Problem-solving training via videoconferencing for family caregivers of persons with spinal cord injuries: A randomized controlled trial

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ARTICLE INFO

Article history:
Received 29 August 2007
Received in revised form 13 August 2008
Accepted 14 August 2008

Keywords:
Caregiver
Randomized controlled trial
Spinal cord injury
Telehealth
Problem-solving

ABSTRACT

Objective: To examine the effectiveness of an individualized problem-solving intervention delivered in videoconferencing sessions with family caregivers of persons living with a spinal cord injury (SCI) and possible contagion effects on care recipients.

Design: Family caregivers were randomly assigned to an education-only control group or an intervention group in which participants received problem-solving training (PST) in monthly videoconference session for a year.

Participants: Sixty-one caregivers (54 women, 7 men) and their care recipients (40 men, 21 women) consented to participate.

Main outcome measures: The Social Problem-Solving Inventory-Revised was administered to caregivers. Caregivers and care recipients completed the Inventory to Diagnose Depression, the SF-36 and the Satisfaction with Life scale at pre-treatment, 6 months and 12 months.

Results: Twenty-eight caregivers discontinued the study and their follow-up data were unavailable at the final assessment. Older caregivers were more likely than younger caregivers to remain in the study. Intent-to-treat analyses projected a significant decrease in depression among caregivers receiving PST; efficacy analyses indicated this effect was pronounced at the 6th month assessment. ITT analyses and efficacy analyses revealed that care recipients of caregivers receiving PST reported gains in social functioning over time.

Conclusions: Community-based, telehealth interventions may benefit family caregivers and their care recipients, but the mechanisms of these effects are unclear. Attrition and sample issues should be considered in future studies with these populations.

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Introduction

Family caregivers “…constitute the largest group of care providers” in the United States (Parish, Pomeranz-Essley, & Braddock, 2003, p. 174) and the number of family caregivers is expected to increase as the number of chronic, debilitating health conditions escalates (Hoffman, Rice, & Sung, 1996). The market value of family caregiving exceeds that spent on formal health and nursing home care (Vitaliano, Young, & Zhang, 2004, p. 13). In their activities, family caregivers may have more influence on care recipient health and well-being than any single health care provider (Lengnick-Hall, 1995).

Many family caregivers experience considerable difficulties with their emotional and physical health (Vitaliano, Zhang, & Scanlon, 2003). Persons who are thrust into a caregiver role when a loved one incurs a sudden-onset disability may be particularly vulnerable, as caregiving usually disrupts normative and routine personal, social and vocational roles (Moen, Robison, & Dempster-McClain, 1995). Furthermore, persons who acquire physical disabilities (e.g., spinal cord injury, traumatic brain injury) may have considerable life expectancies that could necessitate life-long commitments from a family member to perform caregiving duties (Lollar & Crews, 2003).

The health and well-being of family caregivers – and the subsequent ability to assist their care recipients – is a public health priority (Talley & Crews, 2007). In fact, Healthy People 2010 (US Department of Health and Human Services, 2000) explicated the need for behavioral and social initiatives to promote the health and quality of life of persons with disabilities and their family caregivers.

Following the onset of spinal cord injury (SCI) family caregivers experience many lifestyle and quality of life changes (Boschen, 2003).
Problem-solving training (PST) can be used to promote self-management skills (Richards & Perri, 1978), and it has been used to low-income and minority community-residing adults (Nezu & Perri, 1989) and among women with cancer (Nezu, Felgoise, McClure, & Houts, 2003). PST has also been used to promote healthier lifestyles among persons with chronic health problems (Perri, Nezu, McKelvey, Shermer, Renjilian, & Viegenter, 2001). Problem-solving principles can be easily integrated into family caregiver counseling programs offered in a group format (Toseland, Blanchard, & McCallion, 1995) and in individual, face-to-face sessions (Sahler et al., 2005). Moreover, PST may hold particular promise for families limited in mobility by severe disability: PST can be easily and conveniently adapted for use in telehealth applications including telephone sessions (for family caregivers of stroke survivors: Grant, Elliott, Weaver, Bartolucci, & Giger, 2002) and Web-based sessions for downloading (for family members caring for a child with a traumatic brain injury: Wade, Corey, & Wolfe, 2006a, 2006b).

PST can be tailored to meet the unique concerns of each individual caregiver (Elliott & Shewchuk, 2000). This approach is compatible with a collaborative—rather than a paternalistic—model that is sensitive and responsive to the needs, opinions, and resources of the community-residing caregiver. (Israel, Schulz, Parker, & Becker, 1998). Family caregiving associated with acquired disability, in particular, requires a partnership with trusted and involved professional that recognizes and accommodates the fluctuating, dynamic needs of the caregiver and care recipient over time. The partnership would be best suited to (a) understand the caregiving tasks specific to the dyad (e.g., medical needs, social concerns, interpersonal problems, family transitions), (b) assess and monitor the health of the caregiver and their personal and social needs, (c) identify the specific tasks and problems reported and experienced by the caregiver at any given point in time, and (d) maintain ongoing contact with the caregiver to assess their changing needs and challenges (Elliott & Parker, in press). Such a partnership could not be accomplished in brief educational sessions that have a specific focus on caregiving tasks associated with a specific health problem: It requires phenomenological assessment of caregiver needs and concerns, and it necessitates an ongoing monitoring and responsiveness to caregiver perspectives, preferably in their home environment, where problems are perceived and experienced.

To address the concerns of family caregivers of persons with SCI, we developed an intervention grounded in social problem-solving principles (D’Zurilla & Nezu, 1999) and provided it to caregivers in the community with a telehealth application. A variety of telecommunication technologies improve accessibility to health care information and services to individuals who are otherwise limited by mobility problems, compromised health status, or prohibitive distances to hospitals or clinics (Liss, Glueckauf, & Ecklund-Johnson, 2002). Travel to outpatient clinics may be difficult for families who live with SCI, and research has found that distance to the clinic and mobility problems impede their attendance in outpatient therapies (Canupp, Waites, DeVivo, & Richards, 1997). Research has found that families with a disabled loved one often prefer telecommunication sessions with a therapist over traditional face-to-face sessions in an outpatient clinic (Glueckauf et al., 2002). Despite the general interest in telehealth applications, research examining its clinical effectiveness is still necessary to attract greater use in service delivery and support from policymakers (Miller, 2007). Prior research has demonstrated the effectiveness of problem-solving training in telephone sessions with family caregivers of stroke survivors in the first few months post-discharge (Grant et al., 2002), but we have yet to examine other modalities and longer periods of administration. We examined the utility of videoconferencing in this study, as this modality can add a sense of “presence” in interactions between staff and caregiver, and it permits opportunity for staff to observe behavior in the home environment (Smith & Allison, 1995).

Finally, our study was designed to examine possible contagion effects of the intervention on the care recipients. Specifically, care recipient depression and quality of life were assessed as important outcomes for study. Although depression is a secondary complication of major concern among persons with SCI (Elliott & Frank, 1996), to date there have been no randomized controlled trials of the effects of a psychological intervention for its treatment in this population (Elliott & Kennedy, 2004). One unpublished study found patients with SCI reported less distress when their caregivers attended a psychoeducational program that informed them about SCI and prepared them for issues they would face upon their return to the community (Moore, 1989). Therefore, we assessed care recipient adjustment to monitor possible benefits of PST provided to their caregivers.

Method

Recruitment

Prospective participants were recruited from the inpatient rehabilitation program and from the community. Individuals who were admitted to the inpatient program were informed of the study by rehabilitation staff, and those who expressed interest were provided details about the project by a trained research assistant. Community-residing individuals were informed by mailings conducted by the state association for persons with acquired neurological disabilities, from flyers distributed at local conferences, and advertisements on web sites and in a newsletter provided by the rehabilitation facility to interested individuals. Specifically, prospective participants were informed of a home-based training program for family caregivers of persons with SCI (see Rivera, Shewchuk, & Elliott, 2003, for more details). To be eligible to participate, individuals had to be at least 18 years or older, have a family member (or “fictive kin”) who was clearly identified as a caregiver (by the caregiver and the care recipient) and living in the same household as the person with the SCI, and the care recipient had a diagnosed SCI. Participants also had to have a telephone and a television at home to be in the project, and both caregiver and care recipient had to consent to the project and to random assignment to one of two groups (PST control).

Data on the number of inpatients who were not interested or responsive to information presented by rehabilitation staff about the study were not available due to review board expectations to
respect patient confidentiality and personal prerogatives for research participation.

Participants

Consenting participants included seven men (M age = 59.71 years, SD = 16.64) and 54 women (M age = 47.13, SD = 14.19) in caregiver roles for persons with SCI. The sample comprised 42 Caucasian and 19 African-American individuals. Forty-one caregivers agreed to participate while the care recipient was receiving inpatient services for a recent-onset SCI (≤12 months) and 20 community residing caregivers responded to written advertisements, letters or flyers. The majority of caregivers were spouses (N = 24) and parents (N = 19) of the care recipient. Other caregivers were daughters (N = 5), grandparents (N = 4) and siblings (N = 3) of the care recipient. Their care recipients also consented to participate (40 men, M age = 38, SD = 14.83 years; 21 women, M age = 46.29, SD = 19.09 years. To ensure consenting caregivers could understand the verbal instructions and written materials, we administered the Folstein mental status examination (Folstein, Folstein, & McHugh, 1975) and the results indicated that the sample had sufficient capabilities for participating in the project (caregiver average score = 28.61; SD = 1.64; range 23–30).

Twenty-five care recipients had paraplegia and 36 had tetraplegia. Thirty-nine persons had incomplete lesions and 22 had complete lesions. Time since the onset of SCI ranged from 1 month to 324 months (M = 32.10, SD = 68.48). Forty-one individuals had a recent-onset SCI (ranging from 1 month to 11 months since onset) and 20 had lived with SCI for an extended period of time (ranging from 13 months to 324 months). Care recipients averaged 26.57 on the Folstein mental status examination (SD = 3.03; range 19–30), indicating the sample was capable of understanding verbal instructions and completing written materials.

Experimental design

The acting project coordinator visited interested participants who meet inclusion criteria in the first contact (often by telephone) to obtain their informed consent. Informed consent had to be obtained from both caregiver and care recipient for participation. Caregivers were informed that the study intended to “…evaluate different follow-up services which will be provided to patients and family caregivers following a spinal cord injury,” and to “…better understand what arrangements or types of follow-up services are most effective in preventing health problems or other difficulties that patients and their family caregivers sometimes experience during the rehabilitation period.” They were informed that participation would involve periodic communications with a staff person during the year, the use of a videoconferencing unit, and they would be asked to complete assessments at entry, 6 months and 1 year after entering the study. Caregivers and care recipients received $25.00 apiece at the completion of the pre-treatment measures and $25.00 apiece at the completion of the study.

Once consent was obtained by the acting project coordinator, an appointment was made for the project coordinator to visit the caregiver in the residence, install the videoconferencing unit, and conduct separate assessments of the caregiver and care recipient. A research assistant typically accompanied the coordinator to assist in conducting the assessments.

The acting project coordinator provided PST to caregivers assigned to the treatment condition. The same person provided educational materials to and interacted with participants assigned to the control group.

Videoconferencing unit. The ViaTV Videophone (Model VC 105; 8 x 8 Inc.) was used in this study because of its simplicity of use and minimal connection requirements. The unit provided audio and visual communication from the interventionist’s office to participants’ homes through the use of a standard analog telephone line, a touchtone telephone, and a television set. This unit worked with an available television in the home and was connected to an existing land-based telephone line. These units were used in the PST and control groups for monthly contacts.

Random assignment. A simple randomization strategy (with a random numbers table) was used by the first author to assign participants to the education-only control group or to the PST group after informed consent was obtained. The authors did not have contact with prospective participants.

Interventionist training. Two individuals acted as project coordinators at different times during this study. Both had earned doctorates in clinical psychology from accredited programs. They were supervised by the first author. The first coordinator was trained in PST and in the use of the videophone device; the second had prior clinical experience with caregiver interventions and was trained in PST and the use of the videoconferencing device upon joining the research team.

Problem-solving training. We developed a problem-solving training (PST) program for family caregivers based on techniques demonstrated by Nezu et al. (2003) and implemented in other applications with family caregivers (Elliott & Berry, in press; Grant et al., 2002). A treatment manual was not used in the intervention condition: We adapted key elements and techniques of PST to ensure that the major theoretical components of PST were used to address the specific and immediate problems reported by each caregiver over time.

The first session with the caregiver required approximately 2–3 hours in a face-to-face session to conduct the baseline assessment and provide the orientation. Manuals containing information about problem-solving principles were also provided in the first session. Participants receiving problem-solving training were first oriented to the basic steps of the problem-solving process: (a) problem definition, (b) optimism and orientation toward problem-solving, (c) creativity and generating alternatives, (d) understanding and decision-making, and (e) solving the problem with implementation and evaluation of a solution. The interventionist illustrated the principles of obtaining facts, being Optimistic, the benefits of Creativity, the importance of Understanding all aspects of a potential solution, and the steps associated with Solving the problem identified in each card sort administration (Project FOCUS; see Kurylo, Elliott, & Shewchuk, 2001).

Caregivers received training in their residence. The first session required a visit to the caregiver residence, at which time they were also trained in the use of a videophone provided by the project (Rivera et al., 2003). Subsequent sessions were conducted in monthly videoconferencing sessions, in which progress in problem-solving was monitored and reinforced. Telephone contacts were also conducted as requested by the caregiver.

During each videophone session, caregivers were asked about any progress made in the resolution of the problem identified during the previous session and were given the opportunity to ask questions or discuss any new concerns. The FOCUS principles and the five basic steps of problem-solving were then discussed as they pertained to the immediate problem reported by the caregiver. Caregivers were presented with a different problem situation for which they are asked to provide potential solutions. Participants were prompted to think about the principles involved in brain-storming prior to offering their suggestions and, if the respondents evidence difficulty in doing so, these were reviewed by the interventionist. Twelve different scenarios were used, one for each monthly session. In these scenarios, caregivers were required to brainstorm as many possible solutions to the scenario. These were recorded and critiqued with the caregiver. All scenarios reflected some aspect of caregiving or managing personal health.
Education-only control group. Participants assigned to the education-only control group received telephone contacts from a research staff member who discussed educational concerns with the participation. Educational materials were provided at scheduled intervals and as needed, based on the unique interests and issues of each participant. Face-to-face interactions were conducted monthly with the videoconferencing device. Participants also received educational materials from project staff through the mail, and these materials were discussed in subsequent interactions. For each phase, the interventionist was required to monitor participants assigned to the control groups, but at no time were problem-solving principles, strategies or coping skills discussed. The group was also administered the problem situation scenarios, one per session, in the same sequence presented to the PST group. However, solutions generated by caregivers in the control group were recorded and were not discussed or critiqued.

Assessment

Caregivers and care recipients were individually assessed by the project coordinator or a research assistant. In the first home visit, this assessment included a card sort procedure and several self-report measures (described below). The measures were administered in a random order. Arrangements were made by telephone for another assessment at the 6th month of participation. At this time, the card sort procedure and the self-report measures were again administered in the home by the acting project coordinator. At the final, 12th month assessment, this process was repeated at the caregiver residence. Participants were debriefed at the final assessment.

Card sort procedure. Card sort activities were administered at baseline, in the 6th month assessment and at the 12th month assessment in both conditions. In the PST group, the card sort procedure was used to (a) identify specific problems experienced by each individual caregiver and (b) to identify types of problems that could characterize specific subgroups of caregivers. For individuals in the control group, the card sort task served as an assessment procedure and information from the card sort was not used in any therapeutic manner. The card sort activities used identical sets of 24 cards, with each card containing a single statement reflecting some aspect or problem of the caregiving experience. These statements were generated in a focus group with family caregivers of persons with SCI (problems included statements such as “helpful attitudes from care recipient,” “feelings of guilt,” “lack of appreciation,” “not enough time in the day;” see Elliott & Shewchuk, 2002).

Participants were asked first to complete an unforced card sort activity. The caregivers were asked to examine the deck of 24 cards and divide the cards into different stacks based on their perceived similarity. A forced choice card sorting exercise was then used to assess the perceived relevance or relative importance of different problems for each caregiver.

In the PST condition, we used the card sort activities to obtain participant input into the intervention. The card sort activities helped caregivers identify a particular problem and to consider problems that may be outside their awareness. The technique also permitted caregivers to talk about problems that they may have been previously unwilling or unprepared to discuss. The technique also helped caregivers think about possible similarities between problems and assist in generating possible solutions and to prioritize problems that needed immediate attention. In the control group, the problems were simply identified and recorded.

Measures

Social problem-solving abilities. The Social Problem-Solving Inventory-Revised (SPSI-R; D’Zurilla, Nezu, & Maydeu-Olivares, 2002) was used to assess caregiver social problem-solving abilities. The SPSI-R has 52 items that are rated on a 5-point Likert-type scale ranging from not very true of me (0) to extremely true of me (4). Higher scores on each scale indicate a greater propensity in that facet of problem-solving. The SPSI-R has five scales. Two scales measure the constructive dimensions of the problem-solving model: positive problem orientation (PO) and rational problem-solving (RPS); the negative problem orientation (NO), impulsivity/carelessness style (IC), and avoidance style (AV) assess aspects of a dysfunctional problem-solving style (D’Zurilla et al., 2004).

The SPSI-R has shown high reliability, ranging from .69 to .93, and has been found to be moderately correlated with other measures of psychological distress and well-being with significant correlations (D’Zurilla & Chang, 1995; D’Zurilla et al., 2002). Criteron-referenced validity is evidenced by significant correlations with relevant scales on the Problem-Solving Inventory (Heppner, 1988) and with other theoretically related constructs as stress, somatic symptoms, anxiety, depression, hopelessness, and suicidality (D’Zurilla et al., 2002). The SPSI-R scales have been predictably associated with self-esteem, life satisfaction, extraversion, social adjustment, and social skills (Nezu, 2004).

We relied on indicators of constructive and dysfunctional problem-solving levels, using data collected in a study by Elliott et al. (2004). The positive measures (PO, RPS) were summed up to obtain an index of a constructive problem-solving style and the three negative measures (NO, AV, IMP) were summed up to form an index of a dysfunctional problem-solving style.

Depressive symptoms. The Inventory to Diagnose Depression (IDD; Zimmerman & Coryell, 1987) was used to assess depressive symptoms reported by caregivers and care recipients. The IDD was developed to obtain a general severity index of depression and a categorical diagnosis of major depressive disorder (MDD) according to DSM-III-R criteria (American Psychiatric Association, 1987). The IDD is a 22-item measure of depressive behavior and each item is rated on a 5-point scale ranging from no presence of the symptoms (0) to severe symptomology (4) (Zimmerman, Coryell, Corenthal, & Wilson, 1986). The sum of the responses provides a total severity score. Higher scores reflect greater depressive behavior.

Acceptable test–re-test reliabilities (.96 over days) and internal consistency (.92) coefficients have been reported; correlations with structured interview estimates of MDD and other self-report measures of depression have been adequate (range from .80 to .87; Zimmerman & Coryell, 1987; Zimmerman, Coryell, Corenthal, & Wilson, 1986; Zimmerman, Coryell, Wilson, & Corenthal, 1986). The IDD has been found to be a sensitive and rather conservative indicator of depression among community-residing adults and persons with a variety of health problems (Frank et al., 1992).

Life satisfaction. The Satisfaction with Life Scale (SWLS; Diener, 1985) was used to evaluate subjective measures of life satisfaction of caregivers and care recipients. The SWLS is a 5-item instrument with items rated on a Likert-type response format ranging from 1 (strongly disagree) to 7 (strongly agree). Higher scores reflect greater life satisfaction. Psychometric studies of the SWLS have evidenced internal consistency (α = .87) and reliability (2-month test–re-test coefficient = .82; Diener, Emmons, Larsen, & Griffin, 1985).

Quality of life. Caregiver and care recipient quality of life was assessed with the Medical Outcomes Study Short Form Health Survey (SF-36; Ware, Snow, Kosinski, & Gandek, 1993). The SF-36 consists of eight scales; we chose three to assess caregiver and care recipient quality of life at each assessment: General Health (five items), Social Functioning (two items), and Mental Health (five items). These scales were deemed sufficient to assess health perceptions and quality of life in personal and social activities.

We followed the instructions to calculate scale scores from the raw and transposed items, and then transformed the total scores
into the recommended 0–100 score for each scale. Higher scores on each scale indicate more optimal adjustment on the respective dimension. Substantial evidence supports the basic psychometric properties of the SF-36 scales (Ware et al., 1993). Internal consistency reliabilities have ranged from .62 to .96; test-retest coefficients have ranged from .43 to .90 (Ware et al., 1993).

**Data analysis**

Two analytic strategies were used to analyze data from individuals who began but did not complete the expected length of participation (intent-to-treat analyses) and to analyze data from participants who completed the study protocol for the expected 12 month period (efficacy analyses). Indicators of effect sizes were examined in all analyses.

**Intent-to-treat (ITT) analyses**. Multilevel modeling (MLM) is an effective and recommended strategy for conducting ITT analyses (Kwok et al., in press). MLM relies on maximum likelihood routines for estimating model parameters, making use of all available data rather than listwise deletion of cases. We used the Linear Mixed Models module in SPSS to predict caregiver depression, life satisfaction, constructive and dysfunctional problem-solving styles, and scores on the three SF-36 quality of life scales from treatment, time, and the interaction of treatment with time. These same procedures were used to analyze care recipient depression, life satisfaction and scores on the SF-36 quality of life scales. All models were estimated with restricted maximum likelihood methods (REML). Time was treated as a continuous variable (coded 0–2) and an autoregressive variance-covariance structure (AR(1)) was estimated. We used pseudo-$R^2$ statistics as a measure of effect size (Singer & Willett, 2003), which reflects the proportional reduction in residual variance with the addition of a model effect.

**Efficacy analysis**. We analyzed data from participants who completed the study with the general linear model (GLM) repeated measures procedure using SPSS 14.0. The GLM repeated measures models provide a more conservative analysis than alternative models. The same caregiver and care recipient outcome variables used in the ITT were used in the efficacy analyses. Trend analyses were examined to maximize the interpretability of the effects of the intervention over time.

**Results**

**Comparative analyses at pre-treatment**

Fig. 1 depicts the recorded number of individuals who initially responded to the opportunity to participate in the project. Of the 61 caregivers (and their care recipients) who consented, 29 were randomly assigned to the education-only control group and 32 were randomly assigned to the PST group. All participants were then assessed at the first home visit.

To evaluate the effectiveness of the randomization procedure, we ran ANOVAs with the assigned group membership variable and examined age, education and the self-report variables at the pre-treatment occasion. No significant differences were found between caregivers in the two conditions on the demographic variables or on the self-report variables at pre-treatment (all $p$'s > .05). Care recipients assigned to the PST and the control conditions did not differ on a measure of activities of daily living ($M = 2.66$, $SD = 2.07$; $M = 2.59$, $SD = 2.18$, respectively; on the Katz Index of Independence in Activities of Daily Living, Katz et al. 1970).

**Attrition**

Following the initial assessment, 12 caregivers in the control group discontinued the study; three discontinued after the 6th month assessment. In the PST group, six caregivers discontinued the study after the first assessment and five discontinued after the 6th month assessment. The reasons for discontinuation are presented in Fig. 1.

There were no systematic reasons for attrition in each group. Some of the explanations appear to be related to circumstances that often follow in the wake of traumatically acquired disability such as financial hardship (e.g., “moved, left no forwarding address”, “phone disconnected”) and dynamic changes in interpersonal relationships (e.g., “care recipient left to live with her father”, “care recipient went to live with his wife”).

ANOVA were conducted comparing caregivers who completed the study and those who did not. Only one significant finding occurred: Older caregivers were more likely to complete the study, $F(1, 59) = 7.41$, $p < .01$ (completers average age = 52.43, non-completers average age = 43.38). No other differences were found on any demographic or self-report variable from caregivers or care recipients. Additional correlational analyses with all self-report and demographic variables revealed no other significant association with attrition.

**Intent-to-treat (ITT) analyses**. In our initial ITT analyses, random slopes and intercepts were included in the models. Almost all models with random slopes failed to converge successfully. When we included only random intercepts in our models, there were significant individual differences in intercepts for almost all outcomes. In our final models, we included pre-treatment outcome measures as time-invariant covariates and examined only the fixed effects linear trends model. In some models, statistical outliers were removed from the data and model parameters were re-estimated. These outliers were identified by extreme residuals from the model, with statistically significant Cook's distance values; no more than three observations were removed from any analysis.

Among caregivers, depression was the only outcome with a statistically significant interaction between treatment and time, $B = -.239, SE = 1.20, t(128.98) = -1.99, p < .05$ (pseudo-$R^2 = .03$, a small effect). The main effects for treatment and time were not statistically significant. Pre-treatment depression, however, was a significant covariate, $B = .70, SE = .06, t(68.04) = 11.95, p < .01$, suggesting that levels of depression over time were associated with initial status. Fig. 2 presents the modeled linear effects of treatment on depression, projecting a steady decline in depression scores among caregivers assigned to the PST group over the 12 months of participation.

Among care recipients, the only significant interaction of treatment with time was for care recipient social functioning, $B = 9.64, SE = 4.99, t(118.98) = 1.98, p < .05$ (pseudo-$R^2 = .026$, a small effect). There were no significant main effects for treatment or time. The pre-treatment social functioning covariate was statistically significantly, $B = .52, SE = .08, t(70.90) = 6.73, p < .01$. Fig. 3 displays the modeled linear effects of treatment on care recipient social functioning. Care recipients of caregivers assigned to the PST group were projected to have a steady increase in social functioning over the 12 months of participation. In contrast, care recipients of caregivers assigned to the education-only group were projected to decline in social functioning over 12 months.

**Efficacy analyses**. Descriptive statistics for the caregivers and care recipients who completed the study protocol over a 12 month period are presented in Table 1. For caregiver depression, trend analysis with GLM (Tabachnick & Fidell, 2001) revealed a statistically significant linear interaction, $F(1) = 4.412, p = .044, partial \eta^2 = .13$, and a statistically significant quadratic interaction ($F(1, 59) = 5.79, p = .036, partial \eta^2 = .134$). The partial $\eta^2$ values are interpreted similar to $R^2$ (as the amount of variance accounted for). The estimates for the magnitude of effect sizes reflect small to moderate effect sizes.

As depicted in Fig. 4, caregivers in the PST group initially had higher levels of depression than caregivers in the education-only group; however, depression levels among caregivers assigned to the PST group were projected to decline over the 12 months of participation. In contrast, among caregivers assigned to the education-only group, depression levels were projected to increase over the 12 months of participation.

Please cite this article in press as: Timothy R. Elliott et al., Problem-solving training via videoconferencing for family caregivers of persons with spinal cord injuries: A randomized controlled trial, Behaviour Research and Therapy (2008), doi:10.1016/j.brat.2008.08.004
control group. At the 6-month evaluation, caregivers in the PST group reported less depression than caregivers in the education group, and at the 12 month assessment, both the PST group and the education group had similar levels of depression.

Subsequent GLM analyses revealed no statistically significant effects on caregiver satisfaction with life or with the two other quality of life measures from the SF-36. There were no statistically significant effects on the repeated measures of dysfunctional and constructive problem-solving styles.

Among care recipients, trend analysis produced a significant interaction, displayed in Fig. 5, indicates that care recipients who were with caregivers receiving PST reported a significant increase in social functioning over time. Care recipients with caregivers in the control group, however, experienced a steady decline in social functioning over the 12 months of participation.

GLM analyses of care recipient depression, satisfaction with life, and with the three SF-36 scales revealed no other statistically significant effects.

Post-hoc analyses. In light of the lack of observed PST on caregiver dysfunctional and constructive problem-solving styles we examined the solutions generated by caregivers in response to the hypothetical problem situations presented in the monthly sessions. We summed up these responses without coding for quality (as these were generated in a “brainstorming” exercise that was used to
review problem-solving principles in the PST group and the exercise was not designed to serve as a dependent variable. Fig. 6 displays the average number of solutions by session. At baseline, the two groups were equivocal in the average number of solutions they generated. By the fifth session, however, caregivers in the PST group were generating almost double the average number of solutions provided by caregivers in the education-only control group.

Discussion

To our knowledge, the current study is the first RCT to examine the effects of a psychological intervention via videoconferencing for family caregivers of individuals who have incurred a severe physical disability. It is also the first RCT to investigate the possible effects of a psychological intervention for community-residing persons with SCI. Our data provide several intriguing insights into issues that may characterize the caregiver experience following SCI that may, in part, impinge upon community-based interventions for these individuals. We found no systematic differences between the caregivers who completed the protocol and those who dropped out of the study, other than caregiver age. The high number of statistical tests on the many caregiver and care recipient variables pre-treatment increased the likelihood of Type I error in finding differences between those who discontinued and those who completed the study, yet only one difference was identified. The results of the ITT and efficacy analyses of caregiver depression suggest that attrition compromised the detection of PST effects on depression over the expected 12 months of participation. Many factors apparently affect the degree to which community-residing caregivers and persons with SCI may commit to a long-term research protocol. It is possible that the random pattern of attrition reflects the often chaotic experience of persons who incur a severe physical disability in mid-life. People who experience a traumatic-onset SCI often experience a downward spiral in income, and a high percentage of married couples divorce within the first year of SCI (Devivo, Hawkins, Richards, & Gw, 1995). The factors that influence attrition in the present study may represent the realities of living with a traumatically acquired and severe

| Table 1 |
| Means and standard deviations for self-report outcome measures used in efficacy analyses for participants who completed the protocol |
| Caregivers | Care recipients |
| PST | Control | PST | Control |
| **IDD total score** | | | | |
| Pre-treatment | M 11.35 | 4.77 | 10.72 | 12.71 |
| SD | 7.30 | 9.29 | 7.90 | 10.39 |
| 6th month | M 6.05 | 8.77 | 6.56 | 8.07 |
| SD | 3.62 | 13.47 | 6.00 | 5.21 |
| 12th month | M 7.30 | 9.29 | 7.90 | 9.00 |
| SD | 6.63 | 8.36 | 9.04 | 9.40 |
| **SWL** | | | | |
| Pre-treatment | M 20.29 | 23.91 | 17.89 | 19.92 |
| SD | 10.25 | 6.56 | 8.90 | 8.61 |
| 6th month | M 21.53 | 22.27 | 17.83 | 22.15 |
| SD | 9.66 | 9.19 | 7.61 | 9.47 |
| 12th month | M 23.65 | 24.91 | 16.50 | 20.62 |
| SD | 10.79 | 8.26 | 8.94 | 9.05 |
| **Quality of life** | | | | |
| SF-36 Mental Health | | | | |
| Pre-treatment | M 68.00 | 75.64 | 69.11 | 73.33 |
| SD | 21.63 | 22.73 | 23.40 | 18.72 |
| 6th month | M 72.94 | 72.73 | 70.67 | 68.33 |
| SD | 19.05 | 26.46 | 21.34 | 15.86 |
| 12th month | M 71.53 | 80.36 | 69.78 | 73.00 |
| SD | 22.53 | 15.95 | 23.53 | 18.14 |
| SF-36 General Health | | | | |
| Pre-treatment | M 71.12 | 73.45 | 54.67 | 61.08 |
| SD | 19.96 | 17.48 | 26.63 | 21.65 |
| 6th month | M 64.76 | 62.90 | 58.94 | 58.33 |
| SD | 20.31 | 27.30 | 30.93 | 21.12 |
| 12th month | M 69.47 | 74.81 | 49.17 | 56.67 |
| SD | 23.22 | 17.39 | 24.23 | 22.17 |
| SF-36 Social Functioning | | | | |
| Pre-treatment | M 77.21 | 90.91 | 63.89 | 78.13 |
| SD | 28.72 | 20.98 | 32.33 | 21.40 |
| 6th month | M 81.62 | 69.32 | 69.44 | 69.79 |
| SD | 28.68 | 40.06 | 29.46 | 28.93 |
| 12th month | M 90.44 | 93.18 | 81.94 | 70.83 |
| SD | 20.98 | 15.17 | 19.75 | 25.75 |
| **SPRI-R scores** | | | | |
| Constructive style | | | | |
| Pre-treatment | M 62.18 | 56.27 | – | – |
| SD | 15.58 | 15.54 | – | – |
| 6th month | M 54.53 | 53.00 | – | – |
| SD | 19.81 | 19.67 | – | – |
| 12th month | M 63.18 | 52.82 | – | – |
| SD | 21.43 | 18.21 | – | – |
| Dysfunctional style | | | | |
| Pre-treatment | M 26.47 | 24.45 | – | – |
| SD | 20.35 | 17.00 | – | – |
| 6th month | M 23.35 | 25.27 | – | – |
| SD | 18.39 | 25.38 | – | – |
| 12th month | M 20.06 | 21.18 | – | – |
| SD | 12.79 | 15.18 | – | – |

Note. IDD—Inventory to Diagnose Depression; SWL—Satisfaction with Life; SPRI-R—Social Problem-Solving Inventory-Revised.
Significant time \times treatment quadratic interaction on caregiver depression in efficacy analyses (N = 33).

Fig. 4. Significant treatment \times time quadratic interaction on caregiver depression in efficacy analyses (N = 33).

disability (e.g., dwindling financial resources, changes in living arrangements, changes in relationship status) that may have little or no association with the quality of or receptiveness to a psychological intervention. It is also possible that our insistence on consent from both caregiver and care recipient contributed to the high attrition rate (46%). In our other studies with a similar PST protocol, consent was obtained only from the caregiver and lower rates of attrition occurred (30%, Elliott & Berry, in press; 0% Grant et al., 2002; 10%, Rivera et al., 2008). Factors that influence attrition can undermine the ability to prospectively study interventions for psychosocial issues among persons with relatively low-incidence (yet severe and high-cost) disabilities.

We cannot determine from this study the factors that influenced the decreases in caregiver depression and the increases in care recipient social functioning among participants assigned to the PST group. The inability to understand the process of change in these outcome variables complicates our theoretical understanding of problem-solving interventions. Unlike other studies that have found significant changes in general problem-solving abilities (Grant et al., 2002) and dysfunctional styles (Rivera, Elliott, Berry, & Grant, 2008) of caregivers who benefited from PST, we found no significant changes in caregiver constructive and dysfunctional scores as a function of PST. Although PST may have benefited caregivers who received it, these presumed qualities were not reflected in the SPSI-R scores. It may be possible that caregivers who received PST used some of the problem-solving techniques as needed to cope with specific, personal problems they identified in the card sort task without learning certain global strategies that could generalize to other problem scenarios. The interesting pattern of problem solutions in the problem-solving scenarios across the monthly sessions – in which caregivers who received PST generated more solutions – is consistent with this latter possibility.

The focus on a specific, personal problem could be of unique value to caregivers. Interventions are more likely to be successful when the unique concerns and problems – as they are identified, articulated, and experienced by the caregiver – are addressed (Brodaty, Green, & Koschera, 2003). This element is necessary to increase the relevance and timing of interventions, and to capitalize on the expressed motivation and investment of the family caregiver to work collaboratively toward solutions to problems imposed by a chronic health condition. This kind of partnership with the family caregiver may be essential to the optimal management of chronic health conditions (Elliott & Shewchuk, 2004).

The significant decrease in caregiver depression at the 6th month assessment indicates that caregivers were benefiting from some component of the intervention. Prior evidence indicates that caregiver depression exacerbates over a 12 month period (Shewchuk, Richards, & Elliott, 1998) and caregivers with dysfunctional problem-solving styles are particularly at risk (Elliott et al., 2001). The current data suggest that PST may have a palliative effect in lowering initial levels of caregiver depression within the first 6 months of training. Further work is needed to identify caregivers who may benefit the most from a cognitive-behavioral intervention like PST, and those who may respond optimally to educational sessions.

We do not know if predisposing characteristics of consenting participants distinguished them from others who were not interested in the study. Individuals who agreed to be in the study volunteered to participate in a clinical trial that involved random assignment to a control group or a promising intervention condition. This willingness to participate in a study of this nature reflects personal characteristics that can bias clinical trial research, generally, and it likely reflects a small percentage of individuals who are interested in participating in a psychological intervention (Tucker & Reed, in press). These factors may be pronounced among persons who live with chronic health conditions. It is assumed that these unmeasured factors were randomly distributed between the two groups.

It is possible that our education-only control group – designed to maintain attention and involvement over time – did not satisfy
the conditions expected of a true control group experience. Caregivers of persons with SCI receive no routine services in the community. Thus, there was no “treatment-as-usual” condition that could be approximated in a control group experience. Any attention provided to caregivers of persons with SCI would be above and beyond the typical experience of a family caregiver in these circumstances. In some clinical areas, it is difficult—if not impossible—to provide a true control group experience, which in turn complicates our ability to study and detect meaningful differences between groups (Elliott, 2007). It is possible, for example, that the features of the education group were sufficient to maintain the current level of caregiver adjustment over time and prevent further distress. In future work it would be preferable to use alternative designs that feature two control conditions that differ considerably from each other and from the intervention (see Grant et al., 2002). A recent meta-analysis of the PST literature suggests these issues may have a theoretical valence as well: PST is usually superior to control conditions across psychological studies, but equivocal in comparisons to bonafide alternative treatments (Malouff, Thorsteinsson, & Schutte, 2007).

Finally, IIT and efficacy analyses indicated that PST had a positive effect on care recipient social functioning over time. Although neither the effect size nor the care recipient adjustment on the scale reflects involvement in social activities that may well involve active participation from the caregiver, it is a key facet of health-related quality of life that is valued by people with mobility impairments. Previous work has demonstrated that care recipients are susceptible to the negative associations of caregiver dysfunctional problem-solving styles. Perhaps PST had an unmeasured effect on the way caregivers interacted with a care recipient, or helped them construe the issues experienced by care recipients from a different perspective, which in turn facilitated more social activities. Social relationships that provide a sense of attachment are significantly associated with meaningful leisure activities among men with SCI (Elliott & Shewchuk, 1995). We do not know the exact mechanisms by which PST had this positive effect on care recipients in the current study, but the results suggest that cognitive-behavioral interventions that are tailored to meet the specific caregiver problems can benefit their care recipients.

Caution is advised in interpreting the present findings, as our limited and unique sample circumscribes our ability to generalize to other individuals with SCI and their caregivers. The lack of fidelity methods for the intervention and control groups is also a limitation; consequently, we cannot dismiss concerns about the integrity of either group experience. But these data imply that future studies of psychological interventions to benefit caregivers of persons with severe physical disability should attend to possible benefits to care recipients that reflect an improved quality of life.

Acknowledgements

This study was supported by grants from the National Institute on Disability and Rehabilitation Research, Office of Special Education and Rehabilitation Services, US Department of Education (H133B90016) and by Grant No. R49/CCR403641 from the US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Injury Prevention and Control to the University of Alabama at Birmingham, Injury Control Research Center. The contents of this study are solely the responsibility of the authors and do not necessarily represent the official views of the funding agencies.

The authors appreciate the creative input and assistance from Richard Shewchuk, Monica Kurylo, Patricia Rivera, and Morgan Hurst during various stages of this study.

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