Use of e-health communication to improve social wellbeing in older adults

A Structured literature review

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Abstract

Introduction: The aged population is increasing and it correlates with comorbidities and hospital dependency. E-health communication is a potent source of communication between healthcare staff and people using it and it’s a non-medical way of getting access to health. Social well-being is an undeniable determinant of well-being and in older adults, it has special significance and promotes healthy aging.

Aim: The study aims to summarise the evidence on the “use of e-health communication to improve the social wellbeing of older adults”.

Method: This study has used a structured literature review as a methodology to gather and synthesize knowledge concerning the aim of what is already researched in this field. A systematic search was conducted in three databases, Cinahl, PubMed, and Web of Science along with the pearl growing method. 126 studies were found initially and transferred to Covidence. Inclusion criteria of all included studies were: related to humans, in the English language, and relevant to e-health communication of any type, older adults with chronic and without chronic diseases, and hospitalized and non-hospitalized older adults too. Young adults, older adults not using e-health communication of any type, qualitative studies, reviews, and reports were excluded. Studies were finalized after reading the title and abstract and then full-length reading was done. Caldwell’s quality assessment checklist was used to assess the quality of articles and 1 article was removed based on that.

Results: Out of 126 studies, 11 studies were finalized for the review based on inclusion criteria and full article reading. Out of 11 articles, n=3 was cross-sectional, n=5 were surveys, n=1 was a clinical trial, n=1 was a randomized control trial, and n=case-control study. There was a range of geographical regions that arose, most of the studies were from the USA n=5, n=2 from Spain, n=2 from Sweden, n=2 from China, and n=1 from the United Kingdom.
and the European Union. The studies were of good and moderate quality. All included studies showed the scarcity of knowledge on social well-being and its direct link with e-health communication and older adults. Most of the studies presented results with relevant social concepts which eventually define social well-being. Different types of e-health communication tools were being used by older adults. Additionally, e-health communication proved to be useful in improving the social well-being of older adults in many ways. Moreover, satisfaction, quality of life, contentment, and social connectedness were reported in many studies which also come under the domain of social well-being.

**Conclusion:** From systematic literature search and results, it is evident that e-health communication has a positive impact on the social aspect of well-being but due to ambiguity in its definition, a lot of other social concepts are being used in literature and research. Studies should be conducted either quantitative or qualitative to expand the knowledge in this area of study.

**Key words**

E-health communication, social wellbeing, older adults, ageing

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1 Introduction

1.1 Ageing

The aged population (65 years or older) is increasing day by day and it will reach nearly two billion in 2050 as stated by the United Nations (2020) and with that, a lot of challenges can be witnessed in terms of economic, social, and healthcare burdens. Aging has become a worldwide concern nowadays. In 2018, the number of older adults aged 65 or above has increased tremendously and has left behind the number of children born for the first time in history. 22% of the global population will be of age 65 or above as per estimation by 2050 (Nations, 2015).

To tackle this increase in older adults, proper planning, better health services delivery, and provision of basic life facilities will be required to empower this age spectrum with autonomy and happiness. Ageing often goes hand in hand with chronic illness and disabilities and more need for care and aid from the healthcare sector is increased (Landi, 2010). Rantanen et al. (2019) defined active aging as: "the striving for elements of well-being through activities relating to a person’s goals, functional capacities, and opportunities" (p.2). Rantanen et al. (2021) described activity as participation but when it is adhered with aging then this becomes active aging and, in the elderly, mostly physical activity and being able to perform chores is very crucial for the wellbeing and life satisfaction.

The World Health Organization (2002) defined independence in the context of aging as "the ability to perform functions related to daily living i.e., the capacity of living independently in the community with no and/or little help from others" (p.13). Rudnicka et al. (2020) stated healthy aging is the “maintenance of well-being by the development of functional ability (ability to grow, learn, move, get basic needs and to add value to society)” (p.3) nowadays active aging concept is being used widely.
There is a great diversity in the well-being of older adults some live active lives free of major health issues while others are compelled to live with non-communicable diseases. For example, Diabetes, High Blood pressure, and cardiovascular diseases (World Health Organization, 2011). In older adults, there is a probability of having multiple chronic conditions which is 77% higher as compared to young adults. Other related factors include social roles, relationships with friends and family, and decline in physical and mental health with age. The transition in physical and mental health of older adults becomes challenging if health and mental health services are not sufficient and it is a global imperative to provide basic health services to this section of the population (Bähler et al., 2015; Hirst et al., 2013; Luo et al., 2020).

The needs of older populations are quite complicated and it is not easy to co-align them with current healthcare systems. In addition to that, the healthcare system is inclined towards more biomedical treatments and individual diagnosis rather than to focus on the overall well-being of an individual. (Coleman &Boul., 2003; Knight, 2013; Picco et al., 2016).

The concept of aging has been explored a lot during the last few decades. Generally, aging is considered a progression on the age spectrum with an overall decline in health and fitness (Rowe & Kahn., 1997). Ageing is a normal health phenomenon but what matters is to age well. Therefore, successful aging can be defined as aging without any physical disabilities and chronic diseases with that social wellbeing and mental wellbeing should be optimal. (Rowe & Kahn., 1997).

Rowe & Kahn (1997) considered the idea of including mental and social well-being in successful aging for the first time. And explained that no health can be achieved without considering the social aspect of wellbeing.

The idea of living without any major ailment is considered ancient now because at present overall well-being is getting more recognition which includes mental, physical, and social well-being. In 2013, five domain
concepts of healthy aging were introduced and they were based on physiology and metabolism, physical capacity, cognitive functioning, and psychological and social well-being (Hornby-Turner et al., 2017; Lara et al., 2013). In contrast that, Hornby-Turner et al. (2017) classified healthy aging into four basic domains personal, economic, social, and environmental. This highlights that successful aging is a diverse concept with a variety of domains explained by various authors in history. The common terminologies used in aging studies are active aging, ageing well, and successful aging. At present, the term healthy aging is being more appreciated (Lara et al., 2013; Lu et al., 2019).

The reason behind the concept of healthy aging is the definition of health provided by the World Health Organization. The fact is, simply the absence of a disease cannot be considered health because it includes social, mental, and physical well-being as well (Abud et al., 2022). Therefore, these three entities are vital and interlinked for the overall well-being of an individual. Considering three main components of basic human health: Social, mental, and physical as given by WHO, we can further classify and explain the concept of well-being in healthy aging (Solar & Irwin, 2010; Leykum et al., 2022).

There are several determinants of health for example physical, social, environmental, mental and economic etc. Considering the social determinant of health which is non-medical but impacts health in different ways. These include the situations in which people are born and raised, and a variety of factors and systems that affect the quality of life in aging (Solar & Irwin, 2010; Leykum et al., 2022). The world’s aging population faces several discriminations, divisions, and disparities in society because social positioning is based on age. This leads to many age-based inequalities and poor health facilities. Aging and social isolation are interlinked and loneliness affects the overall health or well-being of old adults (Levy et al., 2020; Officer et al., 2020).

1.2 Social well being
Social well-being can be understood based on some aspects which are social meaningfulness, autonomy, independence, connectedness, contribution, and values (Mosley-Johnson et al., 2019). Social wellbeing comprises two criteria for example tangible presence of connections or exchanges which are external criteria and the internal criteria is to get satisfied with the quality of these connections and exchanges (Ahn & Shin., 2013).

“Social well-being” is not a new notion and it has been added by the World Health Organization to the definition of health. Even though it has no appropriate definition until now and different studies have shown different explanations regarding that there are several concepts through which social well-being is being discussed (Waite., 2018; Datta et al., 2019). Social relationships, social engagement, happiness achieved by social interactions, satisfaction, autonomy, social connectedness, and meaningful social activities. This is how, social wellbeing can be explained in the context of these highly relevant social concepts (Waite., 2018; Datta et al., 2019).

Social Isolation can cause disruptive transformations (damaging phenomena) in the elderly population (Datta et al., 2019). Meaningful social relations improve the quality of life of senior citizens and the absence of human contact can tremendously deteriorate the mental and physical health of the elderly. This shows social well-being is highly linked with emotional and physical well-being (Ahn & Shin., 2013).

Social loneliness is an overarching mechanism that is not easy to prevent because a massive number of senior citizens live alone. 7.7 million older adults are living alone in the United States and others are at risk of social isolation (Johnson et al., 2008). With the age progression due to chronic health conditions, social engagement becomes less because of several conditions like changes in marital status, mobility problems, retirement, etc. Social participation, independent living, and quality of life become limited with age (Park., 2009).
Social Isolation and loneliness are the most significant determinants of health and these have the same effect on mortality rate. Social Isolation and loneliness have the same effect on mortality as that of obesity, diabetes, and physical inactivity. Digital health has introduced a lot of interventions to minimize loneliness and social isolation (Feng et al., 2020).

It is said that social well-being is highly affected by physical, psychological, and mental health. If Social wellbeing gets disrupted it will also disrupt the physical and mental health because these are deeply interlinked (Thoits., 2011). Any effect on social well-being can lead to stress and stress causes wear and tear in the human body which results in physical diseases (Thoits., 2011). Social interaction and healthy communication can reduce stress but on the other hand, social interaction can also have a negative impact if it is too complicated, draining, and judgemental. (Offer & Fischer., 2018).

There are several dimensions of social well-being: Social network, social participation, social isolation, social support, social environment, and social inclusion. First of all, social network means the number and range of social connections developed by an individual to socialize with others (Cornwell et al., 2009). Secondly, social participation is taking part in social gatherings, events, and activities. The level of social participation shows how active a person is. It helps to create direct and indirect relations with other participants and create collective support for each other. In older adults’ social participation helps to gain confidence and inner satisfaction which directly improves their overall wellbeing (Bowling et al., 2016).

Socially isolated people have a higher risk of getting chronic stress-related diseases than people who are connected socially. It is a negative factor and adversely affects the aging process because the people who are isolated have less emotional, financial, and social support (Hawkley & Capitanio., 2015). During their sickness, they have possibly fewer people around them who can support them. Such conditions trigger emotional and psychological
disturbances. It is considered a powerful measure of social well-being (Hawkley & Capitanio., 2015).

Social support also affects health because if elderly people get sick, they need resources such as financial support and provision of care. Having good social support can reduce stress and have an overall positive impact on social well-being. It may give the strength to fight ailments (Thoits, 2011).

The social environment influences wellbeing in the same way as the physical environment deteriorates health conditions by pollutants and toxins in the environment. Sometimes it can also improve health for example, in pleasant areas (Cagney et al., 2014). A social environment is a surrounding in which a person interacts with others and with nature. For example, older adults in congested poor conditions where they interact less with the environment, experience more depression. Whereas those adults living in wide open houses/areas experience healthy and pleasant interaction with the environment as well as with other human beings (York-Cornwell., 2013).

Neighbourhood designed according to the age group of individuals is much more effective for the well-being of older adults. The social environment is not just outside of the house but dirty households can also affect health. Both are a part of social contact for health (York-Cornwell., 2013; Cagney et al., 2014). Social Inclusion can be explained as the valuable involvement of an elderly individual in basic and important matters of household, gatherings, and overall society which makes them feel valued and worthy (York -Cornwell., 2013; Cagney et al., 2013). Spatial barriers and social communication in older adults can be minimized by technology. Technology must be accessible, easy to use, secure, and affordable. Many older adults use digital health to interact with healthcare staff but their knowledge is very limited (Cagney et al., 2013).

Older adults are not skilful and mostly they do not know about the pros and cons of using digital health. Using digital media is quite easy but E-health technology requires some training and guidance. Health literacy (Health
Education) can minimize the deteriorating effects of social loneliness by improving the social participation of older people (Amoah., 2018). The second barrier is economic constraints because digital health is really expensive for people with low socioeconomic status (Amoah., 2018).

In the pre-COVID world, face-to-face interaction was considered significant but covid 19 has transformed the real world into a digital world (Feng et al. 2020).

1.3 E-health Communication

E-health communication is communication through digital applications, the web, video conferencing, etc., and sometimes the use of electronic health records to keep a check on someone’s health. The healthcare system and the user remain connected via this (Neuhauser & Krep, 2010). Hovenga (2010) explained the importance of health information technology and its brewing revolution in healthcare and emphasized the replacement of health communication with e-health communication because of the advancing digital era. Furthermore, e-health communication can be very useful in self-care and self-monitoring of one’s health and overall health can be improved (Neuhauser & Krep, 2010).

Digital health tools are becoming a crucial part of modern healthcare and it is evolving with time. Digital health should be designed in a way that every end user: medical professionals, healthcare staff, and senior citizens can take part to achieve better health (Lokmic-Tomkins et al., 2023). Patient-centred approach (specially designed tool for a specific group of patients) is becoming famous nowadays because of the increasing demand for digital health after covid-19. For example, older adults need specific features that should be useful for them and easy to operate as well like mobile phones, tabs, and laptops with E-health communication options (Lokmic-Tomkins et al., 2023).
The terminologies like telehealth and telemedicine are quite similar and they can be used in place of each other. Telehealth is a part of E-health because telecommunication technology is also used in it. Healthcare information, guidance, and education are delivered using telehealth (Balestra, 2018; Piteira, 2018). Telemedicine is covered by a huge umbrella of telehealth and it is highly likely linked with the delivery of clinical services. Both are almost the same and deal with medical educational programs and monitoring patients remotely with regularity. Consultation of patients via video conferencing, mobile health applications, and transmission of medical diagnostic images and reports are also covered in this category (Balestra, 2018; Piteira, 2018).

Healthcare information technology growth can be seen in a variety of healthcare services using technologies. It was unimagined in history but advancement in telehealth has been stimulated to another level (Piteira, 2018). E-health communication comprises a wide range of healthcare practices and specialties for example telephone exchange between patients and healthcare staff, emailing, video chatting, online conferencing, internet browsing, and various digital mobile health applications. After covid-19 there is a rapid increase in usage of telehealth. Medicine misuse, unnecessary hospital visits, and prolonged hospital stays can be minimized by telemedicine (Piteira, 2018; Lokmic-Tomkins et al., 2023).

E-health communication is very useful in distant areas where practical delivery of healthcare services is nearly impossible. It also reduces patient traveling and waiting time. Therefore, with its quality overall healthcare services can be improved and made accessible to everyone. (Lokmic-Tomkins et al., 2023). Telehealth is getting popular in every age group due to its convenience, affordability, and better access. There are a large number of benefits of E-health communication but this widespread adoption of technology has to face a lot of barriers as well. The biggest barrier is the usage of this E-health technology for older adults because they require much guidance and training to get used to it (Piteira, 2018).
There are a few drawbacks of E-health that cannot be denied. For example, the biggest issue related to this is cyber security breaches in which the privacy and confidentiality of adults are at risk. Another biggest challenge of using E-health is, that it provides limited access to patient examination (Yang & Kozhimannil., 2016; Balestra., 2018). Consultants generally rely on information provided by patients and sometimes can only examine a case superficially which can lead to wrong or incomplete diagnosis. Few medical conditions demand thorough physical evaluation and examination of the patient which is not possible yet by using the E-health system (Yang & Kozhimannil., 2016).

Mobile health is a new concept introduced in the last few years. It is highly linked with the computing traits of mobile phones to make healthcare connections possible with users to improve healthcare delivery (Yang & Kozhimannil., 2016, p.1). Numerous mobile health applications are being successfully used by many patients. Mobile health is most affordable because phones and tabs are available to everyone which are easy to use. Such applications are user-friendly and can be easily used by every age group (Yang & Kozhimannil., 2016). Mobile health apps played a very significant role during the pandemic Covid-19. Before that E-consultation has been a controversial topic in many areas of the world because of its limitations and ethical constraints.

Shop Well is a mobile application used by older adults to educate themselves about healthy customized diets. It can help the older population to monitor and balance their dietary habits. Good dietary habits can help individuals to reduce symptoms of constipation, dyspepsia, and GIT ulcers. Therefore, they can enjoy an energetic and healthy daily routine (Yang & Kozhimannil., 2016; Balestra., 2018).

Pill monitor is another useful application in the field of mobile health. It gives you reminders about medicine timings and dosages. It also keeps a record of a patient's health status which can help in the proper
treatment of patients. It is really needed because as humans grow older, they tend to forget things or suffer from dementia therefore, such application can play a role in this regard (Yang & Kozhimannil., 2016; Balestra., 2018).

The digital era has completely transformed now because it is the time of Artificial intelligence as healthcare has introduced avatars to support patients and increase the effectiveness of their services. An avatar can perform the duties of a human being whether it is related to socializing, communication, care or simply eliminating the side effects of loneliness (Shaked., 2017). You can have virtual avatars that will communicate with you like a natural human being or you can have a robot that can do things for you. You can have a robot friend or a caretaker like a nurse. Virtual agents or avatars are getting popular because they are being incorporated in hospitals, clinics, and even at houses where they perform specific assigned duties 24/7 (Shaked., 2017).

1.4 A triad of e-health communication, social wellbeing and older adults

Using technology for older adults is quite complicated. Aging is linked with an overall decline in health as humans suffer from various conditions like a decrease in cognitive functions, physical weakness, social isolation, and chronic diseases (Wallace et al., 2013). Here, E-health technology can help by improving socialization, and physical activities and helps to become mentally sound and functional. Despite E-health importance, it cannot be denied that there are a lot of barriers too, especially for older adults regarding its use (Wallace et al., 2013).

The number one barrier is the physical barrier, especially for physically weak or disabled older adults because motor functions decline as the age progresses. Another barrier is the acceptance barrier. Many old people tend to believe that they cannot get used to new technology or they are afraid of learning new things (Gitlow., 2014). This can be challenging to train healthcare staff. Few solutions can be proposed to overcome such barriers for
example, technology developers should concentrate on making technology simpler and user-friendly for old individuals (Gitlow., 2014). Clinicians should also motivate patients to use such gadgets and applications by guiding and educating them. This approach can drive good results for both patients and the overall success of the healthcare system (Gitlow., 2014).

In recent years, diverse solutions have been proposed to aid older adults and promote healthy and active aging. Technology is emerging as an impressive solution to support people in old age (Lenca et al., 2018). Digital tools are developed to meet the demands and desires of the older population. Geron-Technologies is a terminology used for digital technologies designed to support the older population’s health because it has features that are specifically related to baby boomers (people of older age) (Lenca et al., 2018).

Diverse geron-technologies and other E-health tools may help older adults in fulfilling regular tasks particularly these are used in people with dementia and other age-related chronic conditions (Lenca et al., 2017; Lenca et al., 2018). E-health tools which provide not any specific assistance in functions but can provide some important information for better functioning for example, fitness activity trackers can measure and track physical activity records. Self-monitoring devices help to measure physiological, cognitive, and other metrics related to fitness e.g., heart rate, blood pressure daily steps count, etc. (Lenca et al., 2017; Lenca et al., 2018).

To maintain healthy aging a person should be actively involved in society and relations with friends and family directly affect the overall health and aging of an individual. Several approaches can be used to promote well-being and to make older adults functionally independent (Lenca et al., 2017). An aging person can join various health-related seminars, events, and gatherings. There are several needs of healthy aging in which mobility is the primary need of life for independent living while decision-making, developing and maintaining relationships, and becoming a potent contributor in society are other important needs (Lenca et al., 2017).
Kibel & Vanstone (2017) stated the importance of digital technology use and its relation to quality of life. Quality of life and well-being are someone’s valuable needs of life in which satisfaction and contentment lie (Burr et al., 2020).

When older adults become able to actively take part in society and are considered autonomous and independent, they achieve social well-being (Datta et al., 2019). E-health communication provides aid to older adults to take part in digital society through various devices from which information can be accessed. They can interact with others too. Technology-based communication offers easy access to healthcare services and features. By these interactive mechanisms negative impact on health caused by social isolation can be omitted (Datta et al. 2019).

Socializing is basically “the activity of mixing and interacting socially with other human beings or it can also be defined as a natural human process of learning to behave or act in a way that is acceptable to society and its members” (Burr et al., 2020, p.4). E-health can play a significant role in eliminating social isolation and related issues in elderly people (Shaked., 2017). As mentioned earlier, special AI Avatars have been introduced which can behave and communicate like human beings therefore, they are capable of eliminating the feeling of loneliness and isolation. It has been seen that the usage of such avatars has improved the mental and social health of many old isolated patients (Shaked., 2017).

Aung et al. (2022) conducted a mixed-method study in Japan, Thailand, the Republic of Korea, and Singapore and figured out that governments have policies to make internet access possible and secure but the main problem is, that old people are not digitally inclusive and this no usage of digital health by elderly leads to the digital divide. The authors highlighted that health promotion and digital inclusion are very crucial for healthy ageing but these can be achieved by keeping culture and circumstances in mind. The DIHAC (digitally inclusive, healthy aging communities) team (the team that
works to keep a check on the regulation of digital health among older adults) 
got different cross-cultural findings and these could be a hallmark in digital 
inclusion for healthy aging (Aung et al., 2022).

Ho & Merchant (2022) concluded that most older people have enough knowledge of how to use e-health but half of them have anxiety and fear associated with the use of e-health and they consider it a financial burden, so more focus should be on the evaluation of these barriers. Chaudhry et al. (2022) agreed that in older people, fear and economic burden are important to address but with that their “Not for me attitude” is also a hurdle that cannot be ignored. Privacy concerns that older people have while using mobile health (e-health applications) are another hurdle.

Andre et al. (2022) and Coley et al. (2022) stated uncertainty about using mobile phone interventions for cognitive and cardio-metabolic disorders because of fewer studies in this area and no prior authentic evidence. To make older people more engaged there should be no inequalities or disparities in promoting health-related behaviours through e-health (Coley et al., 2022). Fadrique et al. (2020) described that assisted active living is in demand because of the growth of the aging population and the use of technologies and figured out that policies and strategies to develop applications and other digital solutions are not a big challenge. The challenges are non-technical parts and those are interoperability, accessibility, privacy, end user engagement and interoperability (Fadrique et al., 2020).

McIlduff et al. (2022) explained the importance of keeping in mind the traditional and cultural aspects while developing any training module or engagement strategies for older people, especially indigenous people. Indigenous people showed satisfaction and a better understanding of technology use in accessing health during a pandemic. Gaspar & Lapão (2022) designed a digital service for the elderly who are prone to falls based on previous research recommendations and used a designed research methodology to integrate it into healthy aging. The authors named that service
“BALANCE” and interviewed focus groups of old people who were using these digital solutions to prevent falls participants showed satisfaction but the research team found challenges at the implementation level i.e., the digital divide, and recommended more implementation strategies for digital services (Gaspar & Lapão.,2022).

Technology can play a vital role in promoting active aging and in reducing healthcare burden because more engagement in e-health (use of digital applications and telemonitoring) can empower the elderly as described by Bernardo et al. (2022). Autonomy and independence can be seen more but there is scattered knowledge on the e-health platforms that can facilitate e-health interventions in the elderly (Bernardo et al.,2022).

On the other hand, Robbins et al. (2018) stated that active aging in older adults 65 or older is an ultimate goal of many international entities by increasing life expectancy and focusing on living life with satisfaction. The authors in this systematic review highlighted that telemedicine, telehealth, and many other e-health interventions can be effective and several methodologies are used by researchers to investigate the importance of e-health interventions in active aging. Still, there is less research on the technical aspects of research which is equally important in introducing these digital health interventions to old people. So, both areas of research should go hand in hand to develop an effective strategy for active aging (Robbins et al.,2018).

E-health platforms are facilitating platforms that motivate, counsel and monitor people in social, physical and nutritional domains via the web, telemonitoring videos etc. and are specifically used to facilitate older adults for physical and social benefits by motivating them (Bernardo et al.,2022). Marsch et al. (2019) pointed out the importance of adopting a positive attitude toward healthy ageing. This attitude does not come on its own. A lot of interventions and health promotions help aged people to alter their behaviour toward active ageing which can contribute to their well-being as well. Technology integration while developing interventions and promotional
programs was considered important because technology may contribute positively to the complex process of changing behaviours (Marsch et al., 2019).

On the other hand, Richard et al. (2019) highlighted the improvement in health and health-related outcomes by e-health tools in old people and transition from an unhealthy lifestyle to a healthy lifestyle i.e., in smoking cessation, eating habits, physical activity and other positive attitudes. E-health technologies helped old adults overcome their habits which were pushing them toward chronic conditions like cardiovascular diseases etc. Several internet-based interventions acted as a counselling platform for the elderly and were reported satisfactory for healthy ageing (Richard et al., 2019).

Piera-Jiménez et al. (2020) demonstrated that digital health interventions are becoming popular among people with cardiovascular diseases for self-care but cost-effectiveness (affordable for everyone) is still questionable. Muellmann et al. (2018) compared both digital and non-digital health interventions for social well-being and described that they cannot conclude which kind of intervention is more effective because there is a lack of evidence on that. Van Doorn-van Atten et al. (2018) and Callahan et al. (2021) stated that telemonitoring made older adults more conscious about self-monitoring and evaluating their health-seeking behaviours and also the impact of these changed behaviours on the well-being of older adults.

2 Problem statement/Rationale

Most of the previously reviewed evidence on the e-health interventions (m-health, telehealth and digital apps) to promote healthy aging focused mostly on health-related behaviours like physical activity and suggested to have insight into the social well-being of older adults about e-health (Buyl et al., 2020).
There is a need to conduct a study on the social aspect of health, it may hinder the implementation of e-technology (Daryoush et al., 2020). The acceptance of e-health technologies has proved effective for physical health, but the least knowledge is available on social health (Ho & Merchant, 2022). There are several reviews on the physical well-being and psychological well-being of older adults but studies and reviews are scarce on the social well-being of older adults (Sen et al., 2022). The evidence on digital technology, improvement in social well-being and older adults in general has been reviewed but about e-health still there are not enough studies and reviews (Sen et al., 2022).

From the literature review, it is concluded that the ageing population’s exponential growth has become a global concern and with the increase in aging population, the healthcare burden is increasing. With the development of technology, digital health and e-health interventions, the overall healthcare burden may be less and it may have a very positive effect on the overall well-being of people. Ageing often goes hand in hand with chronic disorders but factors that make the aging process worse and have a negative influence on the process of aging can be modified. These factors could be loneliness, isolation, lack of satisfaction and social involvement. Digital divide and digital illiteracy can be other issues in this.

There is development of healthcare technology especially e-health and its mixed effects (negative and positive) on the wellbeing of young people can be seen but when it comes to older adults 65 years or above, it is still questionable. The use of e-health interventions is challenging in older adults due to a lack of knowledge and the digital divide.

Several studies show the positive outcomes of using digital health in older adults, especially in improving the physical, mental and psychological well-being of older adults. Despite the benefits of using e-health communications of any type, little is known about e-health communication to improve the social well-being of older adults (Sen et al., 2022).
3 Study Aim

This study aims to investigate knowledge on the “use of e-health communication to improve the social well-being of older adults”.

4 Theoretical Framework

In this study, a health promotion model would be used to elaborate and support findings because this seems to be a suitable model with the aim of the study. This model helps to regulate the use of health communication interventions and encompass all aspects of e-health communication and regulation (Yerrakalva et al., 2019) Nola J. Pender developed health promotion model first time in the 1980s to explain the complexity of bio-psychosocial processes through which individuals get motivation to adopt certain health-related behaviours to improve their health and quality of life (Pender, 1996, p.51). It was further modified many times. It is widely used in promoting health-related behaviours in nursing contexts, especially when new interventions are introduced to people by healthcare systems (Pender et al., 2005). Pender et al. (2005) described that there are various dimensions of the nature of individuals as they achieve better health by interacting with the environment.

Three primary areas are considered in Pender’s model (See Figure 1)1. Personal/individual characteristics.

2. Behaviour-specific knowledge/cognition 3. The actions/outcomes are regulated by the effect of knowledge. The modifiable variables, perceived usefulness, perceived benefits, perceived barriers, self-efficacy and interpersonal influences (social support provided by family, friends and clinical staff to learn about interventions) in behaviours-specific knowledge have motivational importance and can be modified by implementing interventions (See Figure 1). Individual characteristics, gender, age, race,
socioeconomics, prior knowledge, and psychosocial and sociocultural aspects are modifying factors (See Figure 1) that can alter modifiable variables too (Pender et al., 2005).

These modifiable variables when modified by interventions might result in improved health and well-being, better quality of life and increased ability to function (Pender et al., 2011).

According to this model, the variables perceived usefulness, perceived barriers self-efficacy etc. can be influenced by using interventions and recent studies are showing the use of e-health communication as an intervention to influence these variables to improve well-being (Yerrakalva et al., 2019). This framework is relevant to this study since it explains how individual characteristics and interventions might change behavior-specific knowledge to get a desired outcome which is social in this study. Furthermore, previous studies have used this model to evaluate the use of e-health to improve the different domains of well-being and how the framework of this model supports the findings of those studies (Yerrakalva et al., 2019). Sen et al. (2022) used this model to evaluate the use of technology to improve social well-being in older adults and this model supported many findings of that study.

Additionally, self-efficacy (the ability to achieve a goal to regulate well-being by having control over environmental factors) and social cognition (to interact socially but it can have both negative and positive impacts on well-being) were introduced by Bandura (2004) in the context of a health promotion model. And explained that wellbeing cannot be achieved without giving importance to the social aspect of wellbeing. The social environment should be designed in a way that should meet individuals’ characteristics because how an individual perceives a social environment feasible for interaction varies from individual to individual.

List of definitions related to Health promotion model
<table>
<thead>
<tr>
<th>Variables</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived usefulness/benefits</td>
<td>The extent to which an individual believes that use of technology can be beneficial/useful (Pender et al., 2005).</td>
</tr>
<tr>
<td>Perceived barriers</td>
<td>The extent to which an individual believes that use of technology is not possible due to certain barriers (Pender et al., 2005).</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>The ability to achieve targets by believing in oneself (Bandura, 2004).</td>
</tr>
<tr>
<td>Interpersonal influences</td>
<td>Social support provided by clinical staff, friends and families to use interventions (Pender et al., 2005).</td>
</tr>
<tr>
<td>Behaviour-specific cognition</td>
<td>The knowledge of an individual’s own behaviour. (Pender et al., 2005).</td>
</tr>
<tr>
<td>Modifying factors</td>
<td>Those factors which can alter other variables (Pender et al., 2005).</td>
</tr>
<tr>
<td>Modifiable factors</td>
<td>Those factors which can be altered by modifying factors and interventions (Pender et al., 2005).</td>
</tr>
</tbody>
</table>

Figure 1. Health promotion model

e-health communication, applications, interventions and platforms are usually target based in which some goals are to be achieved for example in an application for physical activity if someone walks 1 km, he or she gets an appreciation by default features of the application. This is how a person gets help in regulating healthy habits and well-being. The appreciation, feedback, alerts and information from web browsers aid people in getting motivation to use e-health communication and maintenance. (Yerrakalva et al., 2019). These types of applications can make people more committed to acting in a certain way to achieve targets which can be more social participation in this study (Yerrakalva et al., 2019).

On the other hand, interaction, by digital counselling, video conferencing, and telehealth can make people motivate to be involved more in their social environment and then through this interaction, social well-being and positive outcomes can be achieved (Peiris et al., 2022).

This theoretical framework is being used for health promotion purposes and by using this the results of this study can be evaluated further because this study deals with social well-being (the outcome) and interventions like e-health communication.

In this study, e-health communication and its different types will be taken into account as interventions. On using this intervention, what can be the possible improvement in the social wellbeing of older adults?

5 Transdisciplinary Position of degree project

Piaget (1972) stated that trans-disciplinarity is a level where two types of interactions occur, one with the specialised areas and one with the whole system without any distinct boundaries between different disciplines and the sum of knowledge helps to solve complex problems (p.138). Sargent et al.
(2022) explained that trans-disciplinarity is very important to address today's complex situations like health-related, policy-making and research collaborations to find solutions to problems.

Sargent et al. (2022) discussed bringing theoretical knowledge to practice for promoting healthy ageing because ageing is such a complex problem and to deal with it, there is a need to make a framework that is realistic and not just theoretical. For healthy ageing, some implementational and practical approaches were concluded as a result of translational knowledge beyond disciplines (Sargent et al., 2022). Health promotional programs, personalised health for better engagement and age in place with telemonitoring and counselling can lead to healthy and productive aging and the elderly can contribute to society in a better way without becoming a burden on the healthcare system (Sargent et al., 2022).

Yeung et al. (2021) discussed that AGE- WELL program, a trainee program is used in Canada to make elderly people engage with technology and make them oriented toward better living by knowing the challenges and barriers of complex health and societal issues this program is developed by the collaborative efforts of different stakeholders involved in making aging active and easy for people.

Yeung et al. (2021) after interviewing trainees, researchers and collaboration teams who were working to make this program successful, suggested that trans-disciplinarity should be included otherwise so many tiny but important issues would be ignored to deal with these complex issues like aging. The best way is to add academic and non-academic disciplines and cultural backgrounds to make elderly people focused on healthy aging. Technology involvement can play a vital role in making old people aware of everything related to their aging process. (Yeung et al.,2021).

My topic is quite important when it is seen through a transdisciplinary lens and a lot of programs, collaborations and research (gerontology, core biology,
environmental science, social science, health science health informatics etc.)
are being conducted using a transdisciplinary approach to make aging a
productive process. This would be further discussed in the discussion.

6 Degree project’s relevance with health sciences
current research

Health is quite a complicated phenomenon and to deal with this, a
holistic approach may help because it’s beyond the WHO’s definition
presented by Ruggeri et al. (2020) and stated by “the complete presence of
physical, mental and social well-being, not just the absence of disease” (p.2).
“Wellbeing” is a more holistic approach that overarches the fixed definition of
health and every determinant of it whether physical, social or mental is
important. If any of these is missing, overall, well-being will be affected
(Ruggeri et al., 2020; Verdoni et al., 2020).

Ageing is associated with several chronic diseases if well-being is not
taken into account. Just like well-being has determinants like social, physical
and psychological, ageing has also these determinants. To achieve well-being
in the elderly, all of these determinants must be considered to alleviate the
burden on the healthcare system (Plácido et al., 2022). Age-related
comorbidities put stress on using polypharmacy and more healthcare
dependency, which puts utmost pressure on the healthcare system, staff and
strategies. To alleviate this burden, it is necessary to have promotions of well-
being and make aged people aware of social wellbeing and physical well. E-
health is the best source of promoting any sort of well-being by motivating
older adults and interacting with them (Plácido et al., 2022).

By considering this, Hovenga (2010) explained that health informatics
is a discipline that is oriented towards making healthcare better and making
health accessible with technology aid to people. Whether it is about using CT,
MRI and other radiological tools to get images of people going through illness for better diagnosis or it is about telemedicine, telemonitoring, electronic records and other digital health applications. Digital health is a practice of health informatics and it has a great tie with wellbeing. On the other hand, health sciences as a discipline also deals with health by improving the healthcare system, conducting research and collaborating with other disciplines to make well-being possible. SDG 3 for health and wellbeing is greatly considered by e-health developers because the core idea of e-health interventions is the promotion and access to health (Garrard, 2020).

Kim et al. (2017) described the importance of using digital health to alleviate the burden on the healthcare system and the ageing population because new technologies are shifting the care system around digital health in terms of telemedicine, telehealth and telemonitoring and many others to make elderly people grow, learn and live-in place along with the community. Garrard (2020) discussed that health science deals with the health and well-being of people and electronic health is an innovative way to address well-being, it's just a switch towards technology otherwise the core purpose is the same.

Gómez et al. (2021) explained that healthy ageing has a lot of determinants i.e., behavioural, social, environmental and health-related and health informatics and more appropriately e-health deals with most of them to make healthy ageing possible (Gray, 2022) and health sciences also contribute to healthy ageing by keeping in view the holistic approach of the biopsychosocial model to deal with complex health issues beyond the biomedical approach and social wellbeing is one of the non-medical approaches which can be used to help the aged population in terms of being healthy and fit (Garrard, 2020).

Lastly, The United Nations decade of healthy ageing 2021-2030 has been associated with healthy ageing and its core purpose is to align ageing with sustainable development goals presented in the United Nations Agenda 2030 of sustainable development goals. Healthy ageing is being researched through the lens of several SDGs but mainly SDG 3 which is for health and well-being.
and is considered the most important as with ageing several comorbidities become obvious. And by looking at ageing in this view, healthy ageing can be achieved. (Shevelkova et al., 2023)

That’s why this project is highly linked with health sciences because health sciences encompass many disciplines. Here, ageing, social well-being and e-health communication all three have great ties with health in many ways.

7 Methodology

7.1 Structured literature review

In this degree project, a structured literature review methodology is used because it investigates the knowledge on the use of e-health communication to improve the social well-being of older adults and gathers multiple evidence to add up to the current body of research in this area and to aid in resource allocation (Davies., 2019). A structured literature review is almost the same as a systematic review except for some criteria like time and two reviewers because a structured literature review can be done with one reviewer (Grant & Booth, 2009).

Although in this review, all the studies were quantitative because of the relevance with PICO (Population, Intervention, comparable, outcomes) and the aim of meta-analysis was not possible due to the heterogeneity of population, geographical locations, characteristics of studies etc (Siddaway et al., 2019). So, the evidence was searched, screened, appraised, analysed and summarised systematically and this review was a structured literature review. Several steps were taken in executing this structured literature review (Bettany-Saltikov., 2016).

1. Developing PICO with clarified aim 2. Formulating inclusion and exclusion criteria 3. Writing relevant keywords relating to PICO in search blocks and Selection of relevant databases based on aim, in this study, PubMed, Cinahl and Web of Science were chosen 4. Searching for keywords along with Mesh
terms/subject headings (not in the Web of Science database) and Boolean operators “OR” and “AND”5. Export results from databases to the reference manager (EndNote) and remove duplication 6. Export results to Covidence, a software to screen and analyse searched articles to avoid any bias and cherry-picking. 7. After careful screening in Covidence, copy the PRISMA flow chart from Covidence which is a default feature, and then extract findings from the final selected articles and critically appraise those articles too.8. Lastly, synthesise all the findings in a summary to present final results (Muka et al. (2020). Details of the steps are given below along with tables and flow diagrams.

Conduct a review is the most feasible methodology in the e-health field because professionals in this field need to stay updated on current knowledge and it gathers and appraises existing knowledge without involving personal bias and unethical selection of studies for desired results and scoping review is prone to bias while systematic reviews are done to remove that bias (Tawfik et al., 2019).

Pollock & Berge (2018) stated that systematic review is time constrained and it can take about a year to complete a systematic review two reviewers are mandatory to execute a systematic review which is why in this degree project instead of a systematic review, a structured literature review is used to investigate knowledge on the use of e-health communication to improve the social wellbeing of older adults. Bettany-Saltikov (2016) put forward very systematic ways to conduct systematic literature along with the formulation of PICO. Several steps are taken to conduct a systematic search which are as follows

7.2 Systematic search strategy

The first step was to develop a Pico mnemonic which was intended for a population like older adults aged 65 or above, Interventions like e-health
communication, and comparable were not applicable here because there were no comparison groups; rather, it was intended to see general outcomes and lastly outcomes were effects on social well beings. The following table. 1 gives insight into PICO.

Table. 1 PICO in accordance with the aim for this review

<table>
<thead>
<tr>
<th>PICO</th>
<th>Parts of aim being searched</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>older adults</td>
</tr>
<tr>
<td>Intervention</td>
<td>e-health communication</td>
</tr>
<tr>
<td>Comparable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Outcome</td>
<td>Social well being</td>
</tr>
</tbody>
</table>

*Comparable not applicable because no comparison group is there


Three databases were selected PubMed, Cinahl and Web of Sciences in which a structured literature search was conducted along with Boolean operators “OR” and “AND” and subject headings in the Cinahl database were used like (MH "Medical Informatics"), Mesh terms were used in PubMed database like "Telemedicine"[Mesh] and no subject headings were used in Web of science because it has no default algorithm related to that. Free text words were also used in all of the three databases. Boolean Operators, asterisks and parentheses, and quotation marks were used as in Appendices 1, 2 and 3 for instance "e-health communication*"[Title/Abstract] OR "m-health"[Title/Abstract] OR "electronic health record*"[Title/Abstract] OR "telehealth"[Title/Abstract] OR "telemedicine"[Title/Abstract] OR "telemonitoring"[Title/Abstract] OR "digital counsel*"[Title/Abstract] OR "medical informatic*"[Title/Abstract] OR "Health technology"[Title/Abstract] OR "health informatic*"[Title/Abstract] OR
"digital health technology"[Title/Abstract] OR "health information technology"[Title/Abstract] OR "patient centered care"[Title/Abstract] OR "mobile health"[Title/Abstract] OR "home health monitoring device*"[Title/Abstract] OR "technology enabled care"[Title/Abstract] OR "Connected health"[Title/Abstract] OR "Digital health"[Title/Abstract] OR "E-health"[Title/Abstract]. Filters like Language, species, time duration and no review articles were also applied to get specified results.

The detailed description along with step-by-step searching is in the appendices below and Table 2 shows details. There were several keywords for three search blocks and these were selected based on test searching in PubMed, Cinahl and Web of Science databases. This pilot search helped in choosing the most relevant keywords for Pico's specific aim. Table 3 shows the relevant keywords in three search blocks.

Table 2. Search blocks with keywords

<table>
<thead>
<tr>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Older adults</td>
<td>E-health communication</td>
<td>Social wellbeing</td>
</tr>
<tr>
<td>Senior citizens</td>
<td>e-health</td>
<td>Social contentment</td>
</tr>
<tr>
<td>Seniors</td>
<td>m-health</td>
<td>Social inclusion</td>
</tr>
<tr>
<td>Baby boomer</td>
<td>technology enabled care</td>
<td>Social Protection</td>
</tr>
<tr>
<td>Elderly</td>
<td>electronic health records</td>
<td>Social participation</td>
</tr>
<tr>
<td>Aged</td>
<td>Telehealth</td>
<td>Social identity</td>
</tr>
<tr>
<td></td>
<td>Telemedicine</td>
<td>Social interaction</td>
</tr>
<tr>
<td></td>
<td>Telemonitoring</td>
<td>Social satisfaction</td>
</tr>
<tr>
<td>Connected health</td>
<td>Social allostasis</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>Digital health</td>
<td>Social involvement</td>
<td></td>
</tr>
<tr>
<td>Digital counselling</td>
<td>Social autonomy</td>
<td></td>
</tr>
<tr>
<td>Medical informatics</td>
<td>Social health</td>
<td></td>
</tr>
<tr>
<td>Health technology</td>
<td>Social connectedness</td>
<td></td>
</tr>
<tr>
<td>Health informatics</td>
<td>Social identification</td>
<td></td>
</tr>
<tr>
<td>digital health technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>health information technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>patient centred care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mobile health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Home health Monitoring devices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>technology enabled care</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7.3 Eligibility criteria of studies

7.3.1 Inclusion Criteria

In this structured literature review, inclusion and exclusion criteria were selected to avoid any ambiguity in the further process according to the pneumonic PICO because it helps to guide the search strategy effectively as presented by Bettany-Saltikov (2016). In Table 3 Inclusion criteria in the population are older adults 65 years old and above who are presenting with chronic illness or not, with any kind of disabilities or not and hospitalized and non-hospitalized.

Other inclusion criteria were gender, both genders were included (male and female). Coming on interventions, E-health communication usage of any
form/type by older adults. There were no comparable applicable in this review because there was no comparison group. Possible outcomes could be, better quality of life, social well-being, satisfaction and other relevant concepts. Other inclusion criteria other than PICO were, any geographical region, quantitative studies having English language, time duration between 2018-2023 and human studies.

Social well-being was defined (in the introduction) in the context of different concepts. Any article with social concepts that are relevant to social well-being (because it is still ill-defined and presented in the form of different social concepts) was included. Studies showing social concepts related to well-being in titles and abstracts were added to the review.

### 7.3.2 Exclusion Criteria

Exclusion criteria were studies based on young adults and older adults who never used e-health communication or any form of it in their lifetime. On the other hand, qualitative studies, reviews, case reports, non-accessible studies, non-human studies and non-English language studies were excluded. Table 3 shows some details.

**Table 3: Inclusion and exclusion criteria along with PICO for this review**

<table>
<thead>
<tr>
<th>PICO</th>
<th>Inclusion criteria</th>
<th>Exclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
<td>- Older adults 65 years old or &gt;</td>
<td>Young adults</td>
</tr>
<tr>
<td></td>
<td>- Any gender</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- With or without disability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- With or without any chronic disease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Hospitalised and community dwelling</td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>-Used e-health communication of any type/using e-health communication</td>
<td>-Not using e-health communication/never used e-health communication</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Comparator</td>
<td>Nothing specified</td>
<td>Nothing specified</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Increased quality of life, social responsibility, satisfaction and other relevant concepts Positive, negative and neutral outcomes</td>
<td>Nothing specified</td>
</tr>
</tbody>
</table>

### 7.4 Data screening and data analysis

After searching in three databases, the final hits were exported to reference manager EndNote 20 and duplicates were removed. Out of 153 total articles, 27 were duplicates. After removing duplicates, data was exported to Covidence, a software for organised and well-defined review writing and it avoids biases and gives smooth results for better synthesis of results. It also generates a PRISMA flow chart to minimise self-picking of articles and inclusion and exclusion criteria can be added to the software before screening to make the review streamlined and the software automatically excludes the articles which do not fulfil inclusion criteria (Muka et al. (2020)).

126 articles were then screened at first based on title/abstract reading in Covidence. After the removal of articles based on exclusion criteria and title/abstract reading, 22 articles were finally selected and after full-text reading 12 articles were chosen along with pearl growing for critical appraisal and to synthesise findings. Table 4. shows a brief description and a detailed description is shown in Figure 2 Prisma flow chart which was automatically generated by Covidence software with some aftermath manual changes to make it reader-friendly.
7.5 Quality Appraisal of Studies

Quality appraisal of the articles was done based on Caldwell et al. (2011) and there were different levels of scoring i.e., high scoring, medium scoring and low scoring. Scoring more than 8 was considered high, less than 8 and higher than 5 was considered medium and scoring less than 4 was considered low. Two articles were excluded based on low scoring. Appendix 4 shows a detailed description of the use of the quality appraisal checklist and how the scoring was done based on that Caldwell et al. (2011). Out of 11 studies included, 4 shows scored 8 and are of good quality and 7 were of moderate quality (see Appendix 4).

7.6 Ethical Consideration

Although from the Ethical Committee, the ethical approval was not needed here because it is a structured literature review in which previous evidence was combined, investigated and appraised, not a trial or any other qualitative and qualitative study in which consent is mandatory (Grant & Booth 2009) but there are many ethical aspects which were kept in mind while conducting the search strategy as well as article screening and selection. In the included studies, ethical issues like approval from the ethical committee, informed consent, aware participants, autonomy, privacy, no harm during studies, withdrawal at any level, security and other issues (according to the Helsinki Declaration of 1975, revised in 2008) were considered (Barrow et al., 2022).

Suri (2020) stated some of the ethical aspects while conducting a systematic review which is relevant here too because the structured literature review follows the same steps. Transparency, the appropriate purpose for doing a review, structured searching of relevant literature, no random picking of articles, proper evaluation, interpretation and unbiased selections described by Suri (2020), were considered. Covidence, reference manager EndNote 20, PRISMA flow diagram (see Figure 2) and quality appraisal tool were used to
be more transparent and unbiased. One of the articles showed some ethical issues and it was not included in the finalised articles. These ethical aspects are shown along with the quality checklist in Appendix 4.

8 Results

8.1 Overview

Out of 153 articles selected from three databases by systematic literature search, 27 articles were removed because of duplication. 126 articles were transferred to Covidence and by a careful reading of the title and abstract 22 articles were selected. Full text reading of 22 studies was done and 11 articles were chosen. One study was selected based on pearl growing and after critical appraisal of 12 studies, one was removed due to very low quality and finally, 11 studies were included. Details of the selection of studies can be seen in Table 4 and Figure 2.

Table 4. Studies selected for synthesis

<table>
<thead>
<tr>
<th>Selection of articles from databases, EndNote 20 and Covidence</th>
<th>Final hits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total articles after systematic search in databases</td>
<td>153</td>
</tr>
<tr>
<td>Relevant articles after removing duplicates in EndNote 20</td>
<td>153-27=126</td>
</tr>
<tr>
<td>In Covidence, after removal on the basis of exclusion/inclusion criteria and title/abstract screening</td>
<td>126-104=22</td>
</tr>
</tbody>
</table>
Prisma diagram was used to document final searches, although there was an automatic generation of Prisma diagram from Covidence but here manual and automatic screening and analysis were merged to make it more comprehensible. The first step was searching in databases based on some of the inclusion/exclusion criteria mentioned in Table 1, searches were finalised and after that in the second step automatic tools were used like EndNote 20 for duplication removal and Covidence for further screening and full-text reading. The inclusion/exclusion criteria which were not executed in databases, here in Providence, were included to make screening smoother. Lastly, the manual exclusion of 1 article was done based on low quality by using Caldwell’s quality appraisal checklist. Two articles were chosen by snowball effect from the references of relevant studies and were added. Figure 2 shows the PRISMA checklist below.
**Figure 2: PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) Diagram and Checklist**

- PubMed =295, excluded after filters (exclusion/inclusion criteria) i.e., time duration 2018-2023, English language, human studies and no review articles =195
- Cinahl =36, excluded on the basis of above-mentioned reasons =16
- Web of science =45, excluded on the basis of above-mentioned reasons, n=12
- Total =376-223=153

- PubMed =295, excluded after filters (exclusion/inclusion criteria) i.e., time duration 2018-2023, English language, human studies and no review articles =195
- Cinahl =36, excluded on the basis of above-mentioned reasons =16
- Web of science =45, excluded on the basis of above-mentioned reasons, n=12
- Total =376-223=153

- Excluded articles, (rest of inclusion/inclusion criteria other than databases)
  - Qualitative studies =51
  - Title/abstract irrelevance =53

- Exclusion of articles on the basis of low quality =12

- Total articles for final synthesis =11

n in databases searches
n in EndNote 20
n in Covidence after abstract/title screening and on the basis of rest of the inclusion criteria
8.2 Study categories and characteristics

Out of 11 articles selected, all were of different geographical regions, n=5 from the USA, n=2 from Spain, n=1 from Sweden, n=2 from China, n=1 from the United Kingdom and the countries from the European Union (Italy, Spain, Germany, Sweden, Denmark, France and Netherlands. The majority of the studies were from the USA and Europe. All studies included were quantitative, n=3 was cross-sectional, n=1 was a clinical trial, n=1 was a randomised control trial, n=1 was a case-control study and n=5 were surveys based on questionnaires. Several concepts arose in different studies 1) social participation 2) social engagement 3) social inclusion 4) social interaction and 5) social health. Different types of e-health communication were seen in different studies 1) Digital health 2) mobile health 3) Internet browsing for health 4) video conferencing 5) consultation on calls. The summary of study categories and categories are highlighted in detail in Table 5. See Appendix 5 to have deep insight into the evidence included in the reviews and synthesis of findings.

Table 5 - Summary of study categories and characteristics
<table>
<thead>
<tr>
<th>#</th>
<th>Reference</th>
<th>Location</th>
<th>Objective</th>
<th>Design</th>
<th>Concepts related to social context</th>
<th>E-health communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Goodman-Casanova et al. (2020)</td>
<td>Spain</td>
<td>The study was conducted to determine the effect of telephone based and television based social support on the health of older adults diagnosed with cognitive impairment or mild dementia, during covid19</td>
<td>Survey/quantitative study</td>
<td>Increased Quality of life, wellbeing, Social interaction</td>
<td>Telehealth (home-based instructions and motivation)</td>
</tr>
<tr>
<td>2</td>
<td>Jenevic et al. (2020)</td>
<td>USA</td>
<td>The aim of the study is to check the feasibility of m-health and trackers on older adults. It was also aimed to measure the patient’s adherence to reporting through the three modes Phone calls, Text</td>
<td>Quantitative study. Randomised controlled trial and feasibility trial.</td>
<td>Increased Social participation</td>
<td>Mobile health with wearable trackers (reminders, feedbacks, alerts)</td>
</tr>
<tr>
<td>3</td>
<td>Sun et al. (2020)</td>
<td>China</td>
<td>The aim of the study is to assess the demand/Need of the Internet browsing for health information.</td>
<td>Quantitative study. Cross-sectional study</td>
<td>Increased participation social, improved quality of life</td>
<td>Internet browsing for health information</td>
</tr>
<tr>
<td>4</td>
<td>Mitzner et al. (2022)</td>
<td>USA</td>
<td>aim to test and develop tele wellness approach via Tai Chi (an evidence-based exercise intervention)</td>
<td>Survey/Quantitative</td>
<td>Social engagement increased, social practices increased and health becomes good</td>
<td>Videoconferencing (for consultation)</td>
</tr>
<tr>
<td>5</td>
<td>Noble et al. (2022)</td>
<td>USA</td>
<td>aimed in reducing social isolation in older adults, improving telehealth support healing the participants to improve latest technology skills and support through community.</td>
<td>Survey/Quantitative</td>
<td>Increase in Social inclusion, engagement and health</td>
<td>Calls to motivate and guide about tell wellness</td>
</tr>
<tr>
<td>6</td>
<td>Poli et al. (2019)</td>
<td>Sweden</td>
<td>The study aims to develop a measuring</td>
<td>Survey/Quantitative</td>
<td>Social inclusion increased if education/knowl</td>
<td>Digital health</td>
</tr>
<tr>
<td>#</td>
<td>Author(s) &amp; Year</td>
<td>Country</td>
<td>Study Aim</td>
<td>Method</td>
<td>Key Outcomes</td>
<td></td>
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<tr>
<td>7</td>
<td>Marcelino et al. (2018)</td>
<td>Spain</td>
<td>Study aimed to improve the overall wellbeing of older adults more specifically social inclusion by developing an ecosystem for the specific population</td>
<td>Survey/Quantitative</td>
<td>Social inclusion, empowerment, Increase in well-being</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Meinert et al. (2020)</td>
<td>United Kingdom and the European Union</td>
<td>Study aimed to make mobile app for promoting wellbeing by maintaining social distancing and as a means of social interaction</td>
<td>Case-control study</td>
<td>Social participation, social connectedness and improved well being</td>
<td>e-services for medical purposes, Mobile health applications</td>
</tr>
</tbody>
</table>
### 8.3 Synthesis of findings from studies included in review

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Study Design</th>
<th>Aim of Study</th>
<th>Findings</th>
<th>Technology Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bott et al. (2019)</td>
<td>USA</td>
<td>Clinical trial</td>
<td>Aimed at assessing how Embodied conversational agents impact the depression, loneliness in older adults in hospitals</td>
<td>Social interaction leads to improvement in health</td>
<td>Embodied conversational agent</td>
</tr>
<tr>
<td>He et al. (2022)</td>
<td>China</td>
<td>Cross-sectional</td>
<td>Aimed to test whether social participation and internet use have positive effects on the visual impairment and depression.</td>
<td>Social inclusion leads to health outcomes</td>
<td>Health information through internet browsing</td>
</tr>
<tr>
<td>Craig et al. (2021)</td>
<td>USA</td>
<td>Cross-sectional</td>
<td>The use of information and communication technology and ride hailing services to decrease social loneliness and to improve social connectedness in older adults.</td>
<td>Social inclusion, social health improvement</td>
<td>Digital health technology</td>
</tr>
</tbody>
</table>
Goodman-Casanova et al. (2020) illustrated that using devices for example computers, tablets and mobile phones can promote communication and social interaction with friends and family. It reduces social loneliness and motivates people to communicate and become socially active. Another thing is, by knowing how to use technology, older people can interact with health-related mobile applications especially those with dementia and cognitive problems. Home-based instructions via mobiles, computers and tablets from healthcare can promote health-related behaviours in people with lower cognitive functions. The study also showed that overall well-being becomes optimal in the affected population. Home-based telephone and television-based social support was considered and it had ultimate stimulating effects on cognition (Goodman-Casanova et al., 2020).

Jenevic et al. (2020) described by doing a randomised controlled trial and feasibility trial that m-health is quite feasible because the activity tracker is easy to use and reporting and feedback in these trackers lead to motivate older people to use it for active living. Many participants complained about not having proper knowledge and a learning environment. Social participation increased as reported by participants and they feel socially inclusive and confident because of continuous feedback. Participants with chronic pain reported that pain worsens when they don’t become active and social participation in different activities leads to pain improvement (Jenevic et al., 2020).

Sun et al. (2020) demonstrated in a cross-sectional study in China that 38.6% of people use the internet but it depends upon the socioeconomic status of older people because whoever has low socioeconomic status uses less internet. 63% of older adults use the internet for health-related information by browsing different health-related websites. Activities performed through the Internet are very helpful in maintaining health relations socially and reducing isolation.22.5% elderly population use the internet for health-related problems like disease, drugs and healthy lifestyles. Noble et al. 2020 highlighted that 95% of older adults reported less loneliness but with that, they felt happiness,
a sense of achievement and moral support when they get calls for their better health to become socially active. Participants said that they felt excitement before the call and they mentally prepared themselves to talk about innovative topics. This brief call interaction boosts their energy and encourages them to remain involved in social activities. Older adults who were 65 or above showed more excitement and happiness. Because they felt more productive (Noble et al., 2020).

Mitzner et al. (2022) figured out how a wellness approach can be used to increase social engagement and physical activity. Clinicians, instructors and exercise trainers were there to deliver tele wellness (a program through which instructions, demos, and motivation are given to the participants). The authors concluded that tele wellness can enhance social connectedness, social health, social practices and social skill development. Participants showed contentment and considered it effective for social engagement due to group video conferencing with other participants and they felt immense happiness because they can talk, share their opinions and give suggestions to each other. (Mitzner et al., 2022). On the other hand, Poli et al. (2019) developed a tool NPART (a questionnaire consisting of 26 questions) to evaluate non-participation in digital health research and analysis showed that a lower level of education and less social involvement can be the cause of non-participation. The participants who were more educated and more socially involved, were already interested in digital health and were willing to participate in research related to e-health. But they also stressed proper knowledge about digital health. Some candidates said technology usage is very complicated and they got fed up even if they were interested in using that. Socially inclined participants were more interested in digital health. Age was also a factor that hindered the usage of technology and non-participation of older adults which was more obvious in people aged 65 years but less commonly above 75 years old (Poli et al., 2019).

Marcelino et al. (2018) developed an ecosystem in which older adults can use three types of e-services, medical, leisure and shopping services. The author stated that e-services are significantly useful for senior citizens because
they can make video calls and enjoy the tasks allocated in the proposed ecosystem for active assisted living. In the ecosystem, Participants felt a sense of autonomy, empowerment and independence because they could freely indulge in different social activities and call doctors whenever needed. The response of the participants was positive due to the social orientation of the ecosystem and older people found it engaging. Even motivation was a plus factor which was highlighted by many participants that they get motivation to interact socially and it impacts positively on their overall wellbeing. (Marcelino et al., 2018).

Digital health mobile application is potent in reducing social loneliness and isolation and these applications increase the social connectedness of older people who live isolated Bandura’s health promotion model (derived from social cognitive theory) and the reach effective adoption implementation maintenance framework can be used to enhance social interaction in older adults for their health (Meinert et al., 2020).

Bott et al. (2019) explained the importance of using conversational embodied agents (ECA) in the hospital setting to provide a source of social interaction in the form of a displayed avatar on the screen. The picture of an animal (cat or dog) on the screen of ECA responded to the individual’s verbal words and facial expressions. The intervention group had less loneliness reported and they felt it’s a good way to interact. The group of people who were using this intervention had less delirium, falls and other health issues however, depression was not decreased. Some participants said that the care factor was missing because Avatar was not enough to provide equal nursing care in the absence of nurses and medical staff even though Avatar was connected with the centre where the staff was responding to the patients via Avatar (Bott et al., 2019).

He et al. (2022) stated that internet browsing and social participation proved to be beneficial for depression and this can also lessen visual impairment and depressive symptoms in patients with this health condition.
Social inclusion is also one of the outcomes of using the Internet (He et al., 2022). Craig et al. (2021) explained that participants desired to use digital technology for their social health and to improve their quality of life. It’s very useful to use technology for communication and interaction. Contentment, satisfaction and loneliness were reported by participants (Craig et al., 2021).

9 Discussion

This review of 11 articles was conducted to find out the use of e-health communication on the social well-being of older adults aged 65 years or above to add up to the current body of knowledge related to social well-being, e-health and older adults. By systematically searching three databases with relevant keywords, it was found that there was a lack of studies in this field and studies that came out after careful searching, were describing social well-being in its subtypes or related social concepts which influence social well-being in one way or another. The detail of social concepts and technology influencing them is discussed below. The key findings make us capable of formulating a critique of existing literature and finding out any limitations in the current body of knowledge.

The majority of the articles were from the USA and Europe followed by China but no article was from low- and middle-income countries. It might be because, in e-health, most advanced countries are doing research due to technological developments in these countries. da Fonseca et al. (2021) agreed with the findings that most studies about e-health and older adults are conducted in advanced countries for example USA, European countries and China. Additionally, most of the studies were survey-based studies followed by cross-sectional studies. Similar findings were reported by Sen et al. (2022) whose study was related to the social well-being of older adults about digital technologies. This is a gap that was found that fewer longitudinal studies were conducted.
As it has been discussed, social wellbeing is explained by using different concepts relevant to that. Different studies in the review showed the same pattern of using different concepts instead of social well-being but ultimately those social concepts are a part of social well-being for example, social connectedness, social participation, social health, social interaction and social inclusion etc (Mitzner et al., 2022; Jenevic et al., 2020; Meinert et al., 2020; Craig et al., 2021).

First, Bandura (2004) explained in the health promotion model that the environment where a person interacts should be according to the demand of the person in terms of health status, age and other social needs and it’s different from individual to individual. Social interaction and connectedness can be pleasant if the environment is feasible for individuals. Studies in this structured literature review have shown the use of technologies and the majority of research stressed the use of e-health communication in any form by older adults but some interventions like avatars, tools, and ecosystems were being tested and introduced to achieve social inclusion and those were proved highly effective because of the design was considered crucial according to the real-time needs of older adults (Bott et al., 2019; Marcelino et al., 2018; Poli et al., 2019).

Moreover, Bott et al. (2019) analysed an avatar that was even connected with healthcare staff and they were responding but still, that avatar was developed to remove those barriers that make older adults vulnerable to falling, delirium and other chronic conditions. It was shown that embodied conversational agent was so helpful that older people were inclined to use that and felt socially involved and the others who were not in the interventional group showed no change in their social health and overall well-being was worse than those who were in the interventional group as suggested by Bandura (2004) in health promotion model. Shaked (2017) agreed that the avatars and virtual agents become the only source of social interaction for the elderly when care staff is not on visit to elderly care or home-based care and this is highly influential especially in those people who are hospitalised and are bed-ridden in elderly
care. These avatars are also helpful for people who have dementia because they keep on reminding them about medicine, water intake and visiting toilets.

Furthermore, Marcelino et al. (2018) studied the effects of having a proper technological ecosystem for older adults which was designed according to the daily basic needs of older adults like, medical consultation, leisure activities (gaming, video calling, chatting and texting etc.) and shopping stuff. This concept of having a technological ecosystem in which elderly person can meet their basic needs without any restriction and any human aid is also an example of a designed environment that is suitable for connecting, interacting and contributing socially and this is quite relevant to health promotion Bandura (2004) in which he considered the importance of having an appropriate environment for different age groups and personal demands.

Furthermore, different concepts that are related to social aspects of well-being were being highlighted in several studies as outcomes of using e-health communication and other types of e-health. For instance, social connectedness, social participation, social interaction and social engagement were some outcomes. It showed that e-health communication can help older adults in getting involved socially and it’s a potent technological intervention related to health (Mitzner et al., 2022; Jenevic et al., 2020; Meinert et al., 2020; Craig et al., 2021). The use of e-health communication as an intervention improves the social life of older people and this is supported by Pender’s health promotion model (Yerrakalva et al., 2019). The health promotion model explains that e-health interventions motivate people to contribute to the environment and society by arranging different socially inclusive sessions, and interactions with healthcare staff and with friends and family too (Yerrakalva et al., 2019).

The health promotion model explains how the interaction of human beings affects their thoughts, behaviours and change in the overall environment and many behavioural changes can be achieved. If people use interventions to direct themselves, then modifiable variables can be altered for
example perceived usefulness (Pender et al., 2011). Studies showed that e-health communication can push people to take part in social life because they consider it useful. These technological interventions urge older adults to shape their thought processes and increase their willingness to get connected socially (Mitzner et al., 2022; Jenevic et al., 2020; Meinert et al., 2020; Craig et al., 2021). Sen et al. (2022) agreed with the importance of using e-health and it directs connection with more social interaction and social engagement. Social interactions are important in making people aware of their surroundings and this in reverse helps older adults in improving their quality of life, health and well-being (Sen et al., 2022).

The health promotion model describes that commitment to a plan of action (which is one of the outcomes) can have a positive impact on well-being and quality of life (Pender et al., 2005). Ultimately, social connectedness, social interaction and social engagement can have positive impacts on wellbeing and health. Health has several determinants and every determinant is interlinked with others if any of these gets affected, health will be affected to some extent. By keeping this view, every aspect should be considered important. Human beings are social animals and without proper social environments, social interaction and social connectedness, health cannot be achieved (Sen et al., 2022).

This approach of having the social aspect of health in consideration has already been described by Bandura (2004) in the health promotion model that ignoring social health can hinder in having overall health. Instead of health, Huppert (2009) stated that the word “wellbeing” is being used more because of its holistic approach and “it goes beyond the mere notion of having an absence of disease” (page 2) and wellbeing cannot be achieved if any of its domain is in trouble.

Negative social interactions have negative impacts on social well-being and indirectly on well-being and positive social interactions have positive impacts on well-being but sometimes, social interaction does not have
any impact on well-being. Because it is highly dependent upon the type of social interaction needed by people (Ruggeri et al., 2020). There are several e-health, digital health and technological interventions that can help in achieving every determinant of health in older adults, some are for daily life interactions, others have other features for physical activity and some have features related to cognitive functioning and psychological health. E-health communication improves social connectedness and as a result other determinants of well-being also get influenced (Ruggeri et al., 2020). For instance, Bott et al. (2019) figured out the importance of using conversational agents to improve the social aspect of health but older adults reported that even though they felt socially engaged, physically fit and emotionally stable but their psychological state was same as that before using these conversational agents.

On the other hand, He et al. (2022) disagreed with that and explained the importance of e-health communication on social inclusion, social connectedness and other aspects of health. The older population showed less visual impairment and their depressive symptoms were minimized to a great extent. It means different individuals need a different type of social interaction to have overall well-being and some might perceive it negatively and others might take it positively. On the other hand, some even showed no change in health outcomes (Ruggeri et al., 2020).

It can be correlated with the health promotion model where social interaction depends upon which type of environment is. The environment should be feasible enough for different age groups and personalities to interact. And the impact of this interaction would eventually impact social well-being and other determinants of well-being and vice versa (Bandura, 2004; Yerrakalva et al., 2019).

The health promotion model describes the motivational importance of behaviour-specific cognitive variables which can be modified by using health interventions depending upon the perceived benefits and self-efficacy of individuals (Pender et., 2011; Bandura, 2004). Older adults especially those
who are admitted to hospitals and who are bedridden due to some chronic health conditions need some beneficial source of interaction for their social wellbeing and social health. On the other hand, community-dwelling older adults needs the motivation to build healthy social connection and communication for example Bott et al. (2019); and Marcelino et al. (2018) described that older adults who are cut off from social life and those who are little active, both can get benefits from e-health communication.

The health promotion model stresses self-efficacy (self-belief to achieve a target) by suggesting having targets/goals to achieve well-being. E-health can act as a source of social interaction for older adults (hospitalised and bed-ridden) (Pender et al., 2011). For example, avatars also can motivate people to get socially involved (who are not bed-ridden and hospitalised) by giving them some targets to achieve (Bott et al., 2019; Marcelino et al., 2018). These findings have already been presented by Shaked (2017) who considered the importance of having a source of social interaction in the form of virtual interaction for the elderly and a motivational source to get inspiration and contribute to society.

Social loneliness is a potent factor that affects social wellbeing negatively and several studies found that e-health communication has proven effective in reducing social loneliness and isolation. This also minimised many health-related issues in older adults because loneliness is directly linked to the arousal of stress and other diseases for example cardiovascular, diabetes and psychological problems (Goodman-Casanova et al., 2020; Noble et al., 2022; Meinert et al., 2020). These findings are supported by Datta et al. (2019) that social loneliness can act as a disruptor that can hurt every aspect of wellbeing especially social wellbeing and meaningful relations can help to reduce the negative impacts of social loneliness. E-health communication helps older adults develop meaningful relations with others and the environment (Meinert et al., 2020; Sun et al., 2020).
The health promotion model stresses that the positive change in perceived usefulness and self-efficacy of individuals can be introduced by using e-health interventions to improve performance, adoption and maintenance. Interpersonal influences (social support to learn about applications) can help people to remain stuck to the use of interventions (Peiris et al., 2022; Yerrakalva et al., 2019). Studies in this review agreed with this theoretical approach and figured out that trackers, monitors, instructions from e-health communication, digital health applications, m-health, web browsing for health information, digital health avatars and specially designed technological ecosystems are very helpful in setting targets and goals by older adults for social participation and social inclusion (Goodman-Casanova et al., 2020; Mitzner et al., 2022; Jenevic et al., 2020). Moreover, adoption, performance and maintenance need some kind of instructions, feedback, alerts and video consultations. These promote more social participation and social connectedness (Mitzner et al., 2022; Meinert et al., 2020; Noble et al., 2022).

Furthermore, the model highlighted that perceived barriers can lead to cessation of intervention use (Peiris et al., 2022; Yerrakalva et al., 2019) which is similarly stated in some of the studies included in the review as the complexity of e-health applications, tools and related interventions also make older adults fed-up and they stopped using those after some time even though they were willing initially. The study has shown that older adults found it complex and not user-friendly for most of the applications and sources of e-health communication (Poli et al., 2019). This supports what Wallace et al. (2013) had already highlighted the complexity of e-health applications and the unwillingness to use them for health in older people because they demand expertise and easy applications should be developed according to the age of people.

On the other hand, some studies highlighted that the level of education, proper knowledge, instructions, socioeconomic status and age are the factors that need to be considered while introducing new applications and interventions under the e-health umbrella to improve social well-being. If older
adults are educated more than their willingness to use e-health becomes more and if their education level is low then they show less tendency to use e-health (Poli et al., 2019; Sun et al., 2022).

Socioeconomic status is another factor because older adults with low socioeconomic status show less interest in e-health and older adults with age more than 70 years as compared to older people who are 65 years old show less willingness to use e-health (Poli et al., 2019; Sun et al., 2020). Al-Dhahir et al. (2022) agreed that socioeconomic status and education level are the main barriers to using e-health. People with more education and good financial conditions are highly likely more interested in technology usage for health and well-being. These findings are similar to what the health promotion model stated. These modifying factors (sociodemographic factors and prior education) are very crucial because these can lead to intervention failure by changing modifiable variables (See Figure 1) (Pender et al., 2011).

Lastly, happiness, contentment, satisfaction and excitement about using e-health have been reported in several studies in review because older adults consider it as a source of interaction and motivation to engage socially which ultimately improves their well-being (Goodman-Casanova et al., 2020; Noble et al., 2022; Craig et al., 2021). See & Yen (2018) stated that happiness has a crucial link with good health. Happiness, contentment and satisfaction comes when a person achieves well-being. Overall, e-health communication helps to improve the social aspect of health in older adults and its use is quite effective (Noble et al., 2022).

9.1 An account of degree project’s transdisciplinary position

The degree project revolves around a tremendously significant and complex topic of ageing with e-health communication and social well-being. To tackle ageing issues and concerns itself is a big task. Along with that, social well-being is an area less studied along with aging, and e-health. E-health is a very innovative and evolving field that is being transformed day by day. All
three of these topics are very crucial to deal with and together they make a project more demanding, in terms of the need for an integrative approach to deal with this (Sun et al., 2022).

Integration of different fields, disciplines and stakeholders would not be easy. But if all possible stakeholders join hands to work on one goal, then the results can be astonishing and it will help to tackle the issues of introducing e-health communication in older adults to improve social wellbeing. The stakeholders who may collaborate and integrate by a transdisciplinary approach can be health professionals, e-health experts, e-health technological development companies, public health professionals, geriatrics, gerontologists, social scientists, researchers from e-health, health informatics, social sciences, gerontology and geriatrics fields, government agencies related to health and government authorities related to finance regulation, law-making agencies policy makers and older adults(See Figure 3).

The collaboration between these stakeholders can be made possible by bringing them to one table. Dialogues at each level can enhance the chances of better collaboration (Sargent et al., 2022). At first, identification of problems by every stakeholder must be compulsory and then a transformative map can be developed. Secondly, by figuring out the ideas, plans, capacities and possibilities for change, a transformative strategy can be developed. This strategy then can be processed by policymakers and can be forwarded to the implementation stage (Sargent et al., 2022). During this whole process of developing and implementing through a transdisciplinary framework, every stakeholder must take part and missing one of those would not give the desired results (See Figure 3).
Figure 3: Transdisciplinary framework for collaboration among stakeholders

Adopted from: (Sargent et al., 2022)

Most importantly, the awareness programs, seminars, and educational and promotional events done by public health and e-health agencies must be inclusive and must correlate with the learning skills of older adults because the complex way of teaching about a new e-health intervention in the aged population will not be fruitful (Wu et al., 2022). Jurado & Salvachúa (2021) suggested an integrative approach for the aging population and e-health introduction because of its complexity and without a transdisciplinary approach and collective efforts, it is not possible to get the required results.

Vaitkevičienė et al. (2023) described the importance of an integrative approach for older adults and it must be a patient-centred approach in which
people who are required to use e-health must be kept on priority while developing, introducing and strategy making because this stakeholder often gets ignored. The authors also explained that neglecting any of the stakeholders may lead to the failure of perfectly designed e-health communication tools (Vaitkevičienė et al. 2023). Integrating every stakeholder may lead to a very well-defined strategy development and regulation of plans to introduce e-health in older adults. This overarched approach can significantly reduce the burden on the healthcare system as well as policymakers because each stakeholder is contributing in such a way their ultimate goal has become one (Vaitkevičienė et al., 2023).

It is unforgettable to watch out for the importance of aging, e-health and social well-being from a global perspective. Ageing is a global concern so is the smooth introduction of e-health for older adults, Global collaboration between international health agencies (WHO, CARE and UNICEF), global networking between countries' e-health agencies, geriatrics agencies, public health agencies, social scientists and researchers should collaborate to work on the causes (less access, the complexity of interventions, bad implementation strategies, digital divide and not user-friendly interventions) of not using e-health communication for wellbeing in older adults to reduce the healthcare burden. It may facilitate better approaches to dealing with the aged population (Martínez & González., 2023).

Thus, by using trans-disciplinarity, it will be easy to tackle this ongoing concern because trans-disciplinarity encompasses each part of the system in which the problem exists.
9.2 Degree project’s relevance with human and non-human health in the times of climate change

Jansson & Hofmockel (2020) stated the definition of climate change as “the change in the pattern of climate with human activities and industrial emissions” (p.1) and describe that human activities have increased the overall temperature of the planet and it may reach 1.5 °C in between 2030-2050. This can lead to many problems and one of the contributors to changing climate patterns is the healthcare system.

Gray (2022) described digital health as an innovation of health informatics that aims to better healthcare systems with the addition of technology and deals with many determinants of health except the environment but now the trend is getting changed and more attention is directed to the climate change aspect of health. Because it can help to reduce the carbon footprints of healthcare sectors by reducing the burden of patients indirectly by reducing carbon dioxide emissions and directing people towards using technology for wellbeing (Gray., 2022).

Pichler et al. (2019) already stated that 4% to 5% of carbon dioxide emission is due to healthcare systems by several sources (inhalers, staff transport, food and catering and the technical sector working on electricity). And digital technology can help reduce the emission of carbon dioxide. Thompson (2021) argued that health informatics itself is contributing to climate change a lot by emitting carbon dioxide through the production and disposal of wearables and other devices and artificial intelligence and machine learning health applications consume a whopping amount of energy and other centers for processing data, telecommunication and for operating all digital health systems also use energy which in short contributing to climate change.

Godbole et al. (2023) suggested creating a framework for guidelines and awareness for careful disposal and production of devices and other energy-consuming equipment should be made energy efficient to mitigate climate
impacts of healthcare sectors and the author weighed the importance of using
digital technology because it can reduce carbon emission if it is used properly.

Katzman & Katzman (2021) described the importance of using e-
health and stressed that telehealth, awareness campaigns and many helpful
strategies can be made to mitigate climate change by making people aware of
their contribution to climate change and then the impacts of climate change on
their health. Gray (2022) explained that the use of technology in healthcare
has a variety of advantages, for the health of patients as well as for
environmental health and health informatics can play the role of a leader to
join other disciplines by making more energy-efficient equipment for digital
health.

Nowadays, data sensors in digital health setups are gaining popularity
because they can detect weather transitions and sudden changes in
temperatures, humidity and other factors early and then notifications are sent
to the users of digital health. By this, they can take precautionary measures to
tackle the incoming situations (Rahimi-Ardabili et al., 2022).

This degree project is relevant to climate change because digital health
acts as a saviour in the context of climate change but as we discussed above,
its contribution to climate change cannot be denied because of the release of
carbon dioxide from its massive technological setups, manufacturing and
processing (Thompson., 2021).

On the other hand, this degree project is about the social well-being of
older adults and social interactions, participation in social activities and
interactions with the environment are the basis for achieving social well-being.
Air pollution, pollutants, smoke and many other harmful chemical compounds
that are released into the atmosphere by human activities may lead to more
pronounced bad health outcomes for the elderly (Cagney et al., 2014). Ruggeri
et al. (2020) explained that social connectedness and participation in the time
of climate change may lead to a negative impact on social well-being and
ultimately, quality of life would be affected. It's one of the aspects in which
climate change can harm the social well-being of older adults. Another aspect is due to high temperatures, unpleasant weather conditions i.e., storms and excessive rainfalls would restrict older adults from living in their houses and more social loneliness will impact social well-being negatively (Ruggeri et al., 2020).

Hence, climate change impacts the social well-being of older adults by negatively affecting their social lives. Digital health can play a crucial role in mitigating the effects of climate change on the elderly by keeping them alert before heads and by reducing the burden on healthcare but it’s itself a source of emission of carbon dioxide which is an undeniable fact.

10 Strengths and limitations

The structured literature review methodology helped to gather and synthesise knowledge on the improvement of social well-being by using e-health communication among older adults. Key findings are the rigorous and systematic search to gather and synthesise in the relevant field. Throughout the process, transparency of extracting results was the priority and that’s why Covidence software was used for the extraction of suitable articles and no selection bias was there. This review shed light on how significant it could be the use of e-health communication among older adults.

Moreover, the study highlighted this aspect very clearly that there is a need to study this topic more because the studies present the knowledge about social well-being in chunks and mainly in related concepts (social connectedness, social interaction social engagement etc.). In the future, there is a great need to conduct studies on this topic whether quantitative or qualitative because quantitative studies are scarce too.

There are some limitations of this review, it was performed by a single reviewer, which can make it prone to some human errors. However, one author
was prioritised by this course. Additionally, there were only three databases from where data was extracted and limited search strings were used to answer the aim. The review was time-constrained.

11 Conclusion

This structured literature review highlighted the scarcity of studies on the social well-being of older adults in connection with e-health communication but the studies shed light on the improvement of different social concepts which are directly linked to social well-being or social well can be defined by these concepts for example, social connectedness, social interaction, social health, social engagement and other related terms, satisfaction, contentment and happiness.

Most of the studies showed that E-health communication and its different forms have a significant impact on the social aspect of well-being among older adults. Studies have shown how social interactions, social engagement and social connectedness ultimately improve overall well-being especially physical but psychological wellbeing showed mixed results. Some studies reported a positive association while others showed no association.

On the other hand, avatars which are one of the innovations of e-health communication showed improvement in making older adults engaged socially and indirectly their physical health improved. Satisfaction, contentment, happiness and excitement were reported by older adults in different studies which are associated with well-being. Level of education, age and other socioeconomic factors were considered barriers to using e-health communication by older adults even though they were willing to use and reportedly knew the importance of using e-health. Some studies reported that older adults need some user-friendly applications because this hinders the long-term use of e-health due to the complexity of e-health tools of communication. Learning seminars, events and programs should be conducted to overcome the knowledge barrier among older adults because those who
were not using these tools were not properly equipped with knowledge of using them.

Overall, Studies have shown a positive association between different forms of e-health and social aspects of wellbeing among older adults and these types of interventions can make older adults more inclined towards achieving well-being. As a result, the healthcare burden can be reduced because the ageing population is highly linked with comorbidities. There were more studies in the USA and Europe and no studies were found in Africa and other low-income countries due to this, findings can be different in different geographical regions depending upon other factors.

Policymakers should take these points into account while developing some policies and e-health developers should consider the ease of older adults in developing applications and tools. Social scientists, geriatrics and health informatics professionals should take part in collaborative research on the social well-being of older adults about e-health to aid in healthy ageing because according to the United Nations Decade of Healthy Aging, SDG3(Health and Wellbeing) should be a priority in the ageing phenomenon.
12 References


https://doi.org/10.2196/34229


https://doi.org/10.2147/CIA.S352137


Craig A. Talmage, Richard C. Knopf, Teresa Wu, David Winkel, Pitu Mirchandani & K. Selçuk Candan. (2021) Decreasing Loneliness and Social Disconnectedness among Community-Dwelling Older Adults: The


Knight, S. J. (2013). Bridging the gap at the center of patient centeredness: individual patient preferences in health care decision making: comment on “comparing 3 techniques for eliciting patient values for decision making
about prostate-specific antigen screening”. JAMA internal medicine, 173(5), 369-370.

Landi, F., Liperoti, R., Russo, A., Capoluongo, E., Barillaro, C., Pahor, M., ... & Onder, G. (2010). Disability, more than multimorbidity, was predictive of mortality among older persons aged 80 years and older. Journal of clinical epidemiology, 63(7), 752-759.


Meinert, E., Milne-Ives, M., Surodina, S., & Lam, C. (2020). Agile Requirements Engineering and Software Planning for a Digital Health Platform to Engage the Effects of Isolation Caused by Social Distancing: Case Study. JMIR public health and surveillance, 6(2), e19297.https://doi.org/10.2196/19297


https://doi.org/10.1136/bmjopen-2021-059635


[https://doi.org/10.3390/nu10081062](https://doi.org/10.3390/nu10081062)


Yerrakalva, D., Yerrakalva, D., Hajna, S., & Griffin, S. (2019). Effects of Mobile Health App Interventions on Sedentary Time, Physical Activity, and Fitness in Older Adults: Systematic Review and Meta-Analysis. *Journal of medical Internet research*, 21(11), e14343. [https://doi.org/10.2196/14343](https://doi.org/10.2196/14343)


## Result of article search in PubMed

Database name: PubMed

**Aim:** use of e-health communication to improve social wellbeing among older adults

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Appendix 2 – Result of article search in Cinahl

Database name: Cinahl

Aim: use of e-health communication to improve social wellbeing among older adults

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### Appendix 3 – Result of article search in Web of science

Database name: Web of science

**Aim:** use of e-health communication to improve social wellbeing among older adults

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Appendix 4

Quality Appraisal of selected studies on the basis of Caldwell et al. (2011) checklist

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(+) sign shows the presence of that quality assessment criteria

(-) shows the absence of certain quality assessment criteria
*Scoring >8 = high quality  n=4

*Scoring <8 and >4 = medium  n=7

*Scoring >4 = Low quality

Appendix 5 Summary of evidence of structured literature review in detail
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<th>Study description</th>
<th>Aim/ purpose</th>
<th>Outcomes/Findings</th>
<th>E-health communication</th>
<th>Gaps/strengths/limitations</th>
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<td>Quantitative study. A survey was conducted in Spain from March 25 to April 2020. The survey was based on telephone in the TV-assist Dem clinical trial.</td>
<td>Targeted population were older adults, mean age was 73. 93 participants which included 65 percent women.</td>
<td>Non noted</td>
<td>In 93 individuals, in accordance with Gordons functional health patterns, telephone-based survey was conducted. Participants included in the study (intervention group) were those that were already trained in using TV-assist-Dem. Inclusion criteria: age &gt; 60 Cognitive impairment for minimum 6 months. Written consent. Independent living. Exclusion criteria: Terminal illness, Score &gt; 11 on geriatric depression scale.</td>
<td>The study was conducted to determine the effect of telephone based and television based social support on the health of older adults diagnosed with cognitive impairment or mild dementia, during COVID-19.</td>
<td>Data in this study suggests that using devices like computer, tablets, mobiles that promote communication are effective in improving social interaction and lessening social isolation. Participation in meaningful activities in this population has shown good for cognition and functioning. During the study the overall wellbeing of the affected population was optimal. Steps were taken to provide information of the Tele-health Home-based (Instructions, motivation)</td>
<td>Significant knowledge gap regarding the toxicological and environmental implications of short-chain alternatives, which are now being consistently detected in various food products.</td>
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<td>Study (Jenevic et al., 2020)</td>
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<td>Quantitative study. Randomized controlled trial and feasibility trial.</td>
<td>Older adults aged 65-85 years affected by chronic musculoskeletal pain.</td>
<td>None</td>
<td>50 individuals were selected after which control group and intervention group was made in 2:3, which completed eight week follow up wearing trackers. The participants in the intervention group are advised to report progress via voice calls, text messages and uploading data through app to assess social participation and effect on physical function and pain. 79 percent responded through texts and 69 percent responded through texts and app syncing.</td>
<td>mHealth reporting and wearing activity trackers was feasible for the older adults if they are provided proper instructions and learning environment. 90 percent of participants rated that trackers were easy to use. Older adults reported social participation was increased by using these feedbacks via reporting and texting. Social participation and participation in different activities.</td>
<td>1) Week period was a short duration to impact the physical activities. 2) Use of an inexpensive Fitbit Zip instead of another tracking strategy that would be better for practical use. 3) Have little information as no one individual reported through desktop or laptop. 4) Did not collect qualitative data to provide feedbacks to the participants.</td>
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<tr>
<td>Sun et al., 2020</td>
<td>Quantitative study. Cross-sectional study. May 21 to July 31 2018. China</td>
<td>Study in older adults aged 65 and above. Participants were from 13 cities in Heilongjiang. More than half population were female (65.3 percentage). 89.9% population had secondary education or below. Participants suffering from chronic illness was 78.9%</td>
<td>Study used a questionnaire that consists of 4 parts; 1) Collecting social demographic data 2) Assessing and collecting participants data about health status and online activities 3) Analysing the demand for the digital and ehealth technology 4) Analysing factors that can impact the use of ehealth and internet</td>
<td>The aim of the study is to access the demand/Need of the emerging ehealth and digital health technology among older adults and how they can maintain social inclusion and reducing social isolation. The study concluded that: 38.6% used internet among the Chinese population. Internet use was less in some areas that have low socioeconomic status. Activities performed through internet can assist them maintain social relation and reduce social isolation. 63% of the elderly used internet for health-related information. 22.5% percent used internet for health information. Internet browsing for health information</td>
<td>None noted</td>
<td>1) Small sample size 2) We don’t know how the elder population used the internet.</td>
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<tr>
<td>Mitzner et al., 2022</td>
<td>19 Older adults with disabilities aged 50-70 years</td>
<td>Quantitative study/survey to see a human approach of using telehealth</td>
<td>We aim to test and develop tele wellness approach via Tai Chi exercise program via videoconferencing. This study stated that tele wellness enhances the opportunities of social engagement and physical activity. Tele wellness can be delivered by wide variety of professionals like clinicians and exercise instructors. Tele wellness and telehealth can enhance social participation.</td>
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Among digital health technology highest demand was for smart bracelets (M=2.80) that is a health monitoring mobile tool. Quality of life including psychological health, social participation was found to be improved using internet.
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<tr>
<td>5</td>
<td>(Noble et al., 2022)</td>
<td>Quantitative study. Survey conducted with interviews (both open and closed ended questions) from August 11 2020 to June 30 2020. USA</td>
<td>77 Older adults aged &gt;65 during covid 19.</td>
<td>Not noted</td>
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<td>In this study calls were made to the covid 19 older adults who had</td>
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<td>connectedness as such interventions improve social practices and social skill development and group discussion. Participants felt happiness in engaging socially via video with instructor and co participants. This leads to the improvement in overall physical health.</td>
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<td>1) Limited facility to get individual medical care</td>
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<td>This study aimed in reducing social isolation in older adults, improving telehealth support, helping the participants to improve latest technology skills and support.</td>
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<td>2) Increased risk of social isolation</td>
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<td>This study concluded that most participants reported happy after calls, Some reported that they felt less loneliness (&gt;95%) Some stated that they find it good to get some suggestions to tackle problem. Some demonstrated they felt excited before every call because they got a listener.</td>
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<td>Study consisted of two parts, 1st part was survey while second part included survey evaluation that consisted of 3 components from NIH emotional support and loneliness fixed form scales.</td>
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<td>Calls through volunteer participants for study to become socially active.</td>
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<td>Phase 1: Recall bias and confirmation bias, Phase 2: small sample size, recall and social desirability</td>
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Callers after consent from the participants described the whole process and gather information through community. Some stated the sense of achievement when somebody interacts with them. By becoming socially connected, mostly felt their health is improving.

| 6 | (Poli et al., 2019) | Quantitative study survey conducted with questionnaire. Sweden | 70 participants Older adults > 65 years | Non noted | The study designed a tool called NPART that consists of survey questionnaire (evaluation of non-participation in digital health research) which consisted 26 questions. The researcher collected data through a questionnaire and also the reasons why some older adults decline to participation. The questionnaire included factors like socioeconomic factors, social participation, quality of life, time resources and technology related queries. | The study aims to develop a measuring tool because older adults don’t participate in digital health research | Tool can be used to analyze an individual’s participation in digital health. Study showed that some participants are less likely to use digital health technology due to low education and less social involvement. Some participants showed willingness to use but they have no proper knowledge. Other said its complicated thing and they get fed up Digital health | Small random sampling. The NPART survey questionnaire just covered some aspects |
| 7 | (Marcelino et al., 2018) | Quantitative study (Survey was conducted with questionnaire). Spain | 23 sample size among which (12 female and 11 males) aged 68 years | None noted | up after some time. Socially inclined people use more digital health and age factor also matters, a person of 65 years old use e health technology more as compared to 70 or more |

- In the present study, the unique ecosystem is developed to analyze the environment and vitals of the older adults and then assuring emotional support for improving health and interaction, communication. The eservices portion of the study included
  - **End-user client** (biosensors, services access device, smart home environment sensors
  - **Middleware platform** (connection between end-users and service providers) included 1)

- Study aimed to improve the overall wellbeing of older adults more specifically social inclusion by developing an ecosystem for the specific population

- Study stated that using digital devices a possible use of eservices is beneficial for the senior population. Older adults like making video calls and enjoyed doing tasks in the proposed ecosystem for active assisted living. Participants felt sense of autonomy and empowerment because they get involved in different social activities and can call doctor and e-service - Medical -leisure activities - shopping

- Cannot be generalized to all older adults
- Complex methodology
- False positive results in some findings
- All the seniors cannot afford the costs of the ecosystem
| 8 | (Meinert et al., 2020) | Quantitative study. Case control study. The United Kingdom and the European Union | Older adults Above 65 years 27450 participants | None noted | ● Study aimed to make mobile app for promoting wellbeing by maintaining social distancing and as means of social interaction.  
● Through the mobile apps family members will able to make calls and messages and to consult with medical staff | The study aimed at developing a tool/app to engage and improve overall quality of life especially wellbeing while maintaining social interaction and providing online support to senior population. Previously, there are mixed results that participation | Digital health mobile app Apps to call and interact with others | Continuously evolved process that’s why, traditional method (where software development has already completed) cannot be used because app is still in the process of deployment. |
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<tr>
<th>Study</th>
<th>Design</th>
<th>Participants</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Bott et al., 2019</td>
<td>Clinical trial (case control quasi experimental pre post design), USA</td>
<td>95 hospitalized older adults Age over 65 years</td>
<td>None noted</td>
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</table>
| | | | - The ECA (embodied conversational agent) shows animated dogs or cats on the computers display screenshot and responds to facial expressions and conversations. 
- 2 groups for experimental |
| | | | - This study aimed at assessing how Embodied conversational agents impact the depression, Intervention group used the avatars for most of the day (71.3%). the avatars displayed some video or audio content. Study concluded that intervention group have: |
| | | | - Embodied conversational agents to advocate health (a type of e |
| | | | Older adults that understand English were the only participants 
- Limited data is |
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<tr>
<th>Study</th>
<th>Title</th>
<th>Participants</th>
<th>Methods</th>
<th>Results</th>
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<tr>
<td>10 (He et al., 2022)</td>
<td>Quantitative study. Cross sectional study. China</td>
<td>1976 Chinese adults, among which middle aged (50%) and older adults (50%) &gt;65 years -have depressive symptoms</td>
<td>Behavior change theory</td>
<td>CHARLS is the tool used for assessing the condition of the participants in this study in China. Through this tool data was gathered through structured questionnaire. This study was conducted to test whether social participation and internet use have positive</td>
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<tr>
<td>Study</td>
<td>Design</td>
<td>Country</td>
<td>Sample Size</td>
<td>Methodology</td>
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<tr>
<td>Craig et al., 2021</td>
<td>Cross sectional</td>
<td>USA</td>
<td>241</td>
<td>Participants aged 63-95 years, 95% were of above 65</td>
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