniel (2016) supports the finding that assistive technologies help to reduce the burden of caregivers in providing care to the elderly at home. According to the authors, using ICT to monitor the well-being and health of older people that live at home is expedient for care providers as it supports them in effective management of their time through the reduction of the need for frequent home visits to far locations and minimizes inconveniences from frequent trips that the elderly needs to make to the health care centers.

Furthermore, Klimova's (2019) study concurs with the thesis finding that assistive technology helps the elderly to live independently. The findings confirmed that using assistive technologies such as memory aid systems, social assistive robots, and protection assistive technologies has a positive impact on enhancing the independent and active living of older people. Furthermore, Mortenson et al. (2013) findings agree that using assistive technologies when caring for the elderly decrease

the burden of caregivers as the intervention group caregivers reported significantly increased satisfaction with assistive technologies because they experienced reduced care burden. Vichitvanichphong et al. (2017) further support that assistive technology, such as empowering technologies that offer training to assist the elderly in maintaining their practical capabilities, is vital for them to live independent lives for long periods.

Regarding health benefits, the authors of this thesis found that assistive technologies help improve the security and safety of elderly patients (such as fall prevention) and their ability to cope at home and improve their physical and emotional functioning. A study by Gettel et al. (2021) arrived at the same findings with the thesis view that assistive technologies enhance the security and safety of older people, noting that assistive technologies help to enhance the well-being and health of older adults, with many users deeming the technologies valuable and usable. According to the author's findings, using assistive technologies helps improve the functioning, cognitive and psychosocial status, reduce caregiver burden, and home/individual safety, such as fall prevention.

Concurring with this finding is Agree and Freedman's (2011) study, which showed that assistive technologies support the elderly psychological health as it offers them the capability to select the activity type, time for doing the activity, and approaches of carrying it out. For older individuals, the capability of living in their homes rather than in care institutions is the key life quality component. On the contrary, Scheffer et al. (2012) study found that assistive devices such as a mobile safety alarm having elderly community-dwelling drop sensor, automation of homes the elderly suffering from dementia in group homes, and feedback and gait-speed monitoring device for the elderly at falling risk were not effective in enhancing their safety and mobility. This finding shows the limitation of assistive devices concerning the type of disease that older people suffer.

Regarding economic benefits and impacts, Klimova (2019) study presented similar ideas to the authors of this thesis concerning assistive technologies helping reduce healthcare costs through enhancing self-care and minimizing admission and rehospitalization of the elderly with chronic conditions. Similarly, Vichitvanichphong et al. (2017) study supports this thesis's findings and found that the adoption of assistive technology in elderly home care helps to reduce the health care costs

used in caring for them, primarily through personal assistant services. In this case, assistive technologies help them to monitor their health at home instead in the hospitals using eHealth applications and assistive devices, also reduce the number of hours paid for personal assistant services as most activities in the house can be done independently around the house, hence minimizing the cost associated with care.

6.2 Critical evaluation, ethical considerations, and limitations

To evaluate the quality and credibility of the studies in this literature review, the authors used Hawker et al.'s (2002) assessment instrument. This instrument assessed the aspects of *introduction and Aims, Title and Abstract, Methods and Data, Ethics and Bias, Results, Transferability or Generalizability, Sampling, Data Analysis, Implications and Usefulness* of the selected articles on a scale ranging from one to four (1 representing the lowest while 4 representing the highest) with 36 points as the total derived by multiplying 4 by 9 (aspects assessed). 30 points are the minimum requirement for articles to be included in the review. Accordingly, for author 1, the highest article scored 35 points while the lowest article scored 33 points when critically assessing to select the articles to include for the review, with an average of 34.15 for nine articles selected, as shown in appendix 1. For author 2, the maximum article score was 35, and the minimum score was 33, with an average score of 34 for the nine articles selected, as shown in appendix 3. This assessment and critique criteria yielded the final articles, which the authors utilized to perform the interpretation and synthesis of the research findings.

The articles that were selected for inclusion in this review were restricted to the ones that could be freely available, published in English, or those that could be access freely in public. As such, articles samples selected and included in this study was not comprehensive because the subject of this review which is assistive technologies in elderly home care, is gaining increasing attention, and much research has been done with many findings. Thus, the limitation that could be present in this study includes bias. Although there was an extensive literature search, a likelihood may exist that hypothetically suitable studies may have been left out in this review. Besides, selecting the literature sources may have contained some bias elements and subjectivity. Therefore, this study could cover all the positive and negative findings, limiting the reliability and generalizability of the

thesis findings. Also, there could be a possibility that the study left out some articles within the study context that were published prior to 2012, limiting the validity and reliability of the findings of this thesis. However, the authors used these studies to support the thesis findings in the discussion section, hence enhancing the reliability and validity of the thesis findings.

Regarding ethical considerations, all the data from the selected articles presented in this review has been cited correctly from the primary sources, and the respective authors have received full attribution. The citation format is based on the American Psychological Association's seventh edition, which is the latest parameter and provides full recognition to the authors involved (APA, 7th edition).

7 Conclusion and recommendations for further studies

The adoption of technologies has proven to have a great potential to positively impact the elderly lives in-home care and even group homes. The elderly derive many benefits when using assistive technologies such as social benefits, including improving their independence and mobility; reducing the burden of caregivers by minimizing their stress level and increasing their productivity; helping to bring back the dignity and autonomy of the elderly; and helping to maintain life quality and well-being of older people to remain active members of the society; health benefits that include improving their emotional and physical functioning and enhancing their security and safety and their ability to cope at home; and finally economic benefits and impacts including reducing the healthcare costs associated with treating or caring for the elderly due to their inability to care for themselves.

Despite the benefits of assistive technologies, some of these technologies are not easily accessible, and some are expensive, limiting their use among the elderly despite the dearth of benefits they offer. Therefore, there is a need to conduct proper training for both the elderly and the caregivers when adopting these technologies. Also, there is a need to increase the accessibility of these technologies, which may call for policy responses or government intervention to support the elderly who cannot afford to acquire them.

Additionally, it should be taken into consideration that the effectiveness of assistive technologies on the elderly also depends on the frailty and the type of disease that the elderly are suffering from. This implies that the elderly who are severely impacted by chronic diseases such as dementia or depression, among others, or those with a level of frailty do not experience significant improvement or benefits from using these technologies and are less or insignificantly impacted by the adoption of these technologies, especially regarding independence and functioning. These findings show the limitation of assistive devices concerning the type of disease that older people suffer and their frailty level. Therefore, such older adults will still require personal assistance besides using these technologies.

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Appendices

Appendix 1. Author 1: Critical appraisal of the articles

Author	Title and abstract	Intro-duction and aims	Met-hods and data	Samp-ling	Data analysis	Ethics and bias	Results	Genera-lizabi-lity/ Transfe-rability	Useful-ness and implica-tions	Total score
Dratsiou et al. (2022)	4	3	4	4	4	4	4	4	4	35
Miskelly (2021)	4	3	4	3	4	4	4	3	4	33
Demers et al. (2016)	3	4	4	4	3	4	4	4	4	34
Fotteler et al. (2022)	4	4	3	4	4	4	4	4	4	35
Loi et al. (2018)	3	4	4	4	4	4	3	4	4	34
Nilsson & Lee (2020	4	4	3	4	4	4	4	3	4	34
Sisay (2017)	4	4	3	4	4	4	4	4	4	35
Walsh (2014)	4	3	4	4	4	3	4	4	4	34
Vichit-vanichphong et al. (2013)	3	4	4	4	4	4	4	4	4	35

Appendix 2: Author 1: Data extraction

Author/s, Year, Country and Title of study	Context	Methodology	Key findings	Hawker score
Demers et al. (2016). Effect of a tailored assistive technology intervention on older adults and their family caregiver: a pragmatic study protocol USA	This study examined the impact of a tailored assistive technology intervention that is inclusive of assistance users and their family caregivers.	The study used a combination of quantitative (an experimental, single-blinded study) and qualitative (detailed records of the therapists' interventions and interviews) methods.	The study findings revealed that tailored assistive technologies improves the mobility and functioning of the elderly and reduces the burden of care to family caregivers	34
Loi et al. (2018). Impact of a TV-based assistive technology on older people's ability to self-manage their own health Canada	This study accessed the impact of TV-based assistive technology on older adult's ability to self-manage their own health	It was a pilot study that included 19 older adults	The results were encouraging and indicate that there is the potential for the system to impact on older people' self-management skills.	34
Dratsiou et al. (2022). Assistive Technologies (ATs) for Supporting the Wellbeing of Older Adults. UK	The study aimed at investigating the role of ATs in supporting the elderly wellbeing	The study was implemented as the SHAPES project, which is an EU-funded innovation action	The study found that the SHAPES project enhances the engagement of older adults in a holistic technological ecosystem and, therefore, facilitate the maintenance of a high-quality standard of life.	35
Nilsson, F., & Lee, Y. S. (2020). Assistive Technology Within Elderly Care: A study of professional's attitudes towards using Assistive technology. Sweden	This thesis identified the kinds of assistive technologies currently used within elderly care and further examined the professionals' attitude towards the assistive technology	This was a qualitative study that used semi-structured interviews with a total of four professionals.	The empirical findings revealed that professionals have generally positive attitudes towards the assistive technology as it reduces their care burden for the elderly	34
Sisay, M. (2017). The use of assistive technology to support self-care of the elderly people at home Finland	The study aimed 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	The study employed systematic literature review by selecting 11 scientific articles written on the subject.	The study revealed that technology application plays a significant role in maintaining physical and cognitive functioning of the elderly and empowers them to live independently and safely. cost	35

Walsh, J. E. (2014). The impact of assistive technology device use on the participation levels and living arrangement decisions of older adults. USA	Using nationally representative sample of older adults, the paper examined the use of assistive technology devices (ATDs) designed to aid with mobility and sensory functioning and to improve one's capacity to perform activities of daily living.	The study analysed a new database from the National Health and Aging Trends Study (NHATS), a nationally representative sample of individuals ages 65 and older, drawn from the Medicare enrolment file	The study found that an individual's ATD use has a positive impact on active participation in activities such as visiting family and friends, attending religious services, joining clubs, going out for enjoyment, and volunteering.	34
Fotteler, M. L., Mühlbauer, V., Brefka, S., Mayer, S., Kohn, B., Holl, F., ... & Dallmeier, D. (2022). The Effectiveness of Assistive Technologies for Older Adults and the Influence of Frailty: Systematic Literature Review of Randomized Controlled Trials	The study aimed to evaluate the effectiveness of ATs on relevant outcomes with a focus on frail older adults.	The study applied the use of systematic literature review of randomized controlled trials evaluating ATs according to the PRISMA guidelines	8 trials showed significant effectiveness in all or some of the primary outcome measures. Personal disease management devices seem to be the most effective, with 4 out of 5 studies showing significant improvement of disease-related outcomes	35
Vichitvanichphong, S., Kerr, D., Talaei-Khoei, A., & Ghapanchi, A. H. (2013). Analysis of research in adoption of assistive technologies for aged care. Australia	This study aimed to provide detailed analysis on the research done in adoption for assistive technologies in aged care	The study conducted a systematic search on eight popular academic databases that followed three steps (1) Searching for the initial list of studies, (2) Relevance appraisal, and (3) Extracting data.	The study found that the adoption of assistive technologies in the elderly care enhances their independent living and improves their daily active life	35
Miskelly, F. G. (2021). Assistive technology in elderly care UK	This study reviewed the role of assistive technology in elderly care	The study used systematic review of literature of 16 studies for analysis	The findings revealed that assistive technologies improve older people's safety, security and ability to cope at home.	34

Appendix 3. Author 2: Critical appraisal of the articles

Author	Title and abstract	Introduction and aims	Methods and data	Sampling	Data analysis	Ethics and bias	Results	Generalizability/ Transferability	Usefulness and implications	Total score
Sisay (2017)	4	4	3	4	4	4	4	4	4	35
Dratsiou et al. (2022)	4	3	4	4	4	4	4	4	4	35
Loi et al. (2018)	4	4	4	4	4	4	3	4	4	35
Mlelwa (2020)	3	4	4	3	4	4	4	4	3	33
Saborowski & Kollak (2015)	4	4	4	4	3	4	4	4	4	35
Miskelly (2021)	4	3	4	3	4	4	4	4	4	34
Demers et al. (2016)	3	4	4	4	3	4	4	4	4	34
Prajapati & Sharmila (2020)	4	4	4	4	3	4	4	4	4	35
Nilsson & Lee (2020)	4	4	3	4	4	4	4	3	4	34

Appendix 4: Author 2: Data extraction

Author/s, year, Country and Title of study	Context	Methodology	Key findings	Hawker score
Prajapati, G., & Sharmila, K. (2020). Role of assistive devices in wellbeing of elderly: A review. India	.The study explored the role of assistive devices in wellbeing of elderly	The study employed systematic literature review to extract data and analyse the findings	The study found that the use of assistive devices by the elderly notably devote to a better quality of life, improving parameters of daily living like transportation assistance, communication, and participation in social life	35
Mlelwa, D. (2020). Describing how technology can help nurses in providing care in elderly settings: A systematic literature review Finland	This study explores how technology incorporation in elderly care help elderly to live safe and secured independently while reducing burden and workload on health care professionals	The study used systematic literature review using. Inductive and deductive methods were used to find the correct information.	Assistive technologies help the elderly to maintain cognitive and physical function, support chronic diseases management and minimizing risk of fall, accidents and getting lost.	33
Miskelly, F. G. (2021). Assistive technology in elderly care UK	This study reviewed the use and benefits of assistive technologies on elderly care	Systematic review of literature of 16 studies for analysis	The study found that assistive technologies such as video-monitoring, remote health monitoring, electronic sensors, and equipment such as fall detectors, door monitors, bed alerts, pressure mats and smoke and heat alarms can improve older people's safety, security and ability to cope at home.	34
Sisay, M. (2017). The use of assistive technology to	The study explored the option of assistive technol-	A systematic literature review was conducted by selecting 11	The findings of the study showed that technology applica-	35

support self-care of the elderly people at home Finland	ogy to support elderly people's self-care ability and reduce burden on home care providers by facilitating organized way of care service delivery	scientific articles written on the subject.	tion plays a vital role in maintaining physical and cognitive functioning of the elderly and empowers them to live independently and safely.	
Dratsiou et al. (2022). Assistive Technologies (ATs) for Supporting the Wellbeing of Older Adults. UK	This research investigated the role of assistive technologies in supporting the elderly wellbeing	A framework of shapes project, which is an EU-funded innovation action was employed	The implementation of the SHAPES project improves the engagement of the elderly in a holistic technological ecosystem and, therefore, facilitate the maintenance of a high-quality standard of life.	35
Saborowski, M., & Kollak, I. (2015). "How do you care for technology?"–Care professionals' experiences with assistive technology in care of the elderly. Germany	The study focused on exploring the experiences of the care professionals with assistive technology including the kind of assistive technology they use, the benefits and difficulties they experience using technology, the visions they have	The study employed a series of qualitative interviews with care professionals who work in care services or advise on technical aids for the elderly	The findings showed that the use technologies decreased the burden of caregivers when caring for the elderly. However, they experience some difficulties when using certain technologies	35
Nilsson, F., & Lee, Y. S. (2020). Assistive Technology Within Elderly Care: A study of professional's attitudes towards using Assistive technology. Sweden	This study identified the kinds of assistive technologies currently used within elderly care and further examined the professionals' attitude towards the assistive technology	This study employed semi-structured interviews with a total of four professionals. The authors analysed the empirical findings using Technology Acceptance Model	Findings of the study showed that professionals have generally positive attitudes towards the assistive technology as it reduces their care burden for the elderly	34

Demers et al. (2016). Effect of a tailored assistive technology intervention on older adults and their family caregiver: a pragmatic study protocol USA	This study examined the impact of a tailored assistive technology intervention that is inclusive of assistance users and their family caregivers.	The study employed both quantitative and qualitative methods such as an experimental single-blinded study and interviews	The findings of the study showed that tailored assistive technologies improves the mobility and functioning of the elderly and minimises the burden of care to family caregivers	34
Loi et al. (2018). Impact of a TV-based assistive technology on older people's ability to self-manage their own health Canada	This research measured the impact of TV-based assistive technology on older adult's ability to self-manage their own health	This study was a pilot study that included 19 older adults in the home care	The study found a slight improvement in patient activation measure (PAM) scores after 4 months, not reaching statistically significant values. Simultaneously, the results are encouraging and indicate that there is the potential for the system to impact on older people' self-management skills.	34