Health Informatics Journal

Vol 10(2): 127–137 [1460-4582(200406)10:2;127–137; DOI: 10.1177/1460458204042237]
www.sagepublications.com

The role of information and communication technology in home services: telecare does not satisfy the needs of the elderly

Riitta Söderlund

Computer-based information and communication technology (ICT) is used in many service sectors. In home services, it has been considered whether it would be possible to support independent living of the elderly by using ICT; dependant on the needs of the elderly and whether those needs can be satisfied with ICT. In this study, the coping capabilities of 13 elderly clients of a Finnish home service office were assessed using the Finnish RaVa index. All the clients had severe disabilities and needed help, e.g. to wash and dress. To satisfy such needs, telecare and the telemonitoring of homes are not enough; physical production and human labour are essential in the continuing absence of service robots. Thus, the major focus in organizing home services in the best possible way should be on the use of human labour, not on investing in ICT.

Keywords

elderly, Finland, home services, information and communication technology (ICT), telecare

Introduction

Populations, on average, are ageing in almost every country in the world. This creates major challenges to the provision welfare services sufficient to meet the needs of the elderly. In Finland, about 15 per cent of the population were 65 years of age or older in 2000. Of the elderly, 56 per cent were 65–74 years of age, 34 per cent 75–84 years of age and 10 per cent 85 years of age or older [1]. It is estimated that the proportion of

Finns 65 years old and above will be about 17 per cent in 2010, 23 per cent in 2020 and 26 per cent in 2030 [2]; and of the elderly, 12–14 per cent will be 85 years of age or older [3].

Most elderly want to remain at home as long as possible [4], but in many cases this is not possible without help. In 1999, 87 per cent of Finns 75 years old and above lived at home, and the future objective is for 90 per cent to do so [5]. Help may be available from relatives, friends and/or neighbours (informal helpers) and from the public, private and/or third sector (formal helpers).

Traditionally relatives have had a key role in helping, and informal help is still important in Finland. It is estimated that about 70 per cent of help is from informal helpers. Most often the helper is the elderly spouse or a child [6]. Demand for formal home services is, however, increasing due to changes in society.

In home services as in other service sectors, information and communication technology (ICT) has been promoted to solve problems related to providing services and obtaining cost advantages. Some assume that ICT has the power to change care and cure as much as the automobile and the telephone have changed the ways people move from place to place and communicate with each other [7].

Doing things better than before is one of the two major ways in which an organization can achieve cost advantages [8]. In this respect, ICT may be an appropriate tool. ICT may improve information processing and/or change social relations with better communication and thus enable the substitution of human labour and/or increase productivity [9]. The other way to gain cost advantages is to do different things than before, e.g. to choose a different array of services, which is often achieved by a willingness to make tough trade-offs in choosing what not to do [8].

Because different types of work are needed in different sectors, the possibilities of benefiting from ICT vary significantly. If the major focus in production work is on information or knowledge production, benefit are more probable than if the focus is on physical production. Concerning coordinative work, distance and time differences can be reduced to zero by ICT, and thus, for example, the location of work can be re-examined. In management, ICT may have an effect on both direction and control (cf. [10]).

Concerning home services, the possibilities for benefiting from ICT may vary significantly according to local factors, but physical activities cannot be replaced by virtual activities in any location. In the UK, the National Health Service has estimated that replacing a significant proportion of home care visits by telephone calls would save annually up to £200m [11]. In Canada, it is said that care by phone services is like asking Grandma [12].

Thus there are considerable opinions. Considering work in home services in Finland, would it be possible to benefit from ICT? Would it be possible to satisfy the needs of elderly home service clients by supporting their coping capabilities through new technology? To examine this question, the coping capabilities of 13 elderly clients were assessed in a home service office in a middle-sized Finnish town, and it was evaluated whether it would be possible to do things better by using the new technology.

Deficiencies in coping capabilities

Diseases and injuries bring about impairment that may cause disability, when an individual cannot perform an activity in a manner or within the range considered normal for a

human being. Deficiencies in coping capabilities may induce handicap that depends on the social context of the individual [13] (see Figure 1).

Katz et al. [14] introduced the concept of activities of daily living (ADL), meaning transferring, bathing, dressing, feeding, going to the toilet and continence. Most individuals with severe disabilities have deficiencies in ADL. Minor and moderate disabilities mean better coping capabilities and are often related to limitations in instrumental activities of daily living (IADL). A strict definition for IADL does not exist, but for example Lawton and Brody [15] have included the use of telephone, shopping, cooking, domestic work, laundry, use of transport, medicine taking and taking care of bills in IADL (see Figure 1).

In most cases, individuals with minor deficiencies can handle everyday life by themselves, but it takes a long time. Many individuals with moderate deficiencies need different aids to get along, but severe disabilities prevent an individual from living independently without physical help.

As ageing and diseases are very complex matters due to their biological, psychical and social dimensions, two individuals with the same diagnosis may have very different coping capabilities. Over recent decades, the coping capabilities of the Finnish elderly have improved, and on average frailness begins after the 80th birthday [16]. The results from more recent studies assessing the elderly in Helsinki [17] and Jyväskylä [18] support this view. Contrary to this evidence, it is stated that the need for help will inevitably increase with longevity [19]. Findings from many other countries suggest that the prevalence of severe disability is falling in the age groups under 80, and more in men than in women, but if only moderate disability is taken into account, the question seems to remain unresolved [20].

Supporting coping capabilities with ICT

Physical capabilities are needed in most daily activities, and an individual with deficiencies in these capabilities needs help. Physical help is not possible through virtual intervention,

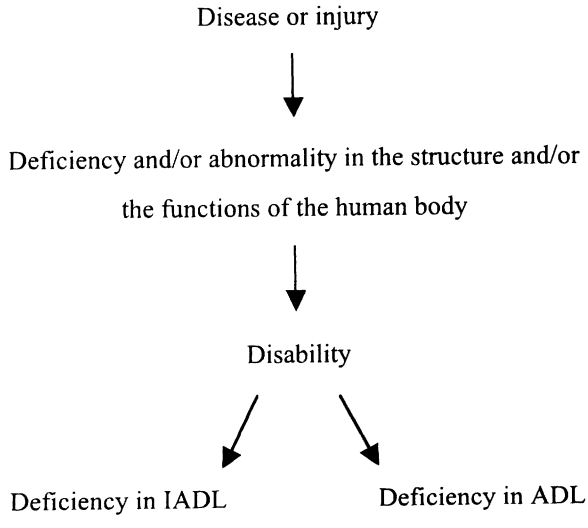

Figure 1 From disease to deficiencies in daily activities

and substituting human labour is not possible without service robots. A service robot is defined as a robot that operates fully or semi-autonomously in performing services useful to the wellbeing of humans [21]. In 2001, it was predicted that service robots will appear in the home by 2010 [22].

Robots are constructed from five modules, of which the core is the situation assessment and behaviour selection module. The core is interfaced with the other modules which continually report to the core, enabling it to assess the situation and coordinate elementary operations for proper robot behaviour [23] (see Figure 2).

Most service robots have only mechanics, sensor systems and software, and they cannot interact with their environment. To interact, a robot needs equipment for recognizing the cooperating partner and for controlling the cooperation, tools and a power source [24].

Structured environments, such as homes, are easy environments for a robot to work in because of the regularities; for example, floors are level and walls are straight. However, the difficulty of these environments lies in unpredictable changes, e.g. human beings move from place to place all the time [24]. Concerning work, a robot is more capable of doing elementary operations like drilling and welding than coordinating elementary operations like assembling a product [25].

Handy I and the Robotic Aid to Independent Living (RAIL) are examples of service robots to help with ADL [26, 27]. Handy I was developed to help a young boy with cerebral palsy to eat unaided. RAIL carried out different hygienic tasks with different trays, but for changing the tray, human labour was needed. Robotic devices have also been installed in wheelchairs to make navigation easier [e.g. 28, 29], and wheelchairs have been equipped with robotic grippers [e.g. 30].

Robots have been designed to help with IADL. Care-O-Bot could fetch things and guide individuals by offering multimedia communication [21]. Hamajima and Kakikura [31] have planned a robot to do household laundry work. Robots for cleaning and cutting grass are already on the market.

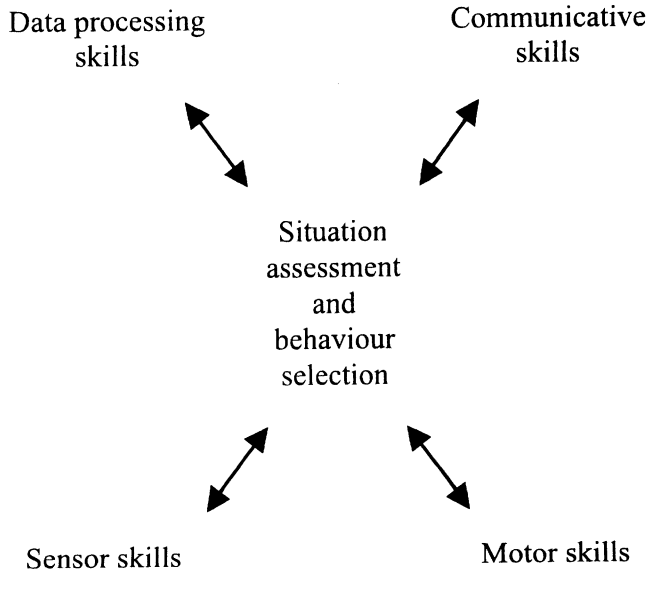

Figure 2 The five modules of a robot (adapted from [23])

For an individual with minor or moderate disabilities, ICT without motor skills may be enough. Reminders may have an effect on medicine taking [32, 33]. Many telecare systems have been developed for improving adherence to medical treatment in general. For example, there are systems for diabetes [34–36], hypertension [37, 38] and asthma [39–41]. For getting advice and guidance for self-care from a nurse, a video-telephone may be used [42].

Different kinds of systems, e.g. fall detectors, pressure mats and bed alerts, are used to remotely monitor individuals' wellbeing [43–46]. Embedded electronic sensors control body temperature, respiration and heartbeat, for example [43, 47, 48].

'Smart' home technology ranges from ordinary telephones to intelligent monitoring systems with sensors and interactive communication [11]. For example, the use of doors, windows, electric power and cookers can be monitored, and some systems monitor inhabitants' movements and can record times of events such as when a person enters the kitchen [49]. There are also integrated systems that can monitor both the house and its inhabitants by moving around the house [50].

For helping the elderly to shop, many models using e-commerce have been discussed [51]. Individuals with deficiencies in their ability to move may particularly benefit from e-shopping. However, it must be remembered that, unlike e-banking, most shopping also demands physical production, e.g. the delivery of goods. Thus an individual with severe disabilities in moving will require help to store the shopping.

Home services in Finland

In Finland, the public sector is most important in formal help, as the philosophy of the Finnish welfare state is founded on public services. The state has delegated the duty to organize the welfare services to the municipalities. The state regulates what services have to be organized, but a municipality can decide how it organizes the services. The options include providing the services themselves, cooperating with another municipality, or buying the services from another municipality or from a private service provider.

Owing to the scarcity of resources, municipal authorities have been obliged to limit the entitlement to public home services, and not all those needing services receive them. There are differences in entitlement criteria between municipalities, but the major criteria are based on health status and coping capabilities [52]. To enable a greater number of the elderly to get help, a municipality can also support the informal care of an aged individual by paying a fee to a relative or another person.

There are three types of home services: home care, home help and support services. Clients of home care are most often patients with diabetes, senile dementia and psychiatric disorders, or need post-operative or terminal care. Home help is for ADL and some IADL. Support services include delivering meals, cleaning, laundry, transporting of aids and night care. Some support services are offered very rarely, e.g. cleaning and transport [52].

In 2000, 11 per cent of the Finnish elderly used public home help, 7 per cent home care and 14 per cent support services. About 2 per cent got support for informal care. The use of the services was higher in the age group 85 and above than in the younger age groups [1].

Assessing coping capabilities of home service clients

In 2000, the use of public home services and the coping capabilities of clients were analysed in a middle-sized Finnish town, to assess the potential benefit of using ICT in providing home services. For the analysis, one of the nine social welfare districts of the town was chosen. In the district, there lived 610 individuals who were 65 years old and above. Of these, 51 per cent were 65–74, 36 per cent 75–84 and 12 per cent above 84.

Of these 610 elderly, 22 per cent (132) were regular clients of home help, 11 per cent were regular clients of home care and 5 per cent got temporary help with cleaning. About one-third of the regular home help clients also used home care services. Concerning support services, 10 per cent used laundry services and 6 per cent meal services. In addition, 9 per cent of the elderly had a safety phone for calling help in emergency situations, e.g. if they fell and could not pick themselves up. In six cases, support was given for informal care.

The officials who provided public home services in the district were asked to choose 13 typical clients of the 132 regular home help clients to represent the whole clientele. Of the 13 typical home help clients chosen, 11 also used home care services due to diabetes, ulcers or fistulas. All used support services and had different aids, e.g. 10 had a safety phone.

Seven individuals also got some help in daily living from relatives. All needed help with taking care of financial matters: one received this from his wife, 10 from other relatives and two from formal helpers. Most of the elderly lived alone; only two men lived with their aged wives. With the exception of two individuals, the elderly had continuous contact with their relatives.

The coping capabilities of the 13 elderly individuals were assessed using the Finnish RaVa index [53]. Two Finnish physicians – Rajala and Vaissi – have constructed the index, and it has been in use since 1989. Currently it is used in about half of the Finnish municipalities. The coping capabilities of an elderly individual are assessed by professionals based on the following 12 dimensions:

- vision
- hearing
- speech
- ability to move
- continence of bladder
- continence of bowels
- feeding
- medicine taking
- dressing
- washing
- memory
- behaviour.

For example, in assessing the ability to move the available options are normal, unstable, falls, independent with walking aids, independent with assistance, independent with

wheelchair, lifted to wheelchair and bedridden; and in medicine taking the options are taking independently, with assistance and under control.

The RaVa index is for assessing ADL and the basic functions of the body. Only one dimension is for IADL, medicine taking, and thus problems with other IADL like shopping cannot be assessed. It is, however, logical to presume that if individuals are not capable of handling ADL, they are not capable of independently handling most IADL either. A more suitable assessment tool should be developed, but the index is satisfactory if the individuals assessed have severe disabilities. In Table 1, the deficiencies in coping capabilities of the 13 elderly are presented using the dimensions of the RaVa index.

ICT does not satisfy the needs

Based on the figures, public home services were used relatively more in this district than in the country as a whole. The difference is in part explained by the fact that the population in the district was older than the population in the whole country, and the use of home services increases significantly with age.

All 13 clients chosen for the assessment had severe disabilities and almost all of them used both home help and home care services. Thus it is very probable that these clients had a greater number of disabilities and needed more help than a typical home service client. These clients were, however, typical enough for the purpose of considering whether it would be possible to benefit from ICT in providing home services.

To satisfy most of these clients' needs, physical production and human labour were essential. ICT could be used to assist the elderly in paying bills, but this was not a major task in the home help office as the relatives handled most of the financial matters of the elderly.

Concerning the benefits of different reminders for taking medicine, it is essential to understand why an individual is not compliant with medicine taking. If the problem is that

Table 1 Deficiencies in coping capabilities of the 13 elderly based on the dimensions of the RaVa index (at most three deficiencies presented)

Age group and sex	*Deficiency in*	*Deficiency in*	*Deficiency in*
Over 84-year-old woman	Ability to move	Medicine taking	
Over 84-year-old woman	Ability to move	Washing	
75–84-year-old woman	Ability to move	Washing	
Over 84-year-old woman	Feeding	Washing	Memory
75–84-year-old woman	Continence of bladder	Feeding	Dressing
Over 84-year-old man	Continence of bowels	Medicine taking	Washing
Over 84-year-old man	Continence of bladder	Medicine taking	Memory
Over 84-year-old woman	Continence of bowels	Dressing	Washing
75–84-year-old man	Continence of bowels	Feeding	Dressing
75–84-year-old woman	Ability to move	Dressing	Washing
Over 84-year-old man	Feeding	Dressing	Washing
Over 84-year-old man	Continence of bowels	Feeding	Dressing
Over 84-year-old woman	Continence of bowels	Dressing	Washing

an individual does not remember to take the drugs, a reminder might be the solution. A reminder is not enough if, for example, an individual with psychiatric disorders does not understand the importance of taking the drugs, and someone must ensure that the tablet is actually swallowed. In this case, the compliance problems were for both reasons and perhaps two clients could have benefited from a reminder. Using reminders is not reasonable if helpers visit the aged individual every day and the tablets can all be taken once a day at the same time.

Other telecare systems could not have created any value for these clients. Some of the elderly had wounds in their legs, but they could not have cleaned the wounds and changed the bandages by themselves. Nor would telemonitoring clients' health status have added value, and in general it is not rational to monitor anybody's health status all the time; even in hospitals, full-time monitoring is restricted to intensive care units. Of the 13 clients, 10 had safety phones, which had a positive effect on perceived safety. Monitoring houses might increase perceived safety, but this monitoring is not among the public home services regulated by the state.

The clients could not have used e-shopping. Helpers may use the new technology for shopping, but it must be remembered that if a client is not able to move and open the door, the keys must be given to the shopping delivery person, which may have a negative effect on perceived safety.

In conclusion, it is not possible to benefit from ICT in providing home help, given that there are no service robots capable of helping in daily activities. The major need for services results from the inability to manage ADL such as washing and dressing: to satisfy those needs, physical help is essential.

ICT is required in home services: but what kind of ICT?

If longer life is not associated with a longer period affected by severe disabilities; the quantity of home services demanded by one individual may not increase. If, however, the period with poor coping capabilities increases, there is a huge increase in demand for services: each individual will need more help, and the number of those needing help will increase. In every case, demand for home services will be high as the elderly want to remain at home as long as possible.

According to the most optimistic ideas, the elderly can live at home if they are connected to a health centre with a computer-based wristband. Based on the severity of the disabilities borne by the clients of Finnish public home services, these ideas have no basis in reality. The clients need physical help due to poor coping capabilities and this fact does not change, although changes in society undoubtedly induce modifications in providing help. In general, it can be said that requirements for information, knowledge, coordination and management increase in the work with formal helpers and this is the area in which ICT is of most benefit.

Formal help requires documenting and reporting, but computer-based systems may create over-enthusiasm in data gathering. For example, in Slovenia information systems increased time spent on computers so that some clients reported that the nurses paid more attention to the computers than to them [54]. What kind of data are really needed for providing home service transactions, managing service chains and directing the service system? Is it really necessary to send all data to a centralized database, or would it be

better to use different means to archive different data? Exception reporting [55], in which only deviations from the expected course of events are gathered, would probably be enough in most cases.

The location of providing home services cannot be changed. Bullen and Bennett [56] have stated that in geographically dispersed fast-paced environments, groupware technology can quite often enhance employees' abilities to carry out their tasks, but it is possible to create high-performing teams without additional technology. What kind of groupware technology is really needed for home services?

Careful evaluation should be made of how the division of work is best carried out. The fewer the workers, the less the need for coordination and tools for improving coordination. Outsourcing activities to many different stakeholders may increase the costs of coordination and management more than the savings achieved.

ICT is not enough to satisfy the needs of those with poor coping capabilities. Nevertheless, the use of ICT might create value to individuals with minor or moderate disabilities and thus benefit home services in other countries, or private service providers in Finland if their clients have better coping capabilities than those of Finnish public home services. Individuals with better coping capabilities might be capable of and willing to handle shopping and some care practices by themselves if supported by ICT. Computer-based wristbands including the ability to monitor health status might be valuable to some, e.g. individuals who recover from an operation but do not have any major disabilities. They could leave the hospital to go home if they can handle cooking and eating by themselves.

The writer may seem pessimistic as to the benefits of new technology in public home services in Finland, but that is not so. The aim is to emphasize that the benefits of ICT are not the same in all sectors, and thus every investment in ICT should be carefully analysed. Mimicking the ICT investments of other sectors is not the best way to obtain cost advantages in home services. To satisfy the needs of the elderly, physical help is the greatest requirement, and that cannot be enabled by ICT without motor skills.

References

1 National Research and Development Centre for Welfare and Health. *Sosiaali- ja terveydenhuollon taskutieto 2002* (*Welfare and Health in Paperback 2002*, only in Finnish). http://info.stakes.fi.

2 Statistics Finland. *Finland in Figures. Population.* 2002. http://www.stat.fi 2002 November.

3 US Bureau of the Census. *International Data Base. Midyear Population, by Age and Sex.* 2002. http://www.census.gov 2002 November.

4 Rissanen S. Omaishoito ja hoivayritykset vanhusten huolenpidon ratkaisuna? (Does informal care by the relatives and private nursing companies solve the problem of taking care of the elderly?, only in Finnish). Kuopion Yliopiston julkaisuja E. Väitöskirja. *Yhteiskuntatieteet* 1999; 73.

5 Ministry of Social Affairs and Health. Vanhuus- ja eläkepoliittisen neuvottelukunnan muistio (Memo of the Advisory Board of Old-Age and Pension Policy, only in Finnish). *Työryhmämuistioita* 2000; 3.

6 Vaarama M, Hakkarainen A, Laaksonen S. *Vanhusbarometri 1998* (*Barometer of Old Age*, only in Finnish). Sosiaali- ja terveysministeriö. *Selvityksiä* 1999: 3.

7 Scherger J E. Primary care in 2010. *Hippocrates* 2000; **14** (3); 27–32.

8 Porter M E. Strategy and the Internet. *Harvard Business Review* 2001; **79** (3); 62–78.

9 Orlikowski W, Iacono C. Research commentary: desperately seeking the 'IT' in IT research – a call to theorizing the IT artifact. *Information Systems Research* 2001; **12** (2); 121–34.

10 Morton M S. How information technologies can transform organizations. In Kling R ed. *Computerization and Controversy: Value Conflicts and Social Choices* 2nd edn. San Diego, CA: Academic, 1996.

11 Tang P, Venables T. 'Smart' homes and telecare for independent living. *Journal of Telemedicine and Telecare* 2000; **6** (1); 8–14.

12 Lightstone S. Health-care-by-phone services spreading across country. *CMAJ* 2002; **166** (1); 80.

13 Wood P. The language of disablement: a glossary relating to disease and its consequences. *International Rehabilitation Medicine* 1980; **2** (2); 86–92.

14 Katz S, Ford A B, Moskowitz R W, et al. Studies of illness in the aged. The index of ADL: a standardized measure of biological and psychosocial function. *JAMA* 1963; **185** (12); 914–19.

15 Lawton M P, Brody E M. Assessment of older people: self maintaining and instrumental activities of daily living. *Gerontologist* 1969; **9** (3); 179–86.

16 Ruikka I, Aalto T, Juva K, et al. *Turun vanhusten terveydentila 1983* (*Health Status of the Elderly of Turku in 1983*, only in Finnish). Kansaneläkelaitoksen julkaisuja ML 43. 1984.

17 Pitkälä K, Valvanne J, Kulp S, et al. Paraneeko vanhusväestön terveys? Helsinkiläisvanhusten toimintakyky ja avuntarve 1989 ja 1999 (Are the elderly becoming healthier? Coping capabilities and need for help among the elderly in Helsinki in 1989 and 1999, only in Finnish). *Suomen Lääkärilehti* 2000; **55** (27–29); 2753–7.

18 Leinonen R, Sakari-Rantala R, Heikkinen E. Terveydentila ja päivittäisistä toiminnoista selviytyminen 65–69-vuotiailla jyväskyläläisillä vuosina 1988–1996 (Health status and performance in the activities of daily living among 65–69-year-old residents of Jyväskylä in 1988 and 1996). In Heikkinen E, Lampinen P, Suutama T eds *Kohorttierot 65–69-vuotiaiden henkilöiden toimintakyvyssä, terveydessä ja harrastustoiminnoissa (Cohort Differences in the Functional Capacity, Health and Leisure Activities of 65–69-Year-Old Persons*, only in Finnish). Kela. Sosiaali- ja terveysturvan tutkimuksia 47. 1999.

19 Tilvis R. Parantuuko suomalaisten vanhusten toimintakyky (Are coping capabilities of the Finnish elderly improving?, only in Finnish). *Vanhustyö* 2000; (7); 4–6.

20 Jacobzone S. *Ageing and Care for Frail Elderly Persons: An Overview of International Perspectives.* Labour Market and Social Policy Occasional Papers no. 38. OECD Deelsa/elsa/wd(1999)1. 1999.

21 International Federation of Robotics. *Service Robots.* 2002. http://www.ifr.org 2002 February.

22 Cetron M J, Davies O. Trends now changing the world: technology, the workplace, management, and institutions. *The Futurist* 2001; **35** (2); 27–42.

23 Bischoff R. System reliability and safety concepts of the humanoid service robot Hermes. In *1st Workshop on Technical Challenge for Dependable Robots in Human Environments, 21–22 May 2001, Seoul.*

24 Finnish Association of Robotics. Palvelurobotiikka (Service robotics, only in Finnish). In Kuivanen R ed. *Robotiikka.* Helsinki: Talentum, 1999.

25 Technical Research Centre of Finland. *Robotiikan historia* (*History of Robotics*, only in Finnish). 2002. http://www.vtt.fi 2002 February.

26 Topping M, Bolmsjö G, Heck H. The development of RAIL (Robotic Aid to Independent Living). In *Proceedings of the 3rd TIDE Congress. Technology for Inclusive Design and Equality: Improving the Quality of Life for the European Citizen, 23–25 June 1998, Helsinki.*

27 Topping M, Smith J. *An Overview of Handy 1, a Rehabilitation Robot for the Severely Disabled.* 1999. http://www.jsrd.or.jp 2002 February.

28 Fioretti S, Leo T, Longhi S. A navigation system for increasing the autonomy and the security of powered wheelchairs. *IEEE Transactions on Rehabilitation Engineering* 2000; **8** (4); 490–8.

29 Levine S P, Bell D A, Jaros L A, et al. The NavChair assistive wheelchair navigation system. *IEEE Transactions on Rehabilitation Engineering* 1999; **7** (4); 443–51.

30 Driessen B J, Evers H G, van Woerden J A. MANUS: a wheelchair-mounted rehabilitation robot. *Journal of Engineering in Medicine* 2001; **215** (3); 285–90.

31 Hamajima K, Kakikura M. Planning strategy for task of unfolding clothes. *Robotics & Autonomous Systems* 2000; **32** (2/3); 145–52.

32 Fulmer T T, Feldman P H, Kim T S, et al. An intervention study to enhance medication compliance in community-dwelling elderly. *Journal of Gerontological Nursing* 1999; **25** (8); 6–14.

33 Shah N B, Der E, Ruggerio C, et al. Prevention of hospitalizations for heart failure with an interactive home monitoring program. *American Heart Journal* 1998; **135** (3); 373–8.

34 Gomez E J, del Pozo F, Hernando M E. Telemedicine for diabetes care: the DIABTel approach towards diabetes telecare. *Medical Informatics* 1996; **21** (4); 283–95.

35 Piette J D, Mah C A. The feasibility of automated voice messaging as an adjunct to diabetes outpatient care. *Diabetes Care* 1997; **20** (1); 15–21.

36 Söderlund R, Reijonen P, Brännback M. A web-based solution for enhancing diabetic well-being. In Eder L ed. *Managing Healthcare Information Systems with Web-Enabled Technologies.* Hershey, PA: Idea Group, 2000.
37 Friedman R H, Stollerman J, Rozenblyum L, et al. A telecommunications system to manage patients with chronic disease. *Medinfo* 1998; **9** (Part 2); 1330–4.
38 Zhang Y, Bai J, Zhou X, et al. First trial of home ECG and blood pressure telemonitoring system in Macau. *Telemedicine Journal* 1997; **3** (1); 67–72.
39 Bruderman I, Abboud S. Telespirometry: novel system for home monitoring of asthmatic patients. *Telemedicine Journal* 1997; **3** (2); 127–33.
40 Finkelstein J, Hripcsak G, Cabrera M R. Patients' acceptance of Internet-based home asthma telemonitoring. In *Proceedings of AMIA Symposia 1998* 336–40.
41 Finkelstein J, O'Connor G, Friedmann R H. Development and implementation of the home asthma telemonitoring (HAT) system to facilitate asthma self-care. *Medinfo* 2001; **10** (Part 1); 810–14.
42 Arnaert A, Delesie L. Telenursing for the elderly: the case for care via video-telephony. *Journal of Telemedicine and Telecare* 2001; **7** (6); 311–16.
43 Celler B G, Lovell N H, Chan D K. The potential impact of home telecare on clinical practice. *The Medical Journal of Australia* 1999; **171** (10); 518–21.
44 Miskelly F G. Assistive technology in elderly care. *Age and Ageing* 2001; **30** (6); 455–8.
45 Peeters P H F. Design criteria for an automatic safety-alarm system for elderly. *Technology and Health Care* 2000; **8** (2); 81–91.
46 Tamura T, Togawa T, Ogawa M, et al. Fully automated health monitoring at home. *Studies in Health Technology and Informatics* 1998; **48**; 280–4.
47 Eisenberg A. A 'smart' home, to avoid the nursing home. *The New York Times on the Web.* http://www.nytimes.com 2002 January.
48 Merkes M. Wired from head to toe: PC update online! http://www.melbpc.org.au 2002 January.
49 Chan M, Bocquet H, Campo E, et al. Remote monitoring system to measure indoors mobility and transfer of the elderly. In *Proceedings of the 3rd TIDE Congress. Technology for Inclusive Design and Equality: Improving the Quality of Life for the European Citizen, 23–25 June 1998, Helsinki.*
50 Irobot. Remote control. *Time Canada* 2000; **156** (13); 41.
51 Heikkilä J, Kallio J, Saarinen T, et al. EC of groceries for elderly and disabled: comparison of alternative service models. In *Proceedings of the 21st Information Systems Research Seminar in Scandinavia, 8–11 August 1998, Sæby.*
52 Ministry of Social Affairs and Health. *Hoitovakuutustyöryhmän muistio* (*Memo of the Working Group on Long-Term Care Insurance*, only in Finnish). Sosiaali- ja terveysministeriön työryhmämuistioita 2001; 7.
53 Association of Finnish Local and Regional Authorities. *RaVa® -järjestelmä* (*The RaVa® System*, only in Finnish). http://www.kuntaliitto.fi/rava 2002 December.
54 Bitenc I, Leskovar R, Rajkovič V, et al. Critical analysis of an information system for community nursing. In *Proceedings of the 8th European Conference on Information Systems, 3–5 July 2000, Vienna.*
55 Hurst K. The managerial and clinical implications of patient-focused care. *Journal of Management in Medicine* 1996; **10** (3); 59–75.
56 Bullen C V, Bennett J L. Groupware in practice: an interpretation of work experiences. In Kling R ed. *Computerization and Controversy: Value Conflicts and Social Choices* 2nd edn. San Diego, CA: Academic, 1996.

Correspondence to: Riitta Söderlund

Riitta Söderlund, Project Manager
Wellcom Health Office, P.O. Box 1,
20701 Turku, Finland
Tel: 358 2 2690 590
Fax: 358 2 2692 172
Email: riitta.soderlund@turku.fi