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Résumé

L'efficacité du vidéotéléphone dans les soins infirmiers donnés aux personnes âgées confinées à domicile

Antonia Arnaert et Lucas Delesie

Le but de la présente étude était double : d'abord, concevoir un instrument de mesure du fonctionnement des personnes âgées confinées à domicile; ensuite, définir les caractéristiques des groupes chez qui les soins infirmiers par vidéotéléphone apportent des résultats notables. Le projet s'inscrit dans le cadre de l'évaluation d'un programme de télésoins établi en Belgique. On a analysé les données recueillies auprès des 71 patients inscrits au programme pour tenter de décrire la nature du rapport entre les soins et l'aide reçus et les résultats cliniques obtenus. Onze critères de mesure du changement ont été mis au point à l'aide d'algorithmes d'analyse multidimensionnelle et appliqués au schéma décisionnel. Ils ont permis d'identifier des groupes de patients ayant démontré une amélioration notable après avoir reçu des télésoins dans des sphères de fonctionnement bien définies. Les résultats de l'étude suggèrent que les télésoins constituent un modèle alternatif pouvant être intégré aux services de soins à domicile dans l'optique d'offrir aux personnes âgées des soins holistiques.

Mots clés : télésoins, vidéotéléphone, personnes âgées confinées à domicile, résultats cliniques

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Effectiveness of Video-Telephone Nursing Care for the Homebound Elderly

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This study had a dual purpose: to develop measures of change in functioning among the elderly, and to identify the characteristics of groups of homebound elderly whose functioning is significantly improved with video-telephone nursing care. As part of the evaluation of a home telecare program in Belgium, data from all 71 elders who received home telecare were examined in order to describe the nature of the relationship between the care/support received and health outcomes. The elders' functioning was measured using 8 assessment scales. Eleven measures of change in functioning were developed using multi-dimensional scaling algorithms. Use of these measures in the decision tree model made possible the identification of groups of homebound elderly who showed significant improvement following tele-nursing care in well-defined domains of functioning. The findings suggest that telecare is an alternative care model that could be integrated into existing home-care services to provide older people with integrated health services.

Keywords: tele-nursing care, video-telephone, homebound elderly, health outcomes

Introduction

As people age, accumulated and continuing changes and losses occur in their health, emotional, mental, social, and functional status (Schein, Gagnon, Chan, Morin, & Grondiness, 2005). Without appropriate care and support, the interactions of these multiple issues place older people at risk for adverse health outcomes, including mortality, falls, institution-alization, and hospitalization (Fried et al., 2001). Caring for the elderly with complex needs continues to be a challenge for health-care systems. In recent years community-based care has been promoted in health policies, as it offers the prospect of considerable cost savings as well as improved outcomes (Johri, Béland, & Bergman, 2003). The home is arguably the best site for the provision of community services, as most older people hope to continue living at home for as long as possible (Hellström & Hallberg, 2001). Health and social programs should be client-centred and respond holistically to the needs and preferences of care recipients (Chapman, Keating, & Eales, 2003; Fisher, 2005).

However, health services are still fragmented (Béland et al., 2006) and involve various health professionals, with little apparent coordination (Young et al., 2004). Some health-care reform initiatives in geriatrics, such as a single-entry-point system with case management, have been implemented successfully (Duke, 2005; Johri et al.). However, the challenge remains to develop complementary evidence-based models of integrated care that provide tailored care and result in improved health outcomes for the homebound elderly (Brown, 2003; Nies & Berman, 2004; Shaul, 2000).

Increasingly, multiple technologies are being used to deliver health care to patients in their homes (Marziali, Serafini, & McCleary, 2005). The availability of health care when it is needed is one of the key benefits of home telecare. This type of care has been defined as the use of information, communication, measurement, and monitoring technologies to evaluate health status and deliver care from a distance to patients in their homes (Celler, Lovell, & Chan, 1999). Home telecare trials for the elderly have shown that the delivery of interventions focused on monitoring, teaching, communication, support, and care results in improved health, autonomy, and quality of life (Bowles & Dansky, 2002; Chumbler, Mann, Wu, Schmid, & Kobb, 2004; Johnson et al., 2001; Savenstedt, Zingmark, & Sandman, 2003). The telecare delivery model makes it feasible, through the deployment of telecommunications networks, to target packages of care in response to assessed needs (Challis & Hughes, 2002). It promotes the delivery of targeted health and social services and enhances cost control, which is of interest to governments everywhere. According to Young (2003), the efficacy of community services is difficult to demonstrate due to a lack of targeting, which dilutes the effect of the interventions over a broad and diverse elderly population. Identifying groups of elderly at particular risk for certain outcomes is an important step in addressing their needs, expectations, and preferences (Diwan, Ivy, Merino, & Brower, 2001). Developing a better profile of the characteristics of the homebound elderly will be useful in formulating strategies that personalize treatment at the point of care and result in improved health outcomes. Although knowledge about the effects of home telecare on health outcomes for the elderly is increasing, and although the need for identification of the types of patients who could benefit from home telecare has been recognized (Shaul, 2000), the effects of tele-nursing on health outcomes for specific groups of homebound elderly have not yet been studied.

The present study had a dual purpose: to develop measures of change in functioning among the elderly, and to identify the characteristics of groups of homebound elderly whose functioning is significantly improved with video-telephone (VT) nursing care.

Methods

Design

As part of the evaluation of Telesenior, an established home telecare program in Belgium, data from all elders ($N = 71$) who received the home telecare intervention were examined in order to describe the nature of the relationship between the care and support received and health outcomes. The protocol was approved by the Telesenior Internal Review Board and the informed consent of the participants was obtained.

Home Telecare Program

Because of the existence of different terms, such as picture-phone, the concept of VT has been used to refer to an audiovisual technological tool for interactive, real-time interpersonal communication. Telesenior began to provide VT nursing services to the homebound elderly in 1992. The clients were 60 years of age or older, had a variety of chronic illnesses, had some degree of functional impairment, required assistance with activities of daily living (ADL), and lived in a geographical area with a well-developed two-way cable television network. The teleservice centre was equipped with a VT, a camera, a Public Switched Telephone Network (PSTN) alarm centre, and a line adapter unit connected to a maximum of three telephone lines. The unit allowed the nurse to switch voice connection among three simultaneous calls based on urgency. Audio and video signals were transmitted bi-directionally using a PSTN channel and an analogue broadcast television channel. Clients were supplied with an integrated home terminal, consisting of an alarm station, telephone, television, camera, and necklace transmitter in case of emergency. Telesenior cost some € 1.5 million over the period 1992 to 1996. During the project, the equipment and VT communication were free for all clients, while some clients received additional benefits, such as an updated television set and free telephone or television cable connection. Each client paid only 50% of all telephone and cable services beyond the limits of the VT project.

The tele-nurses delivered psychosocial support and educational interventions based on three principles: contact and communication, safety and protection, and care mediation (Arnaert & Delesie, 2005). The total number of VT calls during the project was 11,209, but, as one VT call could cover a number of VT interventions, the tele-nurses recorded 21,013 VT interventions, categorized as follows: contact, recreation, physical health, psychological health, social health, housing, finances, care services, social administration, leisure activities, and other care. The main

reasons for making a VT call were contact, physical health, and social support.

Characteristics of the Sample

The mean age of the 71 participants was 72 years (*SD* = 9.3). The sample was 39.4% male (28 participants) and 60.5% female (43 participants). The majority (70.4%) were widowed and lived alone. Of the participants, 51 (71.8%) had attended high school until the age of 14. In 24 cases (33.8%), informal care was provided by a "child not living at home," and 54 participants (76.0%) received formal care.

Procedure and Measures

On the first data-collection date, a trained nurse interviewed the participants in their homes about their use of support services provided by lay and professional caregivers. Sociodemographic data were also collected (age, gender, level of education, marital status, and family situation). Participant functioning was measured on three dates, at intervals of 6 months, using seven reliable assessment scales selected from the literature: Loneliness scale (12 items) (de Jong-Gierveld & Kamphuis, 1985), Geriatric Depression Scale SF-15 (GDS; 15 items) (Burke, Roccaforta, & Wengel, 1991), Lubben Social Network Scale (LSNS; 10 items) (Lubben, 1998), Activities of Daily Living (ADL; 6 items) (Katz & Apkom, 1976), Instrumental Activities of Daily Living (IADL; 8 items) (Lawton & Brody, 1969), Medical Outcome Study SF-36 (MOS SF-36; 36 items) (Ware, Snow, Kosinski, & Gandek, 1993), and Philadelphia Geriatric Center Morale Scale (PGCMS; 22 items) (Lawton, 1975). Mental status was measured using the Mini-Mental State Examination (MMSE; 11 items) (Folstein, Folstein, & McHugh, 1975) on the second date only. Data on the frequency of VT calls were gathered by the telenurses. Only calls actually involving VT care were retained; those concerning technical support or equipment training were excluded, as were accidental calls.

Analysis

The first step was to develop measures of change in functioning. As there was considerable overlap among the scales — for example, the concept of loneliness was measured twice in the PGCMS and in the Loneliness scale; and the MOS SF-36, the GDS, and the PGCMS all included items associated with the concept of depression — the original 120 items across all scales were aggregated into 24 measures of functioning using two multidimensional scaling (MDS) algorithms (Kruskal & Myron, 1978): SPSS®-PRINCALS and SAS®-PRINQUAL (Delesie, 2000). MDS encompasses a set of data analysis techniques that allow investiga-

tion of possible non-linear relationships between the items, between the elderly, and between the items and the elderly through geometrical representation of the relationships. Differences in ridit (Sermeus & Delesie, 1996) scores were used to measure *change in functioning* for the 24 measures. The concept of change in functioning differs from that of functioning, in the same way that acceleration differs from velocity and mood swing differs from mood; it requires more pinpointed, accurate, and sensitive measurement than concept measurement. Because no data were available to measure the change in mental state and only one common change measure for men and women could be retained from the original separate measures of physical IADL, 22 measures of change in functioning resulted. These 22 measures were aggregated using the MDS algorithms into *11 new measures of change in functioning* in the following domains: (1) general health functioning, (2) positive self-perception, (3) feelings of melancholy, (4) memory impairment, (5) levels of social activity, (6) emotional loneliness, (7) social loneliness, (8) ADL, (9) IADL, (10) family network, and (11) friends network. These 11 new measures were used in the analysis of benefits of VT care for specific groups of homebound elderly using the non-linear model of the decision tree algorithm (Takane, Oshima-Takane, & Shultz, 1994), which creates a hierarchical structure of classification rules (if…then…) resembling a tree. The input variables in the decision tree models pertained to support services, sociodemographic variables, and the 24 measures of functioning at the date of entry into the Telesenior program. The target variables in the decision tree models were the 11 new measures of change in functioning. The Goodman-Kruskal gamma coefficient of association (Goodman & Kruskal, 1979) for ordinal data was used to test the association between the 11 new measures and the frequency of VT calls for each group of clients identified in the decision trees.

Results

Measures of Change in Functioning

Table 1 shows, for each of the 11 measures of change in functioning, the key groups of homebound elderly for which VT care had a positive or negative impact. For each group, the significance of the association between the change and the frequency of VT calls is shown.

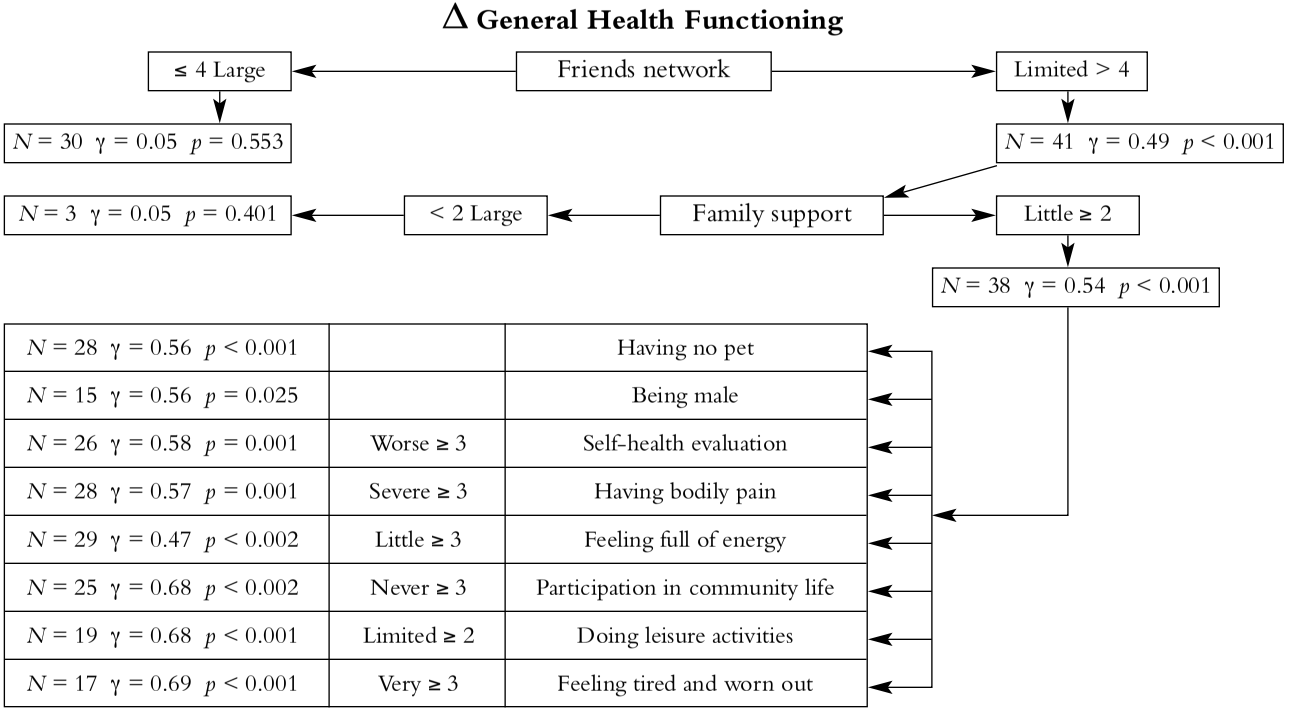
An example of the decision tree model for the measure *change in general health functioning* is outlined in Figure 1. For all relevant input variables, high scores correspond to poor functioning. For example, physical pain ≥ 3 means severe to very severe pain, and friends network ≥ 3 means limited network. The measure *friends network* generated the first binary split from the root node. One group included 30 participants

Table 1 *Groups of Elderly for Whom VT Care Had an Impact on Each of the 11 Measures of Change in Functioning*

Change Concepts	γ	*p*
1. *Change in general health functioning* Group of elderly with limited friends network	0.49 (n = 41)	0.001★
2. *Change in positive self-perception* Group of elderly age > 75 who called their family physician frequently, had a limited friends network, watched TV roughly 5 hours a day, and listened to the radio throughout the day	0.67 (n = 16)	0.001★
3. *Change in feelings of melancholy* Group of elderly age ≤ 70 who had a limited friends network, strong feelings of emotional loneliness, and little life energy	0.60 (n = 11)	0.03★
4. *Change in memory impairment* Group of elderly age ≥ 70 who called their family physician frequently, had severe physical limitations, had moderate housing comfort, and were dissatisfied with their lives	1.00 (n = 8)	0.04★
5. *Change in levels of social activity* Group of elderly age ≥ 70 who had severe physical limitations, had a limited friends network, did not participate in community life, and watched TV roughly 5 hours a day	0.59 (n = 11)	0.04★
6. *Change in emotional loneliness* Group of male elderly age ≤ 70 who had low levels of activity	0.56 (n = 8)	0.005★

Group of male elderly age ≤ 70 who had moderate physical limitations	0.79 (n = 11)	0.01★
Group of male elderly age ≤ 70 who had severe physical pain	0.58 (n = 16)	0.03★
7. Change in social loneliness		
Group of elderly age > 66 who frequently needed nursing care and home help and had strong feelings of emotional loneliness	0.60 (n = 11)	0.01★
Group of elderly age > 66 who frequently needed nursing care and home help and had limited social functioning	0.69 (n = 10)	0.01★
8. Change in friends network		
Group of elderly with extreme feelings of social and emotional loneliness and limited friends and family network	1.00 (n = 8)	0.04★
9. Change in activities of daily living (ADL)		
Group of elderly with severe physical limitations, little family support, and severe physical pain	-0.64 (n = 17)	0.04
10. Change in instrumental activities of daily living (IADL)		
Group of elderly with little housing comfort and little contact with children	-0.79 (n = 10)	< 0.00
11. Change in family network		
Group of elderly with extreme feelings of social loneliness, a limited friends network, and frequent need of nursing care and home help	-0.92 (n = 10)	< 0.00
★ p value less than 0.001.		

Figure 1 ***Decision Tree Analysis of One Measure, Showing Significant Associations between Change and Frequency of VT for All Groups and Subgroups***



who had a moderate to large network of friends. For these participants, the association between frequency of VT calls and *change in general health functioning* was small and not significant ($N = 30, \gamma = 0.05, p = 0.553$). Conversely, there was a positive significant association between frequency of VT calls and *change in general health functioning* for the group of 41 participants with a small network of friends ($N = 41, \gamma = 0.49, p < 0.001$). The second node, *family support,* split the group of 41 into two subgroups, one with considerable family support and one with little or no family support. A positive but non-significant association was found between frequency of VT calls and *change in general health functioning* for the group with considerable family support ($N = 3, \gamma = 0.05, p = 0.401$). A positive highly significant association was found between frequency of VT calls and *change in general health functioning* for the group with poor family support ($N = 38, \gamma = 0.54, p < 0.001$). On the third step, the decision tree split the 38 participants with poor family support into eight overlapping leaf nodes, with no hierarchical order: having no pet, being male, self-health evaluation, having bodily pain, feeling full of energy, participating in community life, participating in leisure activities, and feeling tired and worn out.

A group of 16 participants improved significantly on the measure *change in self-perception*. This group included those who were over 75 years of age, called their family physician weekly or more often, had a limited friends network, watched television roughly 5 hours a day, and listened to the radio throughout the day ($N = 16, \gamma = 0.67, p = 0.001$).

No significant association was found between frequency of VT calls and *change in feelings of melancholy* for the group of 32 participants who had low levels of life satisfaction and a limited friends network ($N = 32, \gamma = 0.09, p = 0.654$). However, one subgroup of 12 who were under 70 years of age with strong feelings of emotional loneliness ($N = 12, \gamma = 0.58, p = 0.047$) and a second subgroup of 11 with little life energy ($N = 11, \gamma = 0.60, p = 0.03$) showed significant improvement on the measure *change in feelings of melancholy.*

A group of eight participants aged 70 or over who called their family physician weekly or more often, had severe physical limitations, had moderate housing comfort, and were dissatisfied with their lives showed significant improvement on the measure *change in memory impairment* ($N = 8, \gamma = 1.00, p = 0.040$).

A positive significant association was found between frequency of VT calls and *change in levels of social activity* for a group of 11 who were 70 or over, had severe physical limitations, had a limited friends network, did not participate in community life, and watched television roughly 5 hours a day ($N = 11, \gamma = 0.59, p = 0.046$).

Men under 70 years of age who had low levels of social activity ($N = 8, \gamma = 0.56, p = 0.005$), moderate physical limitations ($N = 11, \gamma = 0.79, p = 0.014$), or severe physical pain ($N = 16, \gamma = 0.58, p = 0.03$) showed significant changes on the measure *change in emotional loneliness.*

For the measure *change in social loneliness* significant improvement was found for a subgroup who frequently needed nursing care and home help and had strong feelings of emotional loneliness ($N = 11, \gamma = 0.60, p = 0.014$) and for a subgroup who had limited social functioning ($N = 10, \gamma = 0.69, p = 0.017$).

Participants with extreme feelings of social and emotional loneliness and with a limited friends and family network showed positive significant improvement on the measure *change in friends network* ($N = 8, \gamma = 1.00, p = 0.046$).

Although significant, no positive associations were found between frequency of VT calls and the three measures *change in ADL, change in IADL,* and *change in family network.* A group of 17 participants with severe physical limitations, little family support, and severe physical pain showed a negative significant association with the measure *change in ADL* ($N = 17, \gamma = -0.64, p = 0.046$). A negative significant association with the measure *change in IADL* was found for the group of 10 with little housing comfort and little contact with their children ($N = 10, \gamma = -0.82, p = 0.023$) and for a subgroup of men with little housing comfort ($N = 10, \gamma = -0.79, p = 0.000$). The group of 10 who had family or relatives and had extreme feelings of social loneliness, limited friends network, and frequent need of nursing care and home help showed a negative significant association with the measure *change in family network* ($N = 10, \gamma = -0.92, p = 0.000$).

Discussion

Identification of vulnerable groups of patients is a necessary first step in targeting effective strategies for those who are at risk (Diwan et al., 2001; Nies & Berman, 2004). The results of this study demonstrate an association between tailored nursing care delivered via VT and improved health outcomes for specific groups of homebound elderly. They reveal that, for certain groups of older people, an improvement in one domain of functioning is likely to have a spillover effect in another. It has been shown that the concepts of loneliness and isolation in old age, influenced to some degree by one's level of social activity, can be a major cause of "subclinical" levels of unhappiness (McNeil, 1995) for which individuals are unlikely to seek or receive assistance and which may lead to increased depression and deteriorated health. The finding that tailored nursing care delivered via VT can reduce feelings of loneliness for the homebound

elderly is consistent with the results of previous studies (Mickus & Luz, 2002).

Moreover, in the present study those elderly who were older, were widowed, lived alone, had financial problems, and used several health and social services showed positive changes in feelings of social loneliness. The mechanism behind this improvement may be that the VT intervention provided them with a network of relationships in which they felt accepted, had common interests and concerns, and found help, advice, and support. These elders asked to be connected, through VT, with their children who lived far away and with other participants in the telecare program. In other telecare centres (Takano, Nakamura, & Akao, 1995), the multi-point VT network specifically caters to these expectations of its elderly participants. Characteristically, the participants in the present study spent time watching television and listening to the radio from early in the morning until late in the evening. They used their television as a focal point for their daily routines. The television served as a "window to the outside world" and may have been a substitute for primary interpersonal communication and relationships, offering companionship, information, and entertainment, and thus possibly increasing their life satisfaction (Grajczyk & Zollner, 1998).

The VT care may have had an indirect effect on the self-perception of the group of older elders. The results suggest that even leisure activities provided by the VT medium, such as playing games or just having a chat or sharing a joke with the tele-nurse, can improve levels of social activity and memory. An argument can be made that these leisure activities and the use of VT may be providing memory training for some older elderly. Also, Savenstedt et al. (2003) found that VT encounters can increase the attentiveness of elderly people with cognitive impairment and can help them become more focused on communicating.

The group of younger elders who had physical and mental general health problems, low levels of life satisfaction, and reduced levels of social activity showed decreased feelings of emotional loneliness following VT care. This group also showed a positive change in feelings of melancholy. Several studies have reported on the importance of isolation from friends or family or a decline in the social support network as precipitants of depressed feelings related to low levels of life satisfaction (Demura & Sato, 2003; Minardi & Blanchard, 2004). Having a good friend with whom to talk provides a sense of security and offers opportunities for companionship and intimacy that enhance life satisfaction in old age (Holmen & Furukawa, 2002; Lindgren, Svardsudd, & Tibblin, 1994).

The present findings reveal no positive improvements in ADL or IADL despite external help with housekeeping, such as laundry and food preparation, arranged by the tele-nurse. Nakamura, Takano, and Akao

(1999) matched two groups of 16 elderly patients on the basis of age, gender, and independence in ADL, and found significantly more improvement in ADL, communication, and social integration for the telecare group compared with the conventional home-nurse group. This difference may be explained by the fact that the samples were not comparable; the present study investigated the effect of tele-nursing care on groups of homebound elderly rather than the elderly in general. It may also be that the participants in the present study accepted the inevitability of their deteriorating ADL functioning, resulting in a positive change in self-perception rather than a positive change in ADL functioning.

Limitations

This study had several limitations. Frequency of VT calls was used as a measure of intensity of VT care among the participants. Future studies might measure the nature as well as the frequency of the VT calls in order to weigh the frequencies and better represent the level of VT care used. Another limitation is that the sociodemographic characteristics and support-service parameters were recorded only at the start of the Telesenior program, and mental state was measured only at the second data collection point. Also, the intensity of support services provided by lay and professional caregivers and VT care is prone to subtle changes over time, and these changes were not taken into account. Additionally there may have been sensitization of the VT user group. All of the prospective VT recipients were motivated and were encouraged to participate in the Telesenior program. Some participants really enjoyed using the VT. They had many visitors, such as the media, health policy-makers, and health professionals. Also, participation was free of charge and included additional benefits: an updated television set and free telephone and television cable connection. The extra attention may have contributed to changes in self-perception and loneliness, especially for elders with strong social needs.

The findings of this and other studies of VT interventions, and subsequent comparison of the findings with those from control groups, will provide a larger database from which to draw conclusions and on which to base health-care decisions.

Future Directions

The need for support and friendship to combat the effects of loneliness and isolation in old age is self-evident. Combating feelings of loneliness among elderly people will likely have a spillover effect in other domains of functioning related to their quality of life. The evidence indicates that the provision of care via VT for groups of homebound elderly can be

beneficial. In addition, telecare is an alternative care model that could be integrated into existing home-care services to provide older people with integrated health and social services. Additional descriptive and experimental studies need to be carried out in other localities, cultures, and health-care systems in order to identify those patients who could benefit from tele-nursing care.

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