Informal Caregivers' Burden, Commuting Time, and Acceptance Towards Unobtrusive In-Home Monitoring Technology in Home-Based Dementia Care

Leonie Reick

Bachelor Thesis

Positive Clinical Psychology and Technology

Department of Behavioral, Management and Social Sciences, University of Twente

1st Supervisor: Dr. Annemarie Braakman-Jansen

2nd Supervisor: Christian Wrede

July 4, 2022

Table of Contents

Abstract

Background: With dementia cases rising and professional care institutions having reached their limit, the care of people with dementia is increasingly becoming the responsibility of informal caregivers. However, they often suffer under a high burden of care and provide care from a distance. Hence, novel unobtrusive in-home monitoring technologies are currently in development, which may help informal caregivers. To achieve a successful implementation, it is important to understand end users' acceptance towards the novel systems and their contexts.

Objective: The sample's caregiver burden was investigated and how it may be associated with their commuting time to the care recipient. Furthermore, informal caregivers' overall acceptance towards in-home monitoring technology, as well as in specific use scenarios, was measured. Lastly, it was explored how acceptance may be associated with informal caregivers' burden and differ for various commuting times.

Methods: An online quantitative cross-sectional survey was administered with German and Dutch informal caregivers of people with dementia and mild cognitive impairments (N = 87). The 4-item ZBI screening scale was used to measure the caregivers' burden and scales were constructed to investigate their acceptance and commuting time. Five different use scenarios were designed. Data was analyzed with descriptive and inferential (one-way ANOVA, Friedman test, Spearman's rho, Kruskal-Wallis one-way ANOVA) statistics.

Results: Participants experienced a high burden of care and a curvilinear relationship was found between the caregiver burden and commuting times (p=.001). The sample tended to overall agree towards using in-home monitoring technology, as well as in the use scenarios. Acceptance in "acute safety-related situations" was higher than in situations related to "safety-related risk predictions" (p=.005), "selfcare behaviour" (p=.025), and "long-term patterns" (p=.01), while no difference was found to "nocturnal wellbeing" situations (p=.275). Overall acceptance towards in-home monitoring technology, as well as in use scenarios, was not found to be associated with caregiver burden, and not different for various commuting times.

Conclusion: This research focused on the pre-implementation of the novel unobtrusive in-home monitoring technologies and gained an insight into situations in which users may be specifically accepting towards in-home monitoring technologies. It is recommended that future studies further investigate how commuting times may be associated with different needs concerning in-home monitoring technologies while controlling for caregivers' contexts.

Keywords: dementia, informal caregivers, unobtrusive in-home monitoring technology, acceptance, caregiver burden, commuting time, scenarios, use situations, user-centered design

Introduction

Worldwide, 55 million people are currently living with dementia (WHO, 2021). With the aging population, dementia cases are not only expected to increase to 152 million by 2050, but to continue rising thereafter (Nichols et al., 2022). Dementia is a chronic illness and "syndrome […] that leads to deterioration in cognitive function […] beyond what might be expected from the usual consequences of biological ageing" (WHO, 2021). Types of dementia include Alzheimer's, vascular dementia, and Lewy Body dementia (Alzheimer's Association, 2012). Furthermore, an increased loss of healthy neurons in the brain was found to be the biological origin (Alzheimer's Association, 2012), which seriously impacts the orientation, "memory, behavior, thinking, and social abilities" of people with dementia (PwD) and limits them in their daily activities and autonomy (Gauthier et al., 2021). The fact that there is still no available cure (Evans et al., 2015), highlights the dependence of PwD on a good care system.

Dementia progresses through three main stages which differ in the needed assistance. Symptoms in the "mild" stage include forgetfulness and trouble concentrating (WHO, 2021) and help through reminders and in the household may be required (Giebel et al. 2014; Huang et al., 2015). PwD often lose their independence in the "moderate" stage. Symptoms like behavior changes (e.g. repeating questions and wandering) and struggles to perform activities of daily living (ADLs) like personal care are displayed (WHO, 2021). Hence, additional aid concerning the general protection and ADLs may be necessary (Dementia Care Central, 2020; Huang et al., 2015). During the "severe" stage, PwD become entirely dependent on others, may lose motor skills, and the inability to recognize relatives (Dementia Care Central, 2020).

Depending on the dementia stage, living situation, and available support system, there are various care possibilities. Care is provided by formal (e.g. nurses) or informal caregivers, who are family members (e.g. partners or children), neighbors, or friends and provide care without training while receiving little or no compensation for their deed (Budnick et al., 2021; D'herde et al., 2021). Connected to that, there are various initial living situations, with PwD living alone, with a partner, or children (Richardson et al., 2013). In the "mild" and "moderate" stage, PwD usually receive home care from informal caregivers and can attend adult day care (Dementia Care Central, 2019). If informal care is not an option, assisted living or a live-in caregiver at home are possibilities. Home care is usually no longer possible in the "severe" stage, in which PwD typically move into a nursing facility (Richardson et al., 2013).

However, as the number of formal caregivers and nursing home places cannot keep up with rising dementia cases (Evans et al., 2015; Guisado-Fernández et al., 2019), more informal caregivers are pressured to take over high-level care and postpone the placement into nursing

facilities (D'herde, 2021; Moyle, 2019). Home care increases PwD's quality of life (QoL), relieves the professional care system, and saves money of national economies (Brodaty, 2009), making informal caregivers a "key issue" in dementia care (Stall et al., 2018; WHO, 2021). About 92% of PwD receive care from informal caregivers (Alzheimer's Association, 2019), who come up for about 80% of the care (Nikzad-Terhune et al., 2010). Their role is becoming increasingly difficult, as they are responsible for more medical tasks in addition to helping with most ADLs (Schulz & Eden, 2016). Specifically, when the responsibilities of care, connected stress, and high workload are persistent over time, caregivers may experience a high burden.

In a systematic review by del-Pino-Casado et al. (2021), caregiver burden is understood as a multidimensional concept made up of emotional, physical, social, and financial aspects connected to the caregiving role. It is a subjective assessment of negative impacts of caregiving, and how personal resources may be exceeded (Werner et al., 2012). Especially in the dementia context, caregiver burden is a prevalent topic, as the care is found to be more demanding compared to other illnesses (Pinquart & Sorensen, 2007) and requires care for more hours per week and years in total (Nikzad-Terhune et al., 2010; Stall et al., 2018). PwD in the Netherlands live on average six years at home and two in residential care (Ministerie van Volksgezondheid, 2017), where informal caregivers' support often continues (Nikzad-Terhune et al., 2010).

The consistent care implies a chronic and prolonged exposure to the stress hormone cortisol (Allen et al., 2017) which can have hazardous long-term effects on psychological and physical health, making informal caregivers prone to become the "second patient" (van den Kieboom et al., 2020; Xie et al., 2018). Concerning psychological health, caregiver burden was linked with increased anxiety and psychopathology, specifically depression (Evans et al., 2015; Sallim et al., 2015), and a worsened attention and executive function performance (Allen et al., 2017). Negative physical effects include disrupted sleep patterns (Pinquart & Sorensen, 2007), an impaired immune system (Allen et al., 2017) and increased illnesses (Budnick et al., 2021; Xie et al., 2018). The caregiver burden and potential negative health effects were found to increase with care recipients' symptom severity (Berger et al., 2005; van den Kieboom et al., 2020). However, a high caregiver burden can also negatively impact PwD (Sallim et al., 2015) by being associated with a lower QoL, earlier institutionalization, and worsening of behavioral and psychological symptoms of dementia (BPSD) (Stall et al., 2018). As numbers of informal caregivers are increasing (WHO, 2021), caregiver burden will be a substantial issue in the future and affect millions of peoples' QoL in the entire world (del-Pino-Casado et al., 2021). Hence, it is important to investigate factors which may be related to the caregiver burden and

followingly ways to reduce it. Amongst other factors, the informal caregivers' commuting time to the care recipient may be an associated concept.

As caregivers from various commuting times have played a very marginal role in previous research, there is no clear conceptualization of this construct. In this research paper, commuting time is understood as the time it takes informal caregivers to get to the care recipient. It is thematically connected to constructs like the living situation (e.g. living with the PwD vs. not) (Koerin & Harrigan, 2002) and geographical distance (e.g. long-distance caregiving vs. living nearby) (Thompsell and Lovestone, 2002). However, these two constructs may be limited in their informative value, as subtle differences that various commuting times, and therefore distances, may imply, are not regarded. Furthermore, long-distance care is defined inconsistently in studies, with it sometimes being understood as a commuting time of at least one hour (National Alliance for Caregiving, 2004), or two hours (Koerin & Harrigan, 2002), which hinders the comparison of results. While few studies have focused on commuting times of informal caregivers (Checkovich & Stern, 2002; Joseph & Hallman, 1998), these did not concentrate on dementia care and an association with caregiver burden.

Previous research on the living situation and geographical distance indicates that living in the same house as the care recipient may imply a high burden through constant care and fear to leave them alone (Evans et al., 2015; Kinney et al., 2003). Caregivers from a distance usually care for a parent and have their own children and full-time jobs (Koerin & Harrigan, 2002; National Alliance for Caregiving, 2004). The care may for instance burden the career, as those living further away miss more days at work, "take an unpaid leave, turn down a promotion, and lose work benefits", inducing financial problems (D'herde et al., 2021; Koerin & Harrigan, 2002). Furthermore, large distances decrease spontaneous and frequent visits and increase the time, effort, and costs to get to the PwD (Bledsoe et al., 2010; Sriram et al., 2020). This complicates the evaluation of their wellbeing and safety, and may raise worry (Kate et al., 2013; Sriram et al., 2020) and guilt of potentially neglecting the loved one (Cagle & Munn, 2012).

While a high caregiver burden was indicated for those living with the PwD and those caring from a long distance, the caregiver burden has not been compared objectively. Moreover, caregivers from a distance are often studied as a homogenous group, which creates a knowledge gap concerning differences in burden and of caregivers living nearby, such as 10 minutes away. Due to demographic changes, the structure of care is shifting to an increasing number of informal caregivers providing care from various distances (Wang et al., 2021). With caregiver burden being a prevalent topic, investigating how it may differ for various commuting times may provide a clearer picture of the burden and potential means of help.

The increasing need of support for informal caregivers in the home setting calls for innovative solutions, including those from the field of health technology. In-home monitoring technologies, like human activity recognition (HAR), allow to check on the activities, safety, health, and location of care recipients (Bastoni et al., 2021). Past HAR solutions entailed wearable sensing (e.g. smart watches) and vision-based systems (e.g. cameras) (Sharma et al., 2021). Meanwhile, technological advancements enabled the current development of "radio frequency (RF) – based sensing systems" (Sharma et al., 2021). These are unobtrusive sensing systems (USSs) based on Wi-Fi or wireless sensors. A transmitter in the care recipient's house discharges a signal, while a receiver collects the signal's reflections (Sharma et al., 2021).

Such a system may specifically facilitate home-based dementia care and decrease caregivers' burden. Firstly, according to the scoping review by Sharma et al. (2021), USSs based HAR systems are suitable for elderly by not requiring compliance. Secondly, they may reduce caregiver burden as the system continuously monitors physiological activities, like the heart- and breathing rate, and physical activities, like ADL (Sharma et al., 2021). Caregivers can access this data at any time and place and are notified in emergencies, which provides them with more freedom to leave the house and assurance when caring from a distance (van Gemert-Pijnen et al., 2018). Lastly, these artificial intelligence-based systems are promising as they could even predict adverse health events, such as falls and worsening in dementia symptoms (Sharma et al., 2021; Wrede et al., 2021), enabling a more proactive and preventive care.

With unobtrusive in-home monitoring technologies in current development, it is important to investigate how a successful implementation can be achieved, which mainly depends on end-users' acceptance (Liu et al., 2018; Peek et al., 2014). Thus, adopting a user-centered approach is inevitable, by investigating users' needs and followingly considering them in the technology development (Jaschinski, 2018; Peek et al., 2014). Many past eHealth systems applied a technical instead of user-centered approach which resulted in high attrition rates and usability problems (Larizza et al., 2012; Sriram et al., 2020). To increase the uptake, acceptance, and impact of new eHealth technologies, research supports the usage of a holistic design approach, which aims for a match between the technology, user, and context (Kushniruk et al., 2013; van Gemert-Pijnen et al., 2011). The CeHRes roadmap from van Gemert-Pijnen et al. (2011) is a holistic framework and offers practical guidelines for eHealth development with a continuous involvement of the end users throughout five pillars. With the pre-implementation focus of this research, mainly the first two pillars of the roadmap are of significance. In the contextual inquiry, users and their contexts are identified, while in the value specification, values are defined and turned into technical requirements for the design stage

(Kip & van Gemert-Pijnen, 2018). This approach allows drivers and barriers of implementation to be recognized early and accounted for in the design (Triberti et al., 2018; Yusof et al., 2008).

In accordance with the user-centered design approach and CeHRes roadmap, specific factors should be investigated in their association with users' acceptance towards unobtrusive in-home monitoring technologies. But with these technologies still in development, such research is scarce and studies which focused on acceptance towards older forms of HAR technologies may not be applicable. Furthermore, most of this research did not focus on the dementia context and used healthy elderlies as respondents (Claes, 2015; Peek et al., 2014). This is problematic as in-home monitoring devices support extended independent living of PwD by helping informal caregivers, making them in fact the main end-users (Larizza et al., 2012). There are models which aim to predict the acceptance of technologies, with the Unified Theory of Acceptance and Use of Technology Model (UTAUT) one of the most well-known (Peek et al., 2014). However, the model's validity across various types of technologies, contexts, and users is criticized to be limited (Bagozzi, 2007; Peek et al., 2014) and its' main factors are generic and not tailored to the dementia context. Nonetheless, the UTAUT model includes distal factors such as living arrangements and home care visit frequency (Liu et al., 2018), which indicate that the commuting time to the care recipient may be an influencing factor in the acceptance towards technologies. This, however, has not been investigated yet.

Furthermore, it is not only important to investigate informal caregivers' overall acceptance towards in-home monitoring, but also in specific use situations. The qualitative study by Wrede et al. (2021) entails indications leading to the suggestion that informal caregivers' acceptance towards unobtrusive in-home monitoring technologies may vary with use situations, such as personal hygiene and fall detection. However, this has not been studied with a quantitative study, which may allow evidence-based generalizations (Jaschinski, 2018) and reflect informal caregivers' need of in-home monitoring in specific use situations.

Investigating the potential association between caregiver burden, as well as commuting time, with general acceptance of in-home monitoring technology, and in specific use situations, would further enrich understanding of users' needs and contexts. Qualitative studies by Sriram et al. (2020) and Kinney et al. (2003) found that informal caregivers who lived further away, hence have a higher commuting time, saw monitoring technology as helpful, while a review by Bledsoe et al. (2010) indicated those living nearby the care recipient preferred to visit rather than using technology. This suggests that acceptance towards in-home monitoring technology may be higher with a higher commuting time. Furthermore, the interview study by Wrede et al. (2021) indicated informal caregivers not living with PwD to benefit from in-home

monitoring technology, for instance through the possibility of cross-checking self-care information, while some living with them appeared less likely to use the technology in specific contexts, for e.g. monitoring food intake and walking behavior. As it can be seen, even though informal care from a distance is increasing (Wang et al., 2021) and monitoring technologies may especially be useful for this group (Sriram et al., 2020), little is known about their needs **(**Larizza et al., 2012). Acceptance of informal caregivers with different commuting times may be different for various use situations and provide implications for design.

To conclude, investigating informal caregivers' acceptance towards unobtrusive in-home monitoring technology, as well as the association with commuting time and caregiver burden, may enrich the understanding of how a successful implementation of these novel technologies can be achieved. This may, in turn, improve both the caregivers' and PwD's QoL and relieve the overload of professional care.

Research Questions

1. What is the burden of care of informal caregivers of community dwelling people with dementia or mild cognitive impairments and how does this differ for diverse commuting times of the informal caregivers to their care recipient?
2. What is the overall acceptance towards in-home monitoring technology of informal caregivers of community dwelling people with dementia or mild cognitive impairments, as well as their acceptance towards in-home monitoring technology in specific use situations?
3. To what extent does informal caregivers' acceptance towards in-home monitoring technology differ in specific use situations?
4. To what extent is informal caregivers' burden associated with their acceptance towards in-home monitoring technology in specific use situations as well as with their overall acceptance?
5. To what extent do informal caregivers with different commuting times to their care recipient differ in their acceptance towards in-home monitoring technology in specific use situations as well as in their overall acceptance?

Methods

Design

This quantitative research was carried out with a cross-sectional survey design. An online self-report questionnaire was used to investigate the acceptance towards in-home monitoring technology amongst informal caregivers of a community dwelling elderly with dementia (PwD) or mild cognitive impairments (MCI).

Participants

Inclusion criteria for participation were that they had to be at least 18 years old and an informal caregiver of a PwD or MCI. Participants were excluded if they provided care for someone who lived in a nursing home or if they did not fill out all relevant items. To recruit participants, non-probability sampling, specifically convenience sampling, was used. First, the research team distributed the link for the questionnaire in their own network (family, friends, and acquaintances) via WhatsApp, Instagram, Facebook, and e-mail. Secondly, the survey link was sent via e-mail to institutional centers in Germany and the Netherlands, which offer support to informal caregivers of PwD, for instance through self-help groups. Followingly, some centers forwarded the link for the questionnaire to informal caregivers of PwD whom they were in contact with. For instance, the Deutsche Alzheimer Gesellschaft in Germany shared the questionnaire via Facebook and on their official website for Baden-Württemberg. Thirdly, after finishing the questionnaire, participants were asked to distribute it further, hence, snowball sampling was used as well.

Materials

This survey was designed and administered together with a group of researchers who individually investigated different research questions. Hence, the questionnaire included other variables which are not relevant for this research and therefore omitted from this report section. The informed consent form, instructions, scenarios, and scales with items are enclosed in the appendix (see Appendix A and B).

Demographic Questions

First, participants were asked general questions about themselves and the care situation. Information was gathered concerning their age in years, gender, country of residence, highest completed education, whether they are an informal caregiver, the reason of care, relation with

the care recipient, the size of the informal care network, as well as the commuting time to the care recipient. Secondly, information was gathered about the care recipient, with questions about their age in years, time since symptoms, type of dementia or cognitive impairment, housing situation of the care recipient, and the potential use of professional care.

Commuting Time

To assess informal caregivers' commuting time to the care recipient, a single-item ordinal scale was constructed. Followed by the question of how long it takes the respondent to get to the house of the care recipient, they were asked to allocate themselves to one commuting time category. These were "I live in the same house", "I live 1 - 5 minutes away", "I live 6 - 15 minutes away", "I live 16 - 30 minutes away", "I live 31 minutes - 1 hour away", and "I live more than 1 hour away".

Caregiver Burden

To measure the caregiver burden, the 4-item ZBI screening scale by Bédard et al. (2001) was used which was rated on a 5-point Likert scale ranging from 0 (= never) to 4 (= nearly always). The scale is a short form of the 22-item ZBI by Zarit et al. (1980) and its validity has been reviewed by multiple researchers (Higginson et al., 2010; Yu et al., 2018). Items included asking participants how often they feel "that because of the time [they] spend with the person with dementia [they] don't have enough time for [themselves]" and "stressed between caring for the person with dementia and trying to meet other responsibilities (work/ family)". Existing Dutch and German translations of the ZBI scale by Mapi/ICON Language Services (2018) were used. The reliability has been proven to be good ($\alpha = .78$) (Bédard et al., 2001). To examine the internal consistency of the scale, Cronbach's Alpha was calculated with the sample and interpreted according to the rule of thumb by George & Mallery (2020). This led to the conclusion that the scale has an acceptable reliability ($\alpha = .67$). In line with Zarit et al. (1980), the caregiver burden was computed by creating a global score with the sum of all four item scores. Hence, the global score ranged from 0 to 16, with higher scores indicating a higher caregiver burden. Cut-off scores by Bédard (2001) and Yu et al. (2018) were deployed to interpret the global score and the sample's burden of care.

Acceptance Towards In-Home Monitoring Technology

Overall Acceptance Towards In-Home Monitoring Technology. To examine the participants' overall acceptance, a 5-item scale was created. Two items related to perceived usefulness ("I think that contactless in-home monitoring technology can be useful for the care of my loved one…" "… at this point in my life" and "… when cognitive or physical health of my care recipient declines"), two items concerned the intention to use ("I intend to use contactless in-home monitoring technology for the care of my loved one…" "… at this point in my life" and "… when cognitive or physical health of my care recipient declines"), and one item regarding the attitude ("It is a good idea to use contactless monitoring technology in the care of my love one"). All items were answered on a 5-point Likert scale ranging from 1 (= totally disagree) to 5 (= totally agree). A factor analysis was performed and the scree plot as well as the eigenvalues > 1 verified that the five items share one underlying factor, which is suggested to be overall acceptance, and explains 75.24 % of the variance. The scale has an excellent reliability ($\alpha = .92$). An overall acceptance score was created by computing a mean score out of the five items.

Acceptance Towards In-Home Monitoring Technology in Use Scenarios.

The Scenarios. Participants' acceptance towards in-home monitoring technology was examined in five distinct use scenarios. These included the monitoring of (1) acute safety-related situations, (2) safety-related risk predictions, (3) selfcare behaviour, (4) nocturnal wellbeing, and (5) long-term patterns, which are described in Table 1. The use scenarios were derived from the qualitative study by Wrede et al. (2021), which summarized monitoring goals that informal and formal caregivers saw in unobtrusive in-home monitoring systems.

Participants were asked to imagine the in-home monitoring system to be installed in the home of their care recipient and the system to continuously monitor the scenario specific events. To increase understandability, each scenario was enriched with a description of specific situations and examples in which the in-home monitoring technology may be used (see Table 1). Furthermore, participants were informed that they, and possibly other authorized people, would receive an immediate notification in case of major deviations from usual patterns, an emergency, or other conspicuous results.

Table 1

Explanation of the Use Scenarios.

Use Scenarios	Explanation
1. Acute safety-related situations	Real-time detection of emergency situations such as falls and wondering.
2. Safety-related risk predictions	Safety-related risk predictions are made, for instance about falls, based on the continuous monitoring of walking patterns.
3. Selfcare behaviour	Observation of selfcare behaviour such as eating, drinking, and personal hygiene (e.g., bathing, toileting, dressing).
4. Nocturnal wellbeing	Monitoring of well-being during the night. Detection of deviations (such as nocturnal unrest, sleep problems, or a disturbed day and night rhythm).
5. Long-term patterns	Detection of possible changes in health status that gradually evolve over time, such as cognitive or physical deterioration.

Acceptance. Participant's acceptance towards in-home monitoring technology was measured in each scenario, for which a 10-item scale was constructed. The items were introduced with: "using contactless monitoring technology to monitor acute situations ….". Two items asked about the acceptability (e.g. "Would be acceptable for me"), six were related to the perceived usefulness (e.g. "Would support me in reassuring myself about the situation of my loved one"), one was about the willingness to share information ("Would provide me with information that I would like to share with my loved one's healthcare professional(s)"), and one concerned the intention to use ("I intend to use contactless monitoring technology to monitor acute situations in the (near) future"). Each item was measured on a 5-point Likert scale ranging from 1 (= totally disagree) to 5 (= totally agree). A factor analysis was conducted and the scree plot and eigenvalues > 1 implied the 10 items to possess one underlying factor, which comes up for 78.73 % of the variance, and to therefore measure the same construct. Cronbach's Alpha was computed separately for each scenario, with the scale showing excellent reliability across all five scenarios (scenario 1 (α = .93), scenario 2 (α = .95), scenario 3 (α = .96), scenario 4 (α = .96), and scenario 5 (α = .97)). Additionally, Cronbach's Alpha was

computed for all scales together, which also displayed excellent reliability (α = .97). A mean score was created for each scenario, resulting in a total of five use scenario acceptance scores.

Procedure

The questionnaire was created in English via Qualtrics and followingly translated into German (see Appendix A) and Dutch (see Appendix B). If available, validated translations of the scales were used, if not, they were translated by native speaking members of the research team using the forward-backward translation method. Followingly, the German and Dutch versions of the questionnaire were each pretested by two native speaking and middle-aged volunteers. They gave feedback concerning the questionnaire's understandability, based on which the research team made minor adaptions to formulations. After receiving approval from the Ethics Committee of the BMS faculty of the University of Twente, Enschede, Netherlands, the German and Dutch versions of the questionnaire were published and data was collected from April 25th, 2022, until May 22nd, 2022. The questionnaire was filled out privately by participants on their mobile device, computer, etc.

After accessing the participation link, participants were able to choose between the Dutch and German version. The questionnaire started with an explanation of the study's focus and procedure, confidential handling of the data, voluntary participation, as well as the right to withdraw from the study at any moment. After agreeing to the informed consent form, participants were presented with the demographic questions. Followingly, the caregiver burden scale was presented. Next, in-home monitoring technology was explained with a text and graphic. Participants were then presented with the five different use scenarios and items measuring their acceptance towards the in-home monitoring technology in these scenarios. Lastly, questions about their overall acceptance of in-home monitoring technology followed.

It took about 20 minutes to fill out the questionnaire. In the end, participants were thanked for their participation and had the possibility to enter their email address for two different purposes. Firstly, they could take part in the raffle of gift cards as a compensation of their participation. Two 10 Euro Mydays gift cards (for participants living in Germany) and two 10 Euro Cadeaubon gift cards (for participants living in the Netherlands) were given away. Secondly, the email address could be inserted if they agreed to be approached for future research in the field of informal care and technology of the University of Twente.

Data Analysis

The data analysis was performed with the IBM SPSS Statistics version 25. Before performing analyses, the data set was organized and participants who did not fulfill the inclusion criteria were removed. Next, the Shapiro-Wilk test was performed for constructs which were measured on a continuous scale to examine if they were normally distributed. Hence, this test was conducted for the age of the informal caregivers and care recipients, the burden of care, the five acceptance scores of the different scenarios, and lastly the overall acceptance score. Skewness and kurtosis were used to test for a normal distribution of variables which were measured on an ordinal or nominal scale, such as the commuting time variable.

Followingly, the data was explored with descriptive statistics. First, frequencies and percentages were computed for the demographic variables. This included the demographics of the sample (gender, country of residence, and highest completed education), general information about the care situation (relation with the care recipient, commuting time, living situation, and size of care network), as well as the demographics of the care recipients (time since symptoms, the type of dementia / cognitive impairment, housing situation, and use of professional care). Secondly, the mean (SD) was calculated for variables with a normal distribution, while the median (IQR) was computed for those with a non-normal distribution.

To answer the first research question "What is the burden of care of informal caregivers of community dwelling people with dementia or mild cognitive impairments and how does this differ for diverse commuting times of the informal caregivers to their care recipient?", firstly, descriptive statistics were used. The mean (SD) was computed if the caregiver burden was normally distributed, otherwise, the median (IQR) was used. Followingly, it was investigated if there are statistically significant differences between the means/medians of the caregivers' burden amongst the six commuting time categories. A one-way ANOVA was performed if caregivers' burden was normally distributed, if not the Kruskal-Wallis one-way ANOVA test was used. If significant, a Tukey post hoc test was conducted to explore which commuting time categories significantly differed from each other in their caregiver burden score. If there was no normal distribution, the non-parametric Dunn's post hoc test followed.

For the second research question "What is the overall acceptance towards in-home monitoring technology of informal caregivers of community dwelling people with dementia or mild cognitive impairments, as well as their acceptance towards in-home monitoring technology in specific use situations?" means (SD) were computed if the variables were normally distributed, otherwise medians (IQR) were calculated.

To answer research question three “To what extent does informal caregivers’ acceptance towards in-home monitoring technology differ in specific use situations?” it was investigated whether the mean/ median scores were significantly different. The parametric repeated measures ANOVA was used in the case of a normal distribution, the non-parametric Friedman test with a Friedman’s Q, hence Chi-Square, test-statistic in case of a non-normal distribution. In case of significant differences, a post hoc test followed with a Bonferroni correction to investigate which use scenarios differed based on the informal caregivers’ acceptance. A paired samples t-test was used for normally distributed data, and if the data was not normally distributed a Wilcoxon signed rank test was performed between all use-scenarios.

For research question four “To what extent is informal caregivers’ burden associated with their acceptance towards in-home monitoring technology in specific use situations as well as with their overall acceptance?”, the caregiver burden was correlated with the five use-scenario acceptance scores and with overall acceptance. A Pearson correlation was used when all variables had a normal distribution. If at least one was not normally distributed, the Spearman’s rho non-parametric test was conducted instead.

To answer research question five “To what extent do informal caregivers with different commuting times to their care recipient differ in their acceptance towards in-home monitoring technology in specific use situations as well as in their overall acceptance?”, a one-way analysis of variance (ANOVA) was run between commuting time and the five use-scenario acceptance scores, as well as with the overall acceptance in case the variables were normally distributed. If there was not a normal distribution, the non-parametric Kruskal-Wallis one-way ANOVA test was used. If significant differences are found, the parametric t-test or non-parametric Dunn’s post hoc test was performed. In all analyses, findings had to reach a significance level of $p < .05$ to be interpreted as significant.

Results

Initially, a total of 235 people volunteered to participate in the study, of which 148 had to be excluded as they did not fulfill the inclusion criteria. Hence, the analysis was conducted with 87 respondents between the ages of 21 and 81 years ($M = 53.45$, $SD = 12.43$). The majority was female ($N = 68$, 78.2%), from Germany ($N = 62$, 71.3%), and highly educated. Most were the child of the person they cared for ($N = 56$, 64.4%) and shared the informal caregiving role with one other person ($N = 34$, 29.1%). Regarding the commuting time, most respondents lived in the same house as the person they cared for ($N = 25$, 28.7%), or "6 – 15 minutes away" ($N = 23$, 26.4%), with only 10.3% ($N = 9$) living "more than 1 hour away". Table 2 depicts the demographic information of the participants and the use situation.

The care recipients were between 54 and 97 years old ($M = 81.94$, $SD = 8.52$), most have shown symptoms for one to three years ($N = 38$, 43.6%), and Alzheimer was the most prevalent diagnosis ($N = 36$, 41.4%). Furthermore, over half of the care recipients did not live alone ($N = 47$, 54%). The aid of professional care was widespread in the sample, with 81.6% ($N = 71$) receiving at least one kind of professional care. Especially the use of a household assistance ($N = 36$, 24.5%), and home care by a district nurse or caregiver ($N = 32$, 21.8%) were prevalent. Table 3 gives an overview of the demographics of the care recipients.

Table 2

Descriptive Statistics of the Background Information of the Participants (Informal Caregivers) and the Care Situation.

Variable	Category	*n*	*%*	*M*	*SD*
Gender	Male	18	20.7		
	Female	68	78.2		
	Other	1	1.1		
Country of Residence	Germany	62	71.3		
	Netherlands	19	21.8		
	Other	6	6.9		
Relation with care recipient	Spouse/ partner	13	14.9		
	Daughter/ son	56	64.4		
	Daughter/ son in law	8	9.2		
	Grandchild	2	2.3		
	Neighbor/ friend	7	8.0		
	Other	1	1.1		
Highest completed education	Primary or lower education	0	0		
	Secondary education or equivalent	12	13.8		
	Secondary vocational education [1]	18	20.7		
	Bachelor's/ Master's degree or equivalent	42	48.3		
	Doctoral degree	3	3.4		
	Other	1	1.1		
Commuting Time to person of care	Live in the same house	25	28.7		
	Live 1 - 5 minutes away	8	9.2		
	Live 6 - 15 minutes away	23	26.4		
	Live 16 - 30 minutes away	13	14.9		
	Live 31 minutes - 1 hour away	9	10.3		
	Live more than 1 hour away	9	13.3		
Size of Care Network	Only informal caregiver	25	28.7		
	One other person	34	39.1		
	Two other people	15	17.2		
	Three other people	7	8.1		
	Four or more other people	6	6.9		
Caregiver Burden [2]				8.8	2.8
Age of Informal Caregiver in years				53.5	12.4

Note. [1] In the German questionnaire, this was indicated as "Abitur / "Berufsschulabschluss" and as "Voortgezet onderwijs: HAVO, VWO / Middelbaar beroepsonderwijs (MBO)" in the Dutch questionnaire. [2] Measured with the 4-item ZBI screening scale and scores ranging from 0 – 16.

Table 3

Descriptive Statistics of the Background Information of the Care Recipients.

Variable	*Category*	*n*	*%*	*M*	*SD*
Age of Person of Care in years				81.9	8.5
Time since symptoms	Less than 1 year	4	4.6		
	1 to 2 years	19	21.8		
	2 to 3 years	19	21.8		
	3 to 4 years	14	16.1		
	4 to 5 years	14	16.1		
	More than 5 years	17	19.5		
Type of dementia/cognitive impairment	Alzheimer	36	41.4		
	Lewy Body dementia	2	2.3		
	Vascular dementia	11	12.6		
	Mild cognitive impairment	12	13.8		
	Other/ I don't know	15	17.2		
	No diagnosis yet	11	12.6		
Housing situation	Living alone	40	46.0		
	Living together with other(s)	47	54.0		
Use of professional care	Home care by a (district) nurse or caregiver	32	21.8		
	Dementia case manager	19	12.9		
	Day-care/respite care	27	18.4		
	household assistance	36	24.5		
	meals on wheels	17	11.6		
	None of the above	16	10.8		

Test of normality

The Shapiro-Wilk test was used to test for normality of the continuous variables. Results show that except for the caregiver burden, the variables were not normally distributed (see Appendix C). Hence, the mean (SD) and parametric tests were used for the caregiver burden, while median (IQR) and non-parametric tests were used for the other non-normally distributed variables.

Caregiver Burden and Differences in Caregiver Burden for Commuting Times (RQ 1)

The informal caregivers in the sample had a mean caregiver burden of 8.78 (*SD* = 2.8) (see Table 2). As this value lies above the cutoff scores of Bédard (2001) and Yu et al. (2018), the sample was found to experience a high burden of care. A one-way ANOVA analysis showed a significant difference between the caregiver burden mean scores for the six different

commuting time categories ($F(5,81) = 3.430$, $p = .007$) (see Appendix D). A Tukey post hoc test revealed that the caregiver burden was significantly higher when an informal caregiver lived in the same house as the care recipient (10.04 ± 2.35 points of Caregiver Burden, $p = .005$), compared to living 6 to 15 minutes away (7.3 ± 2.8 points of Caregiver Burden). There were no significant differences between the other groups.

Table 4 shows that informal caregivers who lived in the same house reported the highest caregiver burden ($M = 10.04$, $SD = 2.35$) and that the mean score decreased for those living 1 to 5 minutes away, while informal caregivers living 6 to 15 minutes depicted the lowest burden ($M = 7.26$, $SD = 2.83$). The caregiver burden increased again for those living 16 – 30 minutes away and continued to rise up to those living more than one hour away, who reported the second highest burden ($M = 9.78$, $SD = 1.92$). After viewing the characteristics of the relationship between the caregiver burden and commuting time, as displayed in the boxplot in Figure 1, a post hoc curvilinear regression analysis was performed, which yielded significant results ($R = .39$, $F(2,84) = 7.56$, $p = .001$) (see Appendix E and F). Hence, a quadratic model can be used to explain the relationship between the caregiver burden and commuting time.

Table 4

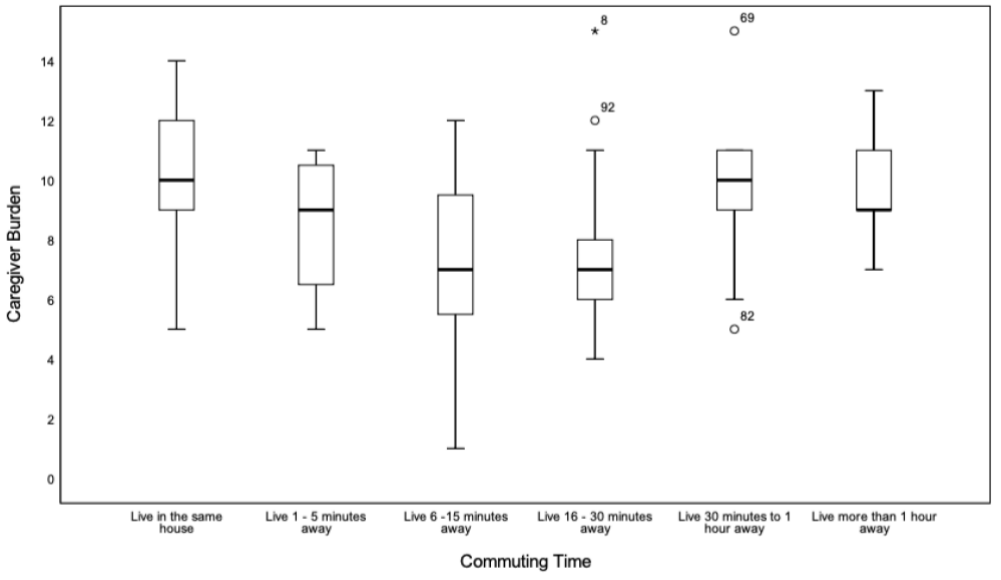
Mean Caregiver Burden Scores for Commuting Time Categories.

	Caregiver Burden	
Commuting Time Categories	*M*	*SD*
Live in the same house	10.04	2.35
Live 1 - 5 minutes away	8.5	2.27
Live 6 - 15 minutes away	7.26	2.83
Live 16 - 30 minutes away	7.92	3.04
Live 31 minutes - 1 hour away	9.56	2.92
Live more than 1 hour away	9.78	1.92

Note. N= 87

Figure 1

Boxplot Depicting the Differences in Informal Caregivers' Burden based on their Commuting Time to the Care Recipient. A Curvilinear Relationship.



Note. N = 87.

Overall Acceptance and Acceptance in Use Scenarios (RQ 2)

The median (IQR) overall acceptance score towards in-home monitoring technology was 3.8(1) (see Table 5). The median is above the Likert score of 3 (= neutral) and close to the score of 4 (= agree). This implies that the sample depicted the tendency to be overall accepting towards using in-home monitoring technologies. Regarding the scenarios, use scenario 1 "acute safety-related situations" was most highly accepted (*Mdn* = 3.8, *IQR* = 1) followed by use scenario 4 "nocturnal wellbeing" (*Mdn* = 3.7, *IQR* = .8). The acceptance for the other three scenarios, hence scenario 2 "safety-related risk predictions" (*Mdn* = 3.6, *IQR* = .9), scenario 3 "selfcare behaviour" (*Mdn* = 3.6, *IQR* = 1), and scenario 5 "long-term patterns" (*Mdn* = 3.6, *IQR* = 1) were equally high. This implies, that the sample also depicted the tendency to agree to the usage of in-home monitoring technologies in the five use scenarios, with acceptance being highest in "acute safety-related situations".

Table 5

Descriptive Statistics of Overall Acceptance and Acceptance towards In-Home Monitoring Technology in Different Use Scenarios

Variable	*Mdn*	*IQR*
1. Acceptance Scenario 1 "acute safety-related situations"	3.8	1
2. Acceptance Scenario 2 "safety-related risk predictions"	3.6	.9
3. Acceptance Scenario 3 "selfcare behaviour"	3.6	1
4. Acceptance Scenario 4 "nocturnal wellbeing"	3.7	.8
5. Acceptance Scenario 5 "long-term patterns"	3.6	1
6. Overall Acceptance	3.8	1

Note. Variables were measured on a 5-point Likert Scale (1 = totally disagree, 5 = totally agree).

Differences in Acceptance Scores in Use Scenarios (RQ 3)

A Friedman test showed informal caregivers' median levels of acceptance to be significantly different in the scenarios ($\chi^2(4) = 9.82$, $p = 0.044$). A post hoc Wilcoxon signed rank test with a Bonferroni correction was used to follow up this finding (see Appendix G). This demonstrated a significant difference between the median acceptance scores of scenario 1 "acute safety situation" in comparison to scenario 2 "safety-related risk predictions" ($Z = -3.3$, $p = .005$), scenario 3 "selfcare behaviour" ($Z = -2.84$, $p = .025$), and scenario 5 "long-term patterns" ($Z = -3.08$, $p = .01$), while there was no significant difference to scenario 4 "nocturnal wellbeing" ($Z = -1.92$, $p = .275$). Hence, in the population of German and Dutch informal caregivers, the acceptance towards in-home monitoring technology in "acute safety-related situations" seems to be higher than in "safety-related risk predictions", "selfcare behaviour", and "long-term patterns", while being similarly high as in "nocturnal wellbeing" situations.

Association of Caregiver Burden with Acceptance in Use Scenarios and Overall Acceptance (RQ 4).

Spearman's rho was performed, however, none of the correlations were significant (see Table 6). Nonetheless, the results show that there was a slight tendency for informal caregivers in the sample with a high caregiver burden to also be more overall accepting towards in-home

monitoring technology, as well as in the five use scenarios. This tendency is illustrated in Figure 2.

Table 6

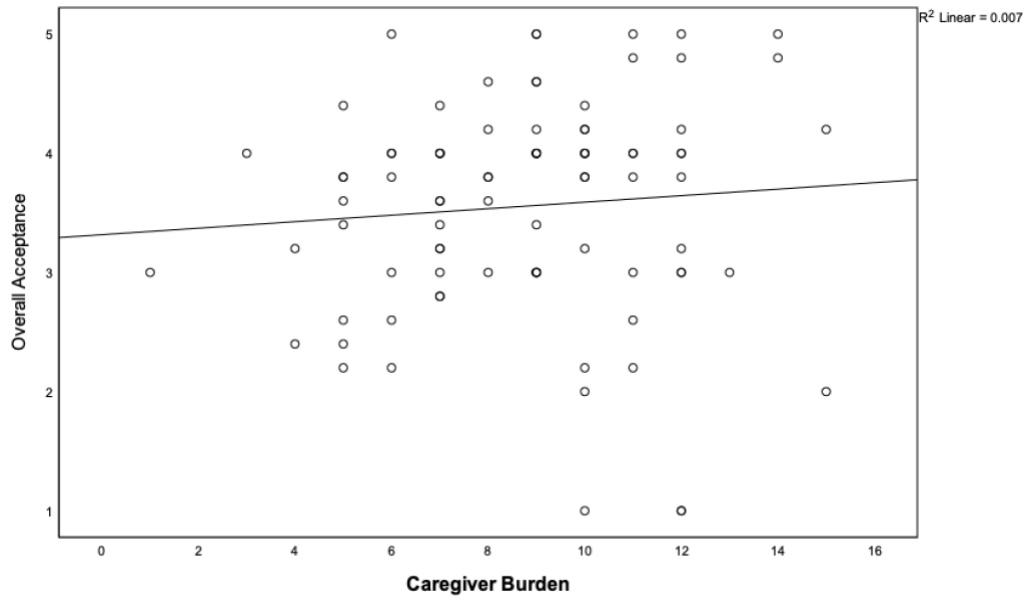
Spearman's Rho Correlations between the Caregiver Burden with the Overall Acceptance and Acceptance in the Use Scenarios.

	Caregiver Burden	
Use Scenarios	*Correlation Coefficient*	*Sig.*
Acceptance Scenario 1 "acute safety-related situations"	.095	.381
Acceptance Scenario 2 "safety-related risk predictions"	.124	.251
Acceptance Scenario 3 "selfcare behaviour"	.187	.083
Acceptance Scenario 4 "nocturnal wellbeing"	.112	.303
Acceptance Scenario 5 "long-term patterns"	.123	.258
Overall Acceptance	.15	.165

Note. N = 87. Correlation significant at p < .05 (2-tailed).

Figure 2

Scatterplot depicting the Relationship between the Caregiver Burden and Overall Acceptance Towards In-Home Monitoring Technology.



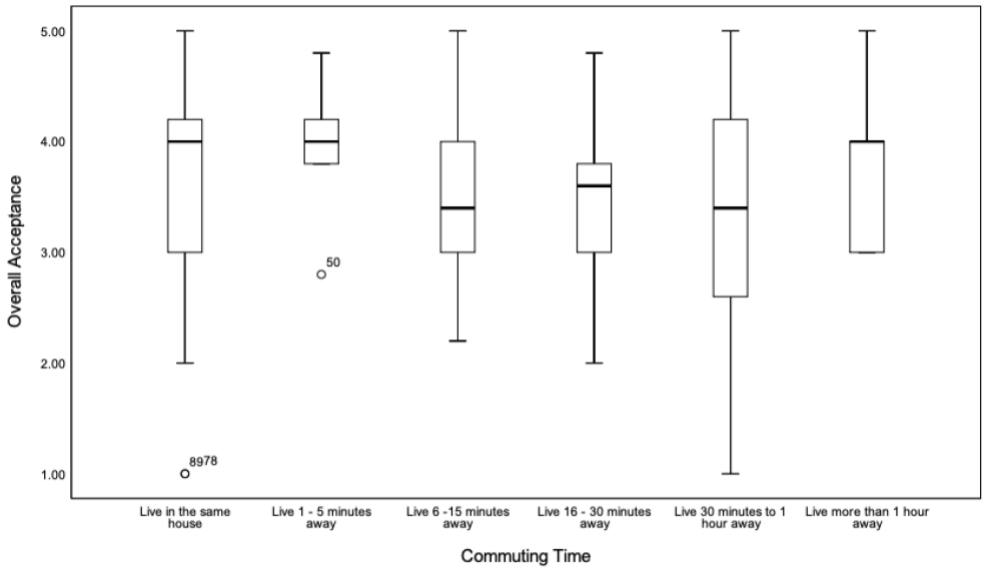
Note. N = 87. A linear line was applied.

Differences in Overall Acceptance and Acceptance in Use Scenarios between Commuting Time Categories (RQ 5)

Figure 3 illustrates the overall acceptance towards in-home monitoring technology for the commuting times. A Kruskal-Wallis H test showed that in the population, there are no significant differences in the overall acceptance scores within the different commuting time categories ($\chi^2(5) = 4.37$, $p = .5$). Likewise, no statistically significant differences were found within the commuting times regarding acceptance scores in use scenario 1 "acute safety-related situations" ($\chi^2(5) = 5.91$, $p = .316$), scenario 2 "safety-related risk predictions" ($\chi^2(5) = 2.41$, $p = .79$), scenario 3 "selfcare behaviour" ($\chi^2(5) = 4.75$, $p = .45$), scenario 4 "nocturnal wellbeing" ($\chi^2(5) = 3.24$, $p = .66$), and scenario 5 "long-term patterns" ($\chi^2(5) = 1.16$, $p = .95$).

Figure 3

Boxplot of the Informal Caregivers' Overall Acceptance Towards In-Home Monitoring Technology for diverse Commuting Times.



Note. N = 87.

Discussion

From the results of this study, it can be concluded that the sample of German and Dutch informal caregivers of PwD and MCI experienced a high burden of care. Furthermore, a curvilinear relationship was found between the caregiver burden and commuting time to the care recipient. The highest burden of care is suggested to be experienced by informal caregivers living in the same house and those living over one hour away, while the lowest is exhibited when living 6-15 minutes away. In addition, participants had the tendency to be overall

accepting towards in-home monitoring technology as well as in the five use scenarios. Furthermore, informal caregivers are found to be more accepting towards in-home monitoring technology in "acute safety-related situations" compared to situations related to "safety-related risk predictions", "self-care behavior", and "long-term patterns", while no difference was found to the acceptance in "nocturnal wellbeing" situations. Lastly, overall acceptance towards in-home monitoring technology, as well as in use scenarios, was neither found to be linked with the caregiver burden, nor different for diverse commuting times.

Interpretation

An interesting discovery was that informal caregivers' acceptance towards in-home monitoring technology differed between the use scenarios, which confirms the suggestion from Wrede et al. (2021) that acceptance towards unobtrusive in-home monitoring technologies may vary with the use situation. In their study, informal caregivers of PwD saw "fall detection and prevention, monitoring day and night rhythm, personal hygiene […], nocturnal restlessness, and eating and drinking behaviour" as the top five monitoring goals for unobtrusive in-home monitoring technologies. Their qualitative study design, however, did not allow to investigate acceptance differences in the population (Wrede et al., 2021), which was done in this research.

The lower acceptance towards in-home monitoring technology in "selfcare behavior" situations compared to "acute safety-related situations" may be due to sample characteristics. With most care recipients living with others and many informal caregivers living with them or nearby, the wish to monitor "selfcare behaviour" with a technology may be lower. This fits to an indication in the literature review by Bledsoe et al. (2010) that, when possible, caregivers prefer checking on care recipients themselves rather than with technology. However, even when living with the care recipient, accidents may go unnoticed. PwD are almost twice as likely to fall at home than healthy elderly (Petersen et al., 2018) and as falls at this age are highly associated with morbidity (Peel, 2011), quick help is crucial. Thus, notifications in emergencies may lead to an especially welcoming attitude towards the technology in "acute safety-related situations". Monitoring "nocturnal wellbeing" situations may be similarly crucial as PwD cannot be observed by caregivers at night. With 40% of injuries happening during the night due to changes in the sleep-wake circle (Rowe et al., 2009), this is one of the most stressful dementia symptoms for caregivers (Craig et al., 2005). Hence, it may be reassuring for them to be informed about care recipients' night behavior as this allows to take preventive measures. In contrast, monitoring "safety-related risk prediction" and "long-term pattern" situations offer future-related information. Some informal caregivers fear to receive more information than

they want to know from monitoring technologies (Wrede et al., 2021), which may induce worry over events they cannot control. Hence, acceptance may have been lower in these situations.

An unexpected finding was that informal caregivers of various commuting times did not differ in their overall acceptance towards in-home monitoring technology. Those with a higher commuting time were expected to be more accepting as literature often depicts in-home monitoring technology to be specifically useful for those caring from further away (Kinney et al., 2003; Sriram et al., 2020). Moreover, acceptance scores in the use scenarios also did not differ with commuting times. This counteracts an indication from the interview study by Wrede et al. (2021), where informal caregivers not living with the PwD saw monitoring of for instance self-care related information to be useful, while some living with the care recipient were less interested in monitoring self-care related information such as food intake and walking behavior. While there may indeed be no differences, insignificant findings could be due to the indication in literature that there is no average informal caregiver. Their care contexts vary based on the relationship to the care recipient (D'herde et al., 2021), care recipients' stage of dementia and required help (Richardson et al., 2013), financial resources for professional support (Collins & Kishita, 2019), size of care network (Tolkacheva et al., 2010), and private demands like children or jobs (Brodaty & Donkin, 2009). Hence, sample characteristics may explain why no effect was found. Most care recipients did not live alone and had professional help, like a home care nurse. With there being someone to watch the care recipients, informal caregivers from a distance may have had a lower urge to monitor them in general, as well as in specific situations.

Another unexpected finding was the curvilinear relationship between the caregiver burden and commuting time to the care recipients. As this association has not been investigated before, it is a meaningful contribution to literature. Findings can be explained with previous indications in literature. Caregivers living in the same house may experience the highest burden of care, as they are confronted 24/7 with care responsibilities and have little freedom in pursuing own activities or leaving the house as they please (Evans et al., 2015; Kinney et al., 2003). Living close by allows a break from the care and to independently pursue activities, while the distance still enables spontaneous checks (Thompsell and Lovestone, 2002). However, a higher distance reduces the possibility of swift and frequent visits and increases time, effort, and costs to get to the PwD (Bledsoe et al., 2010; Sriram et al., 2020). Results suggest this to be linked with a higher burden starting at a commuting time of 16 minutes.

The findings contrast study results of Thompsell and Lovestone (2002), who found informal caregivers of PwD living over one hour away to experience equal levels of burden compared to those living less than one hour away. However, a clear comparison of results is

not possible as Thompsell and Lovestone (2002) did not measure caregivers' burden with a validated scale but by asking participants whether they feel stressed or not. Furthermore, like most previous research on long-distance caregiving, the informal caregivers were divided into two homogenous groups without differentiating the distance, and caregivers living with the care recipients were omitted. This study helps to fill the research gap by having investigated subtle differences in the burden of care within various commuting times.

Strengths and limitations

One strength of this study is that specifically informal caregivers of PwD or MCI were used as a target group. This is important as they are the main users of these types of technologies, however, previous studies often used healthy community dwelling elderlies, informal caregivers not providing care to PwD or MCI, or formal caregivers as respondents (Claes, 2015; Peek et al., 2014). Secondly, the survey was offered in German and Dutch and allowed respondents to respond in their mother tongue. Thirdly, previous research often studied informal caregivers in dichotomous categories, such as living with the PwD vs. not (Koerin & Harrigan, 2002) and long-distance caregiving vs. living nearby (Thompsell and Lovestone, 2002). This research expands the knowledge by having explored different commuting times while also including informal caregivers living with their care recipient.

One limitation is that the sample may not have been representative of the population of informal caregivers due to a higher education level (Hassan et al., 2022; Wójcik et al., 2021), which may have affected two study conclusions. Firstly, in a study by Wójcik et al. (2021) a higher education level amongst European informal caregivers was linked with an increased acceptance towards using technologies in the care setting. Hence, the conclusion of descriptive statistics may have been violated through an overestimation of the informal caregivers' overall acceptance and acceptance in the use scenarios. Furthermore, overestimated and less varied acceptance scores (Wójcik et al., 2021) could have affected conclusions of inferential statistics and led to insignificant results in the association between caregiver burden and acceptance, as well as insignificant differences in acceptance scores within diverse commuting times. As a second limitation, analyses were performed with a mixed sample. While in-home monitoring technologies mainly aim to enable independent living **(**Larizza et al., 2012), the fact that most care recipients lived with others was not accounted for. This may have led to insignificant findings regarding differences in informal caregivers' overall acceptance, as well as in the various care scenarios between the commuting times.

Practical Implications

Many past eHealth technologies faced problems with the implementation, as they did not match users' needs and contexts (van Gemert-Pijnen et al., 2018). Hence, it is important to adopt a user-centered approach and involve users from the start of the development, which was done in this research. Findings can be translated into impactful practical implications for the development of novel in-home monitoring technologies to overcome the discrepancy between a positive acceptance towards monitoring technologies, but low adoption rates (Kramer, 2013).

Firstly, as acceptance can be seen as an indication of users' needs and wishes (Liu et al., 2018; van Gemert-Pijnen et al., 2011), variations in acceptance towards in-home monitoring technology in the use scenarios reflect differences in users' needs. Findings specifically show users' wish to use in-home monitoring technology in safety-related situations (e.g. for detection of falls) and to be notified in emergencies. They seem to similarly appreciate monitoring of care recipients' well-being at night (e.g. nocturnal unrest). Hence, development teams are advised to respect these needs in the "value specification" and "design" steps of the CeHRes roadmap (van Gemert-Pijnen et al., 2011) and to include respective technological features.

Secondly, findings suggest that caregivers of diverse commuting times share similar needs regarding the technology despite their different living situations. However, limitations demonstrated that there may be differences in the population, which would change implications for the design. Informal caregivers living far away may be more in need of in-home monitoring technologies and different commuting times could imply varied wishes regarding situations to be monitored. Relying on incorrect study results may cause low adoption rates, which stresses the importance to further investigate differences while accounting for possible confounding variables. To illustrate, caregivers living one hour away may be more interested in monitoring self-care behaviors than those living 5-16 minutes away, but only if the care recipient lives alone. After such differences are detected, they can be applied in the design. For instance, systems of future in-home monitoring technologies could adjust the monitoring information presented to the caregiver based on their commuting time and whether the care recipient lives alone etc. By adequately meeting the users' needs and not inducing an information overload, technology satisfaction and usage may be increased (van Gemert-Pijnen et al., 2011).

Thirdly, the relationship of the caregiver burden and commuting time is a meaningful contribution to literature by helping explain their state. For instance, after future research has accounted for confounding factors, findings implicate that a higher burden is induced starting at a commuting time of 16 minutes. As informal caregivers of different commuting times

experience different levels of caregiver burden, they may need diverse technological features to balance out specific factors of commuting times which are related to the burden.

Future Research

Firstly, even though this research discovered differences in the acceptance towards in-home monitoring technology in use situations, no factors were found to be associated with these variations. While this may be due to the mentioned study limitations, future research is suggested to explore potential reasons for these differences. A qualitative study design, such as semi-structured interviews or focus groups, is advised to be conducted. Through a following content analysis, this design allows to acquire new knowledge and explore explanatory factors for the observed patterns (Busetto et al., 2020). End-users are also directly involved, which may give further indications of their wishes and concerns (van Gemert-Pijnen et al., 2011).

Secondly, differences in acceptance towards in-home monitoring technology amongst caregivers of diverse commuting times should be further investigated while taking possible confounding variables into account such as if the care recipient lives alone or has professional help. Future research is of great necessity as in-home monitoring technologies may specifically be useful for informal caregivers providing care from a distance (Kinney et al., 2003; Sriram et al., 2020). However, studies show that little is known about their needs (Larizza et al., 2012) and many have the feeling that their wish to receive more information about the care recipient is currently not met by services (Thompsell and Lovestone, 2002).

Thirdly, there are still knowledge gaps regarding the novel research finding of the relationship between the caregiver burden and commuting time. According to a literature review by Cagle and Munn (2012), informal caregivers providing care from a distance often live up to four hours away. Hence, it would be of added value to expand the measurement of commuting time up to, for instance, four hours. This will allow to, firstly, discover if the caregiver burden continues to rise after one hour, secondly, when the curve begins to flatten, and thirdly, if there is a point of saturation, hence, a commuting time after which the burden no longer increases. Moreover, while accounting for potential confounding variables, such as whether the care recipient lives alone, or if professional help is used, future studies are advised to explore aspects of commuting time which may be associated with the variations in caregiver burden. Filling this knowledge gap could offer insights for the “contextual inquiry” and “value specification” steps of development (Guisado-Fernández et al., 2019), be translated into features of in-home monitoring technologies to tackle downsides of specific commuting times and in turn decrease the burden of care.

Conclusion

This research contributes to literature by having investigated end users' acceptance towards novel unobtrusive in-home monitoring technologies and provides guidelines for the pre-implementation and design. Results also include valuable insights to help understand informal caregivers who provide care from a distance. It is of great importance to further investigate the potential relationship between commuting times and the technology acceptance in different use situations while taking caregivers' contexts into account. This may enable the technologies to balance out downsides of specific commuting times which are linked to the burden of care. Striving for an adequate match between the technology, users' needs, and the context, will ultimately lead to a successful implementation of the novel unobtrusive in-home monitoring technologies. These may in turn decrease informal caregivers' burden, enable a longer and more efficient care of PwD at home, and relieve the overload of professional care.

References

Agarwal, R., & Prasad, J. (1998). A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology. *Information Systems Research*, *9*(2), 204–215. https://doi.org/10.1287/isre.9.2.204

Allen, A. P., Curran, E. A., Duggan, I., Cryan, J. F., Chorcoráin, A. N., Dinan, T. G., Molloy, D. W., Kearney, P. M., & Clarke, G. (2017). A systematic review of the psychobiological burden of informal caregiving for patients with dementia: Focus on cognitive and biological markers of chronic stress. *Neuroscience & Biobehavioral Reviews*, *73*, 123–164. https://doi.org/10.1016/j.neubiorev.2016.12.006

Alzheimer's Association. (2019). Alzheimer's Association Report. 2019 Alzheimer's disease facts and figures. *Alzheimer's & Dementia*, *15*(3), 321–387. https://doi.org/10.1016/j.jalz.2019.01.010

Alzheimer's Association. (2012). 2012 Alzheimer's disease facts and figures Alzheimer's Association. *Alzheimer's & Dementia*, *8*(2), 131–168. https://doi.org/10.1016/j.jalz.2012.02.001

Bagozzi, R. (2007). The Legacy of the Technology Acceptance Model and a Proposal for a Paradigm Shift. *Journal of the Association for Information Systems*, *8*(4), 244–254. https://doi.org/10.17705/1jais.00122

Bastoni, S., Wrede, C., da Silva, M. C., Sanderman, R., Gaggioli, A., Braakman-Jansen, A., & van Gemert-Pijnen, L. (2021). Factors Influencing Implementation of eHealth Technologies to Support Informal Dementia Care: Umbrella Review. *JMIR Aging*, *4*(4), e30841. https://doi.org/10.2196/30841

Bédard, M., Molloy, D. W., Squire, L., Dubois, S., Lever, J. A., & O'Donnell, M. (2001). The Zarit Burden Interview. *The Gerontologist*, *41*(5), 652–657. https://doi.org/10.1093/geront/41.5.652

Berger, G., Bernhardt, T., Weimer, E., Peters, J., Kratzsch, T., & Frolich, L. (2005). Longitudinal Study on the Relationship Between Symptomatology of Dementia and Levels of Subjective Burden and Depression Among Family Caregivers in Memory Clinic Patients. *Journal of Geriatric Psychiatry and Neurology*, *18*(3), 119–128. https://doi.org/10.1177/0891988704273375

Bledsoe, L. K., Moore, S. E., & Collins, W. L. (2010). Long distance caregiving: An evaluative review of the literature. *Ageing International*, *35*(4), 293-310. https://doi.org/10.1007/s12126-010-9062-3

Brodaty, H., & Donkin, M. (2009). Family caregivers of people with dementia. *Dialogues in Clinical Neuroscience*, *11*(2), 217–228. https://doi.org/10.31887/dcns.2009.11.2/hbrodaty

Budnick, A., Hering, C., Eggert, S., Teubner, C., Suhr, R., Kuhlmey, A., & Gellert, P. (2021). Informal caregivers during the COVID-19 pandemic perceive additional burden: findings from an ad-hoc survey in Germany. *BMC Health Services Research*, *21*(1). https://doi.org/10.1186/s12913-021-06359-7

Busetto, L., Wick, W., & Gumbinger, C. (2020). How to use and assess qualitative research methods. *Neurological Research and Practice*, *2*(1). https://doi.org/10.1186/s42466-020-00059-z

Cagle, J. G., & Munn, J. C. (2012). Long-Distance Caregiving: A Systematic Review of the Literature. *Journal of Gerontological Social Work*, *55*(8), 682–707. https://doi.org/10.1080/01634372.2012.703763

Checkovich, T. J., & Stern, S. (2002). Shared Caregiving Responsibilities of Adult Siblings with Elderly Parents. *The Journal of Human Resources*, *37*(3), 441. https://doi.org/10.2307/3069678

Cimperman, M., Brenčič, M. M., Trkman, P., & Stanonik, M. D. L. (2013). Older Adults' Perceptions of Home Telehealth Services. *Telemedicine and E-Health*, *19*(10), 786 790. https://doi.org/10.1089/tmj.2012.0272

Claes, V., Devriendt, E., Tournoy, J. and Milisen, K. (2015). Attitudes and perceptions of adults of 60 years and older towards in-home monitoring of the activities of daily living with contactless sensors: and explorative study. *International Journal of Nursing studies 52*: 134-148. https://doi.org/10.1016/j.ijnurstu.2014.05.010

Collins, B., & Kishita, N. (2019). Prevalence of depression and burden among informal caregivers of people with dementia: a meta-analysis. *Ageing & Society*. https://doi.org/10.1017/S0144686X19000527

Craig, D., Mirakhur, A., Hart, D. J., McIlroy, S. P., & Passmore, A. P. (2005). A Cross Sectional Study of Neuropsychiatric Symptoms in 435 Patients With Alzheimer's Disease. *The American Journal of Geriatric Psychiatry*, *13*(6), 460–468. https://doi.org/10.1097/00019442200506000-00004

del-Pino-Casado, R., Priego-Cubero, E., López-Martínez, C., & Orgeta, V. (2021). Subjective caregiver burden and anxiety in informal caregivers: A systematic review and meta analysis. *PLOS ONE*, *16*(3), e0247143. https://doi.org/10.1371/journal.pone.0247143

Dementia Care Central. (2020, April 24). Stages of Alzheimer's & Dementia: Durations & Scales Used to Measure Progression (GDS, FAST & CDR). Dementia Care Central. Retrieved from https://www.dementiacarecentral.com/aboutdementia/facts/stages/

Dementia Care Central. (2019, May 16). Finding Home Care, Assisted Living & Nursing Homes for Dementia / Alzheimer's. Dementia Care Central. Retrieved from https://www.dementiacarecentral.com/dementiacare/

D'herde, J., Gruijthuijsen, W., Vanneste, D., Draulans, V., & Heynen, H. (2021). "I Could Not Manage This Long-Term, Absolutely Not." Aging in Place, Informal Care, COVID-19, and the Neighborhood in Flanders (Belgium). *International Journal of Environmental Research and Public Health*, *18*(12), 6482. https://doi.org/10.3390/ijerph18126482

Evans, J., Brown, M., Coughlan, T., Lawson, G., & Craven, M. P. (2015). A Systematic Review of Dementia Focused Assistive Technology. *Human-Computer Interaction: Interaction Technologies*, 406–417. https://doi.org/10.1007/978-3-319-20916-6_38

Gauthier, S., Rosa-Neto, P., Morais, JA., & Webster. C. (2021). World Alzheimer Report 2021: Journey through the diagnosis of dementia. London, England: Alzheimer's Disease International. Retrieved from https://www.alzint.org/u/World-AlzheimerReport-2021.pdf

George, D., & Mallery, P. (2020). *IBM SPSS Statistics 26 Step by Step: A Simple Guide and Reference* (16th ed.). Routledge.

Giebel, C. M., Sutcliffe, C., Stolt, M., Karlsson, S., Renom-Guiteras, A., Soto, M., Verbeek, H., Zabalegui, A., & Challis, D. (2014). Deterioration of basic activities of daily living and their impact on quality of life across different cognitive stages of dementia: a European study. *International Psychogeriatrics*, *26*(8), 1283–1293. https://doi.org/10.1017/s1041610214000775

Guisado-Fernández, E., Giunti, G., Mackey, L. M., Blake, C., & Caulfield, B. M. (2019). Factors influencing the adoption of smart health technologies for people with dementia and their informal caregivers: scoping review and design framework. *JMIR aging*, *2*(1), e12192. https://doi.org/10.2196/12192

Hassan, A. Y. I., Lamura, G., & Hagedoorn, M. (2022). Predictors of digital support services use by informal caregivers: a cross-sectional comparative survey. *BMJ open*, *12*(4),

e059897. http://doi.org/10.1136/bmjopen-2021- 059897

Higginson, I. J., Gao, W., Jackson, D., Murray, J., & Harding, R. (2010). Short-form Zarit Caregiver Burden Interviews were valid in advanced conditions. *Journal of Clinical Epidemiology*, *63*(5), 535–542. https://doi.org/10.1016/j.jclinepi.2009.06.014

Huang, H. L., Chen, M. C., Huang, C. C., Kuo, H. C., Chen, S. T., Hsu, W. C., & Shyu, Y. I. (2015). Family caregivers' role implementation at different stages of dementia. *Clinical Interventions in Aging*, 135. https://doi.org/10.2147/cia.s60574

Jaschinski, C. (2018). Independent Aging with the Help of Smart Technology: Investigating the Acceptance of Ambient Assisted Living Technologies. University of Twente, Doctoral dissertation. https://doi.org/10.3990/1.9789036546348

Joseph, A. E., & Hallman, B. C. (1998). Over the hill and far away: distance as a barrier to the provision of assistance to elderly relatives. *Social Science & Medicine*, *46*(6), 631–639. https://doi.org/10.1016/s0277-9536(97)00181-0

Kate, N., Grover, S., Kulhara, P., & Nehra, R. (2013). Relationship of caregiver burden with coping strategies, social support, psychological morbidity, and quality of life in the caregivers of schizophrenia. *Asian journal of psychiatry*, *6*(5), 380-388. https://doi.org/10.1016/j.ajp.2013.03.014

Kayser, L., Karnoe, A., Furstrand, D., Batterham, R., Christensen, K. B., Elsworth, G., & Osborne, R. H. (2018). A Multidimensional Tool Based on the eHealth Literacy Framework: Development and Initial Validity Testing of the eHealth Literacy Questionnaire (eHLQ). *Journal of Medical Internet Research*, *20*(2), e36. https://doi.org/10.2196/jmir.8371

Kinney, J. M., Kart, C. S., Murdoch, L. D., & Ziemba, T. F. (2003). Challenges in caregiving and creative solutions: Using technology to facilitate caring for a relative with dementia. *Ageing International*, *28*(3), 295–313.

https://doi.org/10.1007/s12126-0021009-x

Kip, H., & van Gemert-Pijnen, L. J. (2018). Holistic development of eHealth technology. In Gemert Pijnen, V. L., Kelders, S. M., Kip, H., & Sanderman, R. (editors) *eHealth Research, Theory and Development: A Multi-Disciplinary Approach.* Abingdon-on Thames, UK: Routledge, 151-186.

Koerin, B. B., & Harrigan, M. P. (2002). P. S. I love you: Long-distance caregiving. *Journal of Gerontological Social Work*, *40*(1–2), 63–81. https://doi.org/10.1300/J083v40n01_05

Kramer, B. (2013). Dementia Caregivers in Germany and Their Acceptance of New Technologies for Care: The Information Gap: Figure 1. *Public Policy & Aging Report*, *24*(1), 32–34. https://doi.org/10.1093/ppar/prt002

Kushniruk, A. W., Bates, D. W., Bainbridge, M., Househ, M. S., & Borycki, E. M. (2013). National efforts to improve health information system safety in Canada, the United States of America and England. *International Journal of Medical Informatics*, *82*(5), e149–e160. https://doi.org/10.1016/j.ijmedinf.2012.12.006

Larizza, M., Zukerman, I., Bohnert, F., Russell, R. A., Busija, L., Albrecht, D. W., & Rees, G. (2012). Studies to determine user requirements regarding in-home monitoring systems. In *International Conference on User Modeling, Adaptation, and Personalization* (pp. 139-150). Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-31454-4_12

Liu, L., Miguel Cruz, A., & Juzwishin, D. (2018). Caregivers as a proxy for responses of dementia clients in a GPS technology acceptance study. *Behaviour & Information Technology*, *37*(6), 634-645. https://doi.org/10.1080/0144929X.2018.1470672

Mapi/ICON Language Services. (2018). *Zarit Burden Interview (ZBI) - Zarit SH* [Data file]. Retrieved from https://eprovide.mapi-trust.org/instruments/zarit-burden-interview

Ministerie van Volksgezondheid, Welzijn en Sport. (2017, May 17). Working together internationally to tackle dementia. News Item, Government.nl. Retrieved from https://www.government.nl/latest/news/2017/05/16/working-together-internationally-to-tackle-dementia

Moyle, W. (2019). The promise of technology in the future of dementia care. *Nature Reviews Neurology*, *15*(6), 353–359. https://doi.org/10.1038/s41582-019-0188-y

National Alliance for Caregiving. (2004). Miles away: The MetLife study of long-distance caregiving. Westport: MetLife Mature Market Institute. Retrieved from https://www.geckosystems.com/downloads/milesaway.pdf

Nichols, E., Steinmetz, J. D., Vollset, S. E., Fukutaki, K., Chalek, J., Abd-Allah, F., Abdoli, A., Abualhasan, A., Abu-Gharbieh, E., Akram, T. T., al Hamad, H., Alahdab, F., Alanezi, F. M., Alipour, V., Almustanyir, S., Amu, H., Ansari, I., Arabloo, J., Ashraf, T., . . . Vos, T. (2022). Estimation of the global prevalence of dementia in 2019 and forecasted prevalence in 2050: an analysis for the Global Burden of Disease Study 2019. *The Lancet Public Health*, *7*(2), e105–e125. https://doi.org/10.1016/s2468-2667(21)00249-8

Nikzad-Terhune, K. A., Anderson, K. A., Newcomer, R., & Gaugler, J. E. (2010). Do Trajectories of At-Home Dementia Caregiving Account for Burden After Nursing Home Placement? A Growth Curve Analysis. *Social Work in Health Care*, *49*(8), 734–752. https://doi.org/10.1080/00981381003635296

Peek, S. T., Wouters, E. J., Van Hoof, J., Luijkx, K. G., Boeije, H. R., & Vrijhoef, H. J. (2014). Factors influencing acceptance of technology for aging in place: a systematic review. *International journal of medical informatics*, *83*(4), 235-248. https://doi.org/10.1016/j.ijmedinf.2014.01.004

Peel, N. M. (2011). Epidemiology of Falls in Older Age. *Canadian Journal on Aging / La Revue Canadienne Du Vieillissement*, *30*(1), 7–19. https://doi.org/10.1017/s071498081000070x

Petersen, J. D., Siersma, V. D., Christensen, R. D., Storsveen, M. M., Nielsen, C. T., & Waldorff, F. B. (2018). The risk of fall accidents for home dwellers with dementia A register- and population-based case-control study. *Alzheimer's & Dementia: Diagnosis, Assessment & Disease Monitoring*, *10*(1), 421–428. https://doi.org/10.1016/j.dadm.2018.05.004

Pinquart, M., & Sorensen, S. (2007). Correlates of Physical Health of Informal Caregivers: A Meta Analysis. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *62*(2), P126–P137. https://doi.org/10.1093/geronb/62.2.p126

Richardson, T. J., Lee, S. J., Berg-Weger, M., & Grossberg, G. T. (2013). Caregiver Health: Health of Caregivers of Alzheimer's and Other Dementia Patients. *Current Psychiatry Reports*, *15*(7). https://doi.org/10.1007/s11920-013-0367-2

Rowe, M. A., Kelly, A., Horne, C., Lane, S., Campbell, J., Lehman, B., Phipps, C., Keller, M., & Benito, A. P. (2009). Reducing dangerous nighttime events in persons with dementia by using a nighttime monitoring system. *Alzheimer's & Dementia*, *5*(5), 419–426. https://doi.org/10.1016/j.jalz.2008.08.005

Sallim, A. B., Sayampanathan, A. A., Cuttilan, A., & Chun-Man Ho, R. (2015). Prevalence of Mental Health Disorders Among Caregivers of Patients With Alzheimer Disease. *Journal of the American Medical Directors Association*, *16*(12), 1034–1041. https://doi.org/10.1016/j.jamda.2015.09.007

Schulz, R., & Eden, J. (2016). Families caring for an aging America. Washington, DC: National Academies Press. Retrieved from https://www.caregiving.org/wp-content/uploads/2020/05/1NAC-SCHULZ.pdf

Sharma, N., Brinke, J. K., Gemert-Pijnen, J. E. W. C. V., & Braakman-Jansen, L. M. A. (2021). Implementation of Unobtrusive Sensing Systems for Older Adult Care: Scoping Review. *JMIR Aging*, *4*(4), e27862. https://doi.org/10.2196/27862

Sriram, V., Jenkinson, C., & Peters, M. (2020). Carers' experience of using assistive technology for dementia care at home: a qualitative study. *BMJ open*, *10*(3), e034460. https://doi.org/10.1136/bmjopen-2019-034460

Stall, N. M., Kim, S. J., Hardacre, K. A., Shah, P. S., Straus, S. E., Bronskill, S. E., Lix, L. M., Bell, C. M., & Rochon, P. A. (2018). Association of Informal Caregiver Distress with Health Outcomes of Community-Dwelling Dementia Care Recipients: A Systematic Review. *Journal of the American Geriatrics Society*, *67*(3), 609–617. https://doi.org/10.1111/jgs.15690

Thompsell, A., & Lovestone, S. (2002). Out of sight out of mind? Support and information given to distant and near relatives of those with dementia. *International Journal of Geriatric Psychiatry*, *17*(9), 804–807. https://doi.org/10.1002/gps.692

Tolkacheva, N., van Groenou, M. B., de Boer, A., & van Tilburg, T. (2010). The impact of informal care-giving networks on adult children's care-giver burden. *Ageing and Society*, *31*(1), 34–51. https://doi.org/10.1017/s0144686x10000711

Triberti, S., Kelders, S. M., & Gaggioli, A. (2018). User engagement. In Gemert-Pijnen, V. L., Kelders, S. M., Kip, H., & Sanderman, R. (editors) *eHealth Research, Theory and Development: A Multi-Disciplinary Approach.* Abingdon-on-Thames, UK: Routledge, 271-289.

van den Kieboom, R., Snaphaan, L., Mark, R., & Bongers, I. (2020). The Trajectory of Caregiver Burden and Risk Factors in Dementia Progression: A Systematic Review. *Journal of Alzheimer's Disease*, *77*(3), 1107–1115. https://doi.org/10.3233/jad-200647

van Gemert-Pijnen, L. J., Kip, H., Kelders, S. M., & Sanderman, R. (2018). Introducing ehealth. In Gemert-Pijnen, V. L., Kelders, S. M., Kip, H., & Sanderman, R. (editors) *eHealth Research, Theory and Development: A Multi-Disciplinary Approach.* Abingdon-on-Thames, UK: Routledge, 3-26.

van Gemert-Pijnen, J. E., Nijland, N., van Limburg, M., Ossebaard, H. C., Kelders, S. M., Eysenbach, G., & Seydel, E. R. (2011). A Holistic Framework to Improve the Uptake and Impact of eHealth Technologies. *Journal of Medical Internet Research*, *13*(4), e111. https://doi.org/10.2196/jmir.1672

Wang, J., Fu, Y., Lou, V., Tan, S. Y., & Chui, E. (2021). A systematic review of factors influencing attitudes towards and intention to use the long-distance caregiving technologies for older adults. *International journal of medical informatics*, *153*, 104536. https://doi.org/10.1016/j.ijmedinf.2021.104536

Werner, S., Auslander, G. K., Shoval, N., Gitlitz, T., Landau, R., & Heinik, J. (2012). Caregiving burden and out-of-home mobility of cognitively impaired care-recipients based on GPS tracking. *International Psychogeriatrics*, *24*(11), 1836–1845. https://doi.org/10.1017/s1041610212001135

WHO. (2021, September 2). *Dementia*. World Health Organization - Newsroom. Retrieved from https://www.who.int/news-room/fact-sheets/detail/dementia

Wójcik, D., Szczechowiak, K., Konopka, P., Owczarek, M., Kuzia, A., Rydlewska Liszkowska, I., & Pikala, M. (2021). Informal Dementia Caregivers: Current Technology Use and Acceptance of Technology in Care. *International Journal of Environmental Research and Public Health*, *18*(6), 3167. https://doi.org/10.3390/ijerph18063167

Wrede, C., Braakman-Jansen, A., & van Gemert-Pijnen, L. (2021). Requirements for Unobtrusive Monitoring to Support Home-Based Dementia Care: Qualitative Study Among Formal and Informal Caregivers. *JMIR Aging*, *4*(2), e26875. https://doi.org/10.2196/26875

Xie, B., Champion, J. D., Kwak, J., & Fleischmann, K. R. (2018). Mobile health, information preferences, and surrogate decision-making preferences of family caregivers of people with dementia in rural hispanic communities: cross-sectional questionnaire study. *Journal of medical Internet research*, *20*(12), e11682. https://doi.org/10.2196/11682

Yu, Y., Liu, Z. W., Zhou, W., Chen, X. C., Zhang, X. Y., Hu, M., & Xiao, S. Y. (2018). Assessment of Burden Among Family Caregivers of Schizophrenia: Psychometric Testing for Short-Form Zarit Burden Interviews. *Frontiers in Psychology*, *9*. https://doi.org/10.3389/fpsyg.2018.02539

Yusof, M. M., Kuljis, J., Papazafeiropoulou, A., & Stergioulas, L. K. (2008). An evaluation framework for Health Information Systems: human, organization and technology fit factors. *International Journal of Medical Informatics*, *77*(6), 386–398. https://doi.org/10.1016/j.ijmedinf.2007.08.011

Zarit, S. H., Reever, K. E., & Bach-Peterson, J. (1980). Relatives of the impaired elderly: correlates of feelings of burden. *The gerontologist*, *20*(6), 649-655. https://doi.org/10.1093/geront/20.6.649

Appendix A

German Survey

Information Sheet and Informed Consent (German)

Akzeptanz von Überwachungstechnologien in der Pflege älterer Menschen

Vielen Dank für Ihr Interesse an der Teilnahme an dieser Studie über den Einsatz von Technologien in der häuslichen Pflege. Die Studie wird von Psychologie-Studenten der Universität Twente im Rahmen ihrer Bachelor-Arbeiten durchgeführt.

Ziel der Studie ist es, herauszufinden, wie pflegende Angehörige über die Nutzung von Überwachungstechnologien für die Pflege älterer Menschen denken. Pflegende Angehörige sind Personen, die unbezahlte Unterstützung/ Pflege für ein Familienmitglied, einen Freund oder einen Nachbarn leisten. Wenn Sie ein pflegender Angehöriger einer älteren Person, einer Person mit Demenz oder leichter kognitiver Beeinträchtigung sind, sind Sie herzlich eingeladen, an unserer Studie teilzunehmen. Die Teilnahme wird etwa 20 Minuten dauern.

Ihre Angaben werden anonym verarbeitet, sodass diese nicht auf einzelne Personen zurückgeführt werden können. Die erhobenen Daten werden ausschließlich für wissenschaftliche Forschungszwecke verwendet und nicht an Dritte weitergegeben.

Ihre Teilnahme an dieser Studie ist freiwillig und Sie können jederzeit ohne Angabe von Gründen von der Teilnahme zurücktreten. Sollten Sie Fragen zur Studie haben, können Sie sich gerne an Ronja Rosenkranz (r.rosenkranz@student.utwente.nl), eine der Student*innen, oder Frau Dr. Braakman-Jansen (l.m.a.braakman-jansen@utwente.nl), die Projektleiterin, wenden.

Um Ihnen für Ihre Teilnahme zu danken, haben Sie am Ende des Fragebogens die Möglichkeit einen 10€ Mydays Gutschein zu gewinnen.

Einverständniserklärung
Ich bestätige, dass ich 18 Jahre alt bin und mit der oben beschriebenen Verarbeitung der Daten einverstanden bin. Ich nehme freiwillig an dieser Studie teil.

- Ja
- Nein

Survey (German)

Teil 1: Allgemeine Fragen über die Teilnehmer
Vielen Dank. Wir möchten gerne mit einigen Fragen zu Ihrer Person beginnen.

(**Alter**)
Wie alt sind Sie (in Jahren)? _____

(**Geschlecht**)
Mit welcher der folgenden Optionen identifizieren Sie sich am meisten?

a. Männlich
b. Weiblich
c. Anders/ keine Angabe

(**Wohnort**)
In welchem Land wohnen Sie?

a. Niederlande
b. Deutschland
c. Keine der genannten Optionen trifft zu

(**Pflegende/r Angehörige/r**)
Sind Sie ein pflegender Angehöriger/ eine pflegende Angehörige?
(Pflegende Angehörige sind Personen, die unbezahlte Pflege/ Unterstützung für ein gesundheitlich eingeschränktes Familienmitglied (z.B. Partner oder Eltern), einen Freund oder Nachbarn leisten.)

a. Ja
b. Nein

(**Grund der Pflege**)
Was ist der Grund für die Pflege/ Unterstützung? (mehrere Antworten sind möglich)

a. Demenz oder leichte kognitive Beeinträchtigung/ Gedächtnisstörungen
b. Folgen des normalen Alterungsprozess
c. Somatische Beeinträchtigung
d. Psychische Krankheit
e. Andere Gründe

(**Beziehung zur pflegebedürftigen Person**)
Was beschreibt die Beziehung zu der Person, die Sie pflegen/ unterstützen, am besten?
Ich bin...

a. (Ehe)partner
b. Tochter/ Sohn
c. Schwiegertochter/-sohn
d. Schwester/ Bruder
e. Nachbar(in) / Freund(in)

f. Enkel(in)
g. Anders, nämlich: _____

(**Größe des Pflege-Netzwerks**)
Gibt es weitere pflegende Angehörige, die an der Pflege/ Unterstützung Ihres Angehörigen beteiligt sind?

a. Nein, ich bin die einzige Person
b. Ja, 1 weitere Person
c. Ja, 2 weitere Personen
d. Ja, 3 weitere Personen
e. Ja, 4 oder mehr andere Personen

(**Wegzeit**)
Bitte geben Sie an, wie lange Sie brauchen, um zu der Wohnung der Person zu gelangen, die Sie pflegen/ unterstützen. Bitte beziehen Sie sich dabei auf das Fortbewegungsmittel, welches Sie überwiegend für diese Strecke nutzen (z.B. zu Fuß, Fahrrad, Bus, Bahn, Auto etc.)

Wie weit leben Sie von der Person, die Sie pflegen/ unterstützen, entfernt?

a. Ich lebe im gleichen Haus
b. Ich lebe zwischen 1 und 5 Minuten entfernt
c. Ich lebe zwischen 6 und 15 Minuten entfernt
d. Ich lebe zwischen 16 und 30 Minuten entfernt
e. Ich lebe zwischen 31 Minuten und 1 Stunde entfernt
f. Ich lebe mehr als 1 Stunde entfernt

Teil 2: Allgemeine Fragen über die pflegebedürftige Person

Im Folgenden möchten wir Ihnen einige Fragen stellen zu Ihrem/ Ihrer Angehörigen, welche(n) Sie pflegen/ unterstützen.

(**Alter**)
Wie alt ist die Person die Sie pflegen/ unterstützen (in Jahren)?

(**Art von Demenz/ kognitiver Beeinträchtigung**)
(Diese Frage wurde nur angezeigt, wenn bei der Frage "Grund der Pflege" Option A gewählt wurde)

Welche Art von Demenz oder kognitiver Beeinträchtigung betrifft die Person, die Sie pflegen/ unterstützen?

a. Alzheimer
b. Lewy-Body-Demenz bzw. Lewy-Körper-Demenz
c. Vaskuläre Demenz
d. Leichte kognitive Störung

e. Eine andere Art von Demenz/ ich weiß es nicht
f. Es wurde (noch) keine Diagnose festgestellt

(**Zeit seit Symptombeginn**)
(Diese Frage wurde nur angezeigt, wenn bei der Frage "Grund der Pflege" Option A gewählt wurde)
Seit wann hat die Person, die Sie pflegen/ unterstützen, Symptome einer Demenz oder einer leichten kognitiven Beeinträchtigung (Schätzung)?

a. Weniger als 1 Jahr
b. 1 bis 2 Jahre
c. 2 bis 3 Jahre
d. 3 bis 4 Jahre
e. 4 bis 5 Jahre
f. Länger als 5 Jahre

(**Wohnsituation der pflegebedürftigen Person**)
Wie ist die aktuelle Wohnsituation der Person, die Sie pflegen/ unterstützen?

a. Die zu betreuende Person lebt allein
b. Die zu betreuende Person lebt mit anderen Personen zusammen

Wo wohnt die Person, die Sie pflegen/ unterstützen?

a. In einem eigenen (Miet-)Haus / einer eigenen (Miet-)Wohnung
b. In dem Haus/ der Wohnung eines Familienmitglieds
c. In einer (betreuten) Seniorenwohnung oder einer Wohnung, die zu einer Gesundheitseinrichtung gehört
d. In einem Pflegeheim
e. Anders, nämlich: _____

(**Inanspruchnahme professioneller Pflege**)
Welche Art von professioneller Pflege/Dienstleistung erhält Ihr Angehöriger? (Mehrere Angaben möglich)

a. Häusliche Pflege durch eine Krankenschwester oder einen Pfleger
b. Eine feste Ansprechperson welche die Pflege Ihres Angehörigen koordiniert
c. Tagespflege/ Tagesbetreuung
d. Hilfe für den Haushalt
e. Essen auf Rädern
f. Keine der oben genannten Optionen

Teil 3: Wahrgenommene Belastung durch die Pflege

In diesem Teil des Fragebogens interessieren wir uns für die Belastung, die Sie durch die Pflege/ Unterstützung Ihres Angehörigen möglicherweise erfahren.

Nachfolgend wird eine Reihe von Fragen gestellt, in denen es darum geht, wie Menschen, die einen anderen Menschen pflegen, sich manchmal fühlen. Bitte geben Sie zu jeder Frage an, wie oft Sie sich so fühlen: nie, selten, manchmal, ziemlich oft, oder fast immer. Es gibt dabei keine richtigen oder falschen Antworten.

[4-item screening scale of Zarit Burden Interview (ZBI) (Bédard et al., 2001)]

Teil 4: Digitale Kompetenz, Innovations-Affinität & Erfahrung mit Technologien

In diesem Abschnitt des Fragebogens interessieren wir uns für Ihre digitale Kompetenz, Innovations-Affinität und Erfahrung mit Technologien.

(**Digitale Kompetenz**)
Bitte geben Sie an, inwieweit Sie den folgenden Aussagen zustimmen:

[„Ability to Actively Engage with Digital Services in the Healthcare Domain" subscale of the eHealth Literacy Questionnaire (eHLQ) (Kayser et al., 2018)]

(**Innovations-Affinität**)
Wie innovativ sind Sie?
Bitte geben Sie an, inwieweit Sie den folgenden Aussagen zustimmen:

["Personal Innovativeness Towards Technology" (PIIT) scale (Agarwal & Prasad, 1998)]

(**Erfahrung mit Technologien**)
Welche der folgenden Technologien nutzen Sie derzeit oder haben Sie in der Vergangenheit bereits genutzt?

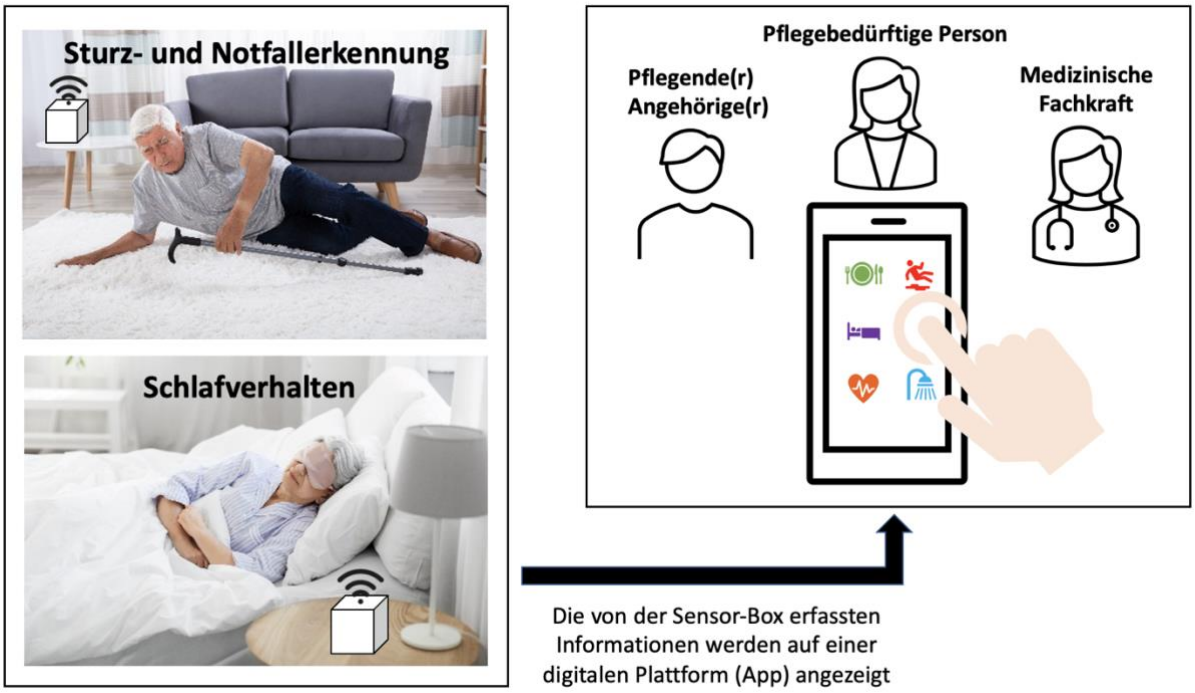
a. Technologien zur Überwachung der täglichen Aktivitäten/des Lebensstils Ihres Angehörigen (z.B. Sensortechnologie, Alarmknöpfe, GPS-Tracker)
b. Digitale Kommunikationstechnologie, um mit Ihrem Angehörigen in Kontakt zu bleiben (z.B. Videoanrufe, Nachrichten Systeme, WhatsApp)
c. Technologie zur Unterstützung des Gedächtnisses oder der Tagesstruktur Ihres Angehörigen (z.B. Erinnerungssysteme, Smartwatch (elektronische Multifunktions-Armbanduhr), automatischer Medikamentenspender (der die Einnahme von Medikamenten kontrolliert))
d. Digitale Pflegeplattformen zur Unterstützung der Koordination der Pflege Ihres Angehörigen (z.B. Plattformen zur Erleichterung der Kommunikation zwischen informellen und professionellen Pflegekräften)
e. Keine der oben genannten Technologien

Teil 5: Kontaktlose Überwachungstechnologie in der Pflege Angehöriger

Bitte sehen Sie sich die folgende Beschreibung und Illustration an, bevor Sie mit den nächsten Fragen fortfahren.

Es werden immer mehr Technologien entwickelt, die darauf abzielen, pflegende Angehörige zu unterstützen und es ihren Angehörigen zu ermöglichen, länger zu Hause zu leben. In diesem Teil des Fragebogens konzentrieren wir uns auf eine spezielle Form der unterstützenden Technologie: kontaktlose Überwachungstechnologien.
Bei kontaktloser Heimüberwachungstechnologie handelt es sich um ein Sensorsystem, das in der Wohnung älterer Personen installiert werden kann und rund um die Uhr Informationen über deren Lebensstil, Gesundheit und Sicherheit liefert. Die Technologie soll dem pflegenden Angehörigen einen besseren Einblick in die Situation des älteren Menschen geben, insbesondere wenn der pflegende Angehörige weit entfernt wohnt oder das Haus verlässt.

Die Technologie funktioniert kontaktlos, d.h. ältere Menschen müssen keine Geräte tragen. Wie in dem Bild zu sehen ist, kann eine kleine Box mit eingebauten Sensoren in einer Ecke der Wohnung platziert werden. Mit Hilfe künstlicher Intelligenz kann dieses System lernen den täglichen Lebensstil Ihres Angehörigen zu erkennen und wichtige Veränderungen zu signalisieren, wie z.B. weniger essen und trinken oder nächtliche Unruhe. In Notfällen (z.B. Sturz) kann das System den pflegenden Angehörigen alarmieren. Die gesammelten Informationen können in Echtzeit auf einer digitalen Plattform angezeigt werden, auf die der pflegende Angehörige, die pflegebedürftige Person und, falls gewünscht, das medizinische Fachpersonal aus der Ferne zugreifen können.



(**Überprüfung der Verständlichkeit**)

Wie verständlich fanden Sie die obige Beschreibung und die Bilder über die kontaktlose Heimüberwachungstechnologie?

a. Nicht klar
b. Ziemlich klar
c. Eindeutig

(**Verbesserungsvorschläge**)
(Diese Frage wird nur angezeigt, wenn bei der Frage "Überprüfung der Verständlichkeit" Option a oder b ausgewählt wird)

Haben Sie Vorschläge, wie man die Klarheit der Beschreibung verbessern kann? _____

Teil 5A: Verschiedene Nutzungsszenarien

Im Folgenden werden Ihnen 5 verschiedene Szenarien vorgestellt. Die Szenarien sind Beschreibungen von Situationen, in denen kontaklose Überwachungstechnologie in der häuslichen Pflege eingesetzt werden könnte. Alle Szenarien enthalten verschiedene Aspekte, die überwacht werden können. Bitte beantworten Sie die folgenden Fragen für jedes Szenario.

Szenario 1: Erkennen von Notsituationen
Stellen Sie sich Folgendes vor: In der Wohnung Ihres Angehörigen wird eine kontaklose Überwachungstechnologie installiert. Diese Technologie überwacht kontinuierlich sicherheitsgefährdende Aspekte, wie z.B. Stürze oder Umherirren. Es kann solche Notsituationen in Echtzeit erkennen und Sie oder eine andere autorisierte Person alarmieren.

Bitte geben Sie an, inwieweit Sie den folgenden Aussagen zu Szenario 1 zustimmen:

Kontaktlose Überwachungstechnologie zur Erkennung von Notsituationen meines Angehörigen…	Stimme überhaupt nicht zu	Stimme nicht zu	Neutral	Stimme zu	Stimme völlig zu
(Akzeptanz)					
Würde ich akzeptabel finden					
Würde mein Angehöriger akzeptabel finden					
(Wahrgenommene Nützlichkeit)					
Wäre nützlich für mich					
Würde mich dabei unterstützen, die bestmögliche Pflege für meinen Angehörigen zu leisten					

Würde mich dabei unterstützen, mich über die Situation meines Angehörigen rückzuversichern					
Würde mir dabei helfen, schneller auf die Pflegebedürfnisse meines Angehörigen einzugehen					
Würde dazu beitragen, dass mein Angehöriger länger Zuhause leben kann.					
Würde mir dabei helfen, in meiner Rolle als pflegender Angehöriger länger durchzuhalten.					
(Bereitschaft Informationen zu teilen)					
Würde mir Informationen liefern, die ich mit den medizinischen Fachkräften meines Angehörigen teilen möchte.					
(Nutzungsabsicht)					
Ich würde die kontaktlose Überwachungstechnologie zur Erkennung von Notsituationen meines Angehörigen in (naher) Zukunft nutzen wollen.					

Szenario 2: Risikovorhersagen

Stellen Sie sich Folgendes vor: In der Wohnung Ihres Angehörigen wird eine kontaklose Überwachungstechnologie installiert. Diese zielt darauf ab, akute Situationen nicht nur zu erkennen, sondern vorherzusagen. So kann die Technologie z.B. kontinuierlich die Gehgeschwindigkeit und das Gehverhalten Ihres Angehörigen überwachen. Anhand dieser Informationen kann das System das Sturzrisiko vorhersagen und Sie oder eine andere autorisierte Person darüber informieren. Das Ziel ist es, Notsituationen wie z.B. Stürze zu verhindern.

Bitte geben Sie an, inwieweit Sie den folgenden Aussagen zu Szenario 2 zustimmen:

Kontaktlose Überwachungstechnologie zur Vorhersage von Risiken …	Stimme überhaupt nicht zu	Stimme nicht zu	Neutral	Stimme zu	Stimme völlig zu
(Akzeptanz)					
Würde ich akzeptabel finden					
Würde mein Angehöriger akzeptabel finden					
(Wahrgenommene Nützlichkeit)					
Wäre nützlich für mich					
Würde mich dabei unterstützen, die bestmögliche Pflege für meinen Angehörigen zu leisten					
Würde mich dabei unterstützen, mich über die Situation meines Angehörigen rückzuversichern					
Würde mir dabei helfen, schneller auf die Pflegebedürfnisse meines Angehörigen einzugehen					
Würde dazu beitragen, dass mein Angehöriger länger Zuhause leben kann.					
Würde mir dabei helfen, in meiner Rolle als pflegender Angehöriger länger durchzuhalten.					
(Bereitschaft Informationen zu teilen)					
Würde mir Informationen liefern, die ich mit den medizinischen Fachkräften meines Angehörigen teilen möchte.					
(Nutzungsabsicht)					
Ich würde die kontaktlose Überwachungstechnologie zur Vorhersage von Risiken in (naher) Zukunft nutzen wollen.					

Szenario 3: Überwachung des Selbstpflegeverhaltens

Stellen Sie sich Folgendes vor: In der Wohnung Ihres Angehörigen wird eine kontaktlose Überwachungstechnologie installiert. Diese überwacht kontinuierlich die Selbstversorgung Ihres Angehörigen wie Essen, Trinken und Körperpflege (z. B. Baden, Toilettengang, Anziehen). Das System kann größere Abweichungen im Selbstpflegeverhalten erkennen und Benachrichtigungen an Sie oder eine andere autorisierte Person senden.

Bitte geben Sie an, inwieweit Sie den folgenden Aussagen zu Szenario 3 zustimmen:

Kontaktlose Überwachungstechnologie zur Überwachung des Selbstpflegeverhaltens meines Angehörigen…	Stimme überhaupt nicht zu	Stimme nicht zu	Neutral	Stimme zu	Stimme völlig zu
(Akzeptanz)					
Würde ich akzeptabel finden					
Würde mein Angehöriger akzeptabel finden					
(Wahrgenommene Nützlichkeit)					
Wäre nützlich für mich					
Würde mich dabei unterstützen, die bestmögliche Pflege für meinen Angehörigen zu leisten					
Würde mich dabei unterstützen, mich über die Situation meines Angehörigen rückzuversichern					
Würde mir dabei helfen, schneller auf die Pflegebedürfnisse meines Angehörigen einzugehen					
Würde dazu beitragen, dass mein Angehöriger länger Zuhause leben kann.					
Würde mir dabei helfen, in meiner Rolle als pflegender Angehöriger länger durchzuhalten.					
(Bereitschaft Informationen zu teilen)					
Würde mir Informationen liefern, die ich mit den medizinischen Fachkräften					

meines Angehörigen teilen möchte.					
(Nutzungsabsicht)					
Ich würde die kontaktlose Überwachungstechnologie zur Überwachung des Selbstpflegeverhaltens meines Angehörigen in (naher) Zukunft nutzen wollen.					

Szenario 4: Überwachung des Wohlbefindens während der Nacht

Stellen Sie sich Folgendes vor: In der Wohnung Ihres Angehörigen wird eine kontaktlose Überwachungstechnologie installiert. Diese überwacht kontinuierlich das Wohlbefinden Ihres Angehörigen während der Nacht. Das System kann Abweichungen (z. B. nächtliche Unruhe, Schlafprobleme oder einen gestörten Tag-Nacht-Rhythmus) erkennen und Benachrichtigungen an Sie oder eine andere von autorisierte Person senden.

Bitte geben Sie an, inwieweit Sie den folgenden Aussagen zu Szenario 4 zustimmen:

Kontaktlose Überwachungstechnologie zur Überwachung des Wohlbefindens meines Angehörigen während der Nacht…	Stimme überhaupt nicht zu	Stimme nicht zu	Neutral	Stimme zu	Stimme völlig zu
(Akzeptanz)					
Würde ich akzeptabel finden					
Würde mein Angehöriger akzeptabel finden					
(Wahrgenommene Nützlichkeit)					
Wäre nützlich für mich					
Würde mich dabei unterstützen, die bestmögliche Pflege für meinen Angehörigen zu leisten					
Würde mich dabei unterstützen, mich über die Situation meines Angehörigen rückzuversichern					
Würde mir dabei helfen, schneller auf die					

Pflegebedürfnisse meines Angehörigen einzugehen					
Würde dazu beitragen, dass mein Angehöriger länger Zuhause leben kann.					
Würde mir dabei helfen, in meiner Rolle als pflegender Angehöriger länger durchzuhalten.					
(Bereitschaft Informationen zu teilen)					
Würde mir Informationen liefern, die ich mit den medizinischen Fachkräften meines Angehörigen teilen möchte.					
(Nutzungsabsicht)					
Ich würde die kontaktlose Überwachungstechnologie zur Überwachung des Wohlbefindens meines Angehörigen während der Nacht in (naher) Zukunft nutzen wollen.					

Szenario 5: Überwachung von langfristigen Gesundheitsveränderungen

Stellen Sie sich Folgendes vor: In der Wohnung Ihres Angehörigen wird eine kontaktlose Überwachungstechnologie installiert. Diese überwacht mögliche Veränderungen des Gesundheitszustandes der Person, die sich im Laufe der Zeit entwickeln. Das System kann Sie oder eine andere autorisierte Person beispielsweise darüber informieren, ob es in einem bestimmten Zeitraum zu einer kognitiven oder körperlichen Verschlechterung gekommen ist. Bitte geben Sie an, inwieweit Sie den folgenden Aussagen zu Szenario 5 zustimmen:

Kontaktlose Technologie zur Überwachung langfristiger Gesundheitsveränderungen meines Angehörigen…

Kontaktlose Überwachungstechnologie zur Überwachung langfristiger Gesundheitsveränderungen meines Angehörigen…	Stimme überhaupt nicht zu	Stimme nicht zu	Neutral	Stimme zu	Stimme völlig zu
(Akzeptanz)					
Würde ich akzeptabel finden					

Würde mein Angehöriger akzeptabel finden					
(Wahrgenommene Nützlichkeit)					
Wäre nützlich für mich					
Würde mich dabei unterstützen, die bestmögliche Pflege für meinen Angehörigen zu leisten					
Würde mich dabei unterstützen, mich über die Situation meines Angehörigen rückzuversichern					
Würde mir dabei helfen, schneller auf die Pflegebedürfnisse meines Angehörigen einzugehen					
Würde dazu beitragen, dass mein Angehöriger länger Zuhause leben kann.					
Würde mir dabei helfen, in meiner Rolle als pflegender Angehöriger länger durchzuhalten.					
(Bereitschaft Informationen zu teilen)					
Würde mir Informationen liefern, die ich mit den medizinischen Fachkräften meines Angehörigen teilen möchte.					
(Nutzungsabsicht)					
Ich würde die kontaktlose Überwachungstechnologie zur Überwachung langfristiger Gesundheitsveränderungen meines Angehörigen in (naher) Zukunft nutzen wollen.					

Teil 5B: Wahrgenommene Vorteile & Bedenken

Im Folgenden möchten wir Sie nach den von Ihnen erwarteten Vorteilen und Bedenken in Bezug auf kontaktlose Überwachungstechnologie fragen.

(**Vorteile**)
Bitte geben Sie an, inwieweit Sie den folgenden Aussagen zustimmen:

Ich glaube, dass mir kontaktlose Überwachungstechnologie in der häuslichen Pflege helfen kann …	Stimme überhaupt nicht zu	Stimme nicht zu	Neutral	Stimme zu	Stimme völlig zu
Zu überprüfen, ob mein Angehöriger angemessen für sich selbst sorgt (z.B. Essen, Trinken)					
Nicht erforderliche Besuche zu vermeiden wie z.B. Besuche zur Kontrolle der Selbstpflege meines Angehörigen					
Mich bezüglich der Sicherheit meines Angehörigen zu vergewissern					
Meine Freiheit und Mobilität wiederzuerlangen					
Faktoren, welche die Unabhängigkeit meines Angehörigen einschränken, zu erkennen und zu beseitigen					
Schneller auf den Pflegebedarf meines Angehörigen zu reagieren, um Gesundheitsrisiken vorzubeugen (z.B. Unterernährung, Schlafprobleme, Einsamkeit)					
Anderen Personen (einschließlich Pflegefachkräften) einen objektiven Einblick in die Situation meines Angehörigen zu geben					
Den optimalen Zeitpunkt für den Übergang meines Angehörigen in ein Pflegeheim oder zu einer anderen Wohnform zu finden					

(**Bedenken**)
Bitte geben Sie an, inwieweit Sie den folgenden Aussagen zustimmen:

Wenn ich kontaktlose Überwachungstechnologie in der häuslichen Pflege einsetzen würde, wäre ich …	Stimme überhaupt nicht zu	Stimme nicht zu	Neutral	Stimme zu	Stimme völlig zu
Besorgt, mit zu vielen Informationen überhäuft zu werden					
Besorgt, dass die Überwachungsinformationen mich unnötig beunruhigen würden					
Verunsichert, auf welche Informationen ich reagieren sollte					
Besorgt, dass Überwachungsdaten ohne unsere Zustimmung an Dritte weitergegeben werden könnten					
Verunsichert, ob die Vorteile des Systems die Verletzung der Privatsphäre meines Angehörigen rechtfertigen					
Besorgt, dass die Technologie den menschlichen Kontakt ersetzen könnte					

Teil 5C: Allgemeine Akzeptanz von kontaktloser Überwachungstechnologie

Nun interessieren wir uns für Ihre allgemeine Akzeptanz von kontaktloser Überwachungstechnologie in der häuslichen Pflege. Bitte berücksichtigen Sie alle Informationen, die Sie nun über die Funktion und den Einsatz dieser Technologien haben und geben Sie an, inwieweit Sie den folgenden Aussagen zustimmen.

	Stimme überhaupt nicht zu	Stimme nicht zu	Neutral	Stimme zu	Stimme völlig zu
(Wahrgenommene Nützlichkeit) Ich denke, dass kontaktlose Überwachungstechnologie in der Pflege meines Angehörigen nützlich sein kann..					
Zu diesem Zeitpunkt in meinem Leben	○	○	○	○	○
Wenn sich die kognitive oder körperliche Gesundheit meiner Pflegeperson verschlechtert	○	○	○	○	○
(Nutzungsabsicht) Ich würde kontaktlose Überwachungstechnologie in der Pflege meines Angehörigen nutzen wollen…					
Zu diesem Zeitpunkt in meinem Leben	○	○	○	○	○
Wenn sich die kognitive oder körperliche Gesundheit meiner Pflegeperson verschlechtert	○	○	○	○	○
(Einstellung) Es ist eine gute Idee kontaktlose Überwachungstechnologie in der Pflege meines Angehörigen zu nutzen	○	○	○	○	○
(Sozialer Einfluss)					
Meine Familie und Freunde würden es gut finden, wenn ich bei der Pflege meines Angehörigen kontaktlose Überwachungstechnologie einsetzen würde	○	○	○	○	○
Die professionellen Pflegekräfte/ medizinischen Fachkräfte meines Angehörigen	○	○	○	○	○

würden es gut finden, wenn ich bei der Pflege meines Angehörigen kontaktlose Überwachungstechnologie einsetzen würde					
(Wahrgenommene Benutzerfreundlichkeit) Die an das Überwachungssystem angeschlossene digitale Plattform (App) bedienen zu lernen wäre leicht für mich	○	○	○	○	○
(Begünstigende Bedingungen) Ich denke, dass ich das nötige Wissen und die Unterstützung habe/ bekomme um kontaktlose Überwachungstechnologie in der Pflege meines Angehörigen zu verwenden	○	○	○	○	○

Teil 5D: Verschiedene Formen von Überwachungstechnologie

Wir sind nun beim letzten Teil des Fragebogens angelangt.
Häusliche Überwachungstechnologie im Allgemeinen kann verschiedene Geräte/Sensoren einsetzen, um Informationen über die tägliche Situation einer pflegebedürftigen Person zu erfassen.Diese Geräte variieren je nach Art des Kontakts mit dem Körper (kontaktlos, indirekter Kontakt, direkter Kontakt). Uns interessiert, was Sie von diesen Geräten halten.

Bitte geben Sie für jedes der unten aufgeführten Überwachungsgeräte an, inwiefern Sie dessen Einsatz für die Pflege Ihres Angehörigen für akzeptabel halten.

	Völlig inakzeptabel	Inakzeptabel	Neutral	Akzeptabel	Sehr akzeptabel
Direkter Kontakt					
Tragbare Geräte (Technologie, die am oder in der Nähe des Körpers getragen wird, wie z.B. Smartwatches, Mobiltelefone, tragbare Alarmknöpfe)					
Indirekter Kontakt					
Objekt-gebundene Technologie: Sensoren, die an Gegenständen des täglichen Gebrauchs angebracht sind (z.B. Bewegungssensoren an Türen, am Kühlschrank oder an der Bettmatratze)					
Kontaktlos					
Visuelle Geräte (z.B. Kameras, die anonymisierte Bilder erzeugen, d.h. Bilder, auf denen Gesichter nicht erkennbar sind)					
Auf Ton basierende Geräte (z.B. Mikrofon, Smart Speaker)					
Radiofrequenz Geräte (z.B. Sensoren, die an einer zentralen Stelle im Haus angebracht werden und Bewegungsdaten per Radar erfassen)					

(**Bildung**)
Zum Schluss noch eine letzte Frage zu Ihrer Person:

Was ist der höchste schulische Abschluss, den Sie erworben haben?

a. Grundschulabschluss oder kein Abschluss
b. Haupt-/Realschulabschluss
c. Abitur
d. Berufsschulabschluss
e. Bachelor-/ Masterabschluss oder Diplom
f. Doktorgrad
g. Keine der genannten Optionen trifft zu

Ende der Umfrage
Vielen Dank für Ihre Teilnahme! Sie haben jetzt die Möglichkeit, einen Preis zu gewinnen!

Wir danken Ihnen für Ihre Hilfe und Entscheidung, an unserer Studie teilzunehmen. Kennen Sie Freunde, Familienmitglieder oder Bekannte, die pflegende Angehörige sind und an dieser Studie teilnehmen könnten? Dann wären wir Ihnen sehr dankbar, wenn Sie diese Umfrage weiterleiten würden.

Als Dankeschön für Ihre Teilnahme haben Sie die Möglichkeit, einen 10-Euro Mydays-Gutschein (falls Sie in Deutschland leben) oder einen Cadeaubon-Gutschein (falls Sie den Niederlanden leben) zu gewinnen. Insgesamt werden 4 Gewinner nach dem Zufallsprinzip verlost. Wenn Sie an der Verlosung teilnehmen möchten, können Sie uns hier Ihre E-Mail-Adresse hinterlassen. (Die Daten werden ausschließlich zum Zweck der Kontaktaufnahme verwendet und getrennt von Ihren Antworten verarbeitet.)

Appendix B

Dutch Survey

Information Sheet and Informed Consent (Dutch)

Acceptatie van innovatieve monitoring technologie in de zorg voor thuiswonende ouderen

Hartelijk dank voor uw bereidheid om deel te nemen aan dit onderzoek. Dit onderzoek wordt uitgevoerd door studenten Psychologie aan de Universiteit Twente als deel van hun Bachelor Scriptie.

Het doel van dit onderzoek is om meer inzicht te krijgen in factoren die een rol spelen bij de acceptatie van technologie voor het monitoren van thuiswonende ouderen. We zijn in dit onderzoek in het bijzonder geïnteresseerd in de mening van mantelzorgers van ouderen met dementie. Mantelzorgers zijn informele verzorgers die op vrijwillige basis onbetaalde zorg/hulp verlenen aan een zorgbehoevende naaste. Voorbeelden van een mantelzorger zijn een echtgenoot, zoon/dochter, een ander familielid of vriend. Deelname aan deze vragenlijst zal ongeveer 20 minuten duren.

Uw antwoorden zullen volledig anoniem worden verwerkt waardoor de gegevens dus niet tot een persoon kunnen worden herleid. Uw gegevens zullen alleen worden gebruikt voor dit wetenschappelijk onderzoek.

Uw deelname in dit onderzoek is volledig vrijwillig, wat betekent dat u op elk gewenst moment kunt stoppen met het invullen van de vragenlijst. Indien u vragen heeft over dit onderzoek kunt u contact opnemen met Maarten Akgül (m.t.d.akguel@student.utwente.nl), een van de onderzoekers, of Dr. L.M.A. Braakman-Jansen (l.m.a.braakman-jansen@utwente.nl), de onderzoeksleider.

Om u te bedanken voor uw deelname bieden we u aan het einde van de vragenlijst de mogelijkheid aan om een prijs te winnen! U kunt namelijk een cadeaubon ter waarde van €10 winnen.

Verklaring van goedkeuring voor deelname
Ik bevestig dat ik 18 jaar of ouder ben en dat ik bovenstaande informatie gelezen en begrepen heb. Op basis van voorstaande keur ik vrijwillig goed om deel te nemen aan dit onderzoek.

- Ja
- Nee

Survey (Dutch)

Deel 1: Algemene vragen over de deelnemers

Fijn dat u mee wilt werken aan dit onderzoek. Wij willen graag beginnen met enkele vragen over uwzelf.

(**Leeftijd**)
Wat is uw leeftijd (in jaartallen)? _____

(**Geslacht**)
Wat is uw geslacht?

a. Man
b. Vrouw
c. Anders

(**Residentie**)
In welk land woont u?

a. In Nederland
b. In Duitsland
c. Anders

(**Mantelzoger**)
Bent u een mantelzorger?
(Een mantelzorger is iemand die vrijwillig (onbetaald) zorg/ hulp verleent aan een naaste. Voorbeelden van een mantelzorger zijn een echtgenoot, zoon/dochter, een ander familielid of vriend)

a. Ja
b. Nee

(**Reden voor zorg**)
Wat is de reden dat u mantelzorg verleent? (U kunt meerdere antwoorden kiezen)

a. Dementie of lichte cognitieve beperking / geheugen klachten
b. Ouderdom
c. Lichamelijke beperking(en)
d. Psychische stoornis
e. Anders

(**Relatie met de zorgbehoevende**)
Wat beschrijft het beste uw relatie met de persoon voor wie u zorgt?
Ik ben …..

a. Echtgenoot/partner
b. Dochter/Zoon
c. Schoondochter/Schoonzoon

d. Zuster/ broer
e. Kleindochter/Kleinzoon
f. Buurman/ Buurvrouw/ Vriend
g. Anders, namelijk:

(**Omvang van het zorgnetwerk**)
Zijn er meer mantelzorgers die een aandeel in de zorg voor uw naaste hebben?
a. Nee, ik ben de enige mantelzorger voor mijn zorgbehoevende naaste
b. Ja, een andere persoon
c. Ja, twee andere personen
d. Ja, drie andere personen
e. Ja, 4 of meer andere personen

(**Reistijd**)
Welke van de volgende opties beschrijft het beste hoelang het gemiddeld duurt om bij de woning van uw zorgbehoevende naaste te arriveren? (Ga hierbij uit van uw meest gebruikte manier van transport).
a. Ik woon in hetzelfde huis als de persoon voor wie ik zorg
b. Ik woon op 1 tot 5 minuten afstand
c. Ik woon op 6 tot 15 minuten afstand
d. Ik woon op 16 tot 30 minuten afstand
e. Ik woon op 31 minuten tot 1 uur afstand
f. Ik woon op meer dan 1 uur afstand

Deel 2: Algemene vragen over de zorgbehoevende
Nu volgen een aantal vragen over de naaste voor wie u zorgt.

(**Leeftijd**)
Wat is de leeftijd van de naaste voor wie u zorgt (in jaartallen)?

(**Type dementie**)
(Deze vraag wordt alleen weergegeven als bij de vraag "Reden voor zorg" optie A is gekozen)

Welk type dementie/cognitieve beperking is van toepassing op uw naaste?
a. Alzheimer
b. Lewy-Body dementie
c. Vasculaire dementie
d. Milde cognitieve stoornis
e. Ander type / Weet ik niet
f. Er is (nog) geen diagnose vastgesteld

(**Tijd sinds het begin van de symptomen**)
(Deze vraag wordt alleen weergegeven als bij de vraag "Reden voor zorg" optie A is gekozen)
Sinds wanneer vertoont uw zorgbehoevende naaste verschijnselen van dementie/ geheugenklachten (naar schatting)?

a. Minder dan 1 jaar
b. 1 tot 2 jaar
c. 2 tot 3 jaar
d. 3 tot 4 jaar
e. 4 tot 5 jaar
f. Meer dan 5 jaar

(**Huisvestingssituatie van de zorgbehoevende**)
Wat is de leefsituatie van uw zorgbehoevende naaste?

a. Alleenwonend
b. Samenwonend

Waar woont uw zorgbehoevende naaste?

a. In een eigen (huur)woning
b. Inwonend bij een familielid
c. In een aanleunwoning of aanleunappartement dat hoort bij een zorginstelling
d. In een verpleeg- of verzorgingshuis
e. Anders, namelijk:

(**Gebruik van professionele zorg**)
Van welke type professionele zorg/ service maakt uw zorgbehoevende naaste gebruik? (meerdere antwoorden mogelijk)

a. Thuiszorg door een (wijk)verpleegkundige of verzorgende
b. Casemanager dementie
c. Dagopvang/ dagbesteding/ tijdelijke opvang
d. Huishoudelijke hulp
e. Maaltijdservice
f. Geen van bovenstaande

Deel 3: Ervaren zorglast

In dit deel van de vragenlijst zijn we geïnteresseerd in de mogelijke zorglast die u ervaart vanwege het verlenen van mantelzorg aan uw zorgbehoevende naaste.

Hieronder vindt u een lijst met uitspraken die weergeven hoe mensen zich soms voelen als ze voor iemand anders zorgen.Duid voor elke uitspraak aan hoe vaak u zich zo voelt: nooit, zelden, soms, redelijk vaak of bijna altijd. Er zijn geen goede of foute antwoorden.

[4-item screening scale of Zarit Burden Interview (ZBI) (Bédard et al., 2001)]

Deel 4: Digitale vaardigheden, innovativiteit & ervaring met technologie

In dit deel van de vragenlijst zijn we geïnteresseerd in hoe goed u uw eigen digitale vaardigheden inschat, in hoeverre u open staat voor nieuwe technologie en tenslotte hoeveel ervaring u heeft met diverse technologieën.

(**Digitale vaardigheden**)
Geeft u alstublieft aan in hoeverre u het eens of oneens bent met de volgende uitspraken:

[„Ability to Actively Engage with Digital Services in the Healthcare Domain" subscale of the eHealth Literacy Questionnaire (eHLQ) (Kayser et al., 2018)]

(**Innovativiteit**)
Hoe innovatief bent u?
Geef aan in hoeverre u het eens of oneens bent met de volgende stellingen:

["Personal Innovativeness Towards Technology" (PIIT) scale (Agarwal & Prasad, 1998)]

(**Ervaring met technologie**)
Welke van de volgende technologieën heeft u gebruikt of gebruikt u momenteel? (Meerdere antwoorden zijn mogelijk).

a. Monitorende technologie voor het monitoren van dagelijkse activiteiten of veiligheid van uw zorgbehoevende naaste (bijvoorbeeld sensoren, Alarm knoppen, GPS trackers)
b. Digitale communicatietechnologie om contact te behouden met uw zorgbehoevende naaste (bijvoorbeeld videobellen, sms en whatsapp en andere messaging apps)
c. Technologie om het geheugen en/ of de dagstructuur van uw zorgbehoevende naaste te ondersteunen (bv. een digitaal dagkalender die herinnert aan dagelijkse activiteiten, of een slimme medicijndispenser die herinnert aan medicatie inname)
d. Digitale zorgplatformen om de coördinatie en afstemming van de zorg voor uw naaste te ondersteunen (bv. communicatieplatformen die de mantelzorger, professionele zorgverleners en zorgontvanger met elkaar verbinden)
e. Geen van bovenstaande

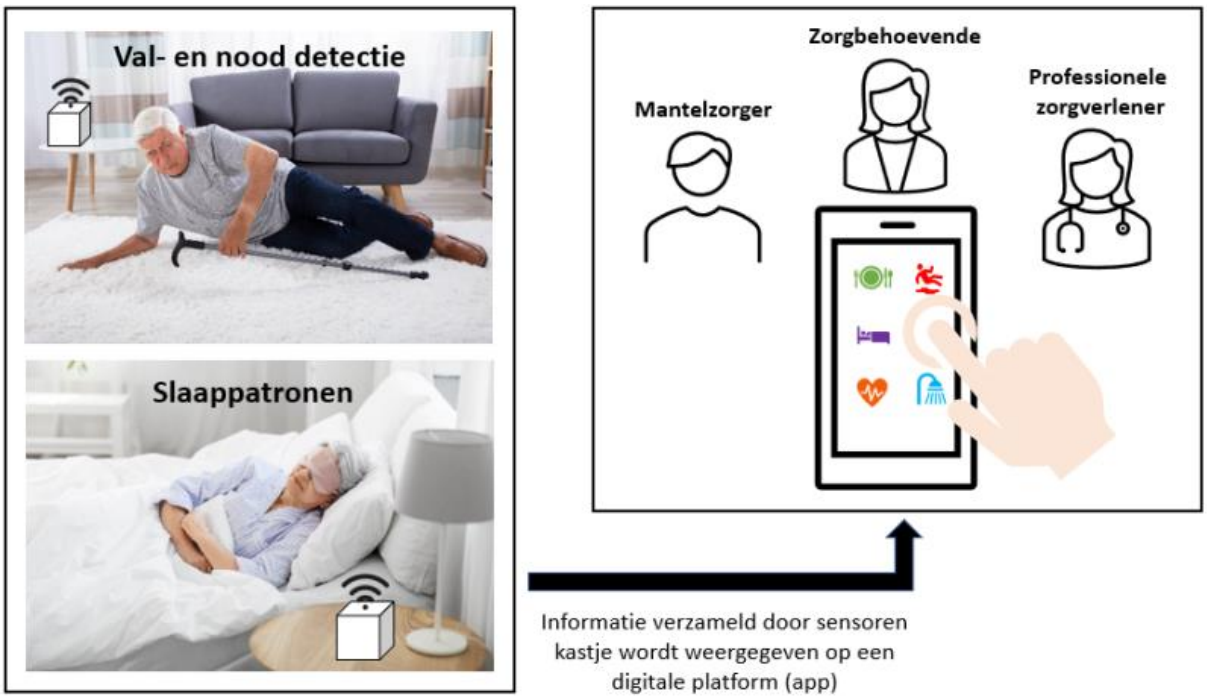
Deel 5: Contactloze monitoring technologie in de zorg voor een naaste

Bekijk a.u.b. de beschrijving en afbeelding hieronder voordat u verder gaat naar de volgende vragen.

Er worden steeds meer technologieën ontwikkeld die tot doel hebben mantelzorgers te ondersteunen en hun naasten in staat te stellen langer thuis te kunnen wonen. In dit deel van de vragenlijst richten we ons op een nieuwe vorm van ondersteunende technologie: Contactloze technologie voor het monitoren van uw zorgbehoevende naaste.
Contactloze monitoring technologie is een sensor systeem voor de thuisomgeving. Het is

bedoeld om de mantelzorger een beter inzicht te geven in de situatie van zijn/haar thuiswonende naaste, vooral wanneer de mantelzorger op afstand woont of het huis verlaat.

De technologie werkt contactloos, d.w.z. de naaste hoeft hierbij geen apparaten te dragen. Zoals u kunt zien in de onderstaande afbeelding kan er een klein kastje met ingebouwde sensoren in een hoek van de woning geplaatst worden. Dit slimme kastje kan met behulp van kunstmatige intelligentie het dagelijks leefpatroon van uw naaste leren herkennen en belangrijke veranderingen waarnemen, zoals minder drinken of eten of nachtelijke onrust. In geval van nood (zoals bv. een val) kan het systeem de mantelzorger alarmeren. De verzamelde informatie kan weergegeven worden op een digitaal platform dat toegankelijk is voor de mantelzorger en naaste. Indien gewenst kan de informatie ook gedeeld worden met betrokken zorgprofessionals.



(**Controle van de begrijpelijkheid**)
Hoe duidelijk vond u de beschrijving en afbeelding over contactloze monitoring technologie in de zorg voor een thuiswonende naaste?

a. Niet duidelijk
b. Een beetje duidelijk
c. Duidelijk

(**Suggesties voor verbetering**)
(Deze vraag wordt alleen getoond indien optie a of b is geselecteerd bij de vraag "Controleer de begrijpelijkheid")
Heeft u suggesties voor het verbeteren van de duidelijkheid van de beschrijving en afbeelding? _____

Deel 5A: Verschillende gebruiksscenario's

In dit deel van de vragenlijst zullen we u 5 verschillende scenario's presenteren. De scenario's beschrijven verschillende situaties waarin contactloze monitoring technologie toegepast kan worden en ieder scenario omvangt andere aspecten waarover het systeem zou kunnen informeren. Voor elk scenario willen wij u graag een aantal vragen stellen.

Scenario 1: Het detecteren van noodsituaties

Stelt u zich voor: Bij uw zorgbehoevende naaste thuis is contactloze monitoring technologie geïnstalleerd. Deze technologie zal voortdurend de veiligheid van uw naaste monitoren in het gehele huis. Het systeem kan bijvoorbeeld valincidenten of dwalen detecteren en u als mantelzorger (of een door u aangewezen persoon) direct informeren over deze noodsituatie.

Geeft u alstublieft aan in hoeverre u het eens of oneens bent met de volgende uitspraken over dit scenario:

Contactloze technologie voor het detecteren van noodsituaties van mijn naaste…	Helemaal mee oneens	Mee oneens	Neutraal	Mee eens	Helemaal mee eens
(Acceptatie)					
Zou ik acceptabel vinden					
Zou mijn zorgbehoevende naaste acceptabel vinden					
(Waargenomen bruikbaarheid)					
Zou behulpzaam zijn voor mij					
Zou mij ondersteunen in het verlenen of organiseren van de best mogelijke zorg					
Zou mij in staat stellen om me gerust te voelen over de situatie van mijn naaste					
Zou mij helpen om sneller te reageren op de zorgbehoeftes van mijn naaste					
Zou mij helpen om mijn naaste langer thuis te laten wonen					
Zou mij helpen om als mantelzorger langer vol te houden					
(Bereidheid om informatie te delen)					

Zou mij informatie geven die ik graag zou willen delen met de zorgprofessional(s) van mijn zorgbehoevende naaste					
(Intentie tot gebruik)					
Ik zou contactloze technologie voor het detecteren van noodsituaties van mijn naaste in de (nabije) toekomst willen gebruiken.					

Scenario 2: Het voorspellen van acute situaties

Stelt u zich voor: Bij uw zorgbehoevende naaste thuis is contactloze monitoring technologie geïnstalleerd. Deze heeft als doel om acute situaties niet alleen te detecteren maar te voorspellen. Zo kan de technologie bijv. voortdurend de loopsnelheid en looppatroon van uw naaste monitoren. Door middel van deze informatie kan het systeem het risico op vallen van uw naaste voorspellen en u (of een door u aangewezen persoon) inlichten over de situatie. Het doel hiervan is om noodsituaties zoals bijv. vallen te voorkomen.

Geeft u alstublieft aan in hoeverre u het eens of oneens bent met de volgende uitspraken over dit scenario:

Contactloze technologie voor het voorspellen van acute situaties van mijn naaste…	Helemaal mee oneens	Mee oneens	Neutraal	Mee eens	Helemaal mee eens
(Acceptatie)					
Zou ik acceptabel vinden					
Zou mijn zorgbehoevende naaste acceptabel vinden					
(Waargenomen bruikbaarheid)					
Zou behulpzaam zijn voor mij					
Zou mij ondersteunen in het verlenen of organiseren van de best mogelijke zorg					
Zou mij in staat stellen om me gerust te voelen over de situatie van mijn naaste					
Zou mij helpen om sneller te reageren op de zorgbehoeftes van mijn naaste					

Zou mij helpen om mijn naaste langer thuis te laten wonen					
Zou mij helpen om als mantelzorger langer vol te houden					
(Bereidheid om informatie te delen)					
Zou mij informatie geven die ik graag zou willen delen met de zorgprofessional(s) van mijn zorgbehoevende naaste					
(Intentie tot gebruik)					
Ik zou contactloze technologie voor het voorspellen van acute situaties van mijn naaste in de (nabije) toekomst willen gebruiken.					

Scenario 3: Het monitoren van zelfzorg

Stelt u zich voor: Bij uw zorgbehoevende naaste thuis is contactloze monitoring technologie geïnstalleerd. Deze technologie zal voortdurend de zelfzorg van uw zorgbehoevende naaste monitoren zoals eten, drinken en persoonlijke hygiëne (bijv. wassen, toiletteren, aankleden). Het monitoring systeem kan belangrijke afwijkingen in de zelfzorg detecteren en u (of een door u aangewezen persoon) hierover inlichten.

Geeft u alstublieft aan in hoeverre u het eens of oneens bent met de volgende uitspraken over dit scenario:

Contactloze technologie voor het monitoren van de zelfzorg van mijn naaste…	Helemaal mee oneens	Mee oneens	Neutraal	Mee eens	Helemaal mee eens
(Acceptatie)					
Zou ik acceptabel vinden					
Zou mijn zorgbehoevende naaste acceptabel vinden					
(Waargenomen bruikbaarheid)					
Zou behulpzaam zijn voor mij					
Zou mij ondersteunen in het verlenen of organiseren van de best mogelijke zorg					

Zou mij in staat stellen om me gerust te voelen over de situatie van mijn naaste					
Zou mij helpen om sneller te reageren op de zorgbehoeftes van mijn naaste					
Zou mij helpen om mijn naaste langer thuis te laten wonen					
Zou mij helpen om als mantelzorger langer vol te houden					
(Bereidheid om informatie te delen)					
Zou mij informatie geven die ik graag zou willen delen met de zorgprofessional(s) van mijn zorgbehoevende naaste					
(Intentie tot gebruik)					
Ik zou contactloze technologie voor het monitoren van de zelfzorg van mijn naaste in de (nabije) toekomst willen gebruiken.					

Scenario 4: Het monitoren van welzijn gedurende de nacht

Stelt u zich voor: Bij uw zorgbehoevende naaste thuis is contactloze monitoring technologie geïnstalleerd. Deze technologie zal voortdurend het welzijn van uw zorgbehoevende naaste monitoren gedurende de nacht. Het monitoring systeem kan afwijkingen van het gewoonlijke nachtelijke patroon (zoals nachtelijke onrust, slaapproblemen of een instabiel dag- en nachtritme) detecteren en u (of een door u aangewezen persoon) hierover inlichten.

Geeft u alstublieft aan in hoeverre u het eens of oneens bent met de volgende uitspraken over dit scenario:

Contactloze technologie voor het monitoren van het welzijn van mijn naaste gedurende de nacht…	Helemaal mee oneens	Mee oneens	Neutraal	Mee eens	Helemaal mee eens
(Acceptatie)					
Zou ik acceptabel vinden					

Zou mijn zorgbehoevende naaste acceptabel vinden					
(Waargenomen bruikbaarheid)					
Zou behulpzaam zijn voor mij					
Zou mij ondersteunen in het verlenen of organiseren van de best mogelijke zorg					
Zou mij in staat stellen om me gerust te voelen over de situatie van mijn naaste					
Zou mij helpen om sneller te reageren op de zorgbehoeftes van mijn naaste					
Zou mij helpen om mijn naaste langer thuis te laten wonen					
Zou mij helpen om als mantelzorger langer vol te houden					
(Bereidheid om informatie te delen)					
Zou mij informatie geven die ik graag zou willen delen met de zorgprofessional(s) van mijn zorgbehoevende naaste					
(Intentie tot gebruik)					
Ik zou contactloze technologie voor het monitoren van het welzijn van mijn naaste gedurende de nacht in de (nabije) toekomst willen gebruiken.					

Scenario 5: Het monitoren van geleidelijke gezondheidsveranderingen

Stelt u zich voor: Bij uw zorgbehoevende naaste thuis is contactloze monitoring technologie geïnstalleerd. Deze technologie zal over een langere termijn veranderingen die geleidelijk ontwikkelen in de gezondheid van uw zorgbehoevende naaste monitoren. Het monitoring systeem kan u (of een door u aangewezen persoon) bijvoorbveeld informeren over cognitieve of fysieke veranderingen van uw naaste in een bepaalde periode.

Geeft u alstublieft aan in hoeverre u het eens of oneens bent met de volgende uitspraken over dit scenario:

Contactloze technologie voor het monitoren van geleidelijke gezondheidsveranderingen van mijn naaste…	Helemaal mee oneens	Mee oneens	Neutraal	Mee eens	Helemaal mee eens
(Acceptatie)					
Zou ik acceptabel vinden					
Zou mijn zorgbehoevende naaste acceptabel vinden					
(Waargenomen bruikbaarheid)					
Zou behulpzaam zijn voor mij					
Zou mij ondersteunen in het verlenen of organiseren van de best mogelijke zorg					
Zou mij in staat stellen om me gerust te voelen over de situatie van mijn naaste					
Zou mij helpen om sneller te reageren op de zorgbehoeftes van mijn naaste					
Zou mij helpen om mijn naaste langer thuis te laten wonen					
Zou mij helpen om als mantelzorger langer vol te houden					
(Bereidheid om informatie te delen)					
Zou mij informatie geven die ik graag zou willen delen met de zorgprofessional(s) van mijn zorgbehoevende naaste					
(Intentie tot gebruik)					
Ik zou contactloze technologie voor het monitoren van geleidelijke gezondheidsveranderingen van mijn naaste in de (nabije) toekomst willen gebruiken.					

Deel 5B: Verwachte voordelen & nadelen

In het volgende willen wij u enkele vragen stellen over de algemene voor- en nadelen m.b.t. contactloze monitoring technologie in de zorg voor uw naaste.

(**Voordelen**)
Geeft u alstublieft aan in hoeverre u het eens of oneens bent met de volgende uitspraken.

Ik denk dat contactloze monitoring technologie mij kan helpen om…	Helemaal mee oneens	Mee oneens	Neutraal	Mee eens	Helemaal mee eens
Te controleren of mijn naaste voldoende voor zichzelf zorgt (bijv. Eten/drinken)					
Onnodige bezoekjes ter controle van de zelfzorg van mijn naaste te voorkomen					
Gerust te zijn over de veiligheid van mijn naaste					
Meer vrijheid en mobiliteit voor mijzelf te verkrijgen					
Factoren te identificeren en te verwijderen die de zelfstandigheid van mijn naaste mogelijk belemmeren					
Sneller te reageren op de zorgbehoeftes van mijn naaste om gezondheidsrisico's te voorkomen (bijv. ondervoeding, slaapproblemen, eenzaamheid)					
Anderen, inclusief professionele zorgverleners, een goed beeld van de situatie van mijn naaste te verstrekken					
Het optimale moment te achterhalen waarin mijn naaste de overstap kan maken naar een andere woonvorm					

(**Nadelen**)
Geeft u alstublieft aan in hoeverre u het eens of oneens bent met de volgende uitspraken.

Als ik contactloze monitoring technologie zou gebruiken, voel ik me…	Helemaal mee oneens	Mee oneens	Neutraal	Mee eens	Helemaal mee eens
Bezorgd om met te veel informatie beladen te worden					
Bezorgd dat de monitoring informatie mij nodeloos bezorgd zou maken					
Onzeker of ik wel of niet moet reageren op informatie uit het systeem					
Bezorgd dat de monitoring informatie gedeeld wordt met derde partijen zonder toestemming					
Bezorgd dat de voordelen niet opwegen tegen de schending van de privacy van mijn naaste					
Bezorgd dat de technologie wellicht het menselijk contact vervangt.					

Deel 5C: Algemene acceptatie van contactloze monitoring technologie

In het volgende zijn we geïnteresseerd in uw algemene acceptatie van contactloze monitoring technologie in de zorg voor een naaste. Houd hierbij rekening met alle informatie die u nu heeft over de functie en mogelijke inzet van deze technologie.

Geeft u alstublieft aan in hoeverre u het eens of oneens bent met de volgende stellingen:

	Helemaal mee oneens	Mee oneens	Neutraal	Mee eens	Helemaal mee eens
(Waargenomen bruikbaarheid) Ik denk dat contactloze monitoring technologie in de zorg voor mijn naaste behulpzaam is voor mij…					
… op dit moment in mijn leven.	○	○	○	○	○
… wanneer de cognitieve of fysieke gezondheid van mijn naaste verslechterd.	○	○	○	○	○
(Intentie tot gebruik) Ik zou contactloze monitoring technologie in de zorg voor mijn naaste willen gebruiken…					
… op dit moment in mijn leven.	○	○	○	○	○
… wanneer de cognitieve of fysieke gezondheid van mijn naaste verslechterd.	○	○	○	○	○
(Houding) Het is een goed idee om contactloze monitoring technologie te gebruiken in de zorg voor mijn naaste.	○	○	○	○	○
(Sociale invloed) Mijn familie en vrienden zouden het positief vinden wanneer ik contactloze monitoring technologie gebruik in de zorg voor mijn naaste.	○	○	○	○	○
De professionele zorgverleners van mijn naaste zouden het positief vinden wanneer ik contactloze monitoring technologie gebruik in de zorg voor mijn naaste.	○	○	○	○	○

(Waargenomen gebruiksgemak) Het zou voor mij gemakkelijk zijn om de aan het monitoring systeem gekoppelde informatieplatform (app) te leren bedienen.	○	○	○	○	○
(Faciliterende voorwaarden) Ik verwacht dat ik voldoende kennis en ondersteuning heb/ krijg om contactloze monitoring technologie in de zorg voor mijn naaste te gebruiken.	○	○	○	○	○

Deel 5D: Verschillende vormen van monitoring technologie

We zijn nu aangekomen in het laatste gedeelte van de vragenlijst. Monitoring technologie in het algemeen kan gebruik maken van verschillende apparaten/ sensoren om informatie in te winnen over de toestand van uw zorgbehoevende naaste. Deze variëren afhankelijk van het soort contact met het lichaam (contactloos, indirect contact, direct contact). We zijn benieuwd wat u van deze apparaten vindt.

Geeft u alstublieft voor elk van onderstaande apparaten/ sensoren aan in hoeverre u ze acceptabel vindt in de zorg voor uw thuiswonende naaste.

	Zeer onnacceptabel	Onnacceptabel	Neutraal	Acceptabel	Zeer acceptabel
Direct contact					
Draagbare apparaten (apparaten die dicht bij het lichaam gedragen worden; zoals smartwatches, mobiele telefoons, draagbare alarm knoppen)					
Indirect contact					

Object-gebonden apparaten (apparaten die vast zitten aan dagelijks gebruikte voorwerpen zoals bewegingssensoren aan deuren of de koelkast of druksensoren op bed matrassen)					
Contactloos					
Visuele apparaten (zoals camera's die geanonimiseerde beelden produceren, d.w.z. beelden waarop gezichten niet herkenbaar zijn)					
Apparaten gebaseerd op geluidsdetectie (zoals microfoons, smart speakers)					
Apparaten gebaseerd op radiofrequenties (zoals bv. een centraal geplaatste sensor die bewegingen binnen het huis kan detecteren via radar)					

(**Opleiding**)
Ten slotte nog een laatste vraag over uwzelf:

Wat is uw hoogst genoten educatie (diploma behaald)?

a. Basisonderwijs of lager
b. Voortgezet onderwijs: VMBO
c. Voortgezet onderwijs: HAVO, VWO
d. Middelbaar beroepsonderwijs (MBO)
e. Bachelor/ Master of gelijkwaardig diploma (HBO of Universiteit)
f. Doctoraal diploma
g. Anders

Einde van het onderzoek
Hartelijk dank voor uw deelname! U maakt nu kans om een prijs te winnen!

Wij danken u voor uw deelname en hulp bij ons onderzoek. Als u nog vrienden, familie of

kennissen kent die ook mantelzorger zijn, zouden wij het zeer waarderen als u deze vragenlijst met hun zou delen.

Voor meer informatie met betrekking tot dit onderzoek kunt u terecht bij Dr. Annemarie Braakman-Jansen (l.m.a.braakman-jansen@utwente.nl), de projectleider, of bij Maarten Akgül (m.t.d.akguel@student.utwente.nl), een van de onderzoekers.

Om u nogmaals te bedanken voor uw deelname en hulp, maakt u kans op een cadeaubon ter waarde van €10,-. In totaal zullen er d.m.v. een loting willekeurig 4 winnaars bekend worden gemaakt. Indien u wilt meedoen aan de loterij kunt u hieronder uw e-mailadres achterlaten:

Appendix C

Measures of a Normal Distribution.

	Shapiro-Wilk Test			Skewness		Kurtosis	
Variable	*Statistic*	*df*	*Sig.*	*Statistic*	*Std. Error*	*Statistic*	*Std. Error*
Age of Informal Caregiver	.912	87	.000				
Age of Care Recipient	.917	87	.000				
Commuting Time	.889	87	.000	.31	.26	-1	.51
Caregiver Burden	.980	87	.202				
Acceptance Scenario 1	.928	87	.000				
Acceptance Scenario 2	.965	87	.017				
Acceptance Scenario 3	.942	87	.001				
Acceptance Scenario 4	.922	87	.000				
Acceptance Scenario 5	.942	87	.001				
Overall Acceptance Score	.947	87	.001				

Note. N= 87.

Appendix D

One-way ANOVA with Caregiver Burden and Commuting Time.

	Sum of Squared	*df*	*Mean Square*	*F*	*Sig*
Between Groups	117.31	5	23.46	3.43	.007
Within Groups	554.4	81	6.84		

Note. N= 87

Appendix E

Model Summary Table of Curvilinear Regression Analysis between Caregiver Burden and Commuting Time.

R	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*
.39	.15	.13	2.6

Note. N= 87

Appendix F

ANOVA Table of Curvilinear Regression Analysis between Caregiver Burden and Commuting Time.

	Sum of Squared	*df*	*Mean Square*	*F*	*Sig*
Regression	102.4	2	51.2	7.558	.001
Residuals	569.01	84	6.78		

Note. N= 87

Appendix G

Post Hoc Wilcoxon Signed Rank Test for Use Scenarios.

Scenarios	*Z*	*P* *
Scenario 2 – Scenario 1	-3.30	.005
Scenario 3 – Scenario 1	-2.84	.025
Scenario 4 – Scenario 1	-1.92	.275
Scenario 5 – Scenario 1	-3.08	.010
Scenario 3 – Scenario 2	-.04	1.0
Scenario 4 – Scenario 2	-.88	1.0
Scenario 5 – Scenario 2	-.16	1.0
Scenario 4 – Scenario 3	-.59	1.0
Scenario 5 – Scenario 3	-.65	1.0
Scenario 5 – Scenario 4	-1.2	1.0

Note. N= 87. Based on negative ranks

**Adjustment for multiple comparisons: Bonferroni.*