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Older People Using e-Health Services—Exploring Frequency of Use and Associations with Perceived Benefits for Spouse Caregivers

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Abstract: ICT, information- and communication technologies, and e-health services are essential for meeting future care demands. Greater knowledge regarding the implementation of e-health services in long-term care for older people is needed. The purpose of the study was to explore older people's use of e-health services and associations between frequency of use and perceived benefits. In the longitudinal comparative intervention study ($n = 65$), intervention group participants ($n = 42$) used an e-health service for 1.5 years. A control group ($n = 23$) used similar services provided in a traditional manner. Data was collected through questionnaires and analyzed using linear and logistic regressions. Although general use of the Internet was similar in both groups, the e-health group perceived significantly higher benefits. The component information- and education programs, developed specifically for the e-health service, had the highest association with benefits. Conclusion: e-health services targeted at supporting older people who care for a spouse at home can provide benefits which most likely will not be obtained without participation in an organized e-service. Care professionals play an essential role in encouraging spouse caregivers to become e-service users.

Keywords: e-health; spouse caregiver; caregiver support; independence; frequency of use; benefits

1. Introduction

In western countries, 70%–80% of care hours for older people living at home are provided by family caregivers [1,2]. Being a family caregiver is a great responsibility which often takes its toll on health [3]. Many old people live with a spouse who needs care and assistance in order to manage everyday life [4]. Caring for a spouse is often a task performed 24 h a day, seven days a week [2,5]. Whether an old person can continue their task of providing care largely depends on their own health and ability to manage a strenuous caregiving situation [6]. To encourage and maintain this highly valuable contribution for society, the provision of caregiver support is essential [1,2].

Information- and communication technologies (ICT) and e-health services are increasingly recognized as valuable means to support family caregivers [7–9]. Services enabled by ICT enhance the sustainability of long-term care and social support for older people, and sometimes offer services more effectively and efficiently than conventional services [10–12]. A key characteristic of e-health services targeted at supporting family caregivers is their ability to provide the help needed, when needed, adjusted to individual needs and regardless of geographic distance [8,10].

Throughout society, a diversity of e-services are provided to support spouse caregivers, including online support groups, online training, videophone, tele-alarms and monitoring systems [8,13].

The ultimate goal for e-health interventions is to attain a positive outcome for its users [14]. Research has concluded that older spouse caregivers who use e-services experience multiple benefits such as increased quality in daily life, increased caregiver competence and reduced feelings of isolation [10,15]. While several studies put forward benefits for older spouse caregivers from using ICT, there is a lack of studies investigating how much they actually use the services.

If taking on a critical view when studying benefits from e-services, a similar positive outcome may be the result of using the Internet in general, as equivalents to many of the features given credit for contributing to the positive outcome are available on the Internet for anyone to use. There may also be a risk that the mere attention achieved when participating in a project has a positive influence on the outcome. To investigate whether benefits were related to receiving e-health caregiver support services or may have originated from general use of the Internet, it is necessary to explore more deeply how older caregivers use e-health services: which components they use, how often, and if specific components may explain the benefits.

The primary aim of this study was to explore older spouse caregivers' use of an Internet-based caregiver support service with a focus on how frequently they used the various components included and to explore associations between the frequency of use and perceived benefits. A secondary aim was to compare experienced benefits between an intervention group receiving caregiver support as an e-service to a control group receiving traditional caregiver support.

2. Materials and Methods

2.1. Study Design

This study was part of a larger longitudinal, comparative intervention study. A full description of the original study design and previous clinical results have been previously reported [10,15,16]. This study refers to long-term follow up after 1.5 years. Data was collected from participants in both the intervention group (IG) and control group (CG) of the longitudinal study and has not been previously analyzed.

2.2. Setting and Intervention

The study was performed in northern Sweden. Caregiver support services in Sweden are provided by municipality operated care centers, specializing in providing support for family caregivers. Participants in the intervention group were provided with a computer and high speed Internet connection to receive a distance spanning e-health service for obtaining caregiver support in their own home. The service offered a combination of six multimedia components, including: (1) Web camera communication with peer caregivers, enabling face to face contact; (2) Web camera communication with professional care staff, enabling higher availability and meeting face to face while remaining in the own home; (3) Information- and education programs focusing on areas encountered in daily caring, including comprehensive education programs about medical conditions, coping strategies, relaxation, and physical- and cognitive training; (4) E-mail; (5) Games, both for individual use or to play online with a partner; (6) Internet access [17]. Care professionals at municipal caregiver support-centers trained and encouraged participants to use the e-health service. Participants in CG received traditional forms of support in accordance with standard provision in their municipality of residence, which mostly occurred at physical meetings at support centers. None of the CG caregivers received e-health support.

2.3. Participants

Inclusion criteria were to be 65 years or older, being primary caregiver for a cohabiting spouse and living in their own home in a rural area. Participants were consecutively recruited at caregiver support centers throughout north Sweden, covering 15 municipalities in three counties. After IG was filled participants were allocated to CG. At the present 1.5 years follow up, 65 individuals remained in

the study, 42 in IG and 23 in CG. Initially, there were 95 participants, 63 in IG and 32 in CG, which represents a dropout rate of 32% (*n* = 30) from the main study. Main causes for falling off were care recipient moving to a care facility, death of care recipient or caregiver becoming unable to care due to own illness.

2.4. Data Collection

Study-specific questionnaires were developed, based on experiences from previous research on internet-based support for spouse caregivers [9]. While taking into consideration the unique context of each group, questionnaires were structured to enable comparison between IG and CG. The questionnaires explored frequency of use and degree of perceived benefits. IG questions concerned frequency of use for the six different components in the e-health service. CG participants were asked if they had a computer/internet at home and if so; how often they used it and for what purpose. Both groups answered identical questions regarding the degree of perceived benefits. Further, there were open-ended questions and an inquiry about the ill spouse (patient) as user. Questionnaires were sent via regular mail and returned in preaddressed envelopes with prepaid postage. Demographic variables included age, gender and previous experiences of using computers.

2.5. Variables and Measures

IG participants were asked how often they used each of the six components: (i) web camera to communicate with peer caregivers; (ii) web camera to communicate with care professionals; (iii) information- and education programs; (iv) e-mail; (v) games; and (vi) internet. For these variables the following names were used: 'Webcam with peers', 'Webcam with support nurses', 'Info and education programs', 'E-mail', 'Games', and 'Internet use'. For each component response was marked on a four-grade ordinal scale from 'On a daily basis' to 'Less than once a month'. There was also a 'Don't know' alternative. For relevant interpretation, recoding was made into three categories: 'Daily or weekly' meaning at least once a week, 'Monthly' meaning less than weekly but at least once a month, and 'Less than monthly'.

Benefit-variables were measured by the degree to which participants rated the service they received as contributing to improve the domains of (i) personal development; (ii) emotions; and (iii) social participation. Each variable was defined as a five-grade Likert scale. Scores were defined as the mean of item responses for each of the three variables, using a number of items graded from 0 to 4. There was also a "not applicable to me" response alternative. The questionnaire included the following phrase, "Using the support service has given me the opportunity to..." followed by 14 items.

2.6. Analysis

Initially univariate frequency analysis was used. For each of the benefit dimensions, variable values were defined as the mean value of item responses, the range of possible values was 0.0 to 4.0. To describe how frequency of use of the different components associated with the three dimensions of benefits defined by items in the survey, multivariate linear regressions and binary logistic regression were performed. Data analysis was performed with the standard statistical package SPSS Statistics 21 [17].

In the linear regression models associations between frequency of use of the different components and experienced benefits were investigated. By entering the different usage variables simultaneously into the model, we were able to find measures of associations between each usage variable and the benefit variables under the control of other usage variables in the regression models. When analyzing the associations between variables with multiple linear regression, it was clear that two explanatory variables, Internet use and E-mail use had low associations with the benefit dimensions and also had the biggest variance inflation factors (VIF) showing multicollinearity in the regression equation. This may be harmful to correctness of statistics calculated and as they did not contribute positively to the model and because of collinearity among independent variables, Internet use and E-mail were

removed from the regression model. When these two variables were removed, the highest VIF was less than 1.6 which is a small value indicating there is no multicollinearity in the model. The final regression model thus contained the remaining four as independent variables with dependent variables Personal development, Emotions and Social participation, one at a time.

Statistics from the binary logistic regression analysis were calculated using the dichotomized versions of the three dependent variables which were used in the linear model. Names used for these variables were 'Personal development (D)', 'Emotions (D)' and 'Social participation (D)'. Variable values were 0 and 1 for the indicators. Cut off gave variables the value 0 if the corresponding benefit variable had a value less than 3 (0 = not useful at all, 1 = slightly useful, 2 = useful), otherwise the value was 1 (3 = very useful, 4 = extremely useful).

2.7. Ethical Considerations

Ethical approval was obtained from the Research Ethics Committee of the Medical Faculty at Umeå University, Sweden (Dnr 2010-187-31).

3. Results

The response rate was 93% for IG (n = 39) and 100% for CG (n = 23). In CG, nine of the 23 participants (41%) had a computer at home and used the Internet regularly, on a daily or weekly basis. None of the CG participants used the Internet for activities or services related to their role as a caregiver or found using the Internet to be beneficial for care-related purposes. Therefore, no further analysis was made of data from CG participants.

Seven IG participants said that the cared-for spouse (patient) also used the Internet. Some examples were provided in the open-ended section: "He can hardly do anything anymore, but we discovered that he could manage the key board and mouse so now he amuses himself with the computer" and "When I go out I can leave her by the computer, it keeps her busy. Before I did not dare to leave her, not knowing what she would get into".

The proportion of participants in IG who had no previous experiences using a computer was 38% (n = 15). More details and demographic characteristics are displayed in Table 1.

Table 1. Demographic data and participants´ previous experience of using a computer.

Variable	Intervention Group n = 39	Control Group n = 23
Age, mean (range)	75 (65–85)	74 (65–84)
Gender		
Women	27 (69%)	14 (61%)
Men	12 (31%)	9 (39%)
Previous experience of using computer		
Much experience	1 (3%)	1 (4%)
Some experience	23 (59%)	14 (61%)
No experience	15 (38%)	8 (35%)

3.1. Frequency of Use

The Internet was the most frequently used component; 30 out of 39 participants (77%) reported that they used it on a daily basis or at least once a week. The e-mail function was used with similar frequency of 69%. Of the specific support-service components, web camera communication with peers was used the most; 51% used this component on a daily basis or at least once a week. Information- and education programs and games were used on a daily basis or at least once a week by 48% and 42% of the respondents respectively. Web camera communication with care professionals was the least used component as 50% of participants used this component less than once a month (Figure 1).

Frequency of use

■ Daily or weekly　　■ Monthly　　■ Less than monthly
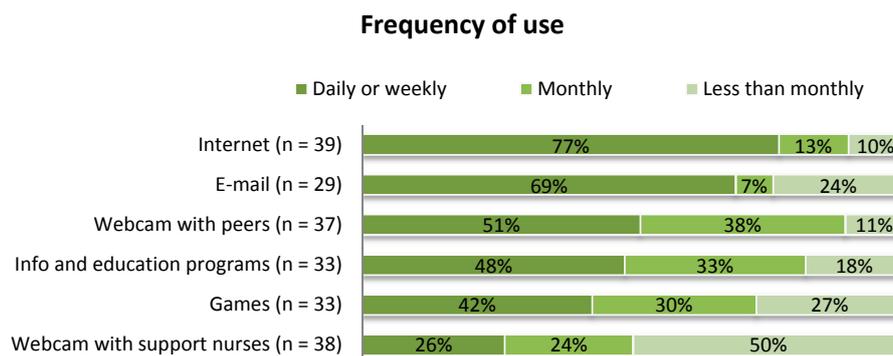
Figure 1. Frequencies of use for the six components included in the e-health service.

From the open-ended questions, a pattern was detected, where participants who were not frequent users (value "less than monthly" on four items or more) had enclosed comments concerning not having used the e-health service as much as expected. Typical comments were "I have been so exhausted from the burden of caring that I didn't have enough energy to put into the computer, all free time I need to sleep", "I did not get as much help as I needed to make using the computer a habit" and "I should have received this earlier, when he was not so sick". Participants who were frequent users highlighted the importance of having received help and coaching from care professionals in learning to use the e-service. When a problem occurred, the professionals helped by solving it. Frequent users described that the need for contact with care professionals had declined as participants found themselves more independent and able to fulfill their needs in other ways than through using the professionals. Examples of comments: "I rarely talk to the care professionals because I have found other ways that suit my needs better", "The professionals were always there to help in the beginning, which was important to get started, but I hardly need them anymore" and "It is better to get advice from someone in the same situation, I also use the experience I have from spouse caring to help others I meet on the Internet".

3.2. Benefits from the Components

Mean values for the three areas of benefits were: personal development 2.6; emotions 2.8 and social participation 2.6. The multiple linear regression with personal development as the dependent variable indicated that information- and education programs had a positive association with a mean effect of 0.55. Controlling for the other variables in the model, i.e., webcam with peer caregivers, webcam with care professionals, and games, the association was highly significant ($p = 0.002$). When emotions was the dependent variable, again information- and education programs was the only independent variable that was significantly associated; the linear effect size was 0.57 with a *p*-value 0.013. When explaining the variable social participation, the linear effect of information- and education programs was 0.79, also highly significant ($p = 0.000$) (Table 2).

Results were compared with the corresponding results from a binary logistic regression. Among these statistics we noted that for personal development (D) only information- and education programs (D) showed a significant association ($p = 0.025$) with an odds ratio (OR) = 10. For social participation (D) the corresponding association was significant ($p = 0.029$; OR = 14). The variable emotions (D) also showed the strongest association with the independent variable information- and education programs (D), but with a non-significant *p*-value ($p = 0,130$) and OR = 5; see Table 2 for details.

When comparing the two ways of analyzing the relationships, we noted that the results were highly similar as to which of the independent variables had the biggest statistical effect size and was most significant. However, since the procedure of dichotomizing variables reduces the amount of information in the data, we conclude that in this case, the use of linear regression can be justified and we will use its results in our discussion.

Table 2. Regressions of frequencies of use and benefits.

Benefit dimension Frequencies of use	Multiple Linear Regression				Binary Logistic Regression	
	Size of effect [1]	*p*-value [2]	Number in analysis	Explanatory power [3]	Odds ratio [4] (95% CI)	*p*-value [5]
Personal development			$n = 27$	$R^2 = 0.459$		
Webcam with peer caregivers	−0.05	0.799			5.7 (0.3; 122)	0.264
Webcam with care professionals	0.17	0.284			3.0 (0.2; 39)	0.403
Info and education programs	0.55	0.002			10.3 (1.3; 80)	0.025
Games	0.23	0.119			0.5 (0.3; 8)	0.620
Emotions			$n = 26$	$R^2 = 0.469$		
Webcam with peer caregivers	0.40	0.082			2.0 (0.1; 42)	0.642
Webcam with care professionals	0.12	0.535			3.5 (0.2; 69)	0.413
Info and education programs	0.57	0.013			5.1 (0.6; 41)	0.130
Games	0.24	0.169			5.1 (0.3; 99)	0.281
Social participation			$n = 26$	$R^2 = 0.599$		
Webcam with peer caregivers	0.29	0.089			0.9 (0.1; 15)	0.967
Webcam with care professionals	0.02	0.868			2.5 (0.1; 47)	0.533
Info and education programs	0.79	0.000			14.1 (1.3; 151)	0.029
Games	0.03	0.810			2.9 (0.2; 43)	0.438

[1] Mean change in the benefit dimension variable for one unit increase of frequency of use, controlling for other model variables; [2] *p*-value for testing size of effect $\neq 0$; [3] Proportion of explained variation in benefit variables; [4] Ratio of odds for more benefit given frequent use and odds for more benefit given infrequent use; [5] *p*-value for testing odds ratio $\neq 1$.

4. Discussion

This study aimed to explore how older spouse caregivers used an e-service for obtaining caregiver support, with a focus on the frequency of use and associations with perceived benefits. Most participants used the e-health service frequently, on a daily or weekly basis, and found it beneficial for them in their role as caregivers on all measured aspects, personal development, emotions and social participation. These findings confirm previous research showing the frequency of use to be associated with the clinical outcome of e-health interventions, which is why it is essential to organize e-services in a manner which promotes use of the service and to prevent attrition [14]. Surprisingly, web camera communication with care professionals was the least frequently used component. Open-ended questions revealed that participants had become independent and managed to fulfil their needs for caregiver support from other sources than professionals. Participants highlighted the importance of receiving help from professionals in learning to use the technology. Adequate help at the initial stages of using a new e-service is essential and can lead to empowerment for spouse caregivers [10,15,18].

We also wanted to explore if there were certain components of the multi-component e-health service which could explain the benefits perceived by participants. In this study the component "information- and education programs" had the strongest positive association with the different variables of perceived benefit, i.e., improvements in the domains of: personal development, emotions and social participation. The information- and education programs were developed specifically for the e-health service used in the intervention [9]. These findings support a notion that it was the e-health service which contributed to the perceived benefits, and not only access to the Internet and its freely available resources, even though general use of the Internet was the most frequently used component.

For basically all components available through the intervention there were equivalent free-of-charge services available on the Internet. One reason for including a control group in this study was to investigate if the highly positive outcome of previously published articles about e-health caregiver support may have other origins than the e-health service itself [10,15,16]. With the research in this article we wanted to inquire more deeply into usage patterns to find possible explanations. We also wanted to see if CG participants who used the Internet on their own experienced the same kind of benefits as IG. Surprisingly, none of CG participants who regularly used the Internet used it for purposes associated with benefits in their role as caregivers. This strengthens the conclusion

that participation in an organized e-health service can be a key factor for experiencing higher levels of benefits.

Several studies have highlighted the importance of providing adequate support when training older people to use ICT [8,19]. Participants have the option to easily discontinue usage and high attrition rates have been reported. Using a framework when implementing e-health services contributes to understanding why caregivers use or do not use e-health interventions and also helps bring forward factors which affect the clinical outcome [14,20]. In our study, care professionals took on the role as the important facilitator, influencing and motivating participants. At the same time, those who rarely used the e-health service mentioned a lack of support from health professionals in learning the technology as a cause for attrition. Influence from someone important to the individual is an essential factor when deciding whether or not to use a new technology [21]. When older people experience benefits from using technology, initial resistance is put aside [9,19].

The support service used in this study was intended to improve the situation for the spouse caregiver; however, the spouse caregiver and patient spouse are a unit, highly affecting each other. Seven of the 39 IG participants mentioned that the e-service had also been useful for the patient spouse.

Methodological Considerations

For the regression analysis, all questionnaires with missing data on one or more questions were excluded. Internal missing data reduced the number of cases in the regression analysis to 26 or 27. Analyzing the frequency of use variables, the number of useable answers ranged from 29 to 39 for the six components. We acknowledge that most of the data analyzed were on a nonparametric ordinal-scale level, and by making a multiple linear regression for this kind of data we violated the assumptions of making a parametric analysis; however, our distribution tests showed a more or less normal distribution in personal development, emotions and social participation. This motivated the use of this method in our analyses. Further, a method triangulation was made, where data used in the multiple linear regressions was dichotomized and thereafter underwent a logistic regression. The logistic regression confirmed the results, and hence we evaluated them as trustworthy.

5. Conclusions

The findings from this study indicate that receiving specific e-health services targeted at supporting older people who are spouse caregivers can provide benefits which most likely will not be obtained without participation in an organized e-service. Benefits may also be experienced by the patient spouse. Care professionals play an essential role in coaching and encouraging spouse caregivers to become e-service users [9,15,20,21]. Lack of help and encouragement during the initial stages of being offered the opportunity to use e-services may lead to spouse caregivers refraining from using the service [14]. This study also concludes that older spouse caregivers who became frequent users of e-services also became more independent and needed less help from care professionals. Given the predicted increase in the future need for long-term care of older people, as well as the shortage of funding resources and lack of health care professionals in many countries, e-services may contribute to increase sustainability and availability of caregiver support [22,23].

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Conflicts of Interest: The authors declare no conflict of interest.

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