Intelligent Environments 2016
P. Novais and S. Konomi (Eds.)

doi:10.3233/978-1-61499-690-3-125

Legal Aspects on Smart House Welfare Technology for Older People in Norway

Veralia Gabriela SÁNCHEZ [a,1] and Carlos F. PFEIFFER [a]
[a] *University College of Southeast Norway, Porsgrunn, Norway*

Abstract.
A Smart House Welfare Technology project to facilitate the independent living of older people at their home is being developed at the University College of Southeast Norway (USN). Smart Houses are a promising and cost-effective option of improving access to home care for older people. The project models behavior patterns using sensor information, detects when deviations of these patterns occur, and notify caretakers in case of a potential dangerous situation. In order to implement the project, it is necessary to consider the legal areas related to Smart Houses development. Therefore, the purpose of this article is to describe existing legal aspects on the deployment of Smart Houses for older people, with emphasis on Norway. The main legal aspects identified were data privacy, data access and management, stakeholders interests , and informed consent.

Keywords., Legal issues, data privacy, informed consent, Scandinavia, elderly

1. Introduction

The main goal of the "Smart House Welfare Technology" (SHWT) project at the University College of Southeast Norway (USN) is to provide the user with the opportunity to live independently at their own home for as long as they are able to, with a dignified independent lifestyle. In Norway, as of January 2016, the population aged 67-79 years represented 10.1% of the total population, and the oldest, 80 years and over represented 4.2% [1]. The ratio of persons aged 67 and over to those aged 20-66 has increased 31.9% from 2005 to 2015. Furthermore, this trend will continue to increase over the years, and by 2060, the group 67 and over will increase to around 19% [1].

The SHWT system seems to be cost effective. In Norway, the majority of older people prefer to live at their own home for as long as possible. The average cost of home health services provided by the municipality of Norway is approximately NOK 227 000 per year per person, while the cost of a person living in a nursing home is estimated to NOK 900 000 per year, as of 2013 [2,3]. Home health services provided

[1]Corresponding Author: Veralia Gabriela Sánchez, University College of Southeast Norway, Porsgrunn, Norway; E-mail: veralia.g.sanchez@hit.no

by the Norwegian government include nurses visiting the older person at their home and assisting them. However, these analyses show that it can still be more cost-effective to allow people live at their homes [4] for as long as they are able to, if their safety is not compromised.

Given the importance of the Smart House project and that the targeted group is conformed by older adults, it is essential to study the legal aspects on how the project will affect the user and the population in general. In this article, description of the main legal concerns that Smart Houses technology present will be disclosed.

2. Methods

The aim of this article is to assess the legal aspects that arise when implementing Smart House systems for older people in Norway. Two search processes were performed: bibliographic search and laws search.

2.1. Bibliographic Search

The search process consisted of a manual search for relevant articles from the year 2000 to the year 2016. All papers containing the terms "legal", "Smart House" or "Smart Home", "elderly" or "older", and "Norway" as main subject headings, abstract, and/or keyword were identified.

The papers included in this article were selected because they met the criteria of either empirical studies or literature surveys on the legal aspects related to welfare technology. In addition, the journals chosen were sources for other literature reviews on Smart House systems. The search was restricted to English written documents.

2.2. Laws search

In addition to the bibliographic search, the law and the Health Ministry regulations from Norway were searched, as well as a search on the European Union law. No restrictions on the language of the documents were made for this.

2.3. Results

The results from both searches were organized in groups to show the recurring topics found on legal aspects of Smart House Welfare Technology. The groups include: Smart Houses concept, data privacy, data access and management, stakeholders' interest, and informed consent of the users and/or the users' family .

3. Results

3.1. Smart House Concept

The Smart House project at USN is aimed to help the third age population. As defined by Saranummi [5], the third age refers to those who are retired, alert, and in full possession of their physical and mental capacities. Therefore, the "Smart House" idea is generally

used to refer to any living or working environment that has been carefully constructed to assist people in carrying out required activities to promote an independent lifestyle [6,7].

Aging population may be regarded as an opportunity to implement information and communication technologies (ICT) including Smart Houses services. Nevertheless, the rapid development of ICT "should not lead to social exclusion or a widening of the digital divide" [10] .

Some reports have highlighted that technology in Smart Houses or Ambient Assisted Living (AAL) should be: "embedded (non-invasive), distributed throughout environment, personalized (according to users needs), adaptive to the user and user's environment, and anticipatory (anticipating users desires as far as possible) " [8].

Grguric [8] continued to point out that the research and development stage in Smart House systems should include a multidisciplinary approach such as the areas of medicine, law, economics, psychology, and other disciplines dealing with gerontology.

Therefore, a Smart House system should ideally control the functions of the house and interact with the person through voice, movement sensors, hand gestures, touch panels, and other devices. In order to achieve this, the Smart House system needs to adapt to the user's need and adjust the functions according to the user's preference [9].

3.1.1. The Smart House Welfare Technology project at the University College of Southeast Norway

The SHWT at USN aims to automatically monitor the older adult on their activities of daily life (ADL) such as eating, bathing, and sleeping habits [12]. Hence, the Smart House system search for patterns in the user behavior, detects when these patterns break, and warns caretakers in case of potential dangerous situations for additional assistance [13,14].

The system integrates information from sensors, including movement detectors, sonars, temperature sensors, weather stations, switches on doors and windows, among others. The system does not require the use of any device on the body, nor requires the user to modify their daily routines [15]. An important part of the system is a computer vision component that allows the usage of multiple cameras, which work as sensors to extract the position and location of the person, but not as a surveillance system. Only reference images are stored and no person can look at any image or video at any time.

The information collected by the system is mapped into discrete state variables in order to ease the task for pattern recognition, classification, analysis, and modeling of discrete events systems [15]. The data collected includes information from the person, the house, and external weather information. In addition, the activities and behaviors of the system are defined based on possible values of the state variables during sequential time spans and obtained using the system states history [15].

3.2. Data Privacy

Legal regulations should be secured to asses patient-identifiable data [16] in order for the older adult to accept monitoring in a Smart House system. Data storing raises a number of legal and privacy issues that are important to consider. A legal solution should be established for storing data from the welfare technological equipment [17].

The European data protection law states that it is important to clarify how data will be shared, stored in the system, and who will be responsible for such data [18,19]. Also, the Norwegian Health Ministry Act §8 adds to specify [20] :

- Purpose of the processing of health data
- Which kinds of information can be processed
- Requirements for identity management
- Requirements for securing data
- Who is the data controller.

Additionally, the update of the European directive concerning the processing of personal data states that "confidentiality of communications" must be "guaranteed in accordance with the international instruments relating to human rights" [21], fundamental rights, and freedom [22].

Keeping health record journal of the older person is regulated by the Health Personal Norwegian law §39 and §40 [23]. Journal recording from health care professionals forms the legal basis for processing necessary and relevant personal health data. There is, therefore, no requirement for specific consent from patients to allow health personal to keep journal records [17].

Data from sensors are generally regarded as information that does not require journaling. Nevertheless, this information may be important to determine whether the person is in need for health care or not. Consequently, it remains the obligation of the municipality regulation to assess if the service offered to the older person is adequate or if the person is in need for other type of service such as further medical or health monitoring [17].

Moreover, security must be ensured through the communication networks in order to protect the freedom and fundamental rights of the person using the Smart House system, especially regarding the large capacity for automated storage and processing of data [21]. Privacy, confidentiality, and data security are the legal issues that stand out in the area of tele-medicine and e-health [24]. The heterogeneous information that is generated by health care is considered sensitive [25], and thus confidentiality is required.

3.3. Data Access and Management

The Smart House system handles sensitive information. It must be decided who will have legal rights to view the data resulting from the monitoring (surveillance, audiotape, sensor information, and others). Moreover, the data must be secured to keep it from falling into the wrong hands [26].

Security must be ensured, and encryption in the system communication lines must be secured. No third party should have access to the data of the Smart House system, and transmission of the data to external entities must comply with legal requirements [27]. Therefore, it is essential to guarantee that whoever access the information ensures confidentiality [28,6], fully understands the situation, and commits to never misuse the information.

The service provider of the Smart House system should safeguard the security of their services, including the selection of regulated network providers, and inform the user about any risk or breach of security in the communication service of the network [21]. The national legislation in some European member states only prohibits intentional unauthorized access to communications [21].

Moreover, treatment of health and personal information requires a legal basis. Current Norway legislation does not allow the central storage of health information in government auspices (Medical Act §10 [17,29]). A proposed solution that would not require

new regulation is to establish national "hosting services" (local data storage) with local ownership that would give voluntary control to store data [17].

Another proposed technical solution is to store data centrally, but separately. This means that health data from various sensors are stored in the same database, but logically separated ensuring that only healthcare working in the same business can access them [17]. Third-party or other stakeholders access to health information from such registry must follow the normal rules for health professionals access to health information (Medical Records Act §10 [17,29]). Also, stakeholders that have signed an agreement on access to health information, as stated in Medical Records Act §19, can directly access the information, while keeping the normal rules for health professionals' right to disclose health data (the Health §25 and §45) [17,23].

Another legal issue that needs to be addressed is liability for malfunctioning equipment [30,31]. Smart House systems, as any other technology, may carry the risk of failure [32]. Such failures include maintenance in the system, false alarms, and others. Therefore, it is essential for users to be fully informed by the service provider of any security risk or any other type of risk that may lie outside the main scope of the Smart House system [21].

3.4. Stakeholders' Interests

Regulations need to be standardized to prevent legal issues. Conflicts between the users and the provider of remote care may arise. In a Smart House environment, informal caregivers, relatives, or friends may be often visiting or living in the house with the older person. Thus, it is important to know who are the direct and indirect stakeholders in order to seek consent from them [33].

An important stakeholder is the user/patient himself. In a report by Trill and Pohl [34], the following key tenets of the patient empowerment philosophy regarding e-health were listed: patients cannot be forced to follow a lifestyle dictated by others, preventive medicine requires patient empowerment to be effective, patients, as consumers, have the right to make their own choices and the ability to act on them.

These points need to be taken into consideration during the research and development process. In addition, there are three dimensions of patient empowerment [34], which can also be considered as stakeholders: professional perspective (Doctors, nurses and other health takers), consumer perspective (self-determination of the users through the individual choices they have), community perspective (social inclusion through the development of collective support).

Other stakeholders are goods suppliers and providers, to whom the lack of standardization and misunderstanding of requirements can hinder the development of Smart House systems. Yet, another stakeholder is the organizations working on legal and economic issues, to whom other barriers such as funding, heterogeneous target groups, and lack of standard and certifications, can also hamper the development of Smart House systems [8].

3.5. Informed Consent

According to Demiris [33] "Informed consent is an individual's autonomous authorization of a clinical intervention or research participation". The major components of in-

formed consent are competence, disclosure, understanding, and voluntary understanding. The European Parliament also states that consent of a person "may be given by any appropriate method enabling a freely given specific and informed indication of the user's wishes" [21].

Informed consent must be sought before implementing a Smart House environment. Informed consent in generally signed by patients or subjects that require or volunteer for diagnostic, therapeutic, or research procedure. The providers offering these services or seeking for volunteers for research need to obtain consent from the subjects. The consent includes the social rules that an organization needs to follow during the research procedure.

In Norway, the type of information that is not regarded as health data, such as the data collected by the Smart House system, requires informed consent for its implementation [17]. This includes the processing of data from the welfare technological equipment such as local storage data from the security-creating technologies; for example: fire alarms, security alarms, and fall alarms. Such storage, where information from the equipment is not to be regarded as personal health data in itself, can be based on the user's consent [17].

In addition, the Smart House system would have the potential to detect early stages of dementia; hence, agreement must explicit detail the ethical and legal aspects to proceed on those cases, and the user must be fully informed [6].

It is important to mention that the Norwegian law on Health Register Act §20 [20] specifies that exceptions exist on the sharing of the health information data. The information may only be disclosed if the person's treatment is of significant interest to the community, concern for patient privacy and confidentiality are safeguarded, and processing is unobjectionable on ethical, medical and health considerations.

4. Discussion

Smart House Technology is relatively new, but it has a promising future. In Norway, Smart House Technology began in the middle of the 90s, with the BESTA project in Tønsberg [35]. However, the BESTA project stagned [26].

Now, the project at USN aims to develop a Smart House system for older people. The project takes into consideration the legal aspects that can raise when developing a Smart House system. With the development of many new technologies, new laws and regulations need to be established.

Health care personal and nursing homes are provided by the Norwegian government. Thus, welfare technology is also an important part that the Norwegian government needs to standardize. "Morgendagens omsorg" (Tomorrow's care) in Norway is dedicated to standardize the welfare technology area. Their mission will contribute to integrate Welfare Technological solutions in 2020 as a natural part of the municipal health and care services [17].

In general, the main concern with the implementation of Smart Houses system is the data privacy and management. It has been stated that as long as data confidentiality and security are ensured, there would not be major legal problem [36].

Smart House systems deal with sensitive data that can result dangerous if unauthorized persons have access to it. Thus, it is crucial to have proper legislation that han-

dles the issue of data privacy. In addition, it is important to know who is responsible for what and when [8]. Acts §29 and §30 on Health Register [20] states some charges and penalties against those who violate the processing of health data.

Also, the person who will deal with malfunctioning of the equipment needs to be identified when deploying a Smart House system. The responsible for system failure should be a person who is capable of giving informed consent.

Analysis and assessment of security and legal aspects need to be prioritized when dealing with a wide range of stakeholders, who are prone to responsibility diffusion implementing a Smart House project [37,24]. There should be a special legal framework that handles important questions regarding the role of Smart Houses Welfare Technology for older people. The characteristics, limitations, and permissions in Smart House system should be stated clearly through a set of guidelines and standards [36].

Finally, with Smart House systems in Norway, signed informed consent is always recommended. The person using the Smart House should be capable of deciding on the implementation of such system at his or her own home. Moreover, the person needs to be aware that the system may detect deviation from the usual behavior pattern, and thus alert to caregivers or family if something is wrong.

4.1. Older People Perception and Ethical Challenges

There are also studies that report older people perception on Smart House systems, as well as the ethical challenges that Smart House systems present from a non-legal perspective. These reports include but are not limited to: "Systematic review of studies of patient satisfaction with telemedicine", "Systematic review of cost effectiveness studies of telemedicine interventions" [38], "A cross-sectional study on person-centred communication in the care of older people: the COMHOME study protocol" [39], "Care work in changing welfare states: Nordic care workers experiences" [40], "Carers' and nurses' appraisals of needs of nursing home placement for frail older in Norway" [41], "Ethical implications of home telecare for older people: a framework derived from a multisited participative study" [28], "Senior residents perceived need of and preferences for smart home sensor technologies" [42], "Findings from a participatory evaluation of a smart home application for older adults" [43], "Privacy and senior willingness to adopt smart home information technology in residential care facilities"[44], "A smart home application to eldercare: Current status and lessons learned" [45].

The main concerns on the ethical challenges described on these articles are privacy of the user being monitored, security and reliability in the system, commercial interest, human interaction, and training or learning process for the older adult.

5. Limitations of the study

A limitation of this study is that there are not enough scholar studies on legal aspects regarding Smart House systems in Norway. Therefore, in order to obtain substantial information for this article, we have included articles on recommendations for the implementation of welfare technology [17] and the Norwegian law [29,20,23].

Although Norway is not part of the European Union, we also included European directives and regulations [18,10,22,21] to have a broader picture on how Europe, in general, is legally dealing with new technologies for the older people such as Smart House systems.

6. Conclusions

Smart House technology have proven to be beneficial for improving older adults home care. Statistics in Norway expect that the number of people aged 70 and older will double in the next 30 years [1]. Therefore, Smart Houses development is an important research topic, which will help to cope with the growing demand and supply of nursing care homes.

Norway has almost 10 years of experience with Smart Houses technology as part of home care services [46]. Nevertheless, legal issues are still unresolved. In this article, the legal aspects of data privacy, data access and management, stakeholders, and informed consent, are presented and briefly discussed. Several reports have addressed the legal aspects that Smart House systems present, but the number of studies found are still limited.

In general, the legal aspect of Smart House systems is a significant barrier that may impede their widespread adoption. Thus, there is the need for standardization, research, surveys and assessment on the legal aspects that Smart House systems convey in order to provide evidence for optimizing the use of this promising technology.

References

[1] S. sentralbyr. (2016) Population, 1 january 2016. Accessed 2016-02-25. [Online]. Available: https://www.ssb.no/en/befolkning/statistikker/folkemengde/aar-per-1-januar

[2] J. Ramm, "Eldres bruk av helse-og omsorgstjenester," *Oslo: Statistisk sentralbyrå*, 2013.

[3] C. Pfeiffer, N.-O. Skeie, S. Hauge, I. Lia, and I. Eilertsen, "Towards a safer home living-behavior classification as a method to detect unusual behavior for people living alone," 2015.

[4] S. Finken and C. Mörtberg, "The thinking house: on configuring of an infrastructure ofcare," 2011.

[5] N. Saranummi, S. Kivisaari, T. Särkikoski, and J. Graafmans, "Ageing & technology," *Institute for Prospective Technology Studies, Joint Research Centre of the European Union, Sevilla*, 1997.

[6] M. Chan, D. Estève, C. Escriba, and E. Campo, "A review of smart homespresent state and future challenges," *Computer methods and programs in biomedicine*, vol. 91, no. 1, pp. 55–81, 2008.

[7] S. Helal, B. Winkler, C. Lee, Y. Kaddoura, L. Ran, C. Giraldo, S. Kuchibhotla, and W. Mann, "Enabling location-aware pervasive computing applications for the elderly," in *Pervasive Computing and Communications, 2003.(PerCom 2003). Proceedings of the First IEEE International Conference on*. IEEE, 2003, pp. 531–536.

[8] A. Grguric, "Ict towards elderly independent living," *Research and Development Centre, Ericsson Nikola Tesla*, 2012.

[9] P. Alahuhta and S. Heinonen, "Ambient intelligence in everyday life: housing," *Report of the Project Ambient Inteigence in Everyday Life*, 2003.

[10] E. Parliament, "Decision no 742/2008/ec of the european parliament and of the council of 9 july 2008 on the communitys participation in a research and development programme undertaken by several member states aimed at enhancing the quality of life of older people through the use of new information and communication technologies."

[11] J. Hoey, "Tracking using flocks of features, with application to assisted handwashing." in *The British Machine Vision Conference*, 2006, pp. 367–376.

[12] E. D. Mynatt, A.-S. Melenhorst, A. D. Fisk, W. Rogers *et al.*, "Aware technologies for aging in place: understanding user needs and attitudes," *Pervasive Computing, IEEE*, vol. 3, no. 2, pp. 36–41, 2004.

[13] P. Rashidi and D. J. Cook, "Keeping the resident in the loop: Adapting the smart home to the user," *Systems, Man and Cybernetics, Part A: Systems and Humans, IEEE Transactions on*, vol. 39, no. 5, pp. 949–959, 2009.

[14] H. Zheng, H. Wang, and N. Black, "Human activity detection in smart home environment with self-adaptive neural networks," in *Networking, Sensing and Control, 2008. ICNSC 2008. IEEE International Conference on*. IEEE, 2008, pp. 1505–1510.

[15] C. F. Pfeiffer, N.-O. Skeie, and V. G. Sánchez, "A discrete event oriented framework for a smart house behavior monitor system," *12th International Conference on Intelligent Environments (IE'16), unpublished article*.
[16] H. Lee, Y.-T. Kim, J.-W. Jung, K. Park, D. Kim, B. Bang, and Z. Bien, "A 24-hour health monitoring system in a smart house," *Gerontechnology*, vol. 7, no. 1, pp. 22–35, 2008.
[17] L. K. Roland, T. Steffensen, H. Õ. Finnsson, and A. Nyeng, "Arkitektur for velferdsteknologi anbefaling for utprving og faser for realisering," *Helsedirektoratet, Rapport*, no. IS-2402, 2015.
[18] E. Directive, "95/46/ec of the european parliament and of the council of 24 october 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data," *Official Journal of the EC*, vol. 23, no. 6, 1995.
[19] O. Nordland, M.-A. Sujan, F. Koornneef, and K. Bernsmed, "Assurance requirements for networked medical sensor applications," in *Industrial Technology (ICIT), 2015 IEEE International Conference on*. IEEE, 2015, pp. 1838–1844.
[20] H. og omsorgsdepartementet (Ministry of Health), "Lov om helseregistre og behandling av helseopplysninger (helseregisterloven)," LOV-2014-06-20-43, accessed: 2016-06-15. [Online]. Available: https://lovdata.no/dokument/NL/lov/2014-06-20-43#KAPITTEL_4
[21] E. Parliament, "Directive 2002/58/ec of the european parliament and of the council of 12 july 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector, off," *JL 201, 31.7. 2002, at 37.(Directive on Privacy and Electronic Communications)*, 2002.
[22] E. parliament, "Regulation (eu) 2016/679 of the european parliament and of the council of 27 april 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing directive 95/46/ec (general data protection regulation)," *OJ L 119, 4.5.2016, p. 188 (Directive on Privacy and Electronic Communications)*, 2016.
[23] H. og omsorgsdepartementet (Ministry of Health), "Lov om helsepersonell m.v. (helsepersonelloven)," LOV-2015-12-18-121 fra 01.01.2016, accessed: 2016-06-16. [Online]. Available: https://lovdata.no/dokument/NL/lov/1999-07-02-64/KAPITTEL_5#KAPITTEL_5
[24] G. Hartvigsen, "Ten lessons for successful implementation of telemedicine services in north norway," in *Scandinavian Conference on Health Informatics 2013*, 2013, p. 25.
[25] L. E. Nohr, M. Nymark, and M. Zmenja, "Report on identified legal issues of the baltic ehealth project," *Baltic eHealth2005*, 2007.
[26] E. K. Faanes, "Smart cities-smart homes and smart home technology," 2014.
[27] M.-R. Tazari, F. Furfari, J.-P. L. Ramos, and E. Ferro, "The persona service platform for aal spaces," in *Handbook of Ambient Intelligence and Smart Environments*. Springer, 2010, pp. 1171–1199.
[28] M. Mort, C. Roberts, J. Pols, M. Domenech, and I. Moser, "Ethical implications of home telecare for older people: a framework derived from a multisited participative study," *Health Expectations*, vol. 18, no. 3, pp. 438–449, 2015.
[29] H. og omsorgsdepartementet (Ministry of Health), "Lov om behandling av helseopplysninger ved ytelse av helsehjelp (pasientjournalloven)," LOV-2014-06-20-42, accessed: 2016-06-15. [Online]. Available: https://lovdata.no/dokument/NL/lov/2014-06-20-42#KAPITTEL_4
[30] E. E. HOGUE, "Telehealth and risk management in home health," *Home Healthcare Now*, vol. 21, no. 10, pp. 699–701, 2003.
[31] T. Botsis, G. Demiris, S. Pedersen, and G. Hartvigsen, "Home telecare technologies for the elderly," *Journal of Telemedicine and Telecare*, vol. 14, no. 7, pp. 333–337, 2008.
[32] K. Turner and M. McGee-Lennon, "Advances in telecare over the past 10 years," *Smart Homecare Technology and TeleHealth*, vol. 1, pp. 21–34, 2013.
[33] G. Demiris and B. Hensel, "smart homes for patients at the end of life," *Journal of Housing for the Elderly*, vol. 23, no. 1-2, pp. 106–115, 2009.
[34] R. Trill and A.-L. Pohl, "The ehealth for regions network-an example of successful european cooperation," *Finnish Journal of eHealth and eWelfare*, vol. 5, no. 4, pp. 189–194, 2013.
[35] S. Bjørneby, S. Clatworthy, and H. Thygesen, "Evaluering av besta-installasjon i tønsberg," 1996.
[36] T. Botsis and G. Hartvigsen, "Current status and future perspectives in telecare for elderly people suffering from chronic diseases," *Journal of Telemedicine and Telecare*, vol. 14, no. 4, pp. 195–203, 2008.
[37] T. Normann, E. Breivik, E. Skipenes, and E. K. Christiansen, "Telemedisin i rutinedrift," *Forutsetninger og tiltak. NST rapport*, 2011.
[38] P. S. Whitten, F. S. Mair, A. Haycox, C. R. May, T. L. Williams, and S. Hellmich, "Systematic review of cost effectiveness studies of telemedicine interventions," *Bmj*, vol. 324, no. 7351, pp. 1434–1437, 2002.

[39] L. Hafskjold, A. J. Sundler, I. K. Holmström, V. Sundling, S. van Dulmen, and H. Eide, "A cross-sectional study on person-centred communication in the care of older people: the comhome study protocol," *BMJ open*, vol. 5, no. 4, p. e007864, 2015.

[40] G.-B. Trydegård, "Care work in changing welfare states: Nordic care workers experiences," *European Journal of Ageing*, vol. 9, no. 2, pp. 119–129, 2012.

[41] A.-M. S. Fjelltun, N. Henriksen, A. Norberg, F. Gilje, and H. K. Normann, "Carers and nurses appraisals of needs of nursing home placement for frail older in norway," *Journal of clinical nursing*, vol. 18, no. 22, pp. 3079–3088, 2009.

[42] G. Demiris, B. K. Hensel, M. Skubic, and M. Rantz, "Senior residents perceived need of and preferences for smart home sensor technologies," *International journal of technology assessment in health care*, vol. 24, no. 01, pp. 120–124, 2008.

[43] G. Demiris, D. P. Oliver, G. Dickey, M. Skubic, and M. Rantz, "Findings from a participatory evaluation of a smart home application for older adults," *Technology and Health Care*, vol. 16, no. 2, pp. 111–118, 2008.

[44] K. L. Courtney, "Privacy and senior willingness to adopt smart home information technology in residential care facilities," 2008.

[45] M. Skubic, G. Alexander, M. Popescu, M. Rantz, and J. Keller, "A smart home application to eldercare: Current status and lessons learned," *Technology and Health Care*, vol. 17, no. 3, pp. 183–201, 2009.

[46] T. Laberg, "Smart home technology; technology supporting independent living: does it have an impact on health," in *Tromsø Telemedicine and eHealth Conference, Tromsø*. Citeseer, 2005, pp. 23–24.