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A randomized controlled trial on Stroke telerehabilitation: The effects on falls self-efficacy and satisfaction with care

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Summary

We determined the effect of a multifaceted stroke telerehabilitation (STeleR) intervention on falls-related self-efficacy and satisfaction with care. We conducted a prospective, randomized, multisite, single-blinded trial in 52 veterans from three Veterans Affairs Medical Centers. Participants who experienced a stroke in the past 24 months were randomized to the STeleR

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intervention or usual care. Participants in the intervention arm were administered an exit interview to gather specific patient satisfaction data three months after their final outcome measure. The STeleR intervention consisted of three home visits, five telephone calls, and an in-home messaging device provided over three months to instruct patients in functionally based exercises and adaptive strategies. The outcome measures included Falls Efficacy Scale to measure fall-related self-efficacy and a Stroke-Specific Patient Satisfaction with Care (SSPSC) scale, a measure separated into two subscales (satisfaction with home care and satisfaction with hospital care) was employed to measure the participants' satisfaction. At six months, compared with the usual care group, the STeleR group showed statistically significant improvements in one of the two SSPSC scales (satisfaction with hospital care, p =.029) and approached significance in the second SSPSC scale (satisfaction with home care, p =.077). There were no improvements in fall-related self-efficacy. Core concepts identified were: (a) beneficial impact of the trained assistant; (b) exercises helpful; (c) home use of technology. The STeleR intervention improved satisfaction with care, especially as it relates to care following their experience from the hospital. With the limited resources available for in-home rehabilitation for stroke survivors, STeleR (and especially its exercise components) can be a useful complement to traditional post-stroke rehabilitation.

Keywords

Telemedicine; stroke; rehabilitation; satisfaction; falls; self-efficacy

Introduction

Evidence confirms that post-acute rehabilitation for stroke patients yields better functional recovery.[1] It also shows that physical function in stroke survivors can decline after completing post-acute rehabilitation, and ongoing participation in supervised therapy can prevent this decline.[2] However, lack of funding and lack of suitable community-based programs limits the ability to provide prolonged supervised therapy services.

Telerehabilitation offers a potential solution to this dilemma. Telerehabilitation refers to the use of any communication modality (telephone, video teleconferencing) for delivery of rehabilitation services at a distance, with physical separation of the patient and practitioner.[3]

Even though some telerehabilitation programs have been studied, few stroke specific telerehabilitation studies have been conducted. This is particularly important because stroke survivors are at high risk for falls over time. Among community-dwelling individuals with stroke, the incidence of falls has been found to range from 37% to 55%.[4] Lai et al. [5] implemented an intervention for stroke survivors consisting of educational talks, exercise and psychosocial support by a physical therapist (PT) via a videoconference link and reported that it resulted in significant improvements in fall risk. Fear of falling is equally as important as falling itself in stroke patients as it is associated with depression, lower quality of life and declines in social functioning in stroke survivors.[6] To our knowledge, no studies have examined the impact of a stroke telerehabilitation in-home intervention on fear of falling, a missed opportunity to ascertain the impact of rehabilitation on a debilitating problem following stroke.

The telemedicine literature overflows with publications on patient satisfaction, which are generally positive; but, conclusions about effectiveness have been hampered due to methodological deficiencies.[7] One systematic review of studies of patient satisfaction with telemedicine identified 32 studies and only one was a randomized controlled trial (RCT). In a 2011 systematic review of telerehabilitation interventions in stroke care, there were nine studies published (four included RCTs), six of which reported patient satisfaction. Stroke participants reported high levels of satisfaction with telerehabilitation interventions.[7] Studies often look at satisfaction at one time point and fail to identify differences in satisfaction levels between hospital care and home-based therapy. Also, there is limited information from RCTs regarding the process of the intervention following open-ended qualitative interviews.

The purpose of the present study was to determine the effect of a multifactorial stroke telerehabilitation (STeleR) in-home intervention on falls-related self-efficacy (fear of falling) and patient satisfaction. The present study tested two hypotheses that participants who received the STeleR in-home intervention would have greater improvements in (1) falls-related self-efficacy and (2) patient satisfaction compared those receiving usual care. We also conducted semi-structured interviews of the intervention group patients regarding their experience with aspects of STeleR.

Methods

The STeleR intervention provided home-based training in exercises and adaptive strategies after the patients had completed standard stroke rehabilitation. A complete description of our methods including explicit details regarding selection of participants, components of the intervention and randomization has been published elsewhere.[8,9] Briefly, this study was a 3-site, 2-arm, single blinded randomized controlled trial, with a fourth Veterans Affairs Medical Center (VAMC) serving as the coordinating center. The study was approved by the appropriate ethics committee at each of the four study sites. All participants signed informed consent forms prior to study participation.

Participants

Participants were eligible if they experienced either an ischemic or hemorrhagic stroke within the previous 24 months. Eligible study participants were randomized by centrally sealed allocation into the STeleR or usual care (UC) groups.

UC participants

Study participants randomized to the UC group were not contacted by study personnel other than for the initial recruitment and consent and to obtain outcome data. The UC participants could receive any services provided as part of their usual VA or non-VA care, such as home health care.

Outcome measures

Self-report outcome measures were completed at baseline, 3-months and 6-months (i.e., three months after the completion of the intervention). A research assistant conducted telephone interviews to collect participant survey and open comments. The research assistant was blinded to study group assignment.

We used the Falls Efficacy Scale (FES)[10] to measure fall-related self-efficacy. This is a 10-item survey that assessed the impact of fear of falling on a person's confidence to perform 10 everyday tasks. Study participants rated each question on a scale of 0 to 10, and the scores are summed to give a total score between 0 (no confidence in ability to manage specified self-care activities without a fall) and 100 (full confidence to accomplish specified self-care activities without a fall). Consistent with previous research, we use the term fear of falling as a general term to describe both low fall-related self-efficacy and being afraid of falling.[6]

Reker et al.'s[11] Stroke-Specific Patient Satisfaction with Care (SSPSC) scale was employed to measure the participants' satisfaction. The SSPSC consists of two dimensions of satisfaction (nine items on hospital care and four items on home-based care.[11] Each of the 15 items is scored using a Likert scale ranging from 1–4, with higher scores indicating greater satisfaction. When this study was developed, a dearth of information existed on validated measures for satisfaction with rehabilitation, especially among stroke patients. Even though the STeleR intervention takes place in a participants' home, satisfaction with hospital care has great relevance. For example, if an acute rehab clinician ordered a "bath-tub bench" and it was incorrectly installed and/or if the stroke patient is unable to figure out how to use it because it looks different than what was used in the hospital, then the patient at home could be upset. This displeasure could compromise timely follow-up care.

In addition, all 23 participants in the intervention arm (100% completion rate) were contacted for an exit interview three months after their final outcome measure to complete a questionnaire that included more in-depth questions related to their satisfaction. The study participants were asked 13 closed-ended questions using a 5-point Likert-type scale with different response options. These closed-ended items measured the intervention participants' view toward specific components of the study: 1) the general intervention (e.g. How would you rate your overall satisfaction with the in-home intervention?); 2) equipment (e.g. How comfortable were you being videotaped and then talking with the therapist?; 3) physical function components of the in-home program intervention (e.g., How did you feel about the number of visits devoted to the toilet and tub/shower training?); and, 4) exercise component of the intervention (e.g., How useful was the exercise training for you?). Finally, four-open ended questions (e.g., If you could change one thing about the whole intervention, what would it be?) concluded the interview.

Covariates

We obtained the study participants' age and race via self-report. Initial stroke severity was assessed by the Canadian Neurological Scale by using the Goldstein and Chilukuri's algorithm[12] based on retrospectively extracted information in the patient's medical record.

Previous research[13,14] showed differences in process and outcomes across types of VAMCs, with and without a rehabilitation bed unit (RBU). Therefore, we used the presence or absence of a RBU as a covariate.

Analysis

Mean differences between variables at baseline were measured using unpaired t tests and chi-squared tests. Intent-to-treat analyses were used for all outcomes. Our outcomes were analyzed by a mixed models analysis of variance procedure using maximum likelihood estimation.[15] All participants with at least one follow-up were included in the mixed-model analyses. Baseline values of the outcome of interest, group, time (month of follow-up), the group-by-time interaction, stroke severity, whether a participant was in a rehabilitation bed unit, and both participant age and race were included as predictors in each model. The statistical power for our study has been reported previously.[8] All analyses were performed using SAS version 9.3 (SAS Institute). We employed grounded theory methodology to develop and integrate codes and core categories that emerged from the open-ended interviews from the exit interviews.[16] Two research team members independently created a preliminary list of salient participant quotes, with particular emphasis on recurrence and repetition of information. The themes were grouped into conceptual themes.

Results

A detailed description of the participants was described elsewhere.[9] Briefly, of the 52 patients who met inclusion criteria, gave written consent and were randomized, 48 patients completed baseline assessments. Of the 48 participants who completed baseline measures, 44 (92%) completed the 3-month surveys and 43 participants completed the 6-month surveys (90%). No differences in demographic characteristics existed between those participants who completed the trial and those who dropped out. The baseline characteristics of the study participants between the STeleR and UC groups have been reported in detail elsewhere.[8]

Changes in study outcomes

Table 1 shows the mean scores of the outcomes (FES and the two sub-scales of the SSPSC) over time (baseline, three months, and at six months). At baseline, no significant differences were found between the STeleR and UC groups in the mean FES scores (81.3 vs. 76.3, p =. 395). No significant differences existed at baseline between the STeleR and UC groups in the mean SSPSC Hospital scores (21.4 vs. 26.1, p =.113) and mean SSPSC Home scores (9.3 vs. 10.6, p =.235). The FES score increased modestly in both groups over time; in the STeleR group it increased 2.3 points, in the UC group it increased 2.2 points. This difference was not significant and it remained insignificant once the baseline FES scores and covariates were considered. There were significant group differences in the two satisfaction with care scores. The STeleR group showed notable increases (4.5 points over six months) with satisfaction from hospital-related care, from 21.4 to 25.9. Conversely, however, the reported mean scores in UC decreased over the 6-month period, ranging from 26.1 to 22.9 (p =.029, overall time effect). After adjusting for baseline satisfaction with hospital care and the other

covariates, this difference in change between the groups remained significant. The satisfaction with home care total score increased from 9.3 to 11.0 in the STeleR group, and declined from 10.6 to 10.2 in the UC group, a difference which approached statistical significance (p =.077).

Exit interview results

Twenty-two of the 23 respondents were satisfied with the in-home intervention, found the intervention to be convenient, and were comfortable being videotaped in their home and talking with their therapist via video. All 23 respondents felt the exercise training was useful. Seventeen of the 23 respondents indicated that on a daily basis they applied what they learned from the exercise training.

Three themes were revealed through open ended questions. The first theme was labeled as *Exercises Helpful* with the following sentiments:

- Exercises help my balance and coordination.
- I can walk better due to the exercises.
- The exercises improved my health.

The second theme was labeled as *Beneficial Impact of the Trained Assistant* coming to the home for visits. Participants emphasized this advantageous experience:

- The attitude of the nursing assistant was positive and her encouragement towards me was good.
- The nursing assistant gave me the confidence to stand and walk and keep my balance.
- Her attitude and care was excellent.

A third theme labeled *Home use of Technology* is specific to the in-home messaging device. Participants expressed the challenges using the in-home messaging device:

- The in-home messaging device was too repetitive
- The in-home messaging device exercise questions were confusing
- The in-home messaging device questions were not useful to me.

Conclusion

The STeleR in-home intervention found a greater effect on hospital satisfaction than home satisfaction. To our knowledge, this was the first stroke telerehabilitation intervention study that examined FES as an outcome. While the intervention was not associated with a statistically significant improvement in falls related self-efficacy, both groups had increased confidence in ability to manage a fall. This finding supports the need for continued research.

Recently, we reported that STeleR significantly improved physical function.[9] Our findings are also consistent with a prior Phase 1 clinical trial showing that a 4-visit telerehabilitation intervention targeting home safety and balance exercises for patients with mobility

impairment resulted in care and outcomes equivalent to services provided in the home by a therapist in person along with high levels of patient satisfaction.[17] Another randomized clinical trial examined use of telerehabilitation for patients recovering from a total knee replacement and found that patients reported a high level of satisfaction with the telerehabilitation.[18] Our study is unique in finding the greatest impact on satisfaction from telerehabilitation was on hospital-related care. The qualitative interviews seemed to indicate that the STeleR intervention may have helped patients better translate and apply the exercises learned during their in-hospital rehabilitation.

As the demand for more empirically-based telehealth intervention grows, research using qualitative methods after a RCT is warranted to define and differentiate the key concepts of home-based telehealth. Future research should consider ways to capitalize on the facilitators and mitigate the barriers of the intervention identified from the exit interviews. For instance, our findings indicate potential benefit from modifying the home messaging equipment or content to more user-friendly format for stroke survivors. Our study did not consider helping patients talk better and future research should consider exploring speech and language pathology mechanisms to telehealth for stroke patients. Our study sample was predominantly male and the qualitative study examined intervention group respondents only. Future research should replicate these findings with a different sample, and potentially examine qualitative differences between telerehabilitation and usual care recipients. In conclusion, our results show that the STeleR intervention can be a valuable alternative to traditional rehabilitation modalities given the challenges accessing in-home rehabilitation care for stroke survivors.

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References

1. Stroke Unit Trialists C. Organised inpatient (stroke unit) care for stroke. Cochrane Database Syst Rev. 2007; 4:CD000197. [PubMed: 17943737]
2. Koh GC, Saxena SK, Ng TP, et al. Effect of duration, participation rate, and supervision during community rehabilitation on functional outcomes in the first poststroke year in Singapore. Arch Phys Med Rehabil. 2012; 93:279–286. [PubMed: 22289238]
3. Chumbler NR, Quigley D, Sanford J, et al. Implementing telerehabilitation research for stroke rehabilitation with community dwelling veterans: Lessons learned. Int J Telerehabi. 2010; 2:15–22.
4. Chin LF, Wany JY, Ong CH, et al. Factors affecting falls in community-dwelling individuals with stroke in Singapore after hospital discharge. Singapore Med J. 2013; 54:569–575. [PubMed: 24154582]
5. Lai JC, Woo J, Hui E, et al. Telerehabilitation — a new model for community-based stroke rehabilitation. J Telemed Telecare. 2004; 10:199–205. [PubMed: 15273029]
6. Cumming RG, Salkeld G, Thomas M, et al. Prospective study of the impact of fear of falling on activities of daily living, SF-36 scores, and nursing home admission. J Gerontol A Biol Sci Med Sci. 2000; 55:M299–M305. [PubMed: 10819321]
7. Johannson T, Wild C. Telerehabilitation in stroke care — a systematic review. J Telemed Telecare. 2011; 17:1–6. [PubMed: 21097560]

8. Chumbler NR, Rose DK, Griffiths P, et al. Study protocol: home-based telehealth stroke care: a randomized trial for veterans. Trials. 2010; 11:74–89. [PubMed: 20591171]
9. Chumbler NR, Quigley P, Li X, et al. Effects of telerehabilitation on physical function and disability for stroke patients: A randomized, controlled trial. Stroke. 2012; 43:2168–2174. [PubMed: 22627983]
10. Tinetti ME, Richman D, Powell L. Falls efficacy as a measure of fear of falling. J Gerontol. 1990; 45:239–243.
11. Reker DM, Duncan P, Horner RD, et al. Postacute stroke guideline compliance is associated with greater patient satisfaction. Arch Phys Med Rehabil. 2002; 83:750–756. [PubMed: 12048651]
12. Goldstein LB, Chilukuri V. Retrospective assessment of initial stroke severity with the Canadian Neurological scale. Stroke. 1997; 28:1181–1184. [PubMed: 9183347]
13. Duncan PW, Horner RD, Reker DM, et al. Adherence to postacute rehabilitation guidelines is associated with functional recovery in stroke. Stroke. 2002; 33:167–178. [PubMed: 11779907]
14. Hoenig H, Sloane R, Horner RD, et al. Differences in rehabilitation services and outcomes among stroke patients cared for in veterans hospitals. Health Services Research. 2001; 35:1293–1318. [PubMed: 11221820]
15. Laird N, Ware J. Random-effects models for longitudinal data. Biometrics. 1982; 38:963–974. [PubMed: 7168798]
16. Charmaz, K. Constructing grounded theory: A practical guide through qualitative analysis. Thousand Oaks, CA: Sage; 2006.
17. Sanford JA, Griffiths PC, Richardson P, et al. The effects of in-home rehabilitation on task self-efficacy in mobility impaired older adults: A randomized controlled trial. J Amer Geri Soc. 2006; 54:1641–1648.
18. Russell TG, Buttrum P, Wootton R, et al. Internet-based outpatient telerehabilitation for patients following total knee arthroplasty: A randomized controlled trial. J Bone Joint Sur. 2011; 93:113–120.

Table 1

Study outcomes over time.

	Baseline	3mo	6mo	Baseline	3mo	6mo	P value
Measure	**STeleR**			**Usual Care**			
FES	81.1 (16.9)	82.8 (17.9)	83.4 (17.1)	76.3 (21.5)	73.3 (25.6)	78.5 (18.5)	.126
SSPSC — hospital	21.4 (9.3)	24.2 (8.4)	25.9 (10.4)	26.1 (8.3)	23.7 (11.3)	22.9 (10.8)	.029
SSPSC — home	9.3 (3.5)	9.8 (3.8)	11.0 (4.3)	10.6 (3.9)	10.5 (4.6)	10.2 (4.3)	.077

*FES: Falls Efficacy Scale; SSPSC — hospital: Hospital dimension of the Stroke-Specific Patient Satisfaction with Care Scale; SSPSC — home: Home dimension of the Stroke-Specific Patient Satisfaction with Care Scale. Higher scores indicate greater self-efficacy (less fear of falling) and greater satisfaction.