Title	Authors	General attitudes toward ICT	Independence / Aging in place	Perceived usefulness	Safety and security
SUMMARY			In many of the studies, participants emphasised the importance of being able to live independently in their own homes for as long as possible (6,8,10,14,19,23). In one study, the participants got a feeling of accomplishment when they managed to carry out an activity on their own, and they all aspired to use the Internet without relying on anyone (5). In another, the elderly envisioned a telehealth kiosk as a tool that can enhance their independence and control over their health status (23). However, some issues regarding technologically aided independence were also reported. In one study, the authors write: "Most respondents indicated that they associated the use of telehealth and telecare with a high degree of dependency and ill health. In the majority of cases, respondents seemed to want to distance themselves from negative connotations of old age, sickness and dependence, and instead depicted themselves as having a strong sense of personal responsibility for maintaining health, self-care and independence that could be threatened by the interventions. (...) Responses commonly indicated a strong sense of personal responsibility for health, illness and self care; and the interventions threatened to undermine such a sense of 'control' and current approaches to managing health problems." (14). Similarly, participants in another study reported that they did not use assistive technologies because they viewed them as something that belonged in a hospital, and felt that it brought them one step closer to institutional care or death (31).	The elderly population generally find the functionality offered by health ICT systems useful (3,4,11,12,23,27,29). This might be linked with their desire for increased independence and/or quality of life: "Determination in sustaining one's independence can affect a WSN [Wireless Sensor Network] system's PU [perceived usefulness] and any indication on WSN's ability to improve an elderly individual's quality of life would appear to have a positive impact on the system's PU." (12) However, one study found that the elderly "did not uniformly accept the smart home IT shown and most indicated a preference for being able to select only the technologies they perceived they needed" (28). The following were identified as factors affecting usefulness of sensor data (7): - Participants' desires to understand personal activity patterns - Changes in health status - Living situation - The availability of contextual information about sensor data - Age - Time when health monitoring begins - Perceived interest level of others in accessing data - Accessibility of data to others	Studies reported a feeling of safety and security as a result of using ICTs, and/or a desire to use ICTs to prevent or detect accidents and medical emergencies (4,6,9,10,12,18,22,24,27,29). In two of the studies, the participants emphasized the importance of facilitating communication between the patient and healthcare providers or emergency services when they needed help (18,22). "The lack of feedback reduced the feeling of safety and increased the uncertainty regarding whether someone would help." (18) There was also a wish for social alarms to work outside the home, which would let the elderly go out without feeling unsafe (18,24). Another study found that the elderly wanted devices or sensors that can detect a range of different emergencies (24). In cases where assistive technologies have a limited uptake and use, one explanation could be that the solution focuses purely on providing safety to the user, but does not improve the lived experience of impairment: "Many of the assistive technologies in this study (e.g. blood pressure monitoring, falls detectors, alarms) had been supplied after an acute event (e.g. stroke, fall). They served, at best, to provide objective information (biometric data, emergency alerts) to health and/or social care providers. But they did not improve the lived experience of impairment. Indeed, they were not designed to do so - but therein may lie one explanation for their limited uptake and use." (31)
Acceptance of Swedish e-health services	M. L. Jung and K. Loria	None of the participants were aware of the e-health solutions offered by their local county council, but once they were introduced to them they had very positive attitudes.		Most of the participants found most of the services very useful. The three characteristics that were acknowledged most were time savings, convenience, and cost savings, with convenience being the most important.	
Advocacy of home telehealth care among consumers with chronic conditions	J. F. Lu, M. J. Chi and C. M. Chen	The majority of participants pointed out the convenience of telehealth.		Most users perceived telehealth care was a convenient and useful model for healthcare-delivery.	Whenever the participants felt any discomfort, they could immediately use the service. Several patients said that telenurses (who reviews health data collected by the service) provided information and positive feedback when they regularly uploaded data so that they felt safer. Perceived support and security was especially increased for one participant who lived alone. The fact that telenurses dealt with the patients' problems right away, greatly helped alleviate their worries.
An ethnographical study of the accessibility barriers in the everyday interactions of older people with the web	S. Sayago and J. Blat		Participants reported a feeling of accomplishment when they were able to carry out an activity on their own. All the participants aspired to go online without relying on anyone.		
An extended view on benefits and barriers of ambient assisted living solutions	C. Jaschinski and S. B. Allouch		Independence is very important to the participants.		Older adults felt that embedded sensors could provide added safety and security by detecting abnormal behavior such as falls or other emergencies, and automatically contact help.
Assessing older adults' perceptions of sensor data and designing visual displays for ambient environments	B. Reeder, J. Chung, T. Le, H. Thompson and G. Demiris			(*Focuses on usefulness of sensor data.*) The following were identified as factors affecting usefulness: - Participants' desires to understand personal activity patterns - Changes in health status - Living situation - The availability of contextual information about sensor data - Age - Time when health monitoring begins - Perceived interest level of others in accessing data - Accessibility of data to others	
Attitudes Toward Information and Communication Technology (ICT) in Residential Aged Care in Western Australia	P. K. Loh, L. Flicker and B. Horner		Residents felt the advantage of being able to stay at the RACF and get access to medical care in their home.		
Bridging the digital divide in older adults: A study from an initiative to inform older adults about new technologies	Y. H. Wu, S. Damnée, H. Kerhervé, C. Ware and A. S. Rigaud	In general, participants were fascinated by the potential of technologies, and for many of them, people who master technologies were considered to be empowered.			Some participants reported that they need ICT products to be rescued in case of an emergency.
Defining the user requirements for wearable and optical fall prediction and fall detection devices for home use	M. Govercin, Y. Költzsch, M. Meis, S. Wegel, M. Gietzelt, J. Spehr, S. Winkelbach, M. Marschollek and E. Steinhagen-Thiessen	The participants did not expect such a system (optical sensor monitoring) to function very well and doubted the effectiveness of the system itself.	All three groups emphasised the importance of mobile independence.		Participants requested that fall-prediction data be communicated first to the users themselves or to a relative, and that actual falls be reported to an emergency call number as soon as possible.
Diabetes management assisted by telemedicine: Patient perspectives	P. M. Trief, J. Sandberg, R. Izquierdo, P. C. Morin, S. Shea, R. Brittain, E. B. Feldhousen and R. S. Weinstock			Participants appreciated the program's focus on monitoring and recording readings, and interaction with diabetes educators and nurses.	
Elderly persons' perception and acceptance of using wireless sensor networks to assist healthcare	R. Steele, A. Lo, C. Secombe and Y. K. Wong			Determination in sustaining one's independence can affect a WSN system's perceived usefulness and any indication on WSN's ability to improve an elderly individual's quality of life would appear to have a positive impact on the system's perceived usefulness. It has been observed that negative perception on nursing homes can increase an elderly person's desire to remain at home.	The participants stated that the ability to detect falls and monitor basic bodily functionalities should be implemented into a WSN health monitoring system.
Exploring an informed decision-making framework using in-home sensors: Older adults' perceptions	J. Chung, B. Reeder, A. Lazar, J. Joe, G. Demiris and H. J. Thompson	Participants were interested in potential benefits and main purpose of sensor technology.		Perceived usefulness of in-home sensors influences how older adults communicate their understanding of technology to others and can influence the process of making an informed decision.	
Exploring barriers to participation and adoption of telehealth and telecare within the Whole System Demonstrator trial: A qualitative study	C. Sanders, A. Rogers, R. Bowen, P. Bower, S. Hirani, M. Cartwright, R. Fitzpatrick, M. Knapp, J. Barlow, J. Hendy, T. Chrysanthaki, M. Bardsley and S. P. Newman		Most respondents indicated that they associated the use of telehealth and telecare with a high degree of dependency and ill health. In the majority of cases, respondents seemed to want to distance themselves from negative connotations of old age, sickness and dependence, and instead depicted themselves as having a strong sense of personal responsibility for maintaining health, self-care and independence that could be threatened by the interventions. Responses commonly indicated a strong sense of personal responsibility for health, illness and self care; and the interventions threatened to undermine such a sense of 'control' and current approaches to managing health problems.		
Findings from a participatory evaluation of a smart home application for older adults	G. Demiris, D. P. Oliver, G. Dickey, M. Skubic and M. Rantz	Residents expressed overall positive perceptions of the sensor technologies.			
Impact of monitoring technology in assisted living: Outcome pilot	M. Alwan, S. Dalal, D. Mack, S. W. Kell, B. Turner, J. Leachtenauer and R. Felder	This study indicated that activity monitoring was acceptable to older adult populations.			
Implementing technology-based embedded assessment in the home and community life of individuals aging with disabilities: A participatory research and development study	K. Y. Chen, M. Harniss, S. Patel and K. Johnson	In general, participants thought the system gave a general sense for physical effort or activity.			
Indoor and outdoor social alarms: understanding users' perspectives	M. Sjolinder and A. Avatare Nou				There was a great need for alarms that could handle both indoor and outdoor environments. The elderly participants pointed out the importance of being able to speak/communicate with the receiver when they had raised the alarm. The lack of feedback reduced the feeling of safety and increased the uncertainty regarding whether someone would help.
Keeping silver surfers on the crest of a wave - Older people's ICT learning and support needs	L. Damodaran, W. Olphert and S. Phipps		Findings show that older people value very highly the benefits and independence that computer use gives them.		
Making sense of mobile- and web-based wellness information technology: cross-generational study	D. Kutz, K. Shankar and K. Connelly	The elderly participants generally took a passive approach to ICT. This means that they expected the technology to do what is required with minimal user intervention, or if they had some concerns, participants would express the expectation that nothing could really be done outside of opting out.			
Meeting seniors' information needs: Using computer technology	R. J. Campbell		Some participants appreciated the amount of health information available on the Internet but remained dependent on their physician for guidance and treatment in terms of their own health. For these participants, the Internet provided them with a chance to learn more about their health care conditions. Ultimately, it was their physicians who controlled their behavior and provided them with the information needed to maintain their current health state or improve.		
Older adults are mobile too! Identifying the barriers and facilitators to older adults' use of mHealth for pain management	S. J. Parker, S. Jessel, J. E. Richardson and M. C. Reid				Participants stated they would use mHealth technologies if the devices were connected to a doctor/healthcare provider, or facilitated communication between patients and healthcare providers or emergency services.
Older adults' acceptance of a community-based telehealth wellness system	G. Demiris, H. Thompson, J. Boquet, T. Le, S. Chaudhuri and J. Chung		Participants saw value in health-related decision making ultimately envisioning a telehealth kiosk as a tool that can enhance their independence and control over their health status.	The telehealth wellness kiosk was perceived as useful by the majority of the subjects in the focus groups. Subjects who already engaged in self-assessment of vital signs in their own home did not see added value of the kiosk: six subjects stated that they were already assessing their blood pressure regularly.	
Older adults' attitudes towards and perceptions of "smart home" technologies: a pilot study	G. Demiris, M. Rantz, M. Aud, K. Marek, H. Tyrer, M. Skubic and A. Hussam	All participants had an overall positive attitude towards the concept of 'smart homes' as they expressed their interest in new technologies and their belief that there can be numerous ways of improving their everyday lives. They also expressed willingness to try out new technologies if those were readily available.			Using devices and sensors that are able to detect a range of emergencies was seen as an important requirement by the participants. Participants did not object to any of these types of installation (wearable, local installation/ambient, and remote operation) and would accept any such device if it were to improve their life or prevent accidents.
Older adults' perceptions of usefulness of personal health records	M. M. Price, R. Pak, H. Müller and A. Stronge				
Older adults' privacy considerations for vision based recognition methods of eldercare applications	G. Demiris, D. P. Oliver, J. Giger, M. Skubic and M. Rantz				
Passive sensor technology interface to assess elder activity in independent living	G. L. Alexander, B. J. Wakefield, M. Rantz, M. Skubic, M. A. Aud, S. Erdelez and S. A. Ghenaimi			All of the users found the information comforting.	All residents stated that collecting this information made them feel safer, knowing that someone was watching for changes in activity levels and potential health problems.
Privacy and senior willingness to adopt smart home information technology in residential care facilities	K. L. Courtney			Respondents did not uniformly accept the smart home IT shown and most indicated a preference for being able to select only the technologies they perceived they needed.	
Senior residents' perceived need of and preferences for "smart home" sensor technologies	G. Demiris, B. K. Hensel, M. Skubic and M. Rantz	Participants had a positive attitude toward smart home technologies in general. Findings suggest that participants focused on the potential of smart home features to detect emergency situations rather than their potential for prevention through early detection of potential health problems.		The sensors (bed sensor, stove sensor, sensor mat, motion sensor, gait monitor, and video sensor) were all generally perceived as useful. Some participants determined the usefulness of the devices based on previous personal adverse health events.	The motion sensor was perceived as an application that could provide ease of mind by detecting intruders and thus providing additional security, as well as monitoring their activity level.
Use of information and communication technology to provide health information: What do older migrants know, and what do they need to know?	K. Goodall, P. Ward and L. Newman				
What matters to older people with assisted living needs? A phenomenological analysis of the use and non-use of telehealth and telecare	T. Greenhalgh, J. Wherton, P. Sugarhood, S. Hinder, R. Procter and R. Stones		A material explanation for low use of assistive technologies was that some participants viewed them as belonging in a hospital and as bringing them one step closer to institutional care or death.		Many of the assistive technologies in this study (e.g. blood pressure monitoring, falls detectors, alarms) had been supplied after an acute event (e.g. stroke, fall). They served, at best, to provide objective information (biometric data, emergency alerts) to health and/or social care providers. But they did not improve the lived experience of impairment. Indeed, they were not designed to do so but therein may lie one explanation for their limited uptake and use.
Willing but Unwilling: Attitudinal barriers to adoption of home-based health information technology among older adults	R. Young, E. Willis, G. Cameron and M. Geana	For most people, the idea of a home-based system to manage personal electronic health records and web messaging was unfamiliar.			
You get reminded you're a sick person: Personal data tracking and patients with multiple chronic conditions	J. S. Ancker, H. O. Witteman, B. Hafeez, T. Provencher, M. Van De Graaf and E. Wei				

Title	Socialisation	Health management	Support / help	Information searching	Support with daily activities
SUMMARY	The elderly wish to use ICTs to socialize and play a more active role in society (5,6,9,23). "Social influence was considered a facilitator to technology use." (9) They want to prevent social isolation, and were positive toward using ICTs to accomplish this (5,6). Participants considered social influence a facilitator to technology use, and most wanted to learn more about ICT in order to maintain an active engagement in life and society. (9). By getting the elderly out of the house and be more socially active, they can get back a sense of life, as well as stimulate their activity level (6). The elderly value the ability to communicate with family and friends through the use of ICT (9,19). Also, sharing health-related information with family members and healthcare providers was a requested feature (20,25). In one study (12), participants did not perceive any ICT system to impose any changes on their social lives, and stated that their social trends would not be affected by such a system. They strongly opposed to the idea of notifying family members about lack of social activities, and similar functionalities.	The elderly are positive towards using ICTs to help manage their own health, by getting information about their current health status (4,11,13,23,25). This will make them less dependent on their physician, and make them more aware of their own health problems and possibly also their underlying causes. One study (25) lists the following desired functionality for a "magic box" tool for managing their health information: Participants expressed a need for a tool that will store all their health information in one place and allow them to share this information with healthcare providers and family members. The e-health tool should be interactive, and help users manage appointments, medications, bills, and statements. It should provide reminders for various health tasks, and provide a diagnosis or answer questions about a concern based on the personal health information stored within the tool. They want a tool that would track their health status over time, and give general health advice based on their personal health information. Older adults indicated that they would prefer to have the responsibility of entering information into the "magic box", rather than giving this responsibility to their doctor. It should provide easy accessibility to their records for healthcare providers.	Several studies found a distinct correlation between the support available to the user, and the users' acceptance and attitudes towards the ICT system (12,19,21). In one of the studies, the authors write: "The availability of help and support has emerged as a key factor of paramount importance to sustaining connection. (...) Human support and encouragement was reported by a significant number (25.2 per cent) of survey respondents to be the most important thing to help them use technology successfully. Most of this help and support was gained informally from family and friends." (19). Another study states: "Most participants pointed out that the availability and quality of user support is crucial in determining whether users can interact successfully with the technology." (12).	In two of the studies, participants valued the ability to use the Internet for information searching (19, 21). In (21), the participants stated that they felt the Internet was "good for finding information that the physicians don't tell you about or forget." However, in another study, some participants considered it a social injustice that people have no choice but to use new technologies to get access to information and services (9).	In three of the studies, participants stated that they used ICTs to aid them in their daily activities, and appreciated this ability. Activities that the technology assists the elders with includes chores and reminders (e.g. medicine and important appointments) (6), online banking, shopping online, writing letters and financial budgeting (19), and enhancing their lives and increasing their productivity in general (21).
Acceptance of Swedish e-health services					
Advocacy of home telehealth care among consumers with chronic conditions		Most patients said that using telehealth care enhanced their ability to play a more active role in their own disease management. Many subjects mentioned that telehealth care could help them improve adherence to their medication and facilitate their understanding of their health condition through regular measurements. Generally, patients described how they obtained more accurate and instantaneous information about their health condition. Furthermore, they changed their eating and lifestyle habits.			
An ethnographical study of the accessibility barriers in the everyday interactions of older people with the web	A key and common motivation for all the participants to use the web was to socialize. They did not want to do activities that could isolate them. They preferred to go online in pairs, and saw this as a way to share knowledge and learn from others. Participants felt they were still active and important when they helped their grandchildren and children to solve everyday problems with computers.				
An extended view on benefits and barriers of ambient assisted living solutions	Social involvement was also perceived as an important advantage of the future SONOPA (assisted living) technology. They values the social network feature, and the ability to communicate with family and friends. They concluded that SONOPA could prevent social isolation by getting people outside the house, motivate them to participate in social life and therefore, give them back a sense of life. This could also stimulate their activity level.				Assistance with chores and reminders (e.g., medicine, important appointments) was a much appreciated feature.
Assessing older adults' perceptions of sensor data and designing visual displays for ambient environments					
Attitudes Toward Information and Communication Technology (ICT) in Residential Aged Care in Western Australia					
Bridging the digital divide in older adults: A study from an initiative to inform older adults about new technologies	Most of the participants mentioned the fact that they need technology to keep in touch with their relatives, to receive information, to communicate with others, and to be connected to the society. Social influence was considered a facilitator to technology use. Most of the participants wanted to learn more about ICT in order to maintain an active engagement in life and society.			Some considered it a social injustice that people have no choice but to use new technologies to get access to information and services.	
Defining the user requirements for wearable and optical fall prediction and fall detection devices for home use					
Diabetes management assisted by telemedicine: Patient perspectives		Their main motivation was to address and cope better with their diabetes condition (all participants were diabetic).			
Elderly persons' perception and acceptance of using wireless sensor networks to assist healthcare	In general, the elderly participants do not perceive WSNs or systems of any type to impose any changes on their social lives and stated that their social trends and habits would continue with or without the system. All participants strongly opposed to the suggestion that social aspects, such as notifying their family of the lack of social activities, should be incorporated into the design of WSNs.		Responses from the participants indicate that types of support available is one factor that can affect user acceptance of WSNs. Most participants pointed out that the availability and quality of user support is crucial in determining whether users can interact successfully with the technology.		
Exploring an informed decision-making framework using in-home sensors: Older adults' perceptions		Participants appreciated technology that could be relevant to individual health status.			
Exploring barriers to participation and adoption of telehealth and telecare within the Whole System Demonstrator trial: A qualitative study					
Findings from a participatory evaluation of a smart home application for older adults					Residents reported that the sensors were not noticeable while performing daily activities, and they did not change their routines because of the system.
Impact of monitoring technology in assisted living: Outcome pilot					
Implementing technology-based embedded assessment in the home and community life of individuals aging with disabilities: A participatory research and development study					
Indoor and outdoor social alarms: understanding users' perspectives					
Keeping silver surfers on the crest of a wave - Older people's ICT learning and support needs	Older adults value the role of ICTs in keeping them in touch with family and friends.		The availability of help and support has emerged as a key factor of paramount importance to sustaining connection. Human support and encouragement was reported by respondents to be the most important thing to help them use technology successfully. Most of this help and support was gained informally from family and friends. Participants report absence of adequate support. When disengagement occurs it is often a gradual process, rather than a single event, and usually results from a combination of factors, including support.	Older adults value the role of ICTs in using the internet for information searching.	Older adults value the use of ICTs to make the mechanics of daily life easier (such as online banking, shopping online, writing letters and financial budgeting).
Making sense of mobile- and web-based wellness information technology: cross-generational study	Older adults could see the benefit in sharing health data with their family and close friends. However, in other scenarios, older adults frequently expressed that sharing did not make sense to them. They didn't see why someone outside the family might be interested.				
Meeting seniors' information needs: Using computer technology				Many participants made use of the computers because they felt that the Internet was "good for finding information that the physicians don't tell you about or forget."	Ten of the seniors living at both facilities used the computers to enhance their productivity in other aspects of their lives. For these individuals the Internet was not only an information source but also was a tool they could use to enhance their lives and increase their productivity.
Older adults are mobile too! Identifying the barriers and facilitators to older adults' use of mHealth for pain management					
Older adults' acceptance of a community-based telehealth wellness system	Several participants emphasized the social benefits of a community system that brings people together.	All subjects agreed that they appreciated the ability to frequently capture physiological parameters and be made aware of their physiological well-being.			
Older adults' attitudes towards and perceptions of "smart home" technologies: a pilot study			Participants expressed concern that the success of such technologies requires human assistance to be available and respond to the data or alarms generated by the technology.		
Older adults' perceptions of usefulness of personal health records	Participants requested the ability to share their health information with healthcare providers and family members.	It may be that older adults have more chronic health concerns and have a need for understanding the underlying causes, or how a medication might affect that concern. Health information technology should help older adults both keep track of general information and have support for these comprehension needs. Participants mostly rely on non-electronic strategies for keeping health information. Participants described the following desired functionality for a "magic box" tool for managing their health information: Both age groups expressed a need for a tool that will store all their health information in one place and allow them to share this information with healthcare providers and family members. The e-health tool should be interactive, and help users manage appointments, medications, bills, and statements. It should provide reminders for various health tasks, and provide a diagnosis or answer questions about a concern based on the personal health information stored within the tool. They want a tool that would track their health status over time, and give general health advice based on their personal health information. Older adults indicated that they would prefer to have the responsibility of entering information into the "magic box", rather than giving this responsibility to their doctor. It should provide easy accessibility to their records for healthcare providers.			
Older adults' privacy considerations for vision based recognition methods of eldercare applications					
Passive sensor technology interface to assess elder activity in independent living					
Privacy and senior willingness to adopt smart home information technology in residential care facilities					
Senior residents' perceived need of and preferences for "smart home" sensor technologies					
Use of information and communication technology to provide health information: What do older migrants know, and what do they need to know?					
What matters to older people with assisted living needs? A phenomenological analysis of the use and non-use of telehealth and telecare			One participant had a very positive attitude to the assistive technologies, assumably because her daughter visited daily and helped use the equipment.		
Willing but Unwilling: Attitudinal barriers to adoption of home-based health information technology among older adults					
You get reminded you're a sick person: Personal data tracking and patients with multiple chronic conditions					

Title	Ease of use and HCI	Privacy	Obtrusiveness / intrusiveness	Comprehension and awareness	Training
SUMMARY	It is important that the system is user friendly and requires minimal to no user action (24). Several factors relating to ease of use and HCI were found, that have a negative impact on acceptance, such as: - icons are confusing, prefer text terms (5) - users are afraid of doing something wrong, and do things slowly to minimize chance (5) - too small buttons (17,30) - too many system functions (30) Perceived ease of use can be affected by preference on the system design, personal preferences and several external factors (12).	Many studies found that some or all participants had concerns about privacy (6,9,10,12,22,24,25,26,28,29,31,32). "Privacy was the bigger barrier to adoption, more so than usability." (25) One of the most emphasised reasons is that the technology makes the elderly feel observed (6,12,24,26,29), e.g. by the use of optical sensors and video surveillance (10,24,26,29). "All participants felt that the use of cameras within their homes for the purpose of identifying falls or other accidents was 'obtrusive' and would be violating the resident's privacy." (24). One way to counteract this invasion of privacy is to make the cameras only detect shadows or silhouettes and movements, and thus hide identifiable features (24,26). The elderly want to be able to control the frequency and location of monitoring (26). Some would like to be able to turn the system off (6,26), and some would like the option to "get rid of it" when desired (12). However, some think such a system would only work to its full potential when it cannot be switched off (6). They want to control which data to share, and who the data is shared with (6). Most want to grant access to their healthcare providers and others who need to process the data for the purposes of monitoring (26,29). Some expressed that they want to grant access to their family members (26,29), while others expressed privacy issues with this feature (26). In one study, the participants thought their physicians ought to be able to see how much activity they were engaged in, while they did not think their caregivers, spouses or children would be interested in that level of detail (17). The elderly population lacks knowledge about computer security (19). They are worried that their information is not stored securely (25,32), and fear that it can be hacked (32). Some accepted that they had to trade privacy and security for perceived utility (32). Despite there being many barriers relating to privacy, several studies found that the participants did not have any issues with privacy (3,13,15,17,22,23). They expressed that they had no concerns about the use of cameras (26), GPS tracking (18), or wireless transmission of health data (12). Reasons for this include that they trust the service provider (3), that the monitoring provides ease of mind (15), and that they value security over privacy (12,28). There needs to be a balance between the benefits of monitoring and the perceived invasion of privacy (15,29).	It is important to the elderly that system components should be unobtrusive (10,12,13,24,29). "Participants have stressed that the system should be unobtrusive." (12) In one study, participants pointed out that some people are 'technophobes' and refuse to utilize new technologies (24). For these people, the devices should be as non-obtrusive as possible, and should not need to be operated or controlled by the user in any way. Generally, smaller devices tend to be seen as less intrusive, and technological devices installed in the home should be hard to see for visitors (29). The use of cameras for video surveillance is considered "too intrusive" (12,24). In the case of wearable devices, the elderly prefer to wear them on the wrist, and women want sensors that can be worn as jewellery (10). See also INSERT LINK TO SENSOR MONITORING SECTION. In several studies, the participants answered that they were not bothered by the technology, and/or that it did not interfere with their daily activities, which would indicate that the developers succeeded in creating an unobtrusive system (13,15,17,29).	Several of the studies found that participants had problems with understanding the technology and/or the terminology (12,19,27,30,31). "Responses suggested that participants did not understand the technology." (30) - "Many had a hazy understanding of their assistive technologies, and we found one fully installed and functioning alarm system (with pendant) of which the intended user claimed to be unaware." (31) - "Many participants reported that they had difficulties understanding technical 'jargon'." (19) - "It is evident that the functionalities and benefits of WSN systems is a concept some elderly persons find hard to grasp. (...) They [participants] expressed their frustration in not being able to understand what happened when error occurs and hence expressed a desire for the system to have 'common sense' and give out meaningful and easy to understand error messages." (12)	Generally, the elderly find it very important to get sufficient training in the ICT system they are supposed to use (5,12,13,19,22,24). It was found that tailored training was considered as the best way to bridge the gap of the digital divide (9). However, the quality of these training sessions can have very varying quality, like in one of the studies where the majority of the participants reported that they still did not know how to use the system after the training session (4). In this case the reasons were that they had too little training, and they did not have access to any kind of help on how to use the device once the training was done. Some people misunderstand and think that the system is more complicated to operate than it actually is (14). This way, some people might give up on even trying to learn how to use the system. Some have even stated that they have no interest in learning how to use computers (30). The number of ICT training courses exclusively available for older adults is limited, and information about ICT training opportunities is generally poorly publicised (19). Some people get training from their family and friends (9). However, one study found that the children of the elderly are generally not the most appropriate teachers, as they tend to be impatient and speak computer jargon without explaining the meaning of technical terms (5). When learning how to use an ICT system, an expert should sit down with the subject and guide him/her through the operating process step by step (4). Repetition is also crucial, since the elderly are more prone to cognitive conditions and thus have a harder time remembering how to do certain tasks (4) (See also INSERT LINK TO "Remembering and cognitive issues" section). A trainer should be patient, have perseverance, and use understandable language (5). The training itself should be accessible, timely, affordable, tailored, local, and in a welcoming and safe environment (19). The elderly also want an instruction manual that they can consult when they are unsure how to perform a certain task (12,24). This manual should be designed specifically for senior citizens, written in an understandable language (24).
Acceptance of Swedish e-health services	Ease of use was considered very important among the participants. Those with the least Internet experience were worried that they would have difficulty using the services. Yet once they tried them, even those who had initially been hesitant reported being confident in their ability to use the services.	None of the participants had any issues regarding privacy and security, because they all trusted the service provider.		One of the biggest concerns among the interviewees was the risk of misunderstanding. Either misunderstanding (health) information provided by the service, or that recipients misunderstand information that the user provides to the service (in this case the written description of the health problem to the doctor).	
Advocacy of home telehealth care among consumers with chronic conditions	At the end of the testing period, the majority of subjects said they could operate the devices by themselves. However, subjects thought that an expert should sit down and guide them through the operating process step by step because they believed the device was complicated.				Some patients stated that they still could not completely understand the functions and operating procedures of the telehealth devices, or they did not know about all the functions offered by the device. One reason for this can be too little training or access to help on how to use the device, as the elderly forget more easily than younger people. Subjects thought that an expert should sit down and guide them through the operating process step by step because they believed the device was complicated. Sometimes, the procedure must be repeated until subjects can properly manage it on their own. It is not appropriate to assume that the older can keep all of this information in their head after only one demonstration.
An ethnographical study of the accessibility barriers in the everyday interactions of older people with the web	Instead of icons, they preferred to have terms on GUI elements, and the terms should be in their vocabulary. Older people are afraid of breaking or deleting something when using computers, and prefers to go slowly to minimize the chance of doing something wrong. See *Functional limitations / ergonomics*.				A key aspect for achieving independence was to receive training support. However, participants indicated that their children, despite being very important for them, were not the right persons for teaching them. They tend to be impatient and speak computer jargon without explaining the meaning of technical terms. Patience, perseverance and using a language allowing older people to understand technical words in their own way were regarded as key qualities for trainers.
An extended view on benefits and barriers of ambient assisted living solutions	Participants were worried about the potential complexity of the SONOPA interface (AAL), and how much user participation is needed to operate the system. Since they did not grow up with technology, they might lack the necessary skills, experience and confidence.	Participants considered the loss of privacy as a negative aspect of the future SONOPA (AAL) technology. Several senior participants felt that the SONOPA technology would invade their personal space, and that they would feel observed. Most participants wanted to be able to switch the system on and off, be aware of which data are shared and decide with whom the data are shared. On the contrary, other participants thought that the system would only work to its full potential, when it could not be switched off.			Participants were interested in informational and educational features for the future SONOPA technology.
Assessing older adults' perceptions of sensor data and designing visual displays for ambient environments					
Attitudes Toward Information and Communication Technology (ICT) in Residential Aged Care in Western Australia					
Bridging the digital divide in older adults: A study from an initiative to inform older adults about new technologies		Privacy violation and cybercrime was mentioned as factors causing concern.			For this group of seniors who did not acquire knowledge on the use of ICTs during their schooling and/or at work, tailored training was considered as the best way to bridge the gap of the digital divide. Training was often provided by family and friends who helped older adults get familiarized with technology.
Defining the user requirements for wearable and optical fall prediction and fall detection devices for home use		Privacy issues were important to the participants. 3 out of 5 did not want optical sensors installed in their home. Participants specifically requested the disclosure of information after a fall or fall-risk assessment.	It was important for participants that wearable sensors were unobtrusive. See (general findings about) sensor technologies.		
Diabetes management assisted by telemedicine: Patient perspectives					
Elderly persons' perception and acceptance of using wireless sensor networks to assist healthcare	An elderly person's preference on the system design, personal preferences and several external factors it appears can affect a user's perceived ease of use of the system. Most of the participants indicated that they would like to have some level of control or interaction with the system.	A majority of the participants showed no concern about having their health information transmitted wirelessly. Participants place their preference on ensuring that help is readily available over privacy or the confidentiality of their health information. There were participants who considered monitoring as a kind of "surveillance". They stated their reluctance to have the system monitoring them all the time and wondered if the implementation would allow them to "get rid of it" when desired.	Participants have stressed that the system should be unobtrusive. While they do not mind having the system monitoring them 24/7, the incorporation of a camera into such system would be "too intrusive."	It is evident that the functionalities and benefits of WSN systems is a concept some elderly persons find hard to grasp. Participants were frustrated by not understanding what happened when an error occurs, and expressed a desire for the system to have "common sense" and give out meaningful and easy to understand error messages.	Many have stated the desire for a demonstration or training to be given so that they would "understand how to use the thing [WSN system]." Others also commented on the fact that a manual should be provided so that they can refer back to it when they cannot remember what was taught during the training.
Exploring an informed decision-making framework using in-home sensors: Older adults' perceptions		Participants recognised the issues of obtrusiveness and privacy with regard to voluntariness, but were not bothered by these.	Participants recognised the issues of obtrusiveness and privacy with regard to voluntariness, but were not bothered by these.	Participants were able to understand information about the technology's purpose, benefits, and limitations. They were able to relate the information about sensor technology to their own goals and values.	Participants addressed the importance of communicating the purpose and benefits of the technology as well as privacy issues to age peers to ensure comprehension and voluntariness.
Exploring barriers to participation and adoption of telehealth and telecare within the Whole System Demonstrator trial: A qualitative study					Uncertainties regarding the technical aspects of the equipment did not seem to be mitigated by explanations presented at the home assessment visit. Participants misunderstood and thought the system was more complicated to operate than it actually was. Comments made in interviews following the home visit indicated a high level of uncertainty regarding the technology being offered and that staff varied in their own knowledge of the intervention.
Findings from a participatory evaluation of a smart home application for older adults		The belief that a balance needs to be struck between the benefits of such monitoring, determined by level of need, and the concomitant perceived intrusion into privacy at home, was key in their decision to participate in the smart home project and allow the installation of the technology in their apartments. Throughout the study, residents stated that they had no privacy concerns and felt that allowing the monitoring of their daily activities was providing ease of mind and/or the sense of contributing to generating of new knowledge by participating in a research study.	Residents and did not feel that they interfered with their daily activities.		
Impact of monitoring technology in assisted living: Outcome pilot					
Implementing technology-based embedded assessment in the home and community life of individuals aging with disabilities: A participatory research and development study	In general, participants reported that the system was easy to use, and did not require significant effort on their part. Several participants had some problems using this tiny switch on the GPS tag. None of the participants had difficulty using the visualization software.	Most participants in our small sample had no concern about the privacy of their location data. They thought their physicians might find it useful to know how much activity they were engaged in. They did not believe that their caregivers, spouses or children would be interested in that level of detail about their movement.	In general, participants reported that the system did not interfere with their daily lives. Participants felt that the installation of WAPs in their home was not intrusive.		
Indoor and outdoor social alarms: understanding users' perspectives	The wearable alarm unit should have a separate alarm button that is easy to see and press.	None of the participants thought that the use of their geographical location was an invasion of their privacy. The benefits were seen as far greater than the disadvantages to be traced using GPS.			
Keeping silver surfers on the crest of a wave - Older people's ICT learning and support needs		Many participants reported that they did not know how to deal with computer security, especially how to deal with/prevent unwanted content such viruses, pop-ups and spam.		Many participants reported that they had difficulties understanding technical "jargon".	Many participants reported that they lacked technical skills/knowledge to do specific tasks or to solve problems when they occur. Qualification-based learning provision is not what the majority of older ICT users say they want. They expressed a preference for learning that is: accessible, timely, affordable, tailored, local, and in a welcoming and safe environment. Participants report that barriers to learning include: lack of confidence and fear of using ICT's, the absence of adequate support,varied provision and quality of ICT training, the high cost of training, memory problems, problems with understanding technical jargon and dealing with pop-ups and spam. Some of these barriers reduce in impact with growing familiarity with ICT's, but some persist. Findings indicate that the number of ICT training courses exclusively available for older adults is limited, and information about ICT training opportunities is generally poorly publicised. The workshops resulted in a "blueprint" that describes the essential operational elements that need to be in place to create and sustain community based ICT learning and support services. This "blueprint" recognises the need for flexible approaches so that local needs can be addressed most effectively utilising local opportunities. It considers the essential features under four headings: venues, services, affordability, and values. For many older people success in learning to use ICT comes about when the learning occurs in a social process that is enjoyable and relevant to their needs and interests. Once people are using ICT to do things that matter to them, they begin to embrace learning, find the experience rewarding and are therefore likely to be motivated to continue using ICTs – and often will expand their skills.
Making sense of mobile- and web-based wellness information technology: cross-generational study					
Meeting seniors' information needs: Using computer technology					
Older adults are mobile too! Identifying the barriers and facilitators to older adults' use of mHealth for pain management		Some participants (19%) were concerned with an invasion of privacy from mHealth tracking their movements. Conversely, 12% of participants were not concerned about privacy and felt that tracking their movements would make them feel less isolated while managing their pain condition.			A majority of participants reported that mHealth training that targets the needs of older adults would be necessary and useful.
Older adults' acceptance of a community-based telehealth wellness system		None of the participants expressed any privacy concerns when using the telehealth kiosk. Several participants expressed that not only did they not have privacy concerns using the telehealth system in a community room, but rather they stated their appreciation for the social interactions that this set-up provided.			Almost all subjects expressed very little interest in the educational videos focusing on aging-related topics (e.g. nutrition, arthritis, mobility) and stated that they prefer to get their healthcare information from the internet, their healthcare provider or clinical textbooks rather than a community kiosk.
Older adults' attitudes towards and perceptions of "smart home" technologies: a pilot study	Using devices and sensors that are user friendly and require no or minimal action on the part of the user, was seen as an important requirement by the participants.	All participants felt that the use of cameras within their homes for the purpose of identifying falls or other accidents was 'obtrusive' and would be violating the resident's privacy. A solution where the cameras could detect shadows and movements, but not identifiable features of the individuals, was seen as more appropriate.	[See Privacy] A participant emphasized the fact that some people are 'technophobes' and refuse to utilize new technologies. For such residents, the argument was made that a non-obtrusive device, one that functions as a sensor and does not need to be operated or controlled by a user, would be more appropriate.		Many participants felt that there is a need for training sessions and manuals that are designed specifically for senior citizens who may not be familiar with the operation of certain devices or the technical language used.
Older adults' perceptions of usefulness of personal health records		Although the ability to share information with others is perceived as an important benefit to using an e-health tool, privacy is also the biggest concern. Privacy was the bigger barrier to adoption, more so than usability. To overcome this barrier, both age groups would need assurance that their information is both secure and backed up.			
Older adults' privacy considerations for vision based recognition methods of eldercare applications		Participants found the silhouette images to be protective of their privacy. Participants also addressed a need for control of the frequency and location of such monitoring, and requested the ability to turn the system on and off. It was also requested that the resident should be able to decide which rooms should have the sensors should be installed. Most participants felt that the camera used in the scenarios was acceptable to have in their homes, and that they would not have problems with family members or friends visiting if the system was installed in their home. Nine participants emphasized that access should be limited to those who needed to process this information for the purposes of monitoring. Seven participants expressed the desire to be able to access their personal "anonymized" image sequences, although not on a regular basis. Two participants wanted access to be granted to family members, while another expressed privacy concerns about this feature.			
Passive sensor technology interface to assess elder activity in independent living	Residents required assistance by interviewers during their interactions with the sensor data interface.			Residents had more difficulty viewing data; they had some difficulty interpreting graphs, thought there was too much information, and did not understand the terminology.	
Privacy and senior willingness to adopt smart home information technology in residential care facilities		Personal definitions of privacy ranged from 1) a desire to be alone, 2) a desire to control the information shared with others, 3) a desire to control access to one's personal property, and 4) a desire to protect oneself from identity theft. For only a handful of respondents, their privacy concerns clearly guided their rejection of smart home IT. Most participants used a pragmatic approach to their technology needs and indicated that their perception of their need for the technology was the most important consideration in the decision to adopt a smart home IT. For participants who had privacy concerns about the smart home IT, the privacy concerns were not as important as their perception of their need for the technology.			
Senior residents' perceived need of and preferences for "smart home" sensor technologies		Two participants expressed concerns about privacy violation resulting from the use of the technology. The video sensor raised greater privacy concerns than the other technologies. Ten participants stated that they would not want to have a video sensor installed in their residence. Most participants saw a balance to be struck between the benefits of such monitoring, determined by level of need, and the perceived intrusion into privacy. Participants stated that they would want their healthcare providers to have access to the data generated by the sensors. Six participants also added that they would like their close family members to be recipients of the data sets. Four participants said that they, themselves, would like to see the information. One participant followed-up indicating that residents should have control of the amount and frequency of information distribution, stating that he would "need to see the information first, before anybody else is bothered".	Participants believed that none of the technologies presented to them would interfere with daily activities. For some participants, the size of the device played a role. A small device was seen as less intrusive. Participants also addressed the issue of integration of the technology in the residence and its degree of visibility to visitors.		
Use of information and communication technology to provide health information: What do older migrants know, and what do they need to know?	Many did not use mobile phones because of the problems they experienced while using the small keys or navigating the numerous functions offered on most phones.			Responses suggested that participants did not understand the technology.	Many participants expressed no interest in learning how to use computers, citing their age or seeing no reason for doing so.
What matters to older people with assisted living needs? A phenomenological analysis of the use and non-use of telehealth and telecare		Some viewed the pendant alarm as potentially exposing them to sinister intrusion or surveillance by unwanted strangers.		Many had a hazy understanding of their assistive technologies, and we found one fully installed and functioning alarm system (with pendant) of which the intended user claimed to be unaware.	
Willing but Unwilling: Attitudinal barriers to adoption of home-based health information technology among older adults		Participants were concerned about the security of storing health records online, repeatedly mentioning the fear of information getting hacked. Physician computers were seen as more secure and trustworthy retainers of sensitive information than personal computers. Respondents were also concerned that information they stored in the system could be used against them, as evidence of preexisting conditions. A few respondents acknowledged that the web was not secure but were resigned to that fact. The perceived vulnerability of information was a fact to be accepted rather than a barrier. These respondents were willing to trade privacy and security for perceived utility.			
You get reminded you're a sick person: Personal data tracking and patients with multiple chronic conditions					

Title	Memory and cognitive issues	Physical abilities and ergonomics	Fear / anxiety / discomfort with use	Technology self-efficacy	Digital divide / generational differences
SUMMARY	Several studies found that elderly people often forget how to use the technology, or forget to use it at all. This includes keeping track of devices (22), putting on wearable sensors (12), charge battery-driven devices (17), and remembering passwords and steps in a process (19). ICT services can also be used to compensate for these cognitive difficulties (9, 23). However, this kind of functionality can also have negative effects: "For some, reminders about appointments or to take medicine were seen as unnecessary or even insulting, an indication that one could not manage health affairs without assistance." (32).	A recurring theme in several studies was that interfaces, including computer mice and small buttons, were not tailored to the elderly population with functional limitations (5,19,22,24,26,27,30). "The majority of interfaces [of new technological devices] are not designed to take into consideration the functional limitations that come with age. As a result, some tasks requiring the use of technological devices become even more difficult for the older adult." (24) One study found that the elderly preferred using the keyboard instead of the mouse, due to normal age-related changes in precision and manual dexterity (5). They did not want to use alternative input devices, as they wished to feel integrated, and they had issues with using accessibility tools for making text and elements larger, since this increased cognitive demands by moving or removing elements.	Many elderly people might experience discomfort, anxiety or even fear while using ICT (5,9,12,16,19,31,32). In one study, many participants even stated that they are "terrified of a computer" (12). Possible causes for these feelings include a low level of comfort with and control of technology, age-related cognitive difficulties, or a lack of familiarity (9,12,32). Elders were also afraid of not getting help quickly if they were to fall while using a fall detection device/system (16). While using a pendant alarm, there are several scenarios where elderly people often chose to deactivate the alarm because they would feel uncomfortable if they had to use the alarm: "Others viewed the pendant alarm as potentially exposing them to sinister intrusion or surveillance by unwanted strangers, or as threatening to precipitate dramatic scenarios that were embarrassing (e.g. ambulance arriving when they were not dressed), socially disruptive (e.g. disturbing their children at work) or personally threatening (e.g. leading to unwanted hospital admission). When such perceptions were held, the device was rarely, if ever, activated." (31). One study found that connectivity could increase older adults' comfort with technology in general (22).	Elders often doubt their own abilities to understand and properly use ICT solutions (3,12,14). One possible reason for this could be that many have had negative experiences with technology in the past, where they were unable to interact with the technology properly (12). However, one study found that even those with the least Internet experience and lowest self-efficacy in the study, reported being confident in their ability to use the services once they had tried them (3).	Elderly people are concerned about using technologies that can make them look different and frail, and they want to be able to use the same technology as their children and grandchildren are using, both to feel closer to them, and to dispel stereotypes they could have about them (5). However, most elderly people are unable to follow the technological trends, which might make some feel labelled as old fashioned and obsolete, which in turn can make them feel inferior or powerless (9). "They [most of the participants] frequently reported social pressure that pushes them to use technologies in order to fit in with the society. Otherwise, they would be excluded from it." (9) One study found an exception to the theory that the digital divide is a significant barrier to the adoption of e-health tools: "Older adults in this study were more likely to adopt some form of technology than younger adults (e.g., create a medication list within a word document). Older adults' willingness to adopt some form of technology may reflect the perceived usefulness and importance of the task of remembering medications, as well as the usefulness of being able to easily edit and print the same information to a multitude of healthcare providers." (25)
Acceptance of Swedish e-health services				Those with the least Internet experience were worried that they would have difficulty using the services. Yet once they tried them, even those who had initially been hesitant reported being confident in their ability to use the services.	
Advocacy of home telehealth care among consumers with chronic conditions					
An ethnographical study of the accessibility barriers in the everyday interactions of older people with the web		All the participants reported that the keyboard helped them to make their notes more readable to others. The keyboard was also easier to use than the mouse, due to normal age-related changes in precision and manual dexterity. Yet, none of the participants wanted to use alternative input devices as they wished to feel integrated. Participants had issues with using accessibility tools for making text and elements larger, since this increased cognitive demands by moving or removing elements. They would rather sit closer to the screen or use reading glasses.	Participants reported a fear of using ICT.		All the participants were concerned about using technologies that could make them look different or frail. Participants indicated that they wanted to use the same technologies as their grandchildren and children, in order to feel closer to them, and to dispel stereotypes that they could have about them.
An extended view on benefits and barriers of ambient assisted living solutions					
Assessing older adults' perceptions of sensor data and designing visual displays for ambient environments					
Attitudes Toward Information and Communication Technology (ICT) in Residential Aged Care in Western Australia					
Bridging the digital divide in older adults: A study from an initiative to inform older adults about new technologies	Some participants reported that they need ICT products to compensate for cognitive difficulties. Age-related cognitive difficulties was mentioned as a factor contributing to a feeling of anxiety when using ICT.		To many of the participants, technology might cause anxiety due to a low level of comfort with and control of technology, age-related cognitive difficulties, or a lack of familiarity.		Most of the participants reported that they lag behind the social trend, which moves with technology progress. The differences between generations, concerning elements such as values, ways of thinking, and lifestyles, were considered to contribute to the digital divide. Some participants reported the feeling of being labeled as old fashioned and obsolete, due to a lack of knowledge on ICTs and their use, which could lead to a feeling of inferiority or powerlessness. Many frequently reported social pressure that pushes them to use technologies in order to fit in with the society. Otherwise, they would be excluded from it.
Defining the user requirements for wearable and optical fall prediction and fall detection devices for home use					
Diabetes management assisted by telemedicine: Patient perspectives					
Elderly persons' perception and acceptance of using wireless sensor networks to assist healthcare			Several participants have stated that they are apprehensive towards technology and demonstrated clear concern about the possibility of having to interact with a WSN system. The majority of the participants emphasized on the fact that computer systems are hard to understand due to their old age. Many have even stated that they are "terrified of a computer."	The majority of the participants have had at least one negative experience with technology, and several of them cited previous incidents when they or their friends have unsuccessfully interacted with technology.	
Exploring an informed decision-making framework using in-home sensors: Older adults' perceptions					
Exploring barriers to participation and adoption of telehealth and telecare within the Whole System Demonstrator trial: A qualitative study				Many respondents discussed their decision to decline the trial in the context of views about the technological nature of the equipment. Participants' reflections on the place of contemporary communication technologies and their sense of alienation from such technologies were often combined with doubts about their capacity to engage with what they understood to be the operational requirements of the equipment.	
Findings from a participatory evaluation of a smart home application for older adults					
Impact of monitoring technology in assisted living: Outcome pilot			Fear of falls and not receiving help quickly were among the top concerns expressed by surveyed residents.		
Implementing technology-based embedded assessment in the home and community life of individuals aging with disabilities: A participatory research and development study	Participants noted that remembering to charge the device was a challenge. However, most participants remembered to charge the device consistently by building it into their daily night time routine. Some participants often forgot to turn the GPS off when going outside, and suggested that it would be better if there was a way for the system to sense when they crossed the boundary between indoors and outdoors automatically.				
Indoor and outdoor social alarms: understanding users' perspectives	The elderly participants pointed out that the wearable alarm unit has to be a device that would not be forgotten as easily as a mobile phone.				
Keeping silver surfers on the crest of a wave - Older people's ICT learning and support needs	Many participants reported that they had difficulties remembering things – for example passwords, or all the steps in a process. When disengagement occurs it is often a gradual process, rather than a single event, and usually results from a combination of factors, including changes in memory.	When disengagement occurs it is often a gradual process, rather than a single event, and usually results from a combination of factors, including changes in physical ability. Many participants reported having physical difficulties – for example using the mouse or keyboard, or seeing the screen.	Participants report a lack of confidence and fear of using ICT's.		
Making sense of mobile- and web-based wellness information technology: cross-generational study					
Meeting seniors' information needs: Using computer technology					
Older adults are mobile too! Identifying the barriers and facilitators to older adults' use of mHealth for pain management	Forgetfulness and concerns about their ability to keep track of a device were mentioned as barriers to using mHealth.	Participants were interested in having the technology tailored and simplified to allow use by older adults with functional limitations such as those with poor eyesight or diminished dexterity. Visual and auditory deficits were mentioned as barriers to using mHealth.	Participants expressed that connectivity could increase older adults' comfort with technology in general.		
Older adults' acceptance of a community-based telehealth wellness system	All twelve subjects found the cognitive assessment (brain fitness) software very useful.	Six subjects discussed severe frustrations with the computer mouse; two of which due to arthritis in their hands.			
Older adults' attitudes towards and perceptions of "smart home" technologies: a pilot study		The majority of interfaces are not designed to take into consideration the functional limitations that come with age. As a result, some tasks requiring the use of technological devices become even more difficult for the older adult.			
Older adults' perceptions of usefulness of personal health records					Contrary to the literature regarding the digital divide between younger and older adults as a significant barrier to the adoption of e-health tools, older adults in this study were more likely to adopt some form of technology than younger adults. Older adults' willingness to adopt some form of technology may reflect the perceived usefulness and importance of the task of remembering medications, as well as the usefulness of being able to easily edit and print the same information to a multitude of healthcare providers. This finding suggests that if PHRs provide similar benefits, older adults are likely to adopt and maintain an electronic or online PHR technology.
Older adults' privacy considerations for vision based recognition methods of eldercare applications					
Passive sensor technology interface to assess elder activity in independent living		Residents had difficulty manipulating the mouse.			
Privacy and senior willingness to adopt smart home information technology in residential care facilities					
Senior residents' perceived need of and preferences for "smart home" sensor technologies					
Use of information and communication technology to provide health information: What do older migrants know, and what do they need to know?		Small buttons were mentioned as a reason for not using mobile phones.			
What matters to older people with assisted living needs? A phenomenological analysis of the use and non-use of telehealth and telecare		Many participants searched proactively for technologies that would compensate for specific physical impairments, like weighted cutlery to compensate for hand tremor, or using an iPad to write after being paralysed. However, the options for compensating for non-specific impairments such as chronic tiredness and poor concentration were much more limited.	Some viewed the pendant alarm as potentially exposing them to sinister intrusion or surveillance by unwanted strangers, or as threatening to precipitate dramatic scenarios that were embarrassing (e.g. ambulance arriving when they were not dressed), socially disruptive (e.g. disturbing their children at work) or personally threatening (e.g. leading to unwanted hospital admission). When such perceptions were held, the device was rarely, if ever, activated.		
Willing but Unwilling: Attitudinal barriers to adoption of home-based health information technology among older adults	For some, reminders about appointments or to take medicine were seen as unnecessary or even insulting, an indication that one could not manage health affairs without assistance.		Many respondents expressed antipathy toward computers. Their workings were mysterious and suspect, they promised to expedite things but actually made them more complicated, and they lacked social presence. The idea of using computers to organize medical information and contact physicians was of dubious value and, to some, downright unappealing. E-mail was used by all respondents, and they were much more comfortable with the idea of health-related interaction via e-mail than with the prospect of storing their EHRs on a personal computer.		
You get reminded you're a sick person: Personal data tracking and patients with multiple chronic conditions					

Title	Cost	Lack of human interaction	Stigmatization and pride	Reliability / trust	Readiness to adopt technology	Other barriers
SUMMARY	Generally, elderly people see the cost of a health-realted ICT solution as an important concern when deciding if they want to buy it (4,6,12,19,22,24,30,32). "Cost was the most significant concern to the elderly participants." (12) ICT systems needs to be affordable for elderly people living on a pension if it is to get a large user base. However, in one of the studies, cost savings for the user was mentioned as a benefit, as it is cheaper (or even free) to use the ICT solution once it is installed, rather than get an appointment with a doctor (3).	An ICT system should not replace human contact. The elderly emphasised the importance of having human care and human interaction, and the thought of replacing this with a computer caused concern (6,8,9). "The need for human contact and a warm relationship appeared paramount to the residents. This was simply and forcefully expressed by a resident who said simply: 'We are not robots here.' More importantly the residents were 'one voice' and in consensus about human contact." (8)	The installation of heath ICT solutions may cause some elders to feel stigmatized or ashamed (6,12,24,29). "While assistance with chores was well perceived by a few older adults, others felt no need for assistance and almost felt insulted by the idea (...). We observed that some older adults were very proud of their independence and therefore, rejected anything which would imply otherwise." (6) They do not want to be seen wearing a health monitoring device, as they were afraid it would stigmatize them as frail or needing special assistance. (12,24).	Elders often have some degree of mistrust or concern about the reliability of an ICT system (4,6,12,22,24,29,32). These concerns involve the accuracy of devices (including false alarms) (4,6,12,29), uncertainty about whether a device is malfunctioning or not (4,12), depleted batteries (12), delivering information to providers in a timely manner (22), and trusting that the computer would do its job (32).	Many of the elderly are reluctant or not at all interested in using the ICT solution after getting a presentation, demonstration or having tried it themselves (6,9,12,29,30,32). They find they have no need for it in their current situation (6,9,32), and think of it as something more appropriate for people who are older, frailer, less independent, less active, less healthy and/or more isolated than themselves (6,9,14,26,29,32). Some acknowledge that they soon will be in need of such technology (9), while others find this hard to imagine (6). Some perceive computers as something only young people use (30).	Some elderly people are worried that a WSN system can have negative effects on their health, like getting cancer from radio waves used for wireless communication, getting allergic reactions, or the pain caused by having a sensor underneath their skin (12). One study investigating self-tracking of data (33) found that elders who tracked their health data themselves recognized this as work, and judged themselves as "good" or "bad" for their data and their diligence in collecting it, and noted that data should be considered within the patient's personal context. Medical data often reminded patients of the negative aspects of their illness, which made many give up self-tracking.
Acceptance of Swedish e-health services	Cost savings was one of the most acknowledged factors that made the services useful for the participants.				Most of the participants gave affirmative answers towards their intention to use two of the three services. The third one had more mixed answers, and the reason was found to be that this service offered much of the same as one of the other services.	
Advocacy of home telehealth care among consumers with chronic conditions	Patients were concerned about the cost. Only a few patients were willing to pay out of their own pocket so long as it was inexpensive and had better and multiple functions. Some patients thought that older people and low-income people with chronic diseases should be partially reimbursed by the government.			Some patients did not know whether or not the results of the measurements were accurate. They were not sure whether they were properly operating the devices. They could not fully realise whether there was any malfunction of the device. However, if the machine frequently failed, patients would doubt the reliability of the measurement.		
An ethnographical study of the accessibility barriers in the everyday interactions of older people with the web						
An extended view on benefits and barriers of ambient assisted living solutions	The AAL system has to be affordable for a person living on a pension.	Participants stated that SONOPA (AAL system) could not and should not replace human care and human interaction.	"While assistance with chores was well perceived by a few older adults, others felt no need for assistance and almost felt insulted by the idea (...). We observed that some older adults were very proud of their independence and therefore, rejected anything which would imply otherwise."	Participants were concerned about the reliability of the future technology, especially the sensors. They worried that the system could give false alarms, and wondered if all parts of the system could be installed in different domestic environments.	Many felt no need for the SONOPA (AAL) system in their current situation. They found the concept more beneficial for people who are less independent, active and healthy; and who are more isolated. They also found it hard to imagine that they might feel less healthy in the near future and would need more assistance. See *Social stigma and pride*.	
Assessing older adults' perceptions of sensor data and designing visual displays for ambient environments						
Attitudes Toward Information and Communication Technology (ICT) in Residential Aged Care in Western Australia		The need for human contact and a warm relationship appeared paramount to the residents. This was simply and forcefully expressed by a resident who said simply: 'We are not robots here.' More importantly the residents were 'one voice' and in consensus about human contact.				
Bridging the digital divide in older adults: A study from an initiative to inform older adults about new technologies		Diminution of human contact was mentioned as a factor causing concern.			Most of the participants reported that they did not need assistive ICT products for the moment, but some mentioned that there would be upcoming needs in the future when they became cognitively or physically frailer. Assistive ICT's were viewed as suitable only for very old people with major cognitive impairment or those who are lonely or isolated.	
Defining the user requirements for wearable and optical fall prediction and fall detection devices for home use						
Diabetes management assisted by telemedicine: Patient perspectives					Participants were positive towards the use of the telemedicine intervention.	
Elderly persons' perception and acceptance of using wireless sensor networks to assist healthcare	Cost was the most significant concern to the elderly participants. Most participants view WSNs as an "extra", and would only consider using the system if "the government or my children pay for it". Participants have suggested that the system should cost no more than "a dollar a day" for them to consider whether or not they will use the system. A majority of the participants were concerned as to the fact that an ambient monitoring implementation would be expensive as most of them assumed that more sensors are required to equip a whole house.		Participants report being ashamed of wearing neck or wrist pendants used in panic alarm systems. They do not want to be seen wearing a "health monitoring device".	Few participants were interested on whether the system is reliable and accurate. Several of them were concerned about what would happen when the battery runs out or how they will be notified when the system malfunctions. Others were concerned about the accuracy of the system, questioning whether the system can diagnose illnesses or accidents and accurately determine the elderly person's needs to the same level as doctors or caregivers.	Participants have commented that they would consider using the system if it is deemed useful, reliable and provides obvious benefits to their current lifestyle. While the participants are aware of the benefits that a WSN system can provide, they were not willing to utilize the system if its cost is substantial, as most of them hold the perception that it is an "emergency response system." Most of them only consider WSNs as a "safety-net" system that provides assistance when emergency occurs. "Social implication" similar to "social influence" as described in UTUAT, is also a significant determinant of whether a user would intend to use WSNs as fear of being stigmatized as frail can result in an elderly person's refusal to wear a wearable sensor device. Participants have stressed that the system should be unobtrusive.	Some participants were worried that the WSN system could have negative effects on their health, like getting cancer from radio waves used for wireless communication, getting allergic reactions, or the pain caused by having a sensor underneath their skin.
Exploring an informed decision-making framework using in-home sensors: Older adults' perceptions						
Exploring barriers to participation and adoption of telehealth and telecare within the Whole System Demonstrator trial: A qualitative study					Most respondents associated the use of telehealth and telecare with a high degree of dependency and ill health. Respondents often described their satisfaction with current services and how they preferred the existing care relationships that they had with health care providers.	
Findings from a participatory evaluation of a smart home application for older adults						
Impact of monitoring technology in assisted living: Outcome pilot						
Implementing technology-based embedded assessment in the home and community life of individuals aging with disabilities: A participatory research and development study						
Indoor and outdoor social alarms: understanding users' perspectives						
Keeping silver surfers on the crest of a wave - Older people's ICT learning and support needs	Participants report that the cost of training is high.					
Making sense of mobile- and web-based wellness information technology: cross-generational study						
Meeting seniors' information needs: Using computer technology						
Older adults are mobile too! Identifying the barriers and facilitators to older adults' use of mHealth for pain management	Cost was a concern noted by 41% of participants (while 12% declared cost was not a barrier). The latter group felt the cost was worth the comfort of having an mHealth technology available.			15% expressed concerns about whether the information generated from the device(s) would reach their provider in a timely manner.	Seven participants (17%) said that they did not need mHealth to help monitor pain-related problems or symptoms. However, the vast majority (85%) of participants reported that they were very willing to use mHealth to help manage their pain condition. Participants were enthusiastic about the potential use of mHealth technology to assist in pain management.	
Older adults' acceptance of a community-based telehealth wellness system						
Older adults' attitudes towards and perceptions of "smart home" technologies: a pilot study	Two participants raised the issue of cost expressing the concern that they might not be able to pay for the installation of smart home technologies.		Some participants stated that they could think of friends or relatives who would refuse to 'wear' a device, being afraid that it would stigmatize them as frail or needing special assistance.	Using devices and sensors that are reliable was seen as an important requirement by the participants.		
Older adults' perceptions of usefulness of personal health records						
Older adults' privacy considerations for vision based recognition methods of eldercare applications					In terms of the use of the extracted images for vision-based recognition, most respondents (N = 7) saw value for the purposes of monitoring, but felt this monitoring was not needed for them but for other older adults in a more frail status.	
Passive sensor technology interface to assess elder activity in independent living						
Privacy and senior willingness to adopt smart home information technology in residential care facilities					The willingness to adopt smart home IT was primarily driven by the residents' perceived need for the technology.	
Senior residents' perceived need of and preferences for "smart home" sensor technologies			Some participants addressed the issue of stigmatization resulting from installing the technology.	Two participants expressed concerns about the accuracy of the devices. One of them specifically addressed the issue of false alarms that could prove burdensome to both residents and facility staff members. Other participants, however, expressed the need to balance safety with privacy and that they would be willing to allow others to monitor their activity levels if that provided an added layer of safety and enhanced their well-being.	Many subjects found the technology useful for residents with greater levels of frailty than themselves. Half of all participants specifically stated that they would agree to having these technologies installed in their own apartment.	
Use of information and communication technology to provide health information: What do older migrants know, and what do they need to know?	Many did not use mobile phones because of the cost.				Participants were generally not interested in using ICTs, and several participants perceived computers to be only for young people.	
What matters to older people with assisted living needs? A phenomenological analysis of the use and non-use of telehealth and telecare						
Willing but Unwilling: Attitudinal barriers to adoption of home-based health information technology among older adults	One participant reported that she could no longer afford wireless Internet access.			Storing information on computers was seen not as expedient but as more complicated, because these respondents did not have faith the computer would do its job.	The imagined user of a system to manage personal EHRs, as interpreted by respondents, was predominantly someone elderly, infirm, or with a chronic condition; someone obsessed with health; or someone irresponsible about health who needed constant reminders. Respondents did not think that they fit within any of these categories. Many participants who were introduced to the idea of home-based health IT and personal EHRs reported that they did not need it, and were satisfied with their current systems of paper record keeping.	
You get reminded you're a sick person: Personal data tracking and patients with multiple chronic conditions						Personal data can carry strong emotional and moral implications. People recognized tracking as work, judged themselves as "good" or "bad" for their data and their diligence in collecting it, and noted that data should be considered within the patient's personal context. Medical data often reminded patients of the negative aspects of their illness, which made many give up self-tracking.

Title	Ambient monitoring	Wearable sensors	Embedded sensors	(General findings about) sensor technologies
SUMMARY				
Acceptance of Swedish e-health services				
Advocacy of home telehealth care among consumers with chronic conditions				
An ethnographical study of the accessibility barriers in the everyday interactions of older people with the web				
An extended view on benefits and barriers of ambient assisted living solutions				
Assessing older adults' perceptions of sensor data and designing visual displays for ambient environments				
Attitudes Toward Information and Communication Technology (ICT) in Residential Aged Care in Western Australia				
Bridging the digital divide in older adults: A study from an initiative to inform older adults about new technologies				
Defining the user requirements for wearable and optical fall prediction and fall detection devices for home use				There was a clear preference for wearable sensors (inertial sensors) over the optical system – especially, if the sensor was unobtrusive in design, preferably attached at the wrist, and could be used outside the home. For the female participants, it was conceivable that inertial sensors could be worn as jewelry.
Diabetes management assisted by telemedicine: Patient perspectives				
Elderly persons' perception and acceptance of using wireless sensor networks to assist healthcare	A majority of the participants were concerned as to the fact that an ambient monitoring implementation would be expensive as most of them assumed that more sensors are required to equip a whole house. Several participants showed concerns over what would happen if accidents occur beyond the vicinity of the sensors. Questions were raised on whether a pure ambient implementation is adequate to ensure that an elderly person is monitored at all times. There were also suggestions that a hybrid solution consisting of both ambient and embedded sensors may be better equip in solving a number of perceived problems.	General attitudes towards the idea of wearable sensors were quite apprehensive with participants showing more enthusiasm towards the idea of embedding sensors into clothing accessories such as a ring or a watch. A discrete and disguised placement like this was preferred, as most elderly persons do not want to be seen wearing a "health monitoring device". Participants generally related wearable sensors to a hearing aid and indicated a willingness to wear a sensor device if it proved to be a practical solution, although some were wary of the fact that they may not be able to remember to wear the sensors on them all the time. Most participants initially responded that they do not mind the concept of wearing sensors on their body; however several questioned how they can still be monitored when they are not wearing any clothes or accessories. Participants generally perceive wearable sensors to have similar capabilities with current panic alarm systems suggesting that panic alarms can be better accepted if they are made smaller or less obtrusive. Most participants stated the need to wear a sensor device is a potential issue as they may not adhere to the system purely because they have forgotten to wear the device. Some have also stated occasions when they have purposely refused to wear a medical device such as a hearing aid simply because they did not want to wear it that day.	Participants demonstrated a strong interest in embedded sensors and expressed a strong acceptance of the concept of embedding sensors under the skin. Participants pointed out that not only would it be invisible to others, the need to worry or remembering to wear the sensors would also be eliminated. Surprisingly, attitudes towards embedded sensors were extremely positive despite the fact that most participants associated this concept with the "micro-chipping" of dogs. However there were concerns about the pain that may be caused by the insertion of the sensors, some participants also questioned whether the sensors need to be taken out in order to replace the battery. Quite a number of participants stated that they would not mind to be chipped as long as the pain is not significant.	
Exploring an informed decision-making framework using in-home sensors: Older adults' perceptions				
Exploring barriers to participation and adoption of telehealth and telecare within the Whole System Demonstrator trial: A qualitative study				
Findings from a participatory evaluation of a smart home application for older adults				Findings indicate that the process of adoption and acceptance of the sensor technologies included three phases: familiarization, adjustment and curiosity, and full integration.
Impact of monitoring technology in assisted living: Outcome pilot				
Implementing technology-based embedded assessment in the home and community life of individuals aging with disabilities: A participatory research and development study				
Indoor and outdoor social alarms: understanding users' perspectives				
Keeping silver surfers on the crest of a wave - Older people's ICT learning and support needs				
Making sense of mobile- and web-based wellness information technology: cross-generational study				
Meeting seniors' information needs: Using computer technology				
Older adults are mobile too! Identifying the barriers and facilitators to older adults' use of mHealth for pain management				
Older adults' acceptance of a community-based telehealth wellness system				
Older adults' attitudes towards and perceptions of "smart home" technologies: a pilot study		Five participants reported experiences of friends and family members who had utilized alarm devices that can be used to notify a call centre in emergency situations. Problems described were the individual's refusal to wear such a device at all times, to use it in actual emergency cases and limitations in mobility as some of these devices would function only within a certain area. Some participants stated that they could think of friends or relatives who would refuse to 'wear' a device, being afraid that it would stigmatize them as frail or needing special assistance.		All participants had an overall positive attitude towards devices and sensors that can be installed in their homes. Participants did not object to any of these types of installation (wearable, local installation/ambient, and remote operation) and would accept any such device if it were to improve their life or prevent accidents.
Older adults' perceptions of usefulness of personal health records				
Older adults' privacy considerations for vision based recognition methods of eldercare applications				
Passive sensor technology interface to assess elder activity in independent living				
Privacy and senior willingness to adopt smart home information technology in residential care facilities				
Senior residents' perceived need of and preferences for "smart home" sensor technologies				
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