Review

Nursing Ethics
1–16

10.1177/0969733019845132
journals.sagepub.com/home/nej

Ethical issues related to the use of gerontechnology in older people care: A scoping review

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Abstract

Background: Demographic trends indicate growth of population aged 65 and older in Western countries. One of the greatest challenges is to provide high-quality care for all. Technological solutions designed for older people, gerontechnology, can somewhat balance the gap between resources and the increasing demand of healthcare services. However, there are also ethical issues in the use of gerontechnology that need to be pointed out.

Purpose: To describe what ethical issues are related to the use of gerontechnology in the care of community-dwelling older people.

Methods: A scoping review was performed to identify and analyse studies concerning ethical issues when using gerontechnology in the home care of older people. The literature search was limited to studies published after 1990 and addressed to the electronic databases CINAHL, PubMed, Cochrane, Medic, IEEE Explore and Web of Science. The search was performed in July–August 2018. Data from empirical studies were analysed using thematic analysis.

Ethical considerations: This scoping review was conducted in accordance with good scientific practice. The work of other researchers was respected and cited appropriately.

Results: A total of 17 studies were identified. Two main themes were found. 'Balancing between the benefits of using gerontechnology and the basic rights of older people', consisted of the subthemes safety, privacy and autonomy. The other main theme, 'Gerontechnology as a risk of insecurity for older people', included the subthemes fear of losing human contact and concern and fear. Surveillance and monitoring technologies were mainly studied.

Conclusion: These results suggest that there may be ethical issues related to the use of gerontechnology and they must therefore be taken into consideration when implementing technology in the care of community-dwelling older people.

Keywords

Technology, older people, ethics, home care, scoping review

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Introduction

The focus of healthcare delivery is changing from facilities to community settings.[1] Technology in older people's care has already changed care practices and provided opportunities to re-organize existing care. Today, technological solutions are developing rapidly and becoming more wide-spread and affordable for an increasing proportion of people.[2] People worldwide are living longer and pace of population aging is now much faster than in the past, which is a major challenge for health and social systems in all countries.[3] Among other societal and financial changes, growing demand of healthcare services lead to inevitable need to ration nursing and healthcare.[4] Hence, even more possibilities of using different technological solutions in older people care may arise. However, the use of technology may raise some ethical issues which need to be considered.

Background

New technology can have a key role in avoidance of disability and institutionalization of the ageing population.[5] Gerontechnology is a technological domain which combines advances in technology and the needs of older people. The term, coined in Europe in the early 1990s, is a combination of the words *gerontology*, the multidisciplinary research field of aging, and *technology*. Gerontechnology is concerned with research combining technological advances and the study of ageing.[5] Gerontechnological devices can be used for different purposes: (1) using advanced technology to assess and detect deficits in motor and cognitive abilities, (2) monitoring the performance of home-dwelling older people by wearable systems and (3) compensating possible deficits with technology, especially in the home.[6]

Several gerontechnological solutions are available to fulfil these purposes. For example, remote care and diagnostic systems can include electronic pill dispensers, wearable devices that gather continuous data (e.g. heart rate, motion),[7] sensors to detect falls,[5,6] or interactive robotic pets for addressing emotional needs.[6,7] In addition to wearable devices, sensors can be inbuilt in carpets[5] or smart clothes and fabrics.[7] Cognitive and leisure games can be used to stimulate users cognitively and socially.[8]

Conceptually, these technological solutions can be divided into various ways by their purpose or design. In their narrative review, Piau et al.[5] used the following definitions: (1) gerontechnology is concerned with research as mentioned earlier; (2) assistive technologies (ATs): a tool or service that helps older people perform different tasks; (3) telecare: providing care, monitoring of health services at a distance (with the overlapping terms telemonitoring, telehealth, telesurveillance and telemedicine) and (4) smart homes: residences with technology enabling telemonitoring and/or enhancing autonomy. There is variation in the use of technology-related terminology in research publications.[5] In this study, gerontechnology was used as an umbrella term for all the technologies mentioned above. For readability, gerontechnology is also referred to with the general term technology.

Ethical nursing and healthcare are based on certain moral principles.[1,9] In the light of these principles, gerontechnology can provide healthcare professionals more opportunities to act for the benefit of community-dwelling older people. In other words, using technology can be a means to practise *beneficence*, as defined by Beauchamp and Childress.[9] The benefits for the older people depend on their living situation, condition and the type of the technology used. For example, earlier research has identified feelings of empowerment and regained autonomy for the frail old when they are able to be in control once more with the assistance of technology.[7,8] Learning to use new technology may have positive effects on the self-esteem, self-confidence and feeling of social inclusion of older people.[8] In addition, in-home monitoring can provide indirect benefits by decreasing the burden of informal caregivers and helping formal caregivers to provide more tailored care.[10]

Ethical implications of the use of gerontechnology have been raised, yet empirical research on the topic is scarce. Zwijsen et al.[11] reviewed scholarly papers and empirical studies concerning ethical considerations of using AT in the care of community-dwelling older people, focusing on dementia. In addition, Chung et al.[12] studied ethical considerations regarding the use of smart home technologies for older adults in their integrative review. Regardless of the focus being on different types of technology, both of these review articles found that the main ethical viewpoints were related to privacy and autonomy of the older adult. In addition, the term obstrusiveness was mentioned in both articles.[11,12] According to Zwijsen et al.,[11] obstrusiveness is often undefined in studies but having meaning of 'undesirably prominent' or 'undesirably noticeable'. Additional concerns were stigmatization, replacement of human contact, affordability and usability issues.[11,12] Chung et al. also brought up the importance of informed consent for ensuring that older people are aware of the mechanisms of information gathering and sharing.[12]

Unlike earlier review articles, this scoping review focused only on empirical evidence of the topic and utilized a broad definition of technology. Also, a principle-based approach was chosen to identify the counterbalances between values related to the use of technology.

Objectives

The aim of this scoping review was to describe what ethical issues are related to the use of gerontechnology in the care of community-dwelling older people. Ultimately, the goal was to raise awareness and promote discussion of ethical issues related to the use of gerontechnology in older people care.

Methods

The methodology was based on a framework developed by Arksey and O'Malley.[13] The literature review process followed the five steps outlined by the framework: (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) charting the data and (5) collating, summarizing and reporting the results. Framework optional stage, consultation exercise, was not utilized in the review.[13] The literature search was guided by the following research question: What kind of ethical issues are related to the use of gerontechnology in the care of community-dwelling older people?

Literature search

The literature search (Figure 1) was limited to empirical research articles published in English after January 1990 (the year the term *gerontechnology* was coined[6]). The search terms were 'aged', 'elderly', 'old people', 'ethics', 'ethical issue', 'moral', 'home care', 'community care', 'technology', 'telecare' and 'gerontechnology'. Search strings were constructed using search terms and their synonyms, wild cards, key words and MeSH terms. After selecting all the relevant search terms and their combinations, all were included in one search string using Boolean operators. The expertise of an informaticist was utilized during the process of search string construction.

Inclusion criteria for articles were (1) study subjects with mean age $\geq$65, (2) community-dwelling older people, (3) their relatives and/or involved healthcare professionals as study subjects, (4) all gerontechnological and telecare devices and that (5) ethical aspects of using gerontechnology were examined. Exclusion criteria were (1) study subjects as hospitalized patients or patients in long-term care facilities, (2) medical devices for the treatment of illnesses, (3) Electronic Health Records, (4) the main topic was research ethics and (5) review articles and commentaries.

The literature searches were addressed to the following electronic databases: CINAHL, Cochrane Library, IEEE Explore, Medic, Medline/PubMed and Web of Science. The search yielded a total of

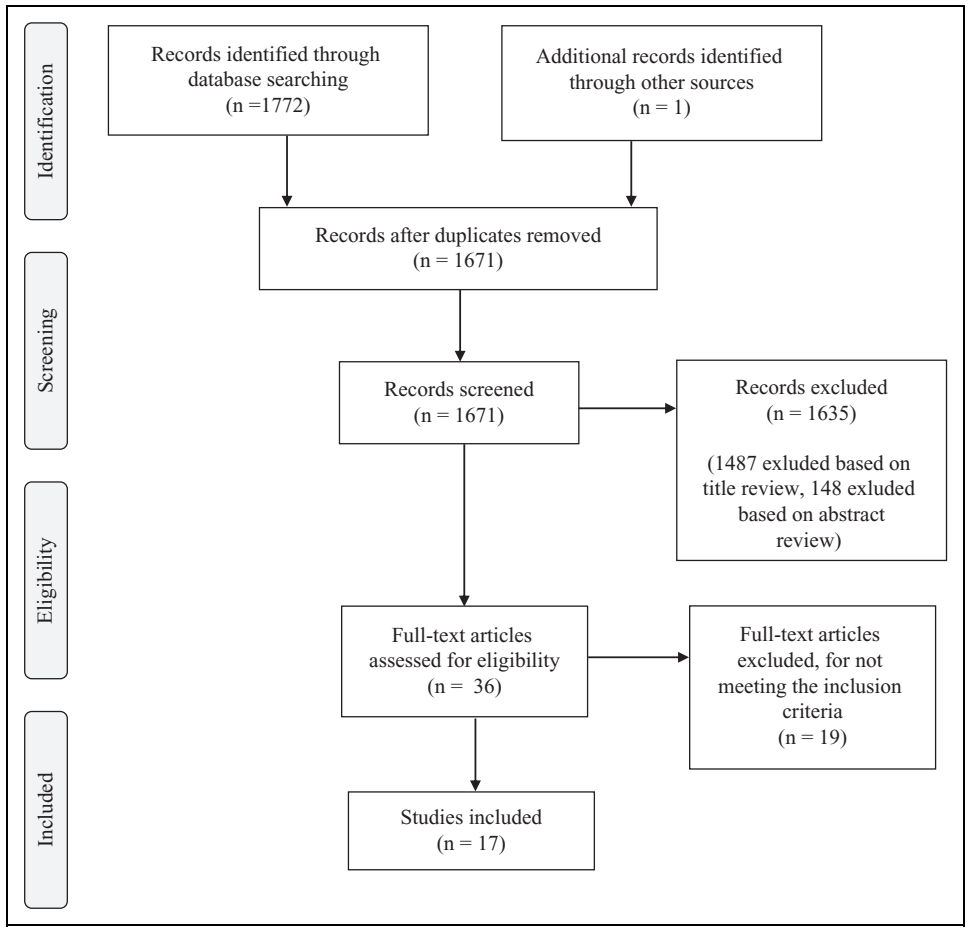

Figure 1. Literature search process (preferred items presented in the Joanna Briggs Institute guidance).[14]

1772 citations. All citations were exported to the citation management programme Refworks 2.0. After removing duplicate citations, 1671 citations remained for title screening. In the next phase, the abstracts of 184 potentially eligible titles were examined. Then, 36 full texts were read for inclusion. Sixteen of these articles were included in the review and synthesis. With one additional article found from the reference lists of the included articles, a total of 17 articles were included in this scoping review.

The literature search was performed by one author (S.S.). The other authors (M.S. and R.S.) checked the search strings and databases and confirmed the included articles.

Quality appraisal

Critical Appraisal Skills Programme (CASP) Qualitative and Cohort Study checklists[15] were used for quality appraisal knowing that formal assessment of the methodological quality of articles included in scoping reviews is generally not performed.[16] Quality was not a criterion for inclusion or exclusion of the studies but rather a means to gain insight into the general quality of the studies in the research field under

scope. Simple scoring logic was used for quality comparison so that one point was given for 'yes' answers and zero for 'no' or 'can't tell' (Table 1).

The qualitative studies were mainly of good quality in terms of methodology and style of reporting. In most of the studies, interviews were conducted with quite competent and healthy older people whose perceptions were based on technology test-use or anticipating the future. Therefore, the data might have been lacking richness and insights of the frailest old with dependence on gerontechnology. The quantitative studies were not generalizable due to relatively small sample sizes which were collected using convenience sampling. This might be with regard to the scarcity of earlier research and ethics being implicitly regarded as a qualitative topic. All in all, the results of the included studies were regarded as valuable.

Data synthesis and analysis

The articles were read and re-read in order to identify key values and areas in which the gerontechnology-related ethical issues appear in the care of community-dwelling older people. Simultaneously with the reading process, data were collected to a table. The topics were author, country, purpose of the study, methodology, type of technology, main results and quality.

Data were analysed using thematic analysis.[34] Guided by the research question, every value-expressing phrase was highlighted with a text highlighter and labelled with a descriptive term. In the labelling process, the terminology used in the studies was respected and no latent meanings were searched for. Finally, all of the labelled phrases with corresponding meaning were combined into themes.

Results

General characteristics of the included articles

The 17 reviewed articles were from Belgium (n = 1), Canada (n = 1), France (n = 1), Israel (n = 4), Netherlands (n = 1), Sweden (n = 6), United Kingdom (n = 2) and United States (n = 1). The studies were published between the years 2006 and 2015. Methodology was qualitative in 11 studies and quantitative in four studies while two studies combined both qualitative and quantitative methods. In addition, the study of Robinson et al.[28] combined a systematic review and qualitative study from which only empirical findings were included in the analysis. The research informants were older people (total n = 806, range = 6–245), their family members and relatives (total n = 294, range = 3–94) or healthcare professionals (total n = 249, range = 10–158). Type of studied technology was telemonitoring (sensor) technology (n = 6), tracking (GPS, Global Positioning System) technology (n = 6), AT services (n = 1), information and communication technology (ICT) (n = 3) and robots (n = 1). Most of the studies focused on perceptions and attitudes about technology (Table 1).

Ethical issues related to the use of gerontechnology in the care of community-dwelling older people

As a result of data summary and analysis, two main themes were found. The first theme, 'Balancing between the benefits of using gerontechnology and the basic rights of older people', consisted of subthemes privacy and autonomy. The other main theme, 'Gerontechnology as a risk of insecurity for older people', included the subthemes fear of losing human contact and concern and fear.

Table 1. Approach, methods, setting and results of studies.

Author and country	Purpose	Methods	Type of technology	Main results	Quality
Boström et al.,[17] Sweden	Perceptions of monitoring technology in terms of personal privacy	Focus group interview Aged, average age 84 (n = 45)	Monitoring technology	Overarching theme was 'maintaining sense of self' with subthemes 'privacy vs intrusion', 'independence vs security' and 'in the best interest of me vs in the best interest of others'. Participants stated that as long as they could maintain a sense of self and had feelings of security, they could accept surveillance at the expense of privacy.	7/10
Claes et al.,[18] Belgium	Attitudes and perceptions of older adults towards contactless monitoring of the activities of daily living	Questionnaire Older people, average age 72.41 (n = 245)	Contactless monitoring	Contactless monitoring was found useful for various purposes. Respondents liked to take part in decisions concerning technology; e.g. where it was installed. Several concerns and fears were brought up concerning functioning and financing of contactless monitoring.	10/14
Essén[19]	Experience of being surveilled in relation to sense of privacy	Interview Seniors aged 68–96 years, participants of telemonitoring project (n = 17)	Telemonitoring devices	Most of the older people perceived monitoring technology as freeing and protecting of privacy as it enables continuing living in their own homes. One individual experienced a violation of privacy and wanted to exit the surveillance service. This supports the dual nature of surveillance.	9/10
Harrefors et al.,[20] Sweden	Healthy older couples' perceptions of using assistive technology services when needing assistance with care	Interview Older couples > 70 years (n = 12, total of 24 participants)	Assistive technology services: from technical aids for daily living to IT-based services for security, communication and remote consultation	Main theme was 'Asset or threat depends on caring needs and abilities'. Three subcategories were 'assistive technology provides an opportunity', 'the consequences of assistive technology are hard to anticipate' and 'fear of assistive technology when completely dependent of care'. There were fears, e.g. that technology could be a burden for partner and of not being seen as a unique person.	9/10
Landau et al.,[21] Israel	Ethical aspects of the use of GPS to track people with dementia	Focus group interview (n = 68) Professional caregivers (n = 32) Family caregivers (n = 36)	Tracking devices, GPS	The most important theme was to balance patients' need for safety with the need to preserve their autonomy and privacy. The locus of responsibility affected views; when caregivers were responsible of the patient, they gave preference to patients' safety more than autonomy. The issue between paternalism vs patients' rights was discussed.	5/10

(continued)

Table 1. (continued)

Author and country	Purpose	Methods	Type of technology	Main results	Quality
Landau et al.,[22] Israel	Attitudes of cognitively intact older people towards the use of tracking devices for people with dementia	Questionnaire and focus group interview Questionnaire: Older people > 65 (n = 42) focus group interview: Older people > 65 (n = 23)	Tracking devices, GPS	Cognitively intact older people support the use of tracking devices when dementia is diagnosed or signs are evident. They value safety over autonomy and expect guidance from professional caregivers of people with dementia.	6/10
Landau et al.,[23] Israel	Attitudes of relevant populations regarding the question of who should decide about electronic tracking for people with dementia	Questionnaire (n = 296) Cognitively intact older people, average age 70.9 (n = 44) Family caregivers of people with dementia (n = 94) Social workers (n = 51) Other professionals working with people with dementia (n = 48) Social work students (n = 59)	Tracking devices, GPS	Figures inside the family closest to the person with dementia were perceived more important in the decision-making process than figures outside the family. Person with dementia was ranked third in the order of the figures. Since tracking raises ethical questions about autonomy, safety and privacy, professionals' reluctance in assisting family members in decision-making is experienced as frustrating.	8/14
Melander-Wikman et al.,[24] Sweden	Experiences of persons through testing a mobile safety alarm and their reasoning about safety, privacy and mobility	Interview Test-users, older persons (n = 9)	Mobile Safety Alarm with GPS and a drop sensor which activates when the user has a fall	The overarching category 'safety and mobility are more important than privacy' emerged. Violation of privacy was not experienced as they could decide how to use the alarm. Surveillance was mainly not perceived as a problem.	8/10
Mihailidis et al.,[25] Canada	Perceptions, preferences and location of different types of home-monitoring technology and sensing systems	Questionnaire and interview Baby boomers 40–59 years (n = 15) Older people > 65 (n = 15)	Home-monitoring technology	Older adults identified personal alarm systems as the monitoring technology they were most willing to install and health and physiological monitoring as the monitoring technology they were least willing to install. Both groups ranked video cameras as types of sensors they were least willing to install and many participants were concerned about the potential privacy invasion. Older adults were more particular about the location.	5/14

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Table 1. (continued)

Author and country	Purpose	Methods	Type of technology	Main results	Quality
Olsson et al.,[26] Sweden	Relatives' reflections on different kinds of information and communication (ICT) devices that are used or can be used in the daily care of persons with dementia	Interview, spouses of persons with dementia (n = 14)	ICT: assistive devices and surveillance technology	The overall theme–shifting between perspectives: my, your and our needs for safety and security was revealed. ICT devices mainly were perceived as useful. Concerns about varying levels of ICT skills, financial aspects, difficulties to make decisions for another person and concern that the person with dementia would not like being supervised were described	9/10
Percival and Hanson,[27] the United Kingdom	Preferences and priorities of older people, carers and relevant professionals concerning telecare	Focus group interviews, case scenarios Older people (n = 92) Carers (n = 55) Professionals (n = 39)	Various telecare technologies	People's rights to choice, self-determination and privacy were seen as important. Telecare should be provided as part of a community care package and should not replace human contact and hands-on care. Many participants stated that telecare should be publicly funded.	6/10
Robinson et al.,[28] the United Kingdom	Perspectives of different stakeholders in the management of wandering in dementia	Systematic review and focus group interviews (n = 19), health and social care professionals (n = 10), family carers (n = 3) and people with mild dementia (n = 6)	Electronic tracking devices (there were also other wandering management interventions studied)	Major theme for carers was the conflict between prevention of harm and person's right to autonomy. People with dementia felt that electronic tagging technology could place them at greater risk, e.g. as target for theft. They also spoke about independence, difficulties to learn technology and their concern over surveillance and the identity of 'big brother'	6/10
Sävenstedt et al., [29] Sweden	Values and perceptions held by professional carers of older people about the use of ICT in elder care	Interview Healthcare personnel (n = 10)	Information and communication (ICT) technology	Duality was revealed where the carers perceived ICT as a promoter of both inhumane and humane care. The dualities found were superficiality and genuineness, captivity and freedom, unworthiness and dignity. There was evidence of resistance towards the use of ICT in elder care.	7/10
Van der Heide et al.,[30] Netherlands	Investigate whether CareTV is a valid instrument for older people to engage in meaningful social contacts by a video connection to avoid loneliness	Questionnaire Aged, average age 73.2 (n = 130)	CareTV: possibility to interact with carers, family and friends	The average feelings of both social and emotional loneliness decreased significantly between the start and the end of the study. For safety, no sum score could be calculated but on item level, most clients felt less safe after 1 year	6/14

(continued)

Table 1. (continued)

Author and country	Purpose	Methods	Type of technology	Main results	Quality
Werner et al.,[31] Israel	Relationship between caregiving burden and out-of-home mobility of care-recipients using GPS technology	Measurements of different variables: caregiver burden (dependent variable) and out-of-home mobility etc. (independent variables) Care-recipient (average age 77.71) and caregiver dyads (n = 76)	Tracking devices, GPS	Care-recipients' lower cognitive status and more time spent out-of-home walking were the strongest predictors of caregiver burden. The connection was strongest when the care-recipient had dementia. Behavioural and emotional states of care-recipients were also related to caregiver burden.	8/14
Wild et al.,[32] the United States	Monitoring needs and expectations of older adults and their family members	Focus group interviews Community-residing older adults (n = 23) Family members (n = 16)	Telemonitoring, in-home sensing technologies	The main themes were: maintaining independence, detecting cognitive decline, sharing of information and the trade-off between privacy and usefulness of monitoring. The acceptance by older people was tied to utility of data generated by technology. Privacy was a secondary issue if the monitoring was useful with respect to safety, maintaining independence and health.	6/10
Wu et al.,[33] France	Perceptions of the older people about robots with regard to robot appearance	Focus group interviews Older adults > 65 (n = 15)	Assistive robots	Some humanoid robots were criticized by most participants and some small creative robots were appreciated. Interaction with robots was not perceived as genuine. There was strong reluctance towards a robot conceived as a substitute for human presence. Financing robots instead of human resources was criticized.	6/10

GPS: Global Positioning System; ICT: Information and communication technology.

Balancing between the benefits of gerontechnology and the basic rights of older people

Gerontechnology can be beneficial for older people in several ways, which were to some extent recognized in all of the studies. Technology had a role in supporting nursing care practices by providing more and deeper information of the home-living older person[27] and leading to more efficient care provision.[20] Using technology was considered to bring freedom and independence for the older people[17,24,26,32] and to give them a possibility to live longer in their own homes, to 'age in place'.[18,29,32] Enhanced possibilities to communicate and interact could also decrease feelings of loneliness among older people.[30] However, increased safety among the older people was the most emphasized technology-related benefit brought up in the studies.

Safety

Gerontechnology and its relation to the safety of the older person were discussed in several studies.[17,21,22,24,26,30,32] The safety of older people living in community was considered to be the main reason for using, for example, monitoring technology and tracking devices[21,22,32] or safety alarms.[24] Technology was seen as useful for obtaining information about the whereabouts of the older person[21] and getting help when needed.[24] On the contrary, it was discussed whether a technological device alone could bring safety and enable older people to remain living in their own homes.[20,32] Hence, in the study of Van der Heide et al.,[30] the older people felt less safe 1 year after implementation of CareTV and remote contact with care personnel. In addition, in the study of Robinson et al.,[28] the people with dementia felt that by carrying a mobile phone, they were at greater risk of being a potential victim for crime.

Another aspect in relation to safety of the older people were the closest relatives and their peace of mind.[21,22,31] Monitoring technology and tracking devices were seen useful especially when the older people had dementia symptoms,[22] but tracking could also increase the burden of relatives when they could see the person with dementia spending less time walking outside the home. The wish for safety of the older people gave rise to questions about different perspectives of different stakeholders and their needs for the use of technology.[21,23,26] Relatives and family members advocated safety and protection of life over privacy or autonomy more than healthcare professionals or the older people themselves.[21]

Hence, conflicts between safety and autonomy were discussed especially in the care of older people with dementia when consent for the use of surveillance technology could not be attained.[21–23] In addition, many studies discussed the relationship between safety and privacy, particularly when the technology used enabled surveillance.[17,21,26,32] Together with the other benefits technology could bring for older people, safety was a counterbalance for the basic rights of privacy and autonomy of the older people.

Privacy

The privacy of older people was one of the most discussed topics. It was a general theme especially in studies focusing on surveillance technology. Privacy was an important issue for the older people, but when technology was regarded as sufficiently beneficial, they were mostly ready to compromise on their wishes for privacy.[17–19,21,32] Increased safety was considered to be the most important benefit of the technology and it was mainly valued more highly than privacy. In other words, surveillance and partial loss of privacy could be accepted if the surveillance technology had the capacity to increase the safety of the older people.[17,21,32] Furthermore, wish for privacy was discussed in relation to risky behaviour when signs of dementia began to appear.[22] On the contrary, there were statements of technology increasing privacy if it

enabled older people to live longer in their own homes. Compared to long-term residential care, living in one's own home with monitoring technology was considered a less privacy-invading form of care.[19]

In the study of Percival and Hanson,[27] the relatives of older people and healthcare professionals made positive statements about the quality and depth of the information that monitoring technology could generate. Information about general behaviour patterns of the older people was seen as beneficial in care as it enables the early detection of possible changes in daily routines.[27] The older people also recognized the benefits the data could bring for the nursing staff[20] and had trust in healthcare confidentiality.[17,19] Professionals stated that with monitoring technology, a more comprehensive picture about the situation of the older person could be obtained. There was also a general view that this information had to be under strict guidelines of confidentiality and could not be delivered or sold further to commercial companies acquiring lifestyle data.[27]

However, concerns about the loss of privacy were also raised and discussed in several studies.[17–21] The older people had concerns about situations where someone unknown could watch them in their own home and considered these situations as an intrusion into one of the most private spheres of their lives.[20] Healthcare professionals also voiced their concern about the influence surveillance and tracking technologies could have on the basic rights of the most vulnerable older people.[21] In the study of Essén,[19] one of the 17 participants experienced a privacy violation and requested to be withdrawn from the test-use. In addition, the closest relatives and spouses of the older persons with dementia considered decision-making on behalf of another person to be challenging. They thought that their older relative or spouse would not necessarily like being watched over.[26] The concept of *big brother* was also mentioned in discussions concerning surveillance technology.[27,28,32]

With regard to privacy, the type of information that was gathered with the technology had significance.[17,18] Measuring physiological functions with sensors was perceived less threatening to privacy than monitoring daily routines.[17] The location of monitoring devices and possibility to switch them off occasionally had positive effects on the experience of maintaining privacy.[18,25] Also, features of the technology had significance; for example, video cameras would mostly have been rejected by the study participants due to privacy violation.[17,18,24] In the study of Claes et al.,[18] most of the participants (82.3%) would have found video cameras useful but regardless of these perceptions, many of them (41.1%) would have not accepted them due to the effects cameras would have on privacy.

Autonomy

The older people emphasized the importance of involving them in decision-making when implementing technology in their care. Discussion, compromises and the possibility to refuse the use of technology were seen as important.[17,18,26,28] The issue of autonomy was most prominent when older people had signs of cognitive deficits.[17,21–23,28,32] In relation to autonomy, technology was seen as either a restricting[21,27] or enhancing factor. The latter viewpoint was related to the consequential quality-of-life improving aspects, such as safe maintenance of physical activity and continued out-of-home mobility. Technology enabled them to get help in case of emergency or getting lost.[22,24,26]

It was discussed in the studies whether the need for the use of technology emerged from the older peoples' own needs or the needs from another stakeholder, that is, relatives or healthcare professionals.[17] The first signs of cognitive deficits or emerging risky behaviour of the older people could increase the stress and caregiving burden of their family members or other informal carers.[31] Therefore, peace of mind of the relatives and family members could be another reason to use technology besides the needs of the older people themselves.[17] In the study of Werner et al.,[31] the caregiving burden of the family members decreased when they were able to track their older relative with dementia symptoms and could see them moving actively outside of their homes. On the contrary, the burden increased in the event of signs and data of low

physical activity.[31] The older people did not wish to be a burden for their family members but were mostly not enthusiastic about sharing everything with them via automatic data transfer.[17]

Pressuring the older people to adapt technology was seen as a risk for autonomy, even when an apparent need was recognized.[21,27] Healthcare professionals discussed whether technology could have an effect on the behaviour and routines of older people and take away their right to take risks in their lives.[27] In the study of Landau et al.,[21] healthcare professionals emphasized co-operation with the older people when making decisions about the implementation of technology. Implementing technology for older people with dementia was seen as a legal and moral issue. Healthcare professionals recognized an ethical issue between paternalism and the rights of older people. Distinctively, relatives put more emphasis on the benefits of the technology and considered autonomy as a secondary issue in relation to the benefits, mostly on the safety of the older people. Some of the relatives stated that the older people would probably refuse to use technology in any case and given that, the use of technology could be coerced if necessary. An example of implanting a microchip under the skin of older people was discussed under this topic.[21]

Gerontechnology as a risk of insecurity for older people

Fear of losing human contact

Human contact and social interaction were highly valued by the older people. They stated that genuine contact with another human being could not entirely be replaced by technology.[17,20,27] In the study of Harrefors et al.,[20] physical touch as well as seeing and hearing other people were very important for the older people. The need of human presence and physical touch increased when the older people became more dependent on care and were living alone. The older people also made observations about technology being able to make care more efficient, which could enable nursing staff having more time to spend with them.[20]

Genuine relationships and social interaction were defined as crucial elements of good care by the older people and healthcare professionals. Furthermore, genuine relationships were defined as face-to-face interaction and the physical presence of another human being.[20,29] In addition, visits by a nurse were seen as important by the older people as part of the experience of belonging to the local community.[27] The older people and healthcare professionals expressed concern about technology being used in order to reduce nursing staff and cut healthcare costs.[27,29] Another observation made by healthcare professionals was that remote surveillance could be too easy an option to choose for a less motivated nursing staff member.[29]

When discussing threats, healthcare professionals expressed their concern that the use of technology could transform relationships from genuine to superficial.[29] The older people had a fear of not being seen as a unique person but merely an alert on a screen.[17,20] Superficiality was also discussed in the robot study of Wu et al.,[33] where the older people perceived communication with robots as non-genuine. The older people also discussed on a more general level how society as a whole is moving towards superficiality. They also criticized the funding of expensive robot projects instead of human resources.[33]

Concern and fear

Several studies had statements about the concerns and fears different stakeholders had in relation to the use of technology.[17,18,20,26–29] Older people expressed concern about technology taking control over their lives or that it could be used to satisfy others' desire to control their lives.[17] They were also concerned about their ability to learn to use new technology due to their old age and its effects on their cognitive capacity.[20,28] Family members also brought up difficulties in understanding technology and user manuals with small print.[26]

Furthermore, the older people were concerned about the stable functioning[20,26] and the usability issues of the technology. Difficulties in handling small buttons, false alarms and alarm limits set without taking aging into account were causes of concern for the older people.[18] They were also afraid that something could go wrong in the systems when being dependent of care.[20] There were also concerns that using technology could contribute to older people being made captive in their own homes[29] and that telecare technology could discourage older people from maintaining personal contacts and as a consequence, have effects on their mobility and general well-being.[27]

Discussion

This review and analysis of empirical evidence brought new insights on the ethical issues as a set of competing values and principles. From the principle-based point of view,[9] ethical issues in the use of gerontechnology seem to appear between values, meanings and underlying principles. In addition to the many positive effects technology could have in areas such as the autonomy or self-confidence of older people,[7,8,10] there might be a counterbalance of experienced loss of privacy.[19–21,26–28,32] Looking at these issues through the principle-based frame, questions can be seen between benefits and harm, beneficence and non-maleficence.[9]

The focus of healthcare delivery moving from facilities to community settings may increase healthcare professionals' individual responsibility and accountability.[1] Like every method of care work, care provided through the use of technology must be discussed within the frameworks of ethical guidelines and principles. It is obvious that nursing care could be more tailored to the needs of older persons[10] with the large amount of data collected using technology. As stated by one informal caregiver in the study of Wild et al.,[32] putting on a good face when meeting healthcare professionals would not be a hindering factor for identifying care needs if data could be collected continuously. However, it must be discussed what is the right thing to do with all the possibilities gerontechnology brings us. For example, balance must be found between the possibility of providing perfectly tailored care and the methods of collecting data for accomplishing that, considering the possibilities going as far as implanting a microchip.[21] Furthermore, it should be considered whether we should have the right to put on a good face regardless of age and retain responsibility for unidentified problems. On the contrary, it also must be brought into discussion whether spouses, relatives or next-of-kin should have a say on these issues or not.

The ethical issues in this review were identified from original studies conducted mostly with relatively competent older people and a narrow set of technologies. Considering the publication years (2006–2015) of the included studies, interest on ethical aspects of technology seems to have risen quite recently. With regard to the types of technology (Table 1) in these studies, the interest in ethical aspects might have risen together with the possibility to track and monitor older people from a distance. However, it can be discussed whether the findings from these studies, test-use periods or future anticipations truly reflect the ethical issues as experienced by the older community-dwellers in need of care.

Privacy and autonomy were found to be concerns of different stakeholders, as was the case in the studies of Zwijsen et al.[11] and Chung et al.[12] Apparently, these issues have been in the spotlight of empirical research[17,19,24,32] as well as scholarly papers.[11] On one hand, this reflects the anticipated world of surveillance and big brother but on the other, it might reflect ethical issues related to specific types of technology. Regardless of the larger scope of technology defined in this study, the technologies represented were quite homogeneous.

In contrast, obstrusiveness[11,12] and intrusiveness[11] were not discussed in the empirical studies included in this review. As criticized by Zwijsen et al.,[11] the definition of these concepts in earlier research is unclear and they might therefore have been unidentified or defined differently in this review. In the study of Chung et al.,[12] obstrusiveness was related to privacy issues, for example, location of video cameras or features of

technology as a source of nuisance or anxiety. In the study of Zwijsen et al., intrusiveness was used in the same meaning as obstrusiveness[11] and discussed in the studies included to this review in close relation to privacy.[19–21] Other dimensions of obstrusiveness include physical discomfort, noises or functional factors of the device.[12] It can be discussed whether these are ethical issues in their true essence or rather practical problems if the privacy and autonomy of the older people is respected in the processes of implementation and use of gerontechnology. On the other hand, practical problems have the potential of evolving into ethical issues if left unsolved and causing harm for the older dweller which could leave the ethical principle of non-maleficence unrealized.[1,9]

Notably, stigmatization[11,12] did not seem to be much of an issue for the older people in the included studies. This might be related to the quite novel technologies used in the studies (e.g. contactless monitoring[18] or ICT-based services[26,29]) and the possibility of those being less stigmatizing. Another aspect might be the rapid development of technology[2] and it becoming less stigmatizing for the older people when comparing new technology to the older devices (e.g. nylon wristband safety-buttons). As one of the baby boomers stated in the study of Mihailidis et al.,[25] technology looked 'pretty sleek',[13,25] which might have importance for many while still quite healthy and competent.

However, nursing care of community-dwelling older people rarely involves caring for those who are healthy and fully competent. It might be concluded that ethical issues related to the use of gerontechnology are an ever-evolving topic as the development of technology takes new leaps forward. Therefore, different aspects of this multifaceted phenomenon must be discussed, with most emphasis on the perspective of the older persons.

Strengths and limitations

The search strategy including databases of different scientific disciplines can be considered as a strength in this review. The number of included articles was surprisingly low in relation to the original hits yielded by the database searches. This might be related to the fact that research ethics is at least mentioned in every research article. The search process was performed by one researcher (S.S.) and the included articles were confirmed by the other members of the study group (M.S. and R.S.).

Literature searches limited to publications in English is one limitation that should be mentioned. Due to this, relevant studies might have been missed, considering the relatively high research activity in Sweden, for example. To some extent, unfamiliarity with technology-related terminology may also have limited the terms used in the database searches. Consulting an expert in this field could have been of assistance in targeting the searches correctly, especially in the information technology databases. In addition, the term 'older people' was not included in the search strings, as was observed after completion of the searches. This might have had some effect on the search results; however, the MeSH term 'aged' was included.

The variation in quality and methodology of the articles posed challenges to data analysis and synthesis. Considering the variation in CASP scores (Table 1), trustworthiness of the study could not always be thoroughly assessed due to insufficiencies in reporting. In most of the cases, these appeared mainly in methodological descriptions. In addition, several studies utilized more than one research method or participants (caregivers, older people) and in some cases, the origin of the expression was not clear. Unclear expressions were excluded from the analysis. In addition, ethics being an abstract topic, it was not always clear under which concept or theme some expressions should be included. Nonetheless, the classifications used in the original articles were respected in the analysis.

Future research

Given the increasing use of technology, more understanding of the ethical issues related to the use of gerontechnology is needed. Considering that the included articles focused mostly on surveillance

technologies, test-use and future anticipations, the next phase of research might be in-depth interviews with older and more dependent people who are using technology as part of their care. A more comprehensive picture of the ethical issues would also be gained by extending the scope of technologies. Furthermore, with increased knowledge of the topic, a tool could be developed for assessing the ethical issues related to the use of gerontechnology.

Conclusion

These results suggest that ethical issues can be related to the use of gerontechnology and must therefore be taken into consideration when implementing and using technology in the care of community-dwelling older people. As using technology can put the basic rights of older people at risk, the benefits and possible harm should preferably be discussed continuously throughout the processes of implementation and using gerontechnology. The divergent perceptions of different stakeholders can pose challenges to ethical discussion and might therefore be an implication to future research as well.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship and/or publication of this article.

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References

1. Thompson IE, Melia KM, Boyd KM, et al. *Nursing ethics*. 5th ed. Edinburgh: Churchill Livingstone, 2006, p. 424.
2. Coughlin JF, Pope JE and Leeddel B Jr. Old age, new technology, and future innovations in disease management and home health care. *Home Health Care Manag Pract* 2006; 18: 196–207.
3. World Health Organization. *10 facts on ageing and health*, http://www.who.int/features/factfiles/ageing/en/ (2017, accessed 31 January 2018).
4. Scott PA, Harvey C, Felzmann H, et al. Resource allocation and rationing in nursing care: a discussion paper. *Nurs Ethics*. Epub ahead of print 1 April 2018. DOI: 10.1177/0969733018759831.
5. Piau A, Campo E, Rumeau P, et al. Aging society and gerontechnology: a solution for an independent living? *J Nutr Health Aging* 2014; 18(1): 97–112.
6. Micera S, Bonato P and Tamura T. Gerontechnology. *IEEE Eng Med Biol Mag* 2008; 27: 10–14.
7. Milligan C, Roberts C and Mort M. Telecare and older people: who cares where? *Soc Sci Med* 2011; 72(3): 347–354.
8. Bobillier Chaumon M, Michel C, Tarpin Bernard F, et al. Can ICT improve the quality of life of elderly adults living in residential home care units? From actual impacts to hidden artefacts. *Behav Inf Technol* 2014; 33: 574–590.
9. Beauchamp TL and Childress JF. *Principles of biomedical ethics*. 7th ed. New York: Oxford University Press, 2013, p. 459.
10. Lexis M. Activity monitoring technology to support homecare delivery to frail and psychogeriatric elderly persons living at home alone. *Technol Disabil* 2013; 25: 189–197.
11. Zwijsen SA, Niemeijer AR and Hertogh CM. Ethics of using assistive technology in the care for community-dwelling elderly people: an overview of the literature. *Aging Ment Health* 2011; 15(4): 419–427.

12. Chung J, Demiris G and Thompson HJ. Ethical considerations regarding the use of smart home technologies for older adults: an integrative review. *Annu Rev Nurs Res* 2016; 34: 155–181.
13. Arksey H and O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Method* 2005; 8: 19–32.
14. Peters MD, Godfrey CM, Khalil H, et al. Guidance for conducting systematic scoping reviews. *Int J Evid Based Healthc* 2015; 13(3): 141–146.
15. Critical Appraisal Skills Programme (CASP). *CASP checklists*, https://casp-uk.net/casp-tools-checklists/ (2018, accessed 22 October 2018)
16. Peters MD, Godfrey CM, Khalil H, et al. *Methodology for JBI scoping reviews. The Joanna Briggs Institute reviewers' manual 2015*. Adelaide, SA, Australia: The Joanna Briggs Institute, 2015, p. 24.
17. Boström M, Kjellström S and Björklund A. Older persons have ambivalent feelings about the use of monitoring technologies. *Technol Disabil* 2013; 25: 117–125.
18. Claes V, Devriendt E, Tournoy J, et al. Attitudes and perceptions of adults of 60 years and older towards in-home monitoring of the activities of daily living with contactless sensors: an explorative study. *Int J Nurs Stud* 2015; 52(1): 134–148.
19. Essen A. The two facets of electronic care surveillance: an exploration of the views of older people who live with monitoring devices. *Soc Sci Med* 2008; 67(1): 128–136.
20. Harrefors C, Axelsson K and Savenstedt S. Using assistive technology services at differing levels of care: healthy older couples' perceptions. *J Adv Nurs* 2010; 66(7): 1523–1532.
21. Landau R, Auslander GK, Werner S, et al. Families' and professional caregivers' views of using advanced technology to track people with dementia. *Qual Health Res* 2010; 20(3): 409–419.
22. Landau R, Werner S, Auslander GK, et al. What do cognitively intact older people think about the use of electronic tracking devices for people with dementia? A preliminary analysis. *Int Psychogeriatr* 2010; 22(8): 1301–1309.
23. Landau R, Auslander GK, Werner S, et al. Who should make the decision on the use of GPS for people with dementia? *Aging Ment Health* 2011; 15(1): 78–84.
24. Melander-Wikman A, Faltholm Y and Gard G. Safety vs. privacy: elderly persons' experiences of a mobile safety alarm. *Health Soc Care Community* 2008; 16: 337–346.
25. Mihailidis A, Cockburn A, Longley C, et al. The acceptability of home monitoring technology among community-dwelling older adults and baby boomers. *Assist Technol* 2008; 20(1): 1–12.
26. Olsson A, Engstrom M, Skovdahl K, et al. My, your and our needs for safety and security: relatives' reflections on using information and communication technology in dementia care. *Scand J Caring Sci* 2012; 26(1): 104–112.
27. Percival J and Hanson J. Big brother or brave new world? Telecare and its implications for older people's independence and social inclusion. *Crit Soc Policy* 2006; 26: 888–909.
28. Robinson L, Hutchings D, Corner L, et al. Balancing rights and risks: conflicting perspectives in the management of wandering in dementia. *Health Risk Soc* 2007; 9: 389–406.
29. Savenstedt S, Sandman PO and Zingmark K. The duality in using information and communication technology in elder care. *J Adv Nurs* 2006; 56(1): 17–25.
30. van der Heide LA, Willems CG, Spreeuwenberg MD, et al. Implementation of CareTV in care for the elderly: the effects on feelings of loneliness and safety and future challenges. *Technol Disabil* 2012; 24: 283–291.
31. Werner S, Auslander GK, Shoval N, et al. Caregiving burden and out-of-home mobility of cognitively impaired care-recipients based on GPS tracking. *Int Psychogeriatr* 2012; 24(11): 1836–1845.
32. Wild K, Boise L, Lundell J, et al. Unobtrusive in-home monitoring of cognitive and physical health: reactions and perceptions of older adults. *J Appl Gerontol* 2008; 27(2): 181–200.
33. Wu Y, Fassert C and Rigaud AS. Designing robots for the elderly: appearance issue and beyond. *Arch Gerontol Geriatr* 2012; 54(1): 121–126.
34. Vaismoradi M, Turunen H and Bondas T. Content analysis and thematic analysis: implications for conducting a qualitative descriptive study. *Nurs Health Sci* 2013; 15(3): 398–405.