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## Factors influencing the adoption of home telecare by elderly or chronically ill people: a national survey

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### ABSTRACT

**Aims and objectives.** The primary aim is to provide insight into client characteristics and characteristics of home telecare contacts, which may influence the adoption of home telecare. Secondary aim is to examine the applicability of four perceived attributes in Rogers' diffusion of innovations theory, which may influence the adoption: relative advantage, compatibility, complexity and observability.

**Background.** Western countries face strongly increasing healthcare demands. At the same time, a growing nursing shortage exists. The use of home telecare may be instrumental in improving independence and safety and can provide support to older and chronically ill people, but a precondition for its uptake is that clients consider it as a useful and helpful technological tool.

**Design.** A survey conducted among clients of seven home care organisations in the Netherlands connected to a home telecare system.

**Methods.** In 2007, a postal questionnaire was distributed to 468 older or chronically ill clients: 254 responded (54%). The data were analysed by regression techniques, employing a theoretical model.

**Results.** This study showed that clients' perceived attributes – relative advantage, compatibility, complexity and observability – have a significant effect on adoption of home telecare explaining 61% of the variance. The chance of adoption is higher when a client already receives long-term personal and/or nursing care, he/she lives alone and when there are fixed daily contacts via the home telecare system. The perception of possible benefits can still be enhanced.

**Conclusions.** The concept of perceived attributes, derived from Rogers' diffusion of innovation theory, has been useful to explain clients' adoption of home telecare.

**Relevance to clinical practice.** Home care organisations can best focus on clients already in care and people living alone, in offering home telecare.

Nurses, who aim to enhance the client's adoption of home telecare, have to take into account clients' perceived attributes of such new technology.

## BACKGROUND

As the population ages and the prevalence of long-term care conditions increases, there is a parallel rise in the number of older clients and the complexity of long-term care problems (Department of Health, UK 2005). At the same time, it is unlikely that in Western European countries, there will be enough nurses to adequately meet these care needs (Buchan 2001, Merrell & Doarn 2006). In long-term care, home telecare is considered a functional and affordable technology (Johnston 2000). Home telecare is a promising innovation that is increasingly used by homecare organisations to manage nursing shortages and rising costs. We defined home telecare in this study as '*an audio-visual connection between a home-dwelling client and remote healthcare professionals, using communication technologies*'. It involves face-to-face real-time contact, between the nurse of the front office and the client, via a display screen. The services offered by home telecare vary (e.g. nursing care, welfare services, advice, monitoring, social and emotional support), as do the type of communication technology and equipment used (see Box 1). It is also possible to engage in home telecare with a client's relative. Generally, stand-alone touch screens or standard television or computer screens are used to initiate the video communication. The home care organisation may invest in ICT equipment and cabling, as well as in the education of staff and instruction of clients.

Home telecare may be important for anticipating the preferences of healthcare users nowadays. Most chronically ill and older people want to remain independent for as long as possible (DeJonge et al. 2009). The use of home telecare may be instrumental in improving their independence and safety (e.g. Rumberger & Dansky 2006, Barlow et al. 2007, Bowles & Baugh 2007, Botsis et al. 2008). Home telecare can be tailored to meet clients' support needs.

Besides, it may give peace of mind to informal carers, knowing that their loved one can easily contact a home care nurse. Particularly, when monitoring functions are included, home telecare may also be an important tool for the self-management of chronic diseases (e.g. Tran et al. 2008).

### [Box 1]

About 10 years ago, home telecare was introduced within Dutch home care. Two main types of home telecare contacts in the Netherlands exist (Peeters et al. 2009):

1. Home telecare contacts initiated only by the client when he/she has a need for contact;
2. Home telecare contacts initiated by a staff member – often a nurse – at a fixed time each day (often called 'good-morning service') in combination with home telecare initiated by the client.

In addition, a distinction can be made in the specific services provided through the home telecare system. These can be subdivided as follows:

1. 'care packages' tailored to the needs of chronically ill people and with an emphasis on advice, instruction and health monitoring;
2. 'welfare packages' specifically tailored to the needs of relatively healthy older people, including security alarms, digital shopping services, educational and leisure activities (such as gaming) and social contacts (such as connecting older people with the same hobbies) and
3. a combination of 'care packages' and 'welfare packages'.

Similarly to other European countries (Botsis & Hartvigsen 2008), the implementation of home telecare in the Netherlands is slower than was expected in advance. There is some empirical evidence on client's outcomes, for example, improved quality of care and safety (DeJonge et al. 2009, Peeters et al. 2009). The value of home telecare to clients is that they can voice questions or concerns as these arise, enabling them to receive nursing support immediately. Another study points out clients' preferences for a combination of home telecare and face-to-face visits, and the need to have real nurse home visits along with telemedicine visits (Jenkins & McSweeney 2001). Despite these positive effects on client outcomes and the expected financial benefits, numerous small-scale pilot projects have failed to move towards mainstream implementation (Rumberger & Dansky 2006). A number of studies have already been executed on factors influencing the implementation of technological innovations in general or home telecare in particular (Barlow et al. 2006, Broens et al. 2007). Studies concerning the adoption of the technology by users often focus on professionals as users (e.g. Venkatesh & Davis 2000, Horton 2008, De Veer & Francke 2010, De Veer et al. 2011). As far as we know, little research has been performed on how clients perceive home telecare (Levy et al. 2003) or on individual characteristics that might influence the adoption of home telecare (Hebert & Korabek 2004). Moreover, earlier studies on factors influencing the adoption of home telecare often lack a theoretical approach, which hampers interpretation of the findings. Concepts related to the well-known 'Diffusion of Innovations Theory' developed by Everett Rogers may apply in explaining the adoption – or lack of adoption – of technological innovations. Rogers' conceptual framework describes the innovation–decision process, which is the process by which an individual passes from first knowledge of an innovation to forming an attitude towards the innovation, to a decision to adopt or reject (Rogers 1962, 1995a,b, Rogers & Shoemaker 1971). The innovation–decision process can lead to either *adoption*, a decision to make full use of an innovation as the best course of action available, or *rejection*, a decision not to adopt the innovation: the individual assesses the concept of the innovation, weighs up the advantages and disadvantages of using it and decides whether to adopt or to reject the innovation.

In writing about individuals' attitudes towards adoption, Rogers (1995a) distinguished five intrinsic characteristics, so called '*perceived attributes*' of innovations, which influence an individual's decision to adopt or to reject an innovation: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability and (5) observability.

The first perceived attribute, *relative advantage*, is defined by Rogers (1995a) as the degree to which an innovation is perceived as better than the idea it supersedes. Rogers suggests that innovations that have a clear, unambiguous advantage over the previous approach will be more easily adopted and implemented. The degree of relative advantage is often expressed as economic profit, client satisfaction or other perceived benefits. If a potential user sees no relative advantage in using the innovation, it will not be adopted.

A second perceived attribute, *compatibility*, is defined as the degree to which an innovation fits with the existing values, past experiences and needs of potential adopters and can be assimilated into an individual's life.

A third perceived attribute concerns *complexity*, the degree to which an innovation is perceived as difficult to understand and use. If the innovation is easy to use, an individual will be more likely to adopt it.

The fourth perceived attribute, *trialability*, is defined as the degree to which an innovation may be experimented with on a limited basis as it is being adopted. Because innovations require the investment of time, energy and resources, innovations that can be tried out before being fully implemented would be more easily adopted.

Finally, *observability* concerns the extent to which the results of an innovation are visible to others. The easier it is for individuals to see the results, the benefits or the impact of an innovation, the more likely they are to adopt the innovation.

In accordance with Rogers' concept 'perceived attributes', we examined in this study four of the five perceived attributes in relation to the adoption of home telecare, namely the perceived relative advantage, compatibility, complexity and observability. The attribute 'trialability' was not investigated, because in the Dutch home care organisations involved home telecare was set up as a small-scale pilot. Clients were asked by the nurse of the home care organisations to try home telecare for a fixed period. Therefore, the trialability is in fact the same for all the home care organisations and clients involved in this study.

In addition, we explored which specific client background characteristics (for example age, living situation) and characteristics of the home telecare contacts are associated with the clients' adoption of the innovation – in this case home telecare. Figure 1 presents the research model, describing the factors that may influence the clients' adoption of home telecare.

#### [FIGURE 1]

The primary aim of this study is to gain insight into individual client characteristics and characteristics of the home telecare, which influence the adoption of home telecare by older or chronically ill clients of home care organisations in the Netherlands. The secondary aim is to examine the applicability of Rogers' concept of

‘perceived attributes’ in explaining the factors that might influence the decision to adopt home telecare.

In accordance with the research model (see Fig. 1), the following questions will be addressed:

1. How do clients perceive the (1) relative advantage, (2) compatibility, (3) complexity and (4) observability of the home telecare?
2. Are client background characteristics related to clients’ perceived attributes regarding home telecare?
3. Are characteristics of the home telecare contacts related to clients’ perceived attributes?
4. Which client background characteristics, characteristics of home telecare contacts and perceived attributes influence the adoption of home telecare?

## **METHODS**

### **Questionnaire**

We developed a questionnaire that addressed clients’ perceived attributes of home telecare. In addition, specific questions concerning the type of contacts through the telecare system were included in the questionnaire. The questionnaire is based to a large extent on a questionnaire used in previous research on home telecare (Bos et al. 2005).

Items that refer to perceived attributes of home telecare were prestructured and formulated as statements. Respondents were asked to indicate their level of agreement with these statements on a five-point scale: 1 = ‘disagree’, 2 = ‘actually disagree’, 3 = ‘do not know/not applicable’, 4 = ‘actually agree’, 5 = ‘agree’. So, the higher the score, the more positive the outcome. The scores of the items regarding ‘complexity’ are the reverse: a (maximum) score of ‘5’ on these items is positive (perceived as not complex), and a score of ‘1’ negative (perceived as complex).

Face validity and content validity of a draft questionnaire were discussed and established in the steering group in which stakeholders and scientists with relevant expertise of home telecare for the older people participated. Subsequently, the revised draft of the questionnaire was pretested for usability and clarity in a sample of five older and chronically ill persons who are living at home. The clients’ observations led to small refinements of some items. It took about 30 minutes on average to fill in the questionnaire, which was found to be acceptable.

Principal component analyses were performed to confirm sub-scales measuring (1) relative advantage, (2) compatibility, (3) complexity and (4) observability. Table 1 shows the items of the four constructs that refer to the clients’ perceived attributes of home telecare, that is, relative advantage, compatibility, complexity and observability. All principal component analyses yielded one component with an eigenvalue  $>1.0$ . In addition, a visual inspection of the scree plots showed one component. Therefore, we may conclude that the scales that refer to perceived

attributes are one-dimensional. Cronbach's alpha ( $\alpha$ ) provided an estimate of satisfactory internal consistency for all four perceived attributes (Table 1).

Adoption of home telecare was measured with three items: (1) 'Do you want to keep home telecare in the future?' referring to the decision to accept or to reject the innovation; (2) 'I believe home telecare is a magnificent invention' and (3) 'I really love to use home telecare', expressions of forming a favourable or unfavourable attitude towards the innovation (Table 1). The possible answers were also indicated on a five-point scale: 1 = 'disagree', 2 = 'actually disagree', 3 = 'do not know/not applicable', 4 = 'actually agree', 5 = 'agree'. Again, a principal component analysis confirmed the presence of one single component (explaining 66.8% of the total variance). Cronbach's  $\alpha$  was 0.74.

### **Participants**

In 2007, all 468 clients with a connection to a home telecare system in one of the seven Dutch home care organisations that delivered home telecare at that time received a postal questionnaire. A total of 254 clients responded to the questionnaire (response rate was 54%).

Table 2 shows the background characteristics of the clients who completed the questionnaire. Seven of ten were female (67.9%), the mean age was 77.8 years (with a range from 36 years up to 97 years), and 35.4% perceived their health as good, 52.7% as average and 11.9% of the clients perceived their own health as poor. About seventy per cent lived alone (70.9%) and 94.1% had one or more chronic disease(s), mostly arthritis of the hips or knees (52.4%), heart failure (36.5%) or diabetes (28.5%). Half of the clients (49.6%) were receiving long-term personal and/or nursing care financed by national health insurance (AWBZ in the Netherlands: people – often chronically ill – only receive care financed by this national health insurance, based on assessments by an independent needs assessment organisation, which determines how much and what kind of care they are entitled to receive).

#### **[TABLE 2]**

Most of the clients used the home telecare system only on their own initiative (72.4%; see Table 3). About half of the clients received welfare packages only (47.6%), a quarter (24.8%) received care packages only and 27.6% had a combination of care and welfare packages (see Box 1 in *Background* for an explanation of the content of the packages).

#### **[TABLE 3]**

### **Data analysis**

The analyses were performed using stata version 11.0 (StataCorp LP, College Station, TX, USA). We used descriptive statistics to describe the background characteristics, the characteristics of the home telecare, the clients' perceived attributes of home telecare and adoption. We used anovas to explore bivariate

relationships between the independent variables (client background characteristics, type of home telecare contacts) and the perceived attributes as well as the dependent variable 'adoption of home telecare'. A final analysis tested the theoretical model (Fig. 1). Three regression analyses were performed with adoption as dependent variable. In the first regression analysis, the relationship between perceived attributes and adoption was tested. The second regression analysis explored the relationship between client characteristics and type of home telecare contacts and adoption, only entering the characteristics with a statistically significant bivariate relation with adoption into the regression analysis. In the third regression analysis, all variables were entered (client characteristics, type of home telecare contacts, perceived attributes) as possibly explaining adoption. By combining the results of the analyses, we concluded whether an independent variable was directly related to adoption, indirectly related to adoption with a mediating role of the perceived attributes or not related to adoption. The hypothesised indirect relationships of client characteristics and type of home telecare contacts and adoption were confirmed by the analyses if the relationship found in the second regression analysis significantly weakens or disappears after adding perceived attributes. The criterion for statistical significance was  $p < 0.05$ .

## RESULTS

### Perceived attributes

To answer the first research question: 'How do clients perceive the home telecare's (1) relative advantage, (2) compatibility, (3) complexity and (4) observability?', we inspected the means of the four scales (Table 4).

#### [TABLE 4]

On average, the clients are positive about the complexity of the home telecare system. As said, complexity is defined as the degree to which an innovation is perceived as difficult to understand and use. Although older people are not generally familiar with technology, they are also on average well able to use the home telecare system and do not perceive the technique as complex: this can be deduced from the mean score on the 'complexity scale', namely 4.06 on a five-point scale ranging from 1–5. Compatibility (the degree to which an innovation fits with the existing values) also has a positive score (mean score, 3.89). The mean scores on relative advantage in the sense of the degree to which an innovation is perceived as better than the idea it supersedes, and observability in the sense of the degree to which the results of an innovation are visible to the adopters, are neither positive nor negative (mean scores, 2.95 and 3.18 on a scale from 1–5).

In summary, the results show that the available home telecare systems are generally experienced as easy to use. There is room for improving both the degree to which an innovation is perceived as better than the idea it supersedes and the visibility of the (positive) results.

## **Client background characteristics in relation to perceived attributes**

To obtain an answer to the question whether clients' characteristics are related to these perceived attributes, we examined the relationship between the client characteristics (Table 2) and the perceived attributes (Table 4; see research question 2). Table 5 displays only the client characteristics that have statistically significant bivariate relations ( $p < 0.05$ ) with at least one of the perceived attributes.

### **[TABLE 5]**

Table 5 shows that the clients' living situation appears to be related to the observability of the home telecare: clients who are living alone perceive the results of home telecare as more visible in comparison with clients who do not live alone. In the introduction, we already indicated that if there are observable outcomes from the implementation of the innovation, the innovation is more adoptable.

Clients who receive long-term care financed by the national health insurance are more positive about the relative advantage, compatibility, complexity and observability of the home telecare in comparison with clients who do not receive long-term care.

## **Type of home telecare contacts in relation to perceived attributes**

Further, we examined the relationship between the type of home telecare contacts and the four perceived attributes (see research question 3). Clients who have home telecare contacts at fixed times daily perceive more relative advantages of home telecare, perceive the technology as more compatible and less complex and perceive more observability, in comparison with clients who only have home telecare contacts on their own initiative (Table 5).

## **Test of the theoretical model**

Finally, we come to the research question: 'Which client background characteristics, characteristics of the home telecare contacts and perceived attributes influence the adoption of home telecare?' Table 4 shows that the scale 'adoption' has a mean score of 3.75 (on a five-point scale, ranging from 1–5), indicating that clients generally have a positive attitude towards home telecare and the adoption of home telecare. To test which individual and contextual characteristics influence the adoption of home telecare (see research question 4), three regression analyses were performed.

The first regression analysis concerned a model with only the perceived attributes explaining adoption. This analysis shows that the perceived attributes *relative advantage*, *complexity*, *compatibility* and *observability* explain 61% of the variance in adoption (Table 6).

**[TABLE 6]**

A second regression analysis in which only the client background characteristics (Table 2) and type of home telecare contacts were included to explain adoption showed that (1) clients who are living alone and/or (2) clients who receive long-term care financed by the national insurance and/or (3) clients who have telecare contacts at fixed times daily are more likely to adopt home telecare. The other individual characteristics from Table 2– gender, age, health and chronic disease – are not related to adoption. The analysis shows that client background characteristics, and characteristics of home telecare contacts (type of contacts) explain 20% of the variance in adoption.

In a final analysis, the four perceived attributes as well as the three background characteristics that were significantly related to adoption (see before) were included in one regression analysis (Table 6). The relationship between the perceived attributes and adoption remained significant. A comparison of the relative contribution of each attribute to adoption (i.e. beta's) showed that observability is most strongly related to adoption. The relationship between 'receiving long-term care' and adoption and the relationship between 'type of home telecare contact' and adoption were not significant any more. This indicates that the relationships between receiving long-term care and type of home telecare contacts on the one hand and adoption on the other hand were mediated by the perceived attributes of home telecare. In addition, the relationship between the clients' living situation ('living alone') and adoption became weaker but remained statistically significant, implying a direct effect of living situation on adoption. The indirect relationship between living situation and adoption was mediated by the perceived positive effects (observability) of home telecare (see Table 5). In the final regression analysis, the perceived attributes and the clients' living situation explained 62% of the variance in adoption of home telecare (Fig. 1).

Accordingly, this final analysis shows that all four perceived attributes (*relative advantage*, *compatibility*, *complexity* and *observability*) of home telecare are significantly associated with the clients' adoption of home telecare. In other words, clients who experience the home telecare system as less complex to use ('complexity'), clients who experience that home telecare easily fits in their daily life ('compatibility') and clients who experience positive effects of home telecare ('observability') are more likely to adopt home telecare. Clients are especially willing to adopt home telecare when they see its benefits. Clients who already receive long-term personal and/or nursing care and clients who have home telecare contacts on a regular basis (fixed times) more positively perceive the four attributes and, as a consequence, are more willing to adopt the home telecare system. Clients who live alone are also more likely to adopt home telecare, partly because they experience the benefits of home telecare and partly their adoption is irrespective of the perceived attributes.

## DISCUSSION

### Main findings

This study describes determinants of the adoption of home telecare and demonstrates that all the clients' perceived attributes (*relative advantage, compatibility, complexity* and *observability*) have a significant influence on adoption. 'Complexity' has the most positive score which means that, in general, clients do not perceive the home telecare system as difficult to use. The score on 'observability', that is the degree to which the benefits are visible to the clients, can still be enhanced.

Clients already receiving personal and/or nursing care and clients who agreed to have contact with the nursing staff member at a fixed time every day judged the four attributes more positively. As a result of that, they are more willing to adopt the home telecare system.

In addition, people who live alone are more likely to adopt home telecare because they experience the benefits of the system. However, a direct effect of living situation on adoption was also found. It is conceivable that this effect of 'living alone' on the adoption of home telecare is owing to a relatively high need for consultation and support, in comparison with people who are living with a partner or a relative.

Elaborating on the concepts of Rogers' diffusion of innovations theory (Rogers 1995a, Rogers 2003), this study shows that the adoption of home telecare is mainly influenced by clients' perceived attributes. Our findings are in accordance with previous literature (e.g. Fleuren et al. 2004, Greenhalgh et al. 2004, Scott et al. 2008) likewise indicating that clients' perceived attributes, such as relative advantage and observability, influence the adoption of an innovation. These findings are also in line with healthcare research by Scott et al. (2008), suggesting that the perceived advantages of an innovation are a *sine qua non* for innovation adoption. For future large-scale implementation of home telecare, it is important to take these influencing factors into account.

### Potential strengths and limitations

A main strength of our study is that we conducted survey-based research among all older people or chronically ill people who are connected to a home telecare system of all seven home care organisations in the Netherlands. These home care organisations offer different systems and facilities. Therefore, the generalisability of the results to other systems and home healthcare organisations is high. Another strength is that we elaborated on the factors that play a role in the adoption of home telecare at the level of the individual users by using concepts of a well-known theory on the diffusion of innovations.

The main limitation of our research is that we had to deal with data from a cross-sectional survey, whereas the decision to adopt an innovation is an active and dynamic process with interactions between the individual background characteristics and clients' perceived attributes of the innovation. As a result, cross-sectional studies

may not fully capture the complexity and timeline of the adoption process. Therefore, we recommend future longitudinal research to examine how perceived attributes and adoption processes evolve over time.

### **Practical implications**

This study provides information about the main determinants of the adoption of home telecare. For nurses dealing with home telecare, it is important to obtain more insight into clients' adoption of home telecare, which is essential for its success.

The following recommendations for nursing practice can be derived from this study. Firstly, the available Dutch home telecare systems are perceived by clients as easy to use. So, if clients are adequately instructed, no great barriers exist for clients to actually use the system.

Second, clients already receiving long-term care are more likely to perceive benefits from the home telecare system. Clients who do not need professional personal or nursing care yet are less likely to benefit from the system and, as a result, are less inclined to adopt it. Many home care organisations in the Netherlands, however, offer home telecare for rather healthy older people. Managers of home care organisations expect that these older people, once they need professional care, will more easily adopt the home telecare technology. The results of this study show that this is probably not an effective policy. An exception might be the group of older and chronically ill clients who live alone: they are more inclined to adopt the home telecare system in comparison with clients who are living with a partner or a relative.

Third, the results show that it is helpful to have home telecare contacts initiated by a staff member – often a nurse – at a fixed time each day (often called 'good-morning service') in combination with home telecare initiated by the client. Having fixed contacts may help older people who are frail to feel safe, thus supporting their independence. This probably also lowers the threshold for contacting the nurse via the home telecare system when it is absolutely necessary.

Finally, the degree to which the benefits are visible to the clients can still be enhanced. It is important to be aware of this for the successful implementation of home telecare. These findings indicate that health organisations should attempt to impress upon clients the positive effects of home telecare, in order to optimise usage of the system. For example, healthcare managers and nurses could demonstrate the benefits of home telecare (improved quality and safety of care) and could encourage older and chronically ill clients to use the home telecare system more often. It is also worthwhile to examine how the facilities and capabilities of the system might be expanded.

If implementation is to be successful, it is also important that nurses understand the possible beneficial effects of home telecare, for example, on the quality and safety of patient care, as perceived by clients (De Veer et al. 2011). Traditional nursing values in patient care are physical touch and the fact that nursing essentially relies on face-to-face contact and on practical tasks. But nurses also want to use technology to

improve healthcare. Previous research in the Netherlands shows that many nurses have been confronted with the introduction of new technologies such as home telecare systems in the last three years (De Veer et al. 2011). If nurses experience no advantages in the technology, or even perceive disadvantages, they are generally less motivated to actually use it. Perceived advantages may include improved quality of care, financial benefits, time saving or more job satisfaction. Nurses who work with home telecare experience the contacts via the home telecare system as valuable (Lorentz 2008, Peeters et al. 2009). This knowledge, as well as the willingness of nurses to increase their skills, constitutes a powerful ally in supporting clients' adoption of home telecare.

## CONCLUSIONS

Home telecare has tremendous potential to contribute to the management of nursing shortages in a cost-effective manner. To use the available technology, provision of access alone is not sufficient. To fully incorporate home telecare in the home care system, good communication skills among professionals are a prerequisite.

Home telecare is an increasingly widespread, innovative nursing care mode that has been applied in home care services in European countries and America. The concept of perceived attributes, derived from Rogers' well-known diffusion of innovations theory, has been useful in this study to explain clients' adoption of home telecare.

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## CONTRIBUTIONS

Study design: JP, AdeV, AF; data collection and analysis: JP, AdeV, LvdH and manuscript preparation: JP, AdeV, AF.

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## TABLES AND BOX

### Box 1: Types of home telecare in the Netherlands

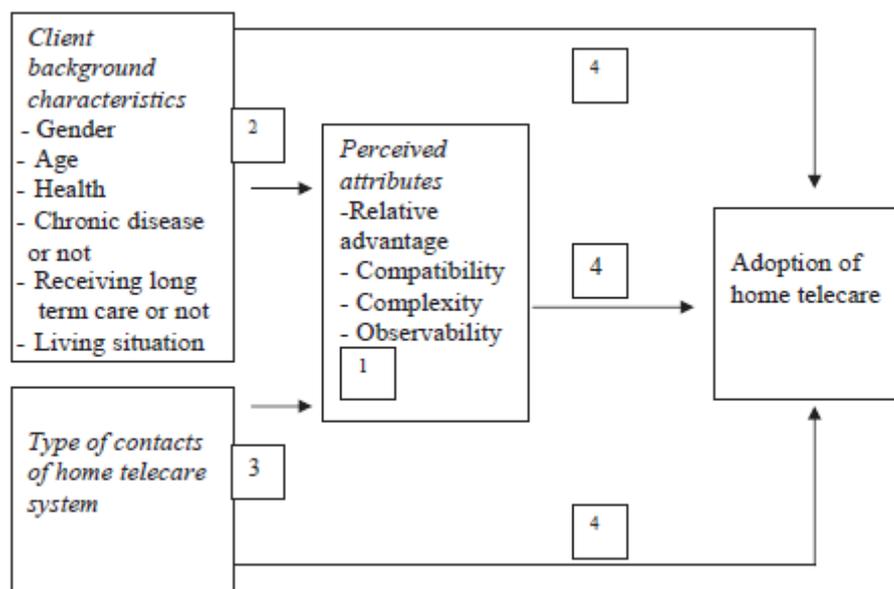
About 10 years ago, home telecare was introduced within Dutch home care. Two main types of home telecare contacts in the Netherlands exist (Peeters *et al.* 2009):

- 1 Home telecare contacts initiated only by the client when he/she has a need for contact;
- 2 Home telecare contacts initiated by a staff member – often a nurse – at a fixed time each day (often called ‘good-morning service’) in combination with home telecare initiated by the client.

In addition, a distinction can be made in the specific services provided through the home telecare system. These can be subdivided as follows:

- 1 ‘*care packages*’ tailored to the needs of chronically ill people and with an emphasis on advice, instruction and health monitoring;
- 2 ‘*welfare packages*’ specifically tailored to the needs of relatively healthy older people, including security alarms, digital shopping services, educational and leisure activities (such as gaming) and social contacts (such as connecting older people with the same hobbies) and
- 3 a combination of ‘*care packages*’ and ‘*welfare packages*’.

Figure 1 The influence of client characteristics, characteristics of the home telecare contacts and perceived attributes on the adoption of home telecare (the numbers refer to the research questions).



**Table 1** Scales of perceived attributes and adoption of home telecare ( $n = 254$ )

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*Perceived attributes*

Relative advantage Cronbach's  $\alpha = 0.78$  (four items)

Because of home telecare, I less often need other professionals (e.g. homecare nurse, doctor) to look after me

Because of home telecare, I less often need informal caregivers to look after me

The contact via the screen of the home telecare system has an added benefit in comparison with contact only by telephone

I am quicker to contact the home care organisation than I did without home telecare

Compatibility Cronbach's  $\alpha = 0.83$  (five items)

I am satisfied with the promptness of care when I contact the home telecare nurse

I can talk to the home telecare nurses as easily as to the home care nurse

I like to have eye contact with the nurse via home telecare

It's fine with me that the nurse of the home telecare can inspect my room

It's useful that I can show things to the home telecare nurses

Complexity Cronbach's  $\alpha = 0.84$  (four items)

It's easy for me to use the technology of the home telecare

I can easily make contact with the home telecare system

I can clearly see the home telecare nurses

I can clearly hear the home telecare nurses

Observability Cronbach's  $\alpha = 0.88$  (six items)

Because of home telecare, I can stay at home longer

By using home telecare, I feel safer

By using home telecare, my self-management is increased

By using home telecare, I receive more emotional support from the home care organisation

By using home telecare, I can do things more independently

My life is more pleasant, now I make use of home telecare

Adoption Cronbach's  $\alpha = 0.74$  (three items)

Do you want to keep home telecare in the future?

I believe home telecare is a magnificent invention

I really love to use home telecare

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**Table 2** Background characteristics of the participants (*n* = 254)

Client characteristics	%	<i>n</i> = 254
<b>Gender</b>		
Male	32.1	<i>n</i> = 81
Female	67.9	<i>n</i> = 171
<b>Age</b>		
Mean (range)	77.8 years (36–97)	<i>n</i> = 248
Younger than 65 years	10.5	<i>n</i> = 26
65–75 years	18.5	<i>n</i> = 46
75–85 years	47.2	<i>n</i> = 117
85 years or older	23.8	<i>n</i> = 59
<b>Living situation</b>		
Living alone	70.9	<i>n</i> = 178
Living with a partner, son or daughter	29.1	<i>n</i> = 73
<b>Health</b>		
Good health	35.4	<i>n</i> = 86
Average health	52.7	<i>n</i> = 128
Poor health	11.9	<i>n</i> = 29
<b>Chronic disease</b>		
One or more chronic disease(s)	94.1	<i>n</i> = 238
No chronic disease	5.9	<i>n</i> = 15
<b>Care received</b>		
Not yet receiving care (‘precare’ clients)	50.4	<i>n</i> = 128
Receiving care, financed by national health insurance covering long-term care	49.6	<i>n</i> = 126

**Table 3** Characteristics of the home telecare system ( $n = 254$ )

	%	$n = 254$
Type of contacts of the home telecare system		
Only on the clients' initiative	72.4	$n = 184$
Also contact at a fixed time daily ('good-morning service')	27.6	$n = 70$
Type of service provision		
Care packages	24.8	$n = 63$
Welfare packages	47.6	$n = 121$
Combination of care packages and welfare packages	27.6	$n = 70$

**Table 4** Means of constructed scales of perceived attributes and adoption ( $n = 254$ )

Constructed scale	Mean*	SE	Min	Max
Relative advantage	2.95	1.14	1	5
Compatibility	3.89	0.95	1	5
Complexity	4.06	1.15	1	5
Observability	3.18	1.16	1	5
Adoption	3.75	1.18	1	5

\*Scale: 1 = 'disagree' 2 = 'actually disagree', 3 = do not know/not applicable' 4 = 'actually agree' 5 = 'agree'.

**Table 5** Bivariate relationships between client background characteristics, characteristics of the home telecare system, perceived attributes and adoption ( $n = 254$ )

	Relative advantage	Compatibility	Complexity	Observability	Adoption
Client background characteristics					
Living situation (living alone or living with a partner, son or daughter)	$F = 3.50$ $p = 0.063$	$F = 1.74$ $p = 0.189$	$F = 0.73$ $p = 0.395$	$F = 9.70$ $p = 0.002^*$	$F = 11.93$ $p = 0.001^*$
Care received (receiving care, financed by national insurance of long-term care or not yet receiving care)	$F = 7.00$ $p = 0.009^*$	$F = 12.66$ $p = 0.001^*$	$F = 15.75$ $p = 0.000^*$	$F = 8.60$ $p = 0.004^*$	$F = 11.71$ $p = 0.001^*$
Type of contacts of the home telecare system					
Type of contact (on clients' initiative or also contact at a fixed time daily)	$F = 12.60$ $p = 0.001^*$	$F = 11.55$ $p = 0.001^*$	$F = 6.18$ $p = 0.014^*$	$F = 14.13$ $p = 0.000^*$	$F = 17.82$ $p = 0.000^*$

\*Relationships are statistically significant,  $p < 0.05$ .

Table 6 Multiple relationships between perceived attributes, client characteristics and characteristics of the home telecare contacts influencing adoption of home telecare ( $n = 254$ )

	Coef.	p-value	$\beta$
<i>Regression analysis 1: Perceived attributes</i>			
Relative advantage	0.17	0.016*	0.17
Compatibility	0.25	0.001*	0.22
Complexity	0.19	0.001*	0.19
Observability	0.34	0.000*	0.35
<i>Regression analysis 2: Client characteristics and type of home telecare contacts</i>			
Gender			
Male (Ref.)			
Female	-0.003	0.987	-0.00
Age			
Younger than 65 years (Ref.)			
65-75 years	-0.23	0.420	-0.08
75-85 years	-0.03	0.891	-0.01
85 years or older	-0.07	0.803	-0.02
Living situation			
Living alone (Ref.)			
Living with partner, son or daughter	-0.38	0.046*	-0.15
Health			
Good health (Ref.)			
Average health	-0.31	0.078	-0.13
Poor health	-0.35	0.180	-0.10
Chronic disease			
One or more chronic disease(s) (Ref.)			
No chronic disease	-0.08	0.830	-0.15
Care received			
Not yet receiving care ('precare' clients) (Ref.)			
Receiving care, financed by national health insurance covering long-term care	0.66	0.000*	0.28
Type of contacts of the home telecare system			
Only on the clients' initiative (Ref.)			
Also contact at a fixed moment a day ('good-morning service')	0.75	0.000*	0.28
<i>Regression analysis 3: Perceived attributes, client characteristics and type of home telecare contacts</i>			
Relative advantage	0.18	0.011*	0.18
Compatibility	0.22	0.004*	0.19
Complexity	0.18	0.002*	0.18
Observability	0.31	0.000*	0.32
Living situation			
Living alone (Ref.)			
Living with a partner, son or daughter	-0.25	0.024*	-0.10
Care received			
Not yet receiving care (precare clients) (Ref.)			

Table 6 (Continued)

Receiving care, financed by national health insurance covering long-term care	0.08	0.407	0.04
Type of contacts of the home telecare system			
Only on the clients' initiative (Ref.)			
Also contact at a fixed time daily ('good-morning' service')	0.15	0.182	0.06

Regression analysis 1:  $R^2 = 0.61$ ,  $F_{4,194} = 75.62$ ,  $p = 0.000$ ; Regression analysis 2:  $R^2 = 0.20$ ,  $F_{10,193} = 4.69$ ,  $p = 0.000$ ; Regression analysis 3:  $R^2 = 0.62$ ,  $F_{7,189} = 44.63$ ,  $p = 0.000$ .

\*Relationships are statistically significant,  $p < 0.05$ .