

Technology-Based Caregiver Intervention Research: Current Status and Future Directions

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In response to the high prevalence of caregiving and the negative health effects associated with caring for a chronically ill or disabled family member, researchers have designed and tested a wide range of intervention strategies aimed at helping the caregiver. In this review we systematically examine the role of technology in caregiver interventions. Three specific questions are addressed: (i) What do we mean by technology when applied to the caregiving context? (ii) What types of technology have been used in caregiving intervention research and have they been effective? and (iii) What direction might future research take in this area? A systematic review of the literature yielded 22 studies which are grouped into three categories based on the general goals of the study: those that report technology-based interventions designed to improve physical or psychosocial health of the caregiver, those that promote independent functioning of the care recipient or older adult at risk, and methodological studies that focus on the development and evaluation of technology-based approaches to health status assessment relevant to the caregiving context. On the whole, these studies show that existing technologies are both acceptable and feasible, although assessments of their impact are mixed. Evidence can be found to support the conclusions that technology can be effective in enhancing social support; enhancing knowledge and understanding of chronic disease, disability, and aging; and promoting emotional well-being and physical health. However these conclusions must be qualified by numerous methodological limitations of these studies, and those studies that do achieve positive outcomes are not able to attribute them to technology per se.

Key Words: caregiving, intervention study, metadata, technology

The personal, social, and health impacts of caregiving have been well documented in recent years¹⁻⁴. These findings in turn have generated intervention studies aimed at addressing the burden, distress, and health-related morbidity associated with caregiving. The majority of intervention studies have focused on caregivers of persons with progressively dementing illnesses such as Alzheimer's disease (AD). Using a wide variety of intervention approaches, researchers have been able to achieve small to moderate decreases in burden and depression and, in a few cases, impressive clinically meaningful outcomes^{3,5}. Similar results have been reported for the intervention literature overall. A recent meta-analysis of the caregiver intervention literature reports that interventions produced significant improvement of .14 to .41 standard deviation units, on average, for caregiver burden, depression, and subjective well-being⁶. However, these conclusions are qualified by a host of methodological problems that still characterize much of this literature. First, sample sizes are often too small to detect even large effects⁷. Second, randomized controlled trial methods have been used infrequently and are often implemented incompletely⁵. Third, interventions are not well described, and treatment implementation data are infrequently collected or reported⁸. Finally, the proportion of studies reporting clinically significant outcomes for important public health indicators is relatively small⁹.

caregiving presents multiple challenges that are not easily addressed. As a result, there is no single, easily implemented, and consistently effective method for achieving clinically significant effects among caregivers or care recipients. Most existing studies include educational components aimed at enhancing knowledge about the disease, the caregiving role, and resources available to caregivers. Educational approaches may be further augmented with general instruction in problem-solving skills, as well as with more focused training for caregivers that teaches strategies

for managing care recipient behaviors or their own emotional response to caregiving. Assistance with case management, counseling, and the provision of various types of instrumental and emotional support have also been tested in caregiver intervention studies.

What role might technology play in achieving these intervention goals? We know intuitively that technology can facilitate communication and thus potentially increase social support, enhance knowledge and understanding of life challenges, promote emotional and physical well-being, facilitate access to services and resources, and address environmental safety concerns. However, a more in-depth understanding of the role of technology in caregiving requires that we systematically address a number of key questions: (i) What do we mean by technology when applied to caregivers and care recipients? (ii) What types of technology have been used in caregiving intervention work and how effective have they been? and (iii) What are the future opportunities for applications of technology to caregiving?

TECHNOLOGY IN CAREGIVER INTERVENTIONS

Technology is broadly defined as the 'the application of scientific knowledge to the practical aims of human life'⁹. Examples of the application of technology to aging include low-level technological adaptations of commonly-used objects in the home such as tableware, writing implements, and bathing facilities, as well as more sophisticated high-technology applications such as biotelemetry (i.e., transferring biological information from the patient's body to the physician or health care provider by means of electronic implants under the skin)¹⁰. Distinctions between low- and high-tech are to some extent arbitrary and likely to change with time. Today's high-tech innovation will become tomorrow's low-tech application. Indeed, the definition of technology itself is so broad that it would be difficult to draw

clear lines between interventions we deem technology-based and those that are not. With these caveats in mind, it is nevertheless useful to examine how technology might serve the needs of caregivers and care recipients.

If we accept the general conclusion that the goal of caregiver interventions should be to maintain and enhance the quality of life of caregivers and care recipients, and we agree that these goals are served through multiple means such as assuring the safety of caregiver and care recipient, enhancing social support, facilitating knowledge and understanding of disease, disability, and the caregiving role, then any technological application that serves these means could be considered a candidate for caregiver intervention approaches. The caregiving intervention literature contains many examples of technology-based approaches to addressing caregiver needs. For example, telemetry and other monitoring devices have been used with dementia patients in order to observe their movements and location. Telephones and more recently personal computers have been used to enhance social support, provide technical assistance, and enhance caregiver's understanding of aging and disability and their role as caregivers. Computers, videotapes, and telephones have also been used as a means for entertaining or distracting the care recipient and providing respite to caregivers.

The cornerstone of most technology-based interventions are the new interactive computer-based communication systems that have several advantages over older communication systems¹¹:

(i) Increased ability to deliver and access information on demand, asynchronously and over long distances. The delivery of information can be tailored to the needs of specific user groups or individuals, and informational resources can be accessed at any time and from different locations. In addition, information flow is more easily bi-directional,

enabling better communication between sender and receiver;

(ii) Increased access to health and social service professionals and social support;

(iii) Improved capabilities for combining various media such as text, audio, and visuals to suit the specific goals of an intervention and the user population. For example, information can be delivered simultaneously in text and audio modes;

(iv) Increased possibility of maintaining anonymity of both sender and receiver. This may facilitate communication of sensitive information related to problems of caregiving that individuals feel uncomfortable discussing in public forums or in face-to-face interactions.

Taken together, the new technologies can play several important roles in the caregiving context. At the most fundamental level, they provide a means for efficiently relaying information that enhances caregiver knowledge about aging, illness and disability, the caregiving role, and community resources available to the caregiver. New computer and telephone technologies can further enhance direct access to experts and professional organizations, which in turn can facilitate shared decision-making by the caregiver.

Another important function of the new technology is its potential for providing peer information exchange and social support. As noted by Robinson et al.¹¹, personal computers are increasingly being used to enable individuals to share information about health difficulties, needs, and strategies for dealing with life challenges.

Computers can also be an efficient means for delivering health risk assessments and health promotion modules. Among caregivers, computers have been used to deliver therapeutic interventions aimed at helping the caregiver manage their anger, reduce symptoms of depression, and achieve positive developmental outcomes¹².

Finally, researchers in caregiving have explored an innovative use of technology that is unique to dementia caregiving. Telephones, computers, and videotapes have been used to engage care recipients with dementia and provide increased respite and activity time to the caregiver¹³.

So far we have focused on the theoretical potential of technology-based caregiver interventions to effect beneficial outcomes. We now examine the literature to answer the question: What evidence is there that technological approaches are effective in enhancing caregiver outcomes? We reserve for later in this paper a discussion of the future directions and implications associated with the new technology.

TECHNOLOGY INTERVENTIONS FOR CAREGIVERS AND CARE RECIPIENTS: LITERATURE REVIEW

The following pages review outcomes of investigations that enrolled caregivers, care recipients, and older adults in studies that delivered interventions through some form of technology. Technologies employed by these studies ranged from low-tech equipment, such as telephones and videotapes, to higher-order devices utilizing interactive and Internet technologies.

Although caregiving interventions are ubiquitous in the gerontological literature, outcomes for interventions that utilize technologically-based delivery approaches are only now emerging in the literature. Exploring the effects of technologically-oriented interventions for caregivers as well as for care recipients and older adults can prove valuable at several levels. Caregivers suffer many of the same risk factors as do care recipients – and older adults in general – with respect to dealing with illness. In addition to the health-related complications that typically accompany older age, caregivers are especially vulnerable to co-occurring medical conditions and psychological distress that require high degrees of support and maintenance^{2,14-15}.

Interventions that are easily delivered and received, and that minimize the stress involved in new learning, are welcomed – and technological approaches may ultimately prove invaluable in helping to streamline access to critical resources.

As indicated previously, caregivers and care receivers stand to obtain mutual benefit from interventions that are successful in improving circumstances for one or the other. It has been generally well-documented that an increase in resources and supports available to caregivers, as well as improvements in their physical and/or psychological status, are associated with positive effects on their experience of caregiving and appear to influence the care recipient as well. Similarly, interventions that are able to effect positive improvement in care recipient mood, functional status, or self-care skills clearly have implications for caregiver benefit.

Outcomes of technologically-based interventions targeting older adults who are not currently care providers or are also important to consider. Interventions that support independent functioning and delay the need for home-based or institutional support benefit family members and friends who might otherwise be called upon to provide direct care. Technology can be used to link older relatives to resources that are readily accessible and available.

Identification of Studies for Review

The studies chosen for review were identified through computerized literature searches using the interlinked search engine OVID, and were conducted between February and August of 2002. The following databases were searched: Medline (1966-2002), PsycINFO (1967-2002), CancerLIT (1975-2002), CINAHL (1982-2002), and evidence-based medicine databases (1991-2002; ACP Journal Club, Cochrane Controlled Trials Register, Cochrane Database of Systematic Reviews, and Database of Abstracts of Reviews of Effectiveness). Hand searches of

study and review article citation lists, and of the tables of contents of the *Journal of Telemedicine and Telecare* and *Telematics & Informatics* were also performed to identify interventions not captured through database searching.

Studies ultimately chosen for review met the following criteria:

- (i) Publication in a peer-reviewed refereed English language journal;
- (ii) Use of technology to deliver intervention to older caregiver and/or older adult/patient coping with chronic physical illness or aging-related issues;
- (iii) Participant outcomes reported.

The following studies were excluded from review:

- (i) Those which used technology solely as an adjunct to a primary, non-technologically-delivered intervention (e.g., follow-up telephone calls after hospital treatment for myocardial infarction);
- (ii) Those which focused solely on personal assistive devices;
- (iii) Those in which technology was incidental to the intervention, or was not distinguished between groups (e.g., where intervention was delivered by videotape to both treatment and comparison groups);
- (iv) Those failing to describe participant numbers or characteristics;
- (v) Those in which reported average participant age was below 55;
- (vi) Those which focused on older residents residing in long-term care facilities.

In all, 26 studies were identified for review. Because four of these studies reported outcomes for the same participant group, and two others also reported results for the same investigation, a total of 22 non-overlapping studies are reviewed here (Appendix 1). All studies were published in refereed journals, and 8 (36.4%) were conducted as randomized clinical trials (RCTs). Five (22.7%) investigations targeted caregivers only, 8 (36.4%) targeted care recipients or older adults only, and 9 (40.9%) focused on both caregivers

and care recipients. The highest percentage of studies (9, or 40.9%) were concerned with dementia; 8 (36.4%) focused on older adults and aging-related issues, 2 (9.1%) on hypertension, and 1 (4.5%) each on stroke, cardiac patients, and the visually-impaired elder. Overall, 16 (72.7%) of interventions were primarily designed to modify behavior or mood state, 5 (22.7%) to assess or monitor health status, and 1 (4.5%) to provide access to information and resources.

Half of the studies (11, or 50%) delivered their interventions via telephone; 3 (13.6%) utilized Internet technology, 2 (9.1%) each employed videotape only, or a combination of video/audio/computer technologies for live interaction, and 1 (4.5%) each used videotape, audiotape, interactive television, infrared sensor, or a combination of videotape and telephone support.

The samples, methods, measures and outcomes reported for each study are shown in Appendix 1. In addition, we have characterized each study in terms of its proximal goals (e.g., what was the immediate intended effect of the intervention?). Proximal goals used to describe the studies reviewed here may be understood as those which the investigator aims to achieve, or influence, through the delivery of the treatment. These proximal goals were identified by the authors through in-depth evaluation of rationales and outcomes of the studies under review, and appear to be consistent across this group of investigations that utilize technology as a means of delivering treatment. Seven proximal goals were identified: knowledge; decision support; social support; affect management; access to experts; respite; and assessment/monitoring. Knowledge was the most-frequently targeted proximal goal, identified by 13 (59.1%) of studies reviewed; 11 (50%) each targeted social support and access to experts; 6 (27.3) targeted decision support; 5 (22.7%) targeted assessment/monitoring; 4 (18.2%) targeted affect management; and 3 (13.6%) targeted respite.

Study Outcomes

Outcomes for the studies under review have been organized into three broad groups based on the primary purpose or intent of the study. The first group is comprised of technologically-based interventions that are designed to improve physical or psychosocial health. Two types of results are reported by these studies: traditional caregiver outcomes such as burden, depression, emotional and relationship strain, and activity restriction; and reports of usability and satisfaction for technological approaches in initial stages of testing. The second set of outcomes consists of studies that promote independent functioning for the care recipient or older adult at future risk of needing caregiver assistance. These investigations take two forms: those that target the care recipient indirectly through caregiver training in modifying care recipient behavior or mood; and those that provide intervention directly to the care recipient or older adult with the purpose of enhancing functional independence. The final group of studies focuses primarily on the development and evaluation of technological approaches to physical or cognitive health status assessment relevant to the caregiving context. These studies typically report on apparatus usability and feasibility, along with indicators of reliability, validity, sensitivity, and specificity of the assessment method under investigation.

Outcomes for Interventions Promoting Physical or Psychosocial Health

Ten (45.4%) of the 22 studies reviewed here reported outcomes for interventions with physical or psychosocial health goals. Five (50%) of these were RCTs; these were also the only studies in this group that used comparison group designs, and 1 utilized investigator blinding as well. The great majority (9, or 90%) of these studies focused on dementia-related issues, and 1 targeted older adults. Five (50%) studies delivered interventions via telephone technology, 2 (20%) provided computer/Internet access to study participants, and 1 (10%) each employed

videotape, interactive television, and a combination of videotape training and telephone support. Participant numbers varied across this subgroup of studies (range of $N_s = 14-242$).

Traditional caregiver outcomes

All six studies described in this section reported treatment-completed data. Though several employed comparison or control group designs, the two studies with the smallest participant groups (both $N=14$) did not, limiting interpretation of results. One of these¹⁶ explored the benefits of telephone-based support for caregivers of individuals with dementia. The authors reported significant decreases in stress-related symptoms and perceived burden over time. Though these results are encouraging, it is unclear whether the study was adequately powered to accommodate ANOVA testing given the small N ; additionally, the authors failed to indicate whether repeated measures (taken at 5 different points in time) were accounted for in their analysis.

Lund, Hill, Caserta, and Wright¹⁷ reported qualitative pilot data on benefits associated with the use of caregiver-prepared videotapes designed to capture the interest and attention of care recipients with dementia. They found that 6 of 7 caregiver participants reported an increase in available free time associated with use of the tapes, and they expressed appreciation for such. Caregiver observations indicated that, for all participants, care recipients' attention was captured better by the tapes than by television programs, and all care recipients provided verbal responses to questions that were presented on the videotape. There were reports that the tape could help to manage disruptive behaviors and support transitions across home and daycare settings. Though entirely anecdotal, these data certainly suggest that this low-tech, videotape-based intervention may provide meaningful benefit for many caregiver-care recipient dyads; comparable results obtained through a more rigorous,

comparison group design would greatly increase the credibility of these results.

Goodman & Pynoos¹⁸⁻¹⁹ and Goodman²⁰ reported treatment-completed outcomes for a RCT (N=132; 66 dementia caregiver/care recipient dyads) that provided telephone-based information and support for dementia caregivers. Study design is strong in several respects: participant characteristics were analyzed across randomized study groups and no differences were found, standardized measures demonstrating strong reliability were employed, and the authors clearly indicated the use of ANOVA that corrected for repeated measures. Positive and significant gains on measures of knowledge, burden, and social support were reported for the intervention group, although care recipient status declined significantly over time. Importantly, however, the same significant gains were also noted for the comparison group, with no meaningful differences in gains identified across the two groups.

At least two factors may have contributed to these results. First, unlike studies that include a control group for which no intervention or usual care only is provided, Goodman & Pynoos¹⁸⁻¹⁹ compared a caregiver group receiving 12 informational lectures over 12 weeks delivered by telephone to a group receiving the same lectures plus participation in telephone-based peer support groups. Perhaps access to telephone-based informational lectures alone were sufficient to influence these results, though this is impossible to assess using the published data. Second, three months into the study, the investigators had participants switch groups, so that those who were previously lecture-only now had access to support groups, and those formerly participating in support groups were no longer able to do so. Assessment at 3 months showed that both groups had improved significantly on measures of perceived social support and support satisfaction; assessment at 6 months indicated that both had significantly declined on the same

measures. More encouragingly, both groups demonstrated significant improvements in burden, social conflict, and degree of social support at 6 months. However, due to the manner in which treatment was delivered, it is unclear exactly what feature(s) of the intervention may have contributed to the gains observed, and it is particularly difficult to characterize the specific contribution of telephone technology to the results.

All three of the remaining studies reported behavioral outcomes for dementia caregivers. Steffen²¹ employed a three-group RCT design (N=28) that used video and telephone interventions to deliver training in psychoeducational techniques for managing anger and frustration. Participants were randomly assigned to either a wait-list control condition, an 8-week home-based video training with telephone support, or an 8-week class-based video training with no additional telephone support. Though the number of participants was somewhat low, the study design provided an opportunity to judge the roles played by the two technologies utilized in the study. A commonly-used, reliable measure (BDI) was administered to assess changes in depressive symptoms; anger and self-efficacy were assessed by less-standardized measures. Differences between the groups were found on all measures; both intervention groups showed significant and positive benefits for anger and self-efficacy above the wait-list controls. Significant improvements in depressive symptoms were also demonstrated by the video + telephone group above wait-list controls, but not above the class-based, video-only group. Effect sizes per treatment condition, infrequently seen in this group of studies, were also provided by the author; eta-squared was .32, .35, and .44 for anger, depressive symptoms, and self-efficacy, respectively. These results suggest that the psychoeducational training was useful in alleviating symptoms of anger, depression, and helplessness for dementia caregivers, although, as acknowledged by the author,

the small sample size limits confidence in study outcomes, and other potential confounds (e.g., broader effects of social contact for caregivers who tend to be isolated) may have also influenced the results. These outcomes also suggest that video-based approaches for affect management can be effective, and it is worth noting that the group which had access to both video- and telephone-based support appeared to demonstrate the most gains overall.

The final two studies reporting traditional caregiver outcomes provided supportive and instructive interventions for dementia caregivers and shared many of the same proximal goals (social support, decision support, and access to experts), but varied in their designs, dependent measures, and technologies used. Brennan, Moore, and Smyth²²⁻²³, Bass, McClendon, Brennan, and McCarthy²⁴, and McGuire²⁵ reported outcomes for a two-group RCT (N=96) that assigned participants to either an information-only comparison group or to a group with access to ComputerLink, an Internet-based support and information network through which caregivers could communicate with peers and experts, and could also access a decision-support module that guided users in solving problems associated with caregiving. Investigators looked at a range of outcomes using both standardized and referential measures, including an analysis of cost-effectiveness based on the relationship between caregiver decision-making confidence and the costs associated with providing home-based care. Significant improvements in decision confidence, emotional strain (for caregivers with more informal support), relationship strain (for spouse caregivers only), and activity restriction (for caregivers with more informal support and a household size of 3 or more) were found for the intervention group. The cost-effectiveness analysis also appeared to demonstrate significant benefits for the intervention group above controls. Measures of depressive symptoms and burden were used as intervening variables in the

regression model; it is unclear whether they were evaluated independently for study participants, but no significant effects were reported for them. These outcomes strongly suggest that Internet-based intervention is a valuable way to effect psychosocial benefits for at least certain groups of dementia caregivers, and demonstrates a relationship between these benefits and incorporating higher-level technology into such treatment approaches. That there were a wide range of resources and activities available to intervention group participants makes it difficult to determine their relative value; however, the group with Internet access to information and personal contact showed meaningful benefits above the information-only, non-Internet participants.

One factor difficult to separate out in Brennan et al.²²⁻²³ was the fact that participants had access to both peer and expert advice and feedback; this variable was better controlled in a study by Davis²⁶, who provided expert contact only to caregivers (N=34; 17 dementia caregiver/care recipient dyads) through weekly telephone calls during which support and problem-solving assistance was provided by a community health nurse. Significant improvements on well-standardized measures of depressive symptoms, social support, and life satisfaction were reported for the 17 caregivers who received the intervention. No significant changes were reported for numbers of care recipient problem behaviors. Unfortunately, no comparison group was included in the study, though other design strengths, such as investigator blinding and reporting treatment-completed data, were evident. Nonetheless, these results are encouraging with respect to the potential for delivering supportive interventions through the use of telephone technology.

Usability and satisfaction outcomes

Three of the four studies described in this section reported usability/feasibility and/or satisfaction pilot data, and the other provid-

ed content analysis results. Czaja & Rubert¹³ reported data extracted from an ongoing study providing structured, home-based family therapy augmented with a computer-integrated telephone system that offered access to discussion groups, voice mail, expert resources, and conference calls, and respite vignettes tailored for care recipients. Participants (N=44) included both Cuban Americans and White Americans. The majority of participants (76%) used the system to contact family members; 15% also contacted friends, and 6% used the system resource menu. Of those using the resource menu, half of the participants used links to the Alzheimer's Association, 40% linked to general information/referral resources, and 33% sought information on respite care. The majority of the participants also participated in on-line discussion groups with other caregivers. Most participants (93%) reported that conference calls were valuable; 80% of participants took part in discussion groups, and of these, 82% and 86% found these to be enjoyable and valuable, respectively. Cuban Americans found the system significantly easier to use and perceived the technology to be more valuable than did the White Americans. These findings lend support for the use of telephone-augmented family therapy, and may have important sociocultural implications as well.

Mahoney, Tarlow, Jones, Tennstedt, and Kasten²⁷ also reported results for a telephone-based interactive voice response system that provided counseling and behavior management strategies through multidisciplinary expert feedback and a peer support group to dementia caregivers (N=93), along with tailored respite conversations for care recipients. Most participants (79%) used the counseling resources, 57% took advantage of the respite feature (and reported high ratings for satisfaction and value), 24% used the support group, and 21% asked for expert feedback. System 'adopters' were significantly older, better educated, married, and more proficient at system use than par-

ticipants overall, and were primarily male. Interestingly, feedback across all caregivers contained strong preferences for personal contact; this factor, in combination with a significant drop in use of the system by participants over time, led the authors to a general recommendation that the system seems best-suited for short-term applications. Unfortunately, no explanation was provided for the reduction in system use. Design features of the technology may have contributed to reduced user interest, as there was a positive relationship between system use and user proficiency. Technical instabilities of the system also appeared to be associated with reduced user time.

Chambers & Connor²⁸ provided 216 care providers, 113 health care professionals, and 26 care recipients with access to an interactive television program that offered information, coping and relaxation techniques, communication with other formal and informal caregivers, and feedback for decision-making. Reasonably high usability ratings were obtained for global usability, attractiveness, controllability, efficiency, helpfulness, and learnability. These pilot data support the use of a multi-faceted programs with both visual and audio features, accessed through a common household item – a television – with which most people are quite familiar.

Results of a content analysis of messages sent by a potential 1015 caregiver, clinician, and researcher subscribers to an Alzheimer Internet mailing list over 10 months²⁹ helped to inform and validate usability and satisfaction results from other studies. Topics and numbers of messages were as follows: personal experience (23 %); information-giving (20%); encouragement (13%); personal opinion (10%); information-seeking (7%); humor (7%); thanks (6%); prayer (3%); and miscellaneous (3%). The content of these recurring topics appeared to correspond to user feedback concerning the utility and value of support, conversation, and information delivered not only over the Internet, as

in this particular study, but over distances via low- (e.g., telephone) to moderate- (e.g., interactive television) technology apparatus.

Outcomes for Interventions Promoting Independent Functioning

Of the seven studies described in this section, three utilized random assignment, and one also used investigator blinding. Three studies targeted older adults; and one each targeted individuals living with the effects of stroke, hypertension, coronary artery bypass graft (CABG) surgery, and visual impairment. Four interventions were delivered by telephone, and one each utilized videotape, audiotape, and Internet technologies. Participant numbers varied considerably across the seven investigations, which ranged from a single-dyad case study to a potential 102,565 community members who were 65 years of age or older.

Care-recipient or older adult indirectly targeted

Two studies under review employed treatment designs that targeted care recipient health status indirectly, through interventions delivered to the caregiver. Although they differ greatly from one another in several respects, both report outcomes that support the incorporation of low-tech apparatus into such interventions, as well as the potential for reciprocal skill-sharing and symptom improvement across the participant dyad.

Mahler and Kulik³⁰ provided outcomes for a 6-month study in which the spouses of 296 first-time CABG patients were randomly assigned to three conditions: usual care only; usual care plus a single viewing of a "mastery" videotape that depicted post-CABG couples as calm, confident, and optimistic about recovery; or usual care plus a single viewing of a "coping" videotape depicting the same couples describing recovery-related events that were more effortful and stressful, though ultimately successfully resolved. Significant outcomes for both care recipients and caregivers were reported, both across

and within conditions. Improvement on measures of both positive and negative affect were obtained over time for all care recipients; however, females reported a significantly greater degree of negative mood than did males. Patients' physical status improved over time for all participants, as reflected by a decline in post-surgical consultations and complications. However, female patients with spouses in the usual care-only condition reported significantly more health problems and first-month re-hospitalization than female patients with spouses in either of the videotape-viewing conditions, suggesting that some measure of post-CABG preparation directed toward spouses – whether entirely or only partially optimistic – yielded a greater spouse-to-patient benefit during the recovery process. Accordingly, spouses in both videotape-viewing conditions reported significantly greater feelings of preparedness than did spouses who received only usual care. These results lend some credibility to the potential long-term benefits of an intervention delivered – even at only one point in time, as in this case – through simple technology.

Care-recipient or older adult directly targeted

Of the five studies that directly targeted care recipients or older adults in their intervention designs, two investigated the benefits of telephone support groups. In a 40-week study, Heller, Thompson, Trueba, Hogg, and Vlachos-Weber³¹ randomly assigned low-income older women (N=276; mean age = 74; 74% lived alone) to participation in a weekly, telephone-based social and support visit with a staff "visitor" who inquired about the participant's well-being and activities (N=238), or to an (detailed, 3-day) assessment-only condition (N=53). After 10 weeks, a second assessment was carried out for all participants, and the participants in the telephone support condition were quasi-randomized into one of four groups and instructed to: initiate telephone support contact with a peer study participant (N=49),

receive peer contact via telephone (N=49), continue with staff telephone contact (N=27); this group had refused peer contact, and receive only assessment during this second phase (N=49). Significant improvements were noted on measures of morale and loneliness for both groups at 10 weeks, but these gains reverted back to baseline for all participants at 40 weeks, except for the group that received assessment only from study onset, which sustained some improvement over time. Unfortunately, save for the CES-D and perceived social support (PSS) scales, the authors failed to provide ranges and/or clear explanations for the measures used, so it was difficult to interpret to what extent a baseline/ceiling effect might have occurred. Though a reasonable proportion of participants (71% at 20 weeks and 56% at 30 weeks) established and remained in telephone contact with peer study participants, this behavior was not sufficient to effect lasting improvement on the targeted outcomes.

The authors concluded that telephone support did not appear to add significantly to benefits that may have been obtained solely from participation in study assessment. They further noted that poor mental health status correlated significantly with perceptions of poor family support; begging the question of whether delivering extra-family support was the correct intervention for this group. However, the PSS scores indicated a high degree of perceived social support, and it is unclear to what degree problems with social support influenced the failure to obtain significant intervention benefit. Generally speaking, given the challenges faced by study participants – the majority lived alone on an annual income of \$9000 or less; 67% were widowed, and CES-D scores appeared to demonstrate a moderate to high degree (e.g., approximately 30 on a 60-point scale) of depressive symptoms across the group – the opportunity to access support from strangers via telephone may not have addressed enough factors to effect any, or

lasting, changes on measures of morale, depression, and loneliness.

Thomas and Urbano³² elicited a different and less ambitious level of evidence from older individuals (N=72) who participated in a weekly telephone-based support group (Telelink) for visually-impaired elders aged 60+ (33% aged 80 or over). A high degree (77%) of users reported that Telelink made an "important difference in their lives," and significant correlations to these high value ratings were obtained for individuals who were older, living alone, and female. On a 10-point satisfaction scale, 45% rated Telelink at 9, 37% of scores were between 7 and 8, and only 18% rated their satisfaction with the group at 6 or below. In addition, the authors noted that Telelink appeared to be particularly important for individuals newly diagnosed with visual impairment, and for individuals (e.g., those of a particular ethnic group) who were able to form "special interest groups" through their Telelink connections. The overall positive nature of these data stand in contrast to Heller et al. above; however, it is critical to note that very different outcome measures were used, and, although both interventions involved weekly telephone support, they differed considerably in how they were delivered to study participants. Taken together, these studies highlight several factors that need to be considered when using telephone technology as a means of delivering support: (i) the characteristics of the participants including their physical, psychological, and socioeconomic status; (ii) the appropriateness of the outcome measures given the scope and goals of the intervention; and (iii) the specific ways in which the telephone can be used to deliver an intervention beyond direct communication.

A different approach to delivering a telephone-based intervention was used by Friedman et al.³³, who randomly assigned elderly, hypertensive individuals (N=267; mean age = 76) to one of two groups: usual

care only, or usual care plus weekly access to a telephone-linked care (TLC) system that ascertained patient status through a series of computer-generated questions and which also provided education and motivational counseling. At six months, significant and positive differences in medication adherence and blood pressure were observed for the intervention vs. usual care condition, and system cost-effectiveness was found to significantly increase with a higher degree of medication compliance. Health status reports automatically generated by the TLC system were sent to all participants' primary care physicians; 85% reported they read the reports on a regular basis, and 40% utilized them in discussions with their (participant) patients. Of the TLC participants, 69% scored in the highest quartile for satisfaction with the system, and 54% scored in the highest quartile on their perceptions of TLC's health benefit. This noteworthy combination of objective and subjective evidence clearly suggests the utility of telephone technology in monitoring health status and influencing health-promoting behavior for older, health-compromised individuals, and also in facilitating communication between patients and health care professionals.

In a design that offered an alternative to telephone-based remote social support and information, Czaja, Guerrier, Nair, and Landauer³⁴ provided older adults (N=36; aged 55-95) with in-home computer access to e-mail communication with study peers as well as to health-related information and entertainment news. A high proportion (95%) of the participants indicated that they found the system of value, and 65% reported satisfaction with e-mail communication. However, significant declines in system use and in the number of messages sent were observed over time, for reasons that remained unclear. Participants 65 to 74 years of age used the system significantly more frequently than did those 75 years of age and above; this latter group was also found to have significantly fewer system contacts

(e.g., e-mail buddies). The authors also reported participant reasons for system use: 92% indicated they wanted to learn something new; 84% enjoyed the mental challenge; 81% used the system primarily for socializing; 57% wanted to meet new people; and 38% appreciated the opportunity to exchange ideas. The authors also obtained baseline measures of depression and loneliness with the stated intention of carrying out an end-of-study comparison, and had utilized these scores as predictors for system use in combination with other participant characteristics, such as typing speed and visual acuity. However, they failed to provide final outcome data for these measures, making it difficult to compare such results with those obtained by other interventions, such as Heller et al., that offered similar sorts of support networks but delivered them through a different technological vehicle. Overall, however, these data help to validate e-mail and access to computerized information as socially- and cognitively-useful resources, particularly for those under 75 years of age.

In an effort to determine the feasibility of, and interest in, an interactive telephone-based system that provided access to dementia information and live resources, Mundt, Kaplan, and Greist³⁵ tracked activity for the system's first month of operation in La Crosse, WI. Potential users primarily targeted were 102,565 area residents, age 65 or above, and the system was advertised in local newspapers and flyers and on a variety of public bulletin boards. Although the age of system users was not tracked, degree of system use, reasons for use, and resources accessed were assessed. Nearly 200 calls were received during the system's first month of operation, primarily between the hours of 8 am and 6 pm; 50% of system users reported calling due to specific concerns about another individual, 25% called with general concerns, and 25% called with personal concerns. Of the resources accessed by callers, 86% wanted information on

dementia and dementia treatment, 22.5% wanted to obtain prevalence and risk factor information, and 15.7% were seeking local resources and caregiver support. A percentage of users (N=19) responded to evaluative questions regarding their experience with the system; 68% found it quite helpful and easy to navigate, and 84% indicated they would recommend the system to others. These preliminary data appear to indicate that a telephone-based system of information and resource linkage to dementia resources is useful to a broad group of (presumably older) individuals; additional data on system use and users gathered over time would help to establish a clearer picture of the system's role in public education on dementia, and its impact in facilitating access to appropriate resources.

Outcomes for Interventions Promoting the Development of Assessment and Monitoring Techniques

Perhaps due to the nature of these investigations, none of the five studies in this section utilized randomized assignment or comparison group designs. Three of these studies targeted older, currently independent adults, and one each focused on dementia and individuals with hypertension. Two studies each delivered their interventions through telephone and videolinked approaches, and one utilized infrared sensor technology. Again, variability in participant numbers across studies was evident, with Ns ranging from 8 to 229.

In a study designed to test the use of a telephone-based approach to assessing cognitive status, Mundt, Kaplan, and Greist³⁶ compared results on the widely-used Mini-Mental Status Examination (MMSE) and the Clinical Dementia Rating Scale (CDRS) obtained both in person and over the telephone with a group of caregivers and older adults (N=155; aged 56-93). Results indicated high satisfaction ratings as well as results of sensitivity (range = 63.5-100%) and specificity (100%) testing, using objective

and informant-completed measures across in-person and remote conditions. Sensitivity calculations for the group of informant-completed CDRS assessments (which included spouse caregivers) were unfortunately at the low end of the reported range (63.5%, compared to 82.0% reported for the MMSE); however, when a lower scoring criterion was used to detect possible impairment (i.e., when the standard score to detect impairment was lowered from 5 to 3), sensitivity of the informant-completed measure rose to 90.4%. Specificity findings of 100% across objective and informant-completed measures, in combination with potentially viable sensitivity ratings, suggest that telephone-based cognitive screening may be a valid and useful clinical tool. Caregivers could potentially benefit from the use of such an assessment due to its automated (e.g., time-saving) design, and from the opportunity to directly contribute to the assessment process through providing their own impressions as a basis for judgment of care recipient impairment rather than relying solely on patient-specific measures.

Another approach to remote evaluation was tested by Montani et al.³⁷, who compared face-to-face vs. videolinked administration of standardized cognitive assessments – the MMSE and the Clock Face Test (CFT) – for a group of older adults (N=15; aged 83-95). The two visits were separated by eight days. Pearson r correlations across the two measures were high for MMSE ($r=.95$) and lower for the CFT ($r=.55$). The authors indicated that the CFT has enjoyed high face-to-face test-retest correlations in another study³⁸, and so questioned the appropriateness of using the CFT in a teleconsultative setting, speculating that a decline in concentration was responsible for the test-retest discrepancies. However, 67% of the participants reported preferences for in-person consultations, with 47% reporting more confidence in face-to-face visits; 47% experienced some degree of difficulty hearing the videolinked test administration, and 40% felt uncomfort-

able during the remote visit. Only 27% of patients indicated any clear interest in the videolinked approach to assessment. It is possible that dislike of and/or discomfort with the testing situation could have contributed to the poorer correlations for the CFT; it might be worth exploring what features of this test could be more susceptible to environmental factors, or patient mood, than the MMSE appeared to be. Additionally, both interviewers and observers offered comments that participants appeared to be more present and engaged in the face-to-face visits. Given that remote assessments were significantly shorter than the face-to-face visits, the authors' comments on the difficulties of establishing rapport at a distance are well taken. It is possible that fewer interactions were initiated during the remote visits (by one or both parties) due to influences concerning the nature of the "faster" technology in use; information may also be gathered through in-person consultations through, e.g., eye contact and subtle physical cues, that cannot be obtained through more remote channels. Further and more detailed testing appears to be required to determine the appropriateness and acceptability of remote approaches to cognitive assessment, at least for the oldest-old.

Patient and physician satisfaction reports were also obtained by a study comparing in-person vs. telemedicine assessment³⁹ designed to monitor physical status for individuals with a history of hypertension (N=62; mean age = 67). Two same-day visits were carried out, one in person and one remotely; the assessment consisted of discussion plus measurement of blood pressure and oxygen levels, body weight, and heart and ear status. As in Montani et al.³⁷⁻³⁸ above, remote consults took significantly less time than did in-person visits, and participants reported significantly less satisfaction with the length of their telemedicine visits, as well as significantly lower ratings for the visit's technical quality. However, 57% reported they would use telemedicine in the future, at least in

some situations, and 59% reported equal satisfaction across the two visit types. The two participating physicians reported significantly higher degrees of work required, mental effort, and psychological stress for the telemedicine vs. in-person consultations. Not surprisingly, they also reported a significantly greater need for technical skills, but at the same time they were uniformly pleased with the degree of functionality, technical quality, and comfort of the telemedicine visits, and believed them likely to mitigate the need for future treatment. These results are encouraging with respect to the acceptability of telemedicine for an older population, and satisfaction on both ends may improve as do physicians' technical skills and familiarity with the technology and patients' comfort with telemedicine as its visibility and availability increases.

Results of test-retest reliability, validity, sensitivity, and specificity were reported by Mahoney, Tennstedt, Friedman, and Heeren⁴⁰, who explored the potential for carrying out functional (ADL and IADL) assessment of older adults (N=20; mean age = 78.9) through three channels: face-to-face in the home environment, through a personal telephone conversation, and through an automated telephone system (Telephone-Linked Elder Care, or TLC) utilizing computer-mediated, voice response technology. All visits were completed within 72 hours and standardized instruments were used to collect data concerning functional status. TLC test-retest reliability was encouraging for both ADL (kappa = 0.76) and IADL (kappa = 0.83) items, with 90%+ agreement for 6 of 7 ADL items and 80%+ agreement for 6 of 8 IADL items. Such specific information could be used to refine these assessments in a way that might make them more compatible with a TLC approach. However, comparisons of TLC results with live telephone assessment fared better than TLC compared to in-home assessments; for ADL items, kappa = 0.68 and 0.53; and for IADL items, kappa = 0.80 and 0.34, respectively. Correlations across

testing environments appeared to be negatively influenced by a greater degree of ADL and IADL impairment, as well as increased depersonalization of the assessment process. Although TLC specificity was 100% for all test items, sensitivity calculations varied from 100% for three ADL items to 60% or below for three IADL items. These data seem to indicate that remote assessments may not be adequate for sufficiently evaluating functional status, at least for older, more impaired populations. On the other hand, it is also possible that the technology tested by this study was not appropriate for the task, but that an alternative method (e.g., one that permitted visual as well as auditory evaluation of the individual) could determine functional status with a higher degree of accuracy and correspondence to traditional approaches. The question in this case may not be whether a technological approach to functional assessment should be used at all, but what type of technology could produce the best results.

Finally, preliminary results of an in-home monitoring system utilizing infrared technology were reported by Ohta, Nakamoto, Shinagawa, and Tanikawa⁴¹ for a small group (N=8) of older adults aged 73-90. The system was designed to track room-to-room movement and to report unusual events (e.g., changes in typical activity patterns) to a family member via telephone or e-mail. Encouraging reports of signal accuracy (error rate below .06%) and good consistency in the room-to-room patterns observed by the system indicate early potential for this automated approach that could potentially support independence for older adults as well as efficiently alert the family member when potential for trouble is identified.

SUMMARY AND CONCLUSION

There are multiple ways in which caregivers and care-recipients might benefit from intervention: enhanced social support, enhanced knowledge and understanding of chronic disease, disability, and aging, and promoting

emotional well-being and physical health. The studies included in this review illustrate how technology can be used to facilitate the achievement of each of these goals. In addition, technology-based approaches to assessment of cognitive and physical functioning as well as monitoring patient movement have the potential of serving as valuable tools in both research and practice applications. However, the reliability and acceptability of these methods need to be enhanced before they can be widely used. On the whole, these studies show that most existing technologies are both acceptable and feasible, although assessments of their impact are mixed.

Judgments of impact, significance, and meaningfulness of interventions utilizing technology are necessarily subject to the same evaluation criteria used to evaluate interventions in general; issues concerning study design, sample size and composition, statistical power and analytic methods, reliability and validity of measures would all, ideally, be taken into account. Careful analyses of the treatment outcomes – critical for establishing evidence-based criteria and replication – can be complex and time-consuming to carry out. This challenge is amplified further here by the question currently being posed: to what extent, and how convincingly, do interventions that employ some form of technology accomplish their stated purpose – and what role, if any, did the technology itself play in influencing study results?

Investigators committed to rigorous, credible research generally subscribe to the ethic that, in order to understand the behavior or effects of a particular variable, that variable must be isolated in some fashion in the study design. However, this feature is currently missing in this small but growing cohort of studies. For the purposes of this review, no studies were found that attempted to characterize the effects of the chosen technology outside of the general intervention being delivered. Consequently, it is difficult to

articulate with any confidence the precise role that technology plays in any of these interventions, or its specific contribution to study outcomes. Nevertheless, it may be possible to assess the value of a technology-based approach by examining the cost-effectiveness of technology-based interventions either independently of or in addition to other commonly accepted interventions. Knowing the cost-effectiveness of an intervention with regard to widely used outcomes used in caregiving intervention studies would enable us to roughly gauge the relative value of a technology-based intervention when compared to more traditional approaches for achieving similar outcomes.

Where do we go from here? Technology-based interventions for caregivers and care-recipients are clearly here to stay; they will become increasingly important as the prevalence and challenges of family caregiving increase. It is useful therefore, to speculate about the key scientific and practical issues that would facilitate growth in this area.

First, in applying new technologies researchers have appropriately focused on issues of feasibility and usability, but have not systematically addressed a broad range of related issues that arise with these new applications. As new technologies come on line it will be equally important to address issues pertaining to training needs associated with technological applications, factors that limit access to technology, the adaptability of technology to individual needs, the extent to which a technology undermines individual autonomy, control, and dignity, as well as possible legal or liability issues raised by some technological applications, particularly in the health arena.

Second, it is essential to recognize the unique potential for harm inherent in some technologies¹¹. For example, information transfer technologies based on the internet or telephones do not have the same element of control inherent in face-to-face interactions.

This opens the door to the proliferation of incorrect or inappropriate information which have the potential for harmful outcomes. In addition, the ease with which information can be exchanged with the new technologies also raises privacy concerns. There is a danger that private personal information may reach persons or organizations other than the intended correspondent, without the user's knowledge or consent.

Third, at the broader scientific level there is need for a better understanding of how technological applications fit into the conceptual frameworks we have developed for a variety of research areas such as caregiving. For example, most caregiver intervention studies are grounded in stress-health frameworks that specify both external observable conditions and psychological processes linked to caregiver outcomes. How do technology-based interventions change our thinking about such models? Can their effects be easily understood within existing frameworks or do we need new ones?

A final suggestion concerns the need to develop a taxonomy for characterizing technology-based interventions. A good taxonomy would be beneficial in a number of ways. It would facilitate comparisons across studies, enhance our ability to identify key mediating mechanisms for important intervention effects, and improve our ability to measure interventions and their outcomes. In sum, we now have enough experience in the business of developing and implementing technology-based caregiver interventions that it would be fruitful for us to step back and develop a more organized view of this area in the hopes of moving it ahead more quickly and effectively.

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Appendix 1. Characteristics of studies utilizing technology-based interventions with caregivers, care receivers, and older adults

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
<p><i>Study: Brennan et al.^{22,23}</i> N = 96 dementia CGs; mean age=64; 67% female; 68% spouses; 72% Caucasian 2 groups: (1) comparison (N=49) (2) ComputerLink (N=47)</p>	<p><i>Study: Bass et al.²⁴; McGuire²⁵ (rcf) (tc)</i> (1) provided with information on local services and resources (2) provided with home access to ComputerLink, an internet- based support and information CG network. CGs communicated via private e- mail and public message board, and could post questions anonymously. Electronic encyclopedia on AD available. Decision-support module guided CGs to identify solutions to problems through posing a series of questions requesting CG to rank and evaluate alternatives. Nurse moderator responded to messages both privately and publicly. Duration: 12 months 2 assessments: baseline 12 months</p>	<p>Knowledge Decision support Social support Access to experts</p>	<p>Information Physical health Cognitive functioning Psychosocial health</p>	<p>-Decision confidence scale (modified) -Number of alternatives generated during decision-making -Instrumental and Expressive Social Support Scale -Impact of Caregiving Scale -Center for Epidemiological Studies Depression Scale -extent of use of community/medical services -Clinical Dementia Rating Scale (CR status) The following measures were investigator-developed: -3-item physical health index -3-item or emotional strain -5-item index of caregiver-care recipient relationship strain -5-item caregiver activity restriction index -perceived information support -Cost-effectiveness analysis based on relationship of costs of providing care at home to caregiver decision confidence Analysis: ANOVA; multiple regression</p>	<p>Decision confidence: (2) > (1) Emotional strain: (2) > (1) for CGs with more informal support Relationship strain: (2) > (1) for spouses only Activity restriction: (2) > (1) for CGs with more informal support and who did not live alone with CR Cost-effectiveness: (2) > (1)</p>
<p><i>Study: Chambers & Connor²⁸</i> N = 242; 216 care providers (103 family members; 113 health care professionals) and</p>	<p>Participants viewed ACTION (Assisting Carers using Telematics Interventions to meet Older persons' Needs), an</p>	<p>Knowledge Decision support Social support Access to experts</p>	<p>Information Cognitive functioning Psychosocial</p>	<p>-Usability analysis via Website Analysis and Measurement Inventory; one global measure and five submeasures: attractiveness, ANOVA; multiple regression</p>	<p>Usability (score of 50 considered 'average'); -Global = 67 -Attractiveness = 76</p>

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
<p>26 CRs across several European countries. 76% female respondents overall; sample not further described</p> <p>1.group: (1) ACTION system testers (N=242)</p>	<p>interactive software program viewed on a television set and operated with a remote control. Program offers information on health promotion, relaxation, and coping; opportunity to communicate with other formal and informal carers; and feedback for CG regarding their coping abilities, provided both electronically and by health experts</p> <p>Duration: usability study</p> <p>1.assessment: single session</p>		<p>health</p>	<p>controllability, efficiency, helpfulness, and learnability</p> <p>-Participant feedback Analysis: Correlational, qualitative</p>	<p>-Controllability = 60 -Efficiency = 71 -Helpfulness = 74 -Learnability = 67.5</p> <p>Feedback: corresponded to usability judgments</p>
<p><i>Study: Czaja et al.¹⁴</i></p> <p>N = 36 older female adults, aged 55-95 (M=68.2); 49% lived alone</p> <p>1.group: (1) older adults (N=36)</p>	<p>(1) trained and provided with in-home computer equipment providing e-mail with other study participants, health-related information, and entertainment news</p> <p>Duration: 6 months</p> <p>3.assessments: baseline 3 months 6 months</p>	<p>Knowledge Social support</p>	<p>Information Psychosocial health</p>	<p>-Feasibility of system</p> <p>-Features used</p> <p>-Perceptions of system</p> <p>-UCLA Loneliness Scale</p> <p>-Center for Epidemiological Studies Depression Scale</p> <p>Analysis: F-tests; qualitative</p>	<p>Feasibility: -System use: averaged 28 times/day (R=1-117) per participant; significant drop in use over time</p> <p>-Number of messages: averaged 14 messages per day per participant (M=13.72; SD=11.4); significant decline in number of messages sent over time</p> <p>-Message length: increased significantly over time</p> <p>-Time per message: composition time decreased significantly over time</p> <p>-Errors: non-significant decrease in errors during 1st 6 months; significant increase in errors during 2nd 6 months</p> <p>Features used: e-mail most</p>

Intervention with Family Caregivers

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
<p><i>Study: Czaja & Rubert³³ (rct). Data extracted from a larger study being conducted at the Miami site of Resources for Enhancing Alzheimer's Caregiver Health (REACH) program</i></p>					
<p>N = 44 dementia CGs; mean age=67.5; 77% female; 47.7% Cuban Americans and 52.3% Caucasian Americans; 64% spouses</p> <p>1 group: (1) dementia CGs (N=44)</p>	<p>(1) provided with a computer-integrated, screen telephone system (CTIS) to augment a structured, home-based family therapy designed to improve burden and family interaction through identification of resources, and problem-solving. Telephone system offers discussion groups, voice mail, expert reminders, access to expert resources, and respite vignettes tailored for each CR.</p> <p>Duration: 6 months 1 assessments: 6 months</p>	<p>Knowledge Affect management Social support Respite</p>	<p>Information Psychosocial health</p>	<p>-System use -Screen phone acceptability -Value of discussion groups -Value of CG resources</p> <p>Analysis: X²; qualitative</p>	<p>popular; used 98.7% of available time</p> <p>Perceptions: 95% found system valuable; 65% satisfied with e-mail communication</p> <p>-Reasons for use: to learn something new (92%); mental challenge (84%); socializing (81%); meet new people (57%); exchange ideas (38%)</p> <p>Use: -49 calls per CG -used approximately 4 times per day -used to contact family (76%), friends (15%), and system resource menu (6%) -93% found conference calls valuable -Cuban Americans found system significantly easier to use than Caucasian Americans -13% of participants had difficulty using the system</p> <p>Screen phone: -used to contact family members (80%); therapists (39%), discussion groups (34%), and other CGs (32%) -Cuban Americans found screen phone significantly more valuable than Caucasian Americans</p> <p>Discussion groups: -80% of CGs participated; of</p>

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
<p>Study: Davies⁴² N=2: 1 stroke patient "Mr. A" (aged 65, male, 5 years post-onset) and his CG spouse (not further described) 1 group: (1) single dyad case study</p>	<p>(1) CG trained to modify content of patient's discourse through audiotaping their visits, analyzing tape content, and providing dyad-specific counseling and prompting training intervention Duration: 5 weeks 24 assessments (3 per session at 15-minute intervals) sessions 1-8</p>	<p>Affect management Access to experts</p>	<p>Psychosocial health</p>	<p>-Beck Depression Inventory -% of positive utterances by Mr. A during wife and extended family visits -Family visit satisfaction Analysis: Qualitative</p>	<p>these, 82% enjoyed participation and 86% found participation valuable CG resources: -links used: Alzheimer's Association (50%), community support groups (44%), general information/referral (40%), and respite care (33%)</p>
<p>Study: Davis³⁵ (fc) N=34: 17 dementia CGs (aged 25-79, M=57.2; 75% female; 60% Caucasian and 40% African-American) and their 17 CRs (aged 64-92, M=79) 1 group: (1) CG telephone intervention (N=17 dyads)</p>	<p>(1) participated in initial in-home training session and then in weekly telephone contact (calls 45-60 minutes in duration) with community health nurse, who provided support and problem-solving assistance to CG-defined problem. Pilot feasibility study. Duration: 12 weeks 2 assessments: baseline post-intervention</p>	<p>Social support Decision support Access to experts</p>	<p>Cognitive functioning Psychosocial health</p>	<p>-Revised Memory and Behavior Problem Checklist (CR status) -Rational Problem-Solving Inventory -Interpersonal Support Evaluation List -Geriatric Depression Rating Scale -Life Satisfaction Index Analysis: t-test</p>	<p>Use of social support: > over baseline Depressive symptoms: > over baseline Life satisfaction: > over baseline</p>

Intervention with Family Caregivers

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
<p><i>Study: Friedman et al.³³ (ct)</i></p> <p>N = 267 elderly hypertensive patients; mean age=76.0; 77% female; 11% African-American</p> <p>2 groups: (1) usual care (N=134) (2) usual care plus TLC (N=133)</p>	<p>(2) placed weekly calls to Telephone-Linked Care (TLC) system that ascertained patients' status through touch-tone telephone keypad responses to computer-generated questions, and provided education and motivational counseling. Patients' physicians received weekly status reports.</p> <p>Duration: 6 months 2 assessments: baseline 6 months</p>	<p>Knowledge Decision support Access to experts</p>	<p>Information Physical health</p>	<p>-Medication adherence control -Blood pressure and perceived health benefit -Physician-perceived utility -Perceived cost-effectiveness</p> <p>Analysis: t-tests</p>	<p>Medication adherence: (2) > (1) Blood pressure: (2) > (1) Satisfaction: 69% scored in highest quartile Perceived health benefit: 54% scored in highest quartile Physician-perceived Utility: 85% read reports regularly; 84% included reports in patient charts; 40% reported discussing report information with patient Cost-effectiveness: increased with higher degree of medication adherence</p>
<p><i>Study: Goodman & Pyrosos^{18,19}, Goodman²⁰ (ct) (tc)</i></p> <p>N = 132: 66 dementia patients (75% with AD; not further described) and their 66 CGs (mean age=64.6; 80% female; 68.5% Caucasian; 74% married)</p> <p>2 groups: (1) informational lecture (N=35 dyads) (2) informational lecture + peer support (N=31 dyads)</p>	<p>(1) CGs listened to 12 prerecorded AD informational lectures via telephone</p> <p>(2) CGs participated in peer telephone support + received pre-recorded AD information via telephone</p> <p>After 3 months, participants switched groups, such that (1) participated in (2) activities and vice versa</p> <p>Duration: 6 months 3 assessments: baseline 3 months 6 months</p>	<p>Knowledge Social support</p>	<p>Information Psychosocial health</p>	<p>-Memory and Behavior Problem Checklist (CR status) -Burden Interview -Caregiver-Elder Relationship Scale -Rand Mental Health Index (38-item) -Social network measure (adapted) -Perceived Social Support for Caregiving and Social Conflict -Knowledge quiz</p> <p>Analysis: ANOVA</p>	<p>CR status: < for both groups at 6 months Burden: < for both groups at 6 months Social network: -Perceived social support: > for both groups at 3 months; < for both groups at 6 months -Perceived social conflict: < for both groups at 6 months -Support satisfaction: > for both groups at 3 months; < for both groups at 6 months -Degree of friend/family support: > for both groups at 6 months Knowledge: > for both groups at 3 and 6 months</p>
<p><i>Study: Heller et al.⁷ (ct) (tt)</i></p> <p>N = 276 older,</p>	<p>2 study phases:</p>	<p>Social support</p>	<p>Psychosocial</p>	<p>-Activities of Daily Living Scale¹</p>	<p>Morale: > from baseline for both</p>

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
<p>community-dwelling women; mean age=74; 67% widowed; 18% married; 74% lived alone; mean annual income=\$7-\$9K</p> <p>2 groups.(Phase 1): (1) assessment only (N=53) (2) telephone visit (N=238)</p> <p>6 groups.(Phase 2): (1) assessment only (N=53) (2) peer contact initiator (N=49) (3) peer contact recipient (N=49) (4) staff contact (refused peer contact) (N=27) (5) staff contact during 1st phase; assessment only during 2nd phase (N=49)</p>	<p>Phase 1 (10 weeks): after initial assessment, participants randomly assigned to receive weekly social and supportive telephone visits conducted by female interventionists age 30-55, or assessment-only control group</p> <p>Phase 2 (10 weeks): participants in staff contact group randomly assigned to continue in same group, to become an initiator or recipient of peer telephone contact, or to become no-contact control. Staff contact withdrawn after 10 weeks; peer dyads had option to continue telephone contact</p> <p>Duration: 40 weeks</p> <p>4 assessments: baseline 10 weeks (end of Phase 1) 20 weeks 30 weeks</p>		<p>health</p>	<p>-Center for Epidemiological Studies Depression Scale -Perceived Social Support Scale -Philadelphia Geriatric Center Morale Scale -Physical health and daily hassles measure (adapted) -Loneliness Scale -Dyad contact after staff support withdrawn Analysis: ANOVA</p>	<p>groups at 10 weeks; > for (4) at 20 weeks; all gains reverted to baseline except for assessment-only group at 40 weeks Loneliness: > from baseline for both groups at 10 weeks; > for (2) and (3) 20 weeks; all gains reverted to baseline except for assessment-only group at 40 weeks Dyad contact: 71% still in contact at 20 weeks; 56% still in contact at 30 weeks</p>
<p>Study: Krousel-Wood <i>et al</i>³⁹ N = 62 hypertensive patients; mean age=67; 57% male; 18% African-American; 77% married Within-group comparison (same N=62): (1) In-person visits</p>	<p>All participants seen by one of two physicians, both (1) in person and (2) via telemedicine on the same day, 1 hour apart. Participants were trained and provided with a portable computer, modem, CD-ROM drive and camera, and remotely-operated medical</p>	<p>Assessment</p>	<p>Physical health</p>	<p>-Short Form 36 -Group Health Association of America Consumer Satisfaction Survey (participant satisfaction) -Pine Ridge Indian Hospital—Mayo Clinic Demonstration Project Questionnaire (physician satisfaction)</p>	<p>Satisfaction (patient): -Technical quality: (2) < (1) -Amount of time spent: (2) < (1) -57% indicated they would use telemedicine in future; 59% reported equal satisfaction across telemedicine and in-person visits Resource-based value</p>

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
(2) Telemedicine visits	measurement devices (blood pressure cuff and monitor, pulse oximeter, body weight scale, ear probe thermometer, and stethoscope). Duration: 12 months 2 assessments per participant: post in-person visit (107 total) post telemedicine visit (107 total)			-Resource-based value relative scale reimbursement system (physician work, effort, skills, and stress) -Subjective physician reports of comfort, image quality, likelihood of visit reducing need for further treatment, and system functionality Analysis: Wilcoxon matched-pairs signed rank test: qualitative. Compared SF-36 results to normative population.	(physician): 2 < 1 for degree of work and mental effort required, need for technological skills, and psychological stress for physicians Subjective physician reports: all positive for comfort, image quality, reducing further treatment, and functionality
<i>Study: Lund et al.¹⁷ (tc)</i> N = 14; 7 dementia CGs and their 7 CRs (no further description) 1 group: (1) videotapes shown to CR (N=7 dyads) chose	30-minute videotapes created by CGs, describing early life experiences of care recipient and encouraging interaction by asking questions, shown to entertain CR whenever CG chose Duration: 2 weeks 1 assessment: 2 weeks	Respite	Psychosocial health	-Interviews re: use, benefits, limitations -Capability of tapes to capture CR attention Analysis: Qualitative	Use: 86% reported "frequent" use; 29.5% used daily; 14% did not use as content appeared to produce negative CR recollections Benefits: 86% reported increase in free time; 14% reported useful for mitigating disruptive CR behavior Limitations: CGs had limited time to create tapes; some lacked confidence and willingness to prepare tape scripts; tapes require high degree of time and resources CR attention: maintained well; attended better to tape than to television; responded verbally to questions posed on tape
<i>Study: Mahler & Kulik³⁰ (rcf) (tc)</i> N=592: 226 male and	Spouses in (1) received only	Knowledge	Information	-Patient physical status and	Patient outcomes:

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
70 female first-time CABG recipients (aged 41-80, M=63.2; 79.4% Caucasian) and their 296 spouses/partners (aged 28-89, M=60.79) 3 groups: (1) usual care (N=101) (2) usual care + mastery tape (N=93) (3) usual care + coping tape (N=101)	usual care and discharge instructions after CABG. Spouses in (2) viewed "mastery" videotape, depicting couples after CABG appearing calm, confident, and optimistic about recovery. Spouses in (3) viewed "coping" videotape, depicting same couples describing effortful but ultimately successful difficulties encountered in CABG recovery process. Narration was provided for both tapes by the same cardiothoracic nurse specialist. Tapes designed to provide procedural (e.g., lifting) and sensory (e.g., emotional) information. Duration: 6 months 4 assessments: baseline 1 month post-discharge 3 months post-discharge 6 months post-discharge	Access to experts	Physical health Psychosocial health	postoperative complications -Abbreviated Dyadic Adjustment Scale -Positive and Negative Affect Schedule -3-item feeling-of-preparedness measure (5-point scale; spouse only) -14-item questionnaire concerning emotional difficulties (7-point scale; spouse only)	-Physical status: > over time, with < surgery problems and < medical consultations. However, (1) > (2), (3) for females in number of health problems and 1 st -month rehospitalizations -Positive and negative affect: both > over time. Females reported > negative mood than males. Spouse outcomes: -Feeling of preparedness: (2), (3) > 1 -Positive and negative affect: both highest at discharge; both < over time. Females reported > negative mood than males. -Emotional difficulties: < over time; females reported > than males at 1 and 3 months
Study: Mahoney et al. ⁴⁰ N = 20 older adults, aged 61-98 (M=78.9); 85% female; 100% Caucasian; moderately disabled (on average, required assistance with 1 ADL and 2-3 IADLs) Within-group comparison (same	All participants received functional (ADL & IADL) assessments as follows: (1) face-to-face in the home environment, (2) via a personal telephone conversation, and (3) via Telephone-Linked Elder Care (TLC-Elder Care), a interactive, voice response system utilizing computer-	Assessment	Physical health Cognitive functioning	-Activities of Daily Living Scale ² -Instrumental Activities of Daily Living Scale -TLC test-retest reliability -TLC validity -TLC sensitivity -TLC specificity Kappa statistic; correlations	TLC test-retest reliability: kappa = 0.76 for ADL and 0.83 for IADL items; 90%+ agreement for 6/7 ADL items, and 80%+ agreement for 6/8 IADL items TLC validity: -comparison with live telephone assessment: kappa = 0.68 for ADL and 0.80 for IADL items -comparison with in-home

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
<p><i>N</i>=20): (1) assessment in home environment (2) assessment via live telephone conversation (3) assessment via TLC</p> <p><i>Study: Mahoney et al.⁷ (rct)</i> <i>N</i>=93 dementia CGs; (for intervention group, mean age=60; 80% female; 80% spouses; no-intervention group not described) 2 groups: (1) no-intervention control (<i>N</i>=51) (2) REACH for TLC (<i>N</i>=42). This group was eventually divided into two sub-groups: (3) "adopters" (<i>N</i>=20) and (4) "non-adopters" (<i>N</i>=22), based on degree of system use</p>	<p>mediated telephone technology. All assessments conducted within a 72-hour period. Duration: not reported 3 assessments per participant: in-home assessment live/telephone assessment TLC telephone assessment</p> <p>(2) provided with access to Resources for Enhancing Caregiver Health through Telephone-Linked Care (REACH for TLC), a computer-mediated, telephone-based interactive voice response system providing weekly monitoring of CR behavior and counseling on behavior management strategies, in-home support via voicemail, multidisciplinary expert feedback, and a pre-recorded 18-minute, personally tailored conversation for CRs, designed to provide CG with respite time Duration: 18 months 1 assessment: 12 months</p>	<p>Knowledge Decision support Social support Affect management Access to experts Respite</p>	<p>Information Cognitive functioning Psychosocial health</p>	<p>-Degree of system use -System modules used -Comparison of adopters and non-adopters -System proficiency -Perceived stress via Revised Memory and Behavior Problems Checklist -7-item mastery scale -3-item self-management assessment -Reasons for failure to adopt system use -Preferences for system vs. in-person communication Analysis: ANOVA; Pearson χ^2; linear and multiple regression; qualitative</p>	<p>assessment: kappa = 0.53 for ADL and 0.34 for IADL items, with in-home reporting > degree of both ADL and IADL impairment TLC sensitivity: ranged from 100% for 3 ADL items to 60% or less on 3 IADL items TLC specificity: 100% for all items</p> <p>System use: average 55 minutes per user (SD=78; $R^2=1-318$); average 11 calls per user (SD=12). Significant drop in use over time. Modules: 79% used monitoring/counseling; 57% used respite; 24% used support group; 21% used expert feedback Adopter vs non-adopter: 3 > 4 for age, education, self-management, male gender, spouse status, and proficiency Non-adopters: low tolerance for technical problems, little personal time System vs in-person: strong preferences for personal contact reported</p>
<p><i>Study: Montani et al.^{7,38}</i> <i>N</i>=15 older adults aged 83-95 ($M=88.2$); 87.5% female Within-group</p>	<p>All participants completed two cognitive assessments with a psychologist, one (1) face-to-face and the other (2) via a</p>	<p>Assessment</p>	<p>Cognitive functioning</p>	<p>-Duration of consults -Durations of testing -Mini-Mental State Examination (overall score)</p>	<p>Consult duration: (2) < (1) MMSE scores: $r= .95$ across 1 & 2 CFT scores: $r= .55$ across 1 & 2</p>

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
<p>comparison (same N=15):</p> <p>(1) In-person visit</p> <p>(2) Telelinked visit</p>	<p>videolink system using a camera, television screen, and microphone. Visits were separated by 8 days.</p> <p>Duration: 4 months</p> <p>2 assessments per participant: post in-person visit post telelinked visit</p>			<p>-Clock Face Test</p> <p>-Patient reactions to consultation types</p> <p>Analysis:</p> <p>t-tests; Spearman's rho; qualitative</p>	<p>Patient reactions: 67% preferred in-person visit; 47% experienced some difficulty hearing during videolink; 40% felt ill-at-ease in videolink visit; 47% had more confidence in in-person visit; 27% were interested in videolink approach</p>
<p>Study: Mundt et al⁵</p> <p>N=102,565</p> <p>(potential) residents of La Crosse County, WI; 11.7% aged 65 or over</p> <p>1 group:</p> <p>(1) county residents (total possible N=102,566)</p>	<p>Studied feasibility of and public interest in interactive, telephone-based system providing pre-recorded information on dementia and providing direct connection to live resource office</p> <p>Duration: 1 month</p> <p>Assessment:</p> <p>Data collected for the month of November, 1999 (first month of operation)</p>	<p>Knowledge</p> <p>Access to experts</p>	<p>Information</p>	<p>-Number of calls received</p> <p>-Length of calls</p> <p>-Time calls received</p> <p>-Reason for calls</p> <p>-Pre-recorded resources accessed</p> <p>-Live resources accessed</p> <p>-Evaluative feedback (N=19)</p> <p>Analysis:</p> <p>qualitative</p>	<p>Number of calls: 193</p> <p>Length of calls: average call = 9.5 minutes</p> <p>Time calls received: 14%, 12-8 am; 67.4 8 am-6 pm; 18.7% after 6 pm</p> <p>Reasons: 50% for specific concerns for another person; 25% general concern; 25% personal concern</p> <p>Resources accessed:</p> <p>- 86% information and treatment</p> <p>- 22.5% prevalence and risk factors</p> <p>- 15.7% local resources and caregiver support</p> <p>Evaluation: 68% found system "very helpful" and information "easy to find;" 84% would recommend system to others</p>
<p>Study: Mundt et al⁵</p> <p>N=229: 155 older adults (aged 56-93, M=76.7; 63% female, 61.3% married, all diagnosed with no or mild dementia) and 74</p>	<p>(1) completed two dementia assessments, one in person and one via an interactive, telephone-based voice response system</p> <p>(2) completed informant</p>	<p>Assessment</p>	<p>Cognitive functioning</p>	<p>-Percentage of assessments completed</p> <p>-Sensitivity and specificity of cognitive screening measures: Clinical Dementia Rating Scale and Mini-Mental State</p>	<p>Assessments completed: 98.7%</p> <p>Sensitivity of cognitive measures across assessment types: 82.0%</p> <p>Specificity of cognitive measures across assessment types: 85/5%</p> <p>Sensitivity of informant measure:</p>

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
<p>"collateral informants" (62% spouses, 36% children)</p> <p>2 groups:</p> <p>(1) Older adults (N=155)</p> <p>(2) Collateral informants (N=74)</p> <p>Study: <i>Ohta et al</i>¹</p>	<p>dementia assessment via interactive telephone system</p> <p>Duration: not reported</p> <p>2 assessments for (1):</p> <p>in-person testing</p> <p>telephone-based testing</p> <p>1 assessment for (2):</p> <p>telephone-based screen</p>			<p>Examination</p> <p>-Sensitivity and specificity of informant-completed Symptoms of Dementia Screener</p> <p>-Participant feedback</p> <p>Analysis:</p> <p>QUEST; qualitative</p>	<p>63.5%</p> <p>Specificity of informant measure: 100%</p> <p>Feedback: system use rated as "very easy" or "easy" by 85% of those without cognitive impairment, and by 76% of those with mild cognitive impairment</p>
<p>N = 8 older adults, aged 73-90 (M=81), 87.5% female</p> <p>1 group:</p> <p>(1) in-house monitoring (N=8)</p> <p>Study: <i>Steffen</i>²¹ (rct) (tc)</p>	<p>(1) received infrared sensor monitoring of in-home movements; unusual movements reported to family member by telephone or e-mail</p> <p>Duration: 80 months</p> <p>Various assessments:</p> <p>Ss monitored from 2-20 months</p>	Monitoring	Physical health	<p>-Infrared signal accuracy --"Usual" vs. "unusual" days, based on length of stay in specific rooms as compared with previous data, no-response time intervals, and movement patterns</p> <p>Analysis:</p> <p>Correlational; qualitative</p>	<p>Signal accuracy: error rate below .06%</p> <p>Usual vs. unusual days: duration of stays demonstrated consistent pattern across different rooms</p>
<p>N = 28 dementia CGs: aged 40-82 (M=64.06); 75.8% female; 54.5% spouses</p> <p>3 groups:</p> <p>(1) wait-list controls (N=9)</p> <p>(2) video viewed at home with telephone support (N=10)</p> <p>(3) video viewed in class (n=9)</p> <p>Study: <i>Strawn & Hester</i>⁶ (short report) (tc)</p>	<p>(2) and (3) participated in video- + telephone-based training in anger management</p> <p>Duration: 8 weeks</p> <p>2 assessments: baseline 8 weeks</p>	<p>Knowledge</p> <p>Affect management</p> <p>Access to experts</p>	<p>Cognitive functioning</p> <p>Psychosocial health</p>	<p>-Caregiver Anger Interview</p> <p>-Beck Depression Inventory (short form)</p> <p>-Revised Caregiving Self-Efficacy Scale</p> <p>-Homework compliance</p> <p>-Interest and perceived helpfulness</p> <p>Analysis:</p> <p>ANCOVA</p>	<p>Anger: (2), (3) > (1)</p> <p>Depression: (2) > (1)</p> <p>Self-efficacy: (2), (3) > (1)</p> <p>Homework compliance: 100% across both groups</p> <p>High ratings for interest (M=6.23 on 7-pt scale) and helpfulness (M=6.31 on 7-pt scale)</p>
<p>N = 14 dementia CGs (no further description)</p> <p>1 group:</p> <p>(1) Telecare (N=14)</p> <p>Study: <i>Strawn & Hester</i>⁶ (short report) (tc)</p>	<p>Weekly telephone-based support and information from clinical psychology student</p> <p>Duration: 12 weeks</p>	<p>Knowledge</p> <p>Social support</p> <p>Access to experts</p>	<p>Information</p> <p>Physical health</p> <p>Psychosocial health</p>	<p>-Brief Symptom Inventory</p> <p>-Burden Interview</p> <p>Analysis:</p> <p>ANOVA</p>	<p>Physical symptoms: > for (1) at 2 weeks post-study</p> <p>Burden: > for (1) at 2 weeks post-study</p>

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
<p><i>Study: Thomas & Urbano²²</i></p> <p>N = 72; 46 visually-impaired elderly Telelink users (67% aged 60-80, 33% aged 80+; 50% urban and 50% rural dwellers), 13 family members (not further described), and 13 former users (not further described)</p> <p>1 group: (1) Telelink users (current and former) and family members (N=72)</p>	<p>5 assessments: baseline #1 (time not specified) baseline #2 (time not specified) study midpoint study end</p> <p>2 weeks post-study</p> <p>Participation by visually-impaired elders in Telelink, a weekly 1-hour telephone-based, peer-led support group</p> <p>Duration: ongoing</p> <p>1 assessment: single interview</p>	<p>Knowledge</p> <p>Social support</p>	<p>Information</p> <p>Psychosocial health</p>	<p>-Interview regarding utility, value, satisfaction, social network of Telelink users</p> <p>-Interview regarding reasons for leaving Telelink</p> <p>Analysis: Correlational; qualitative; retrospective</p>	<p>Value: 77% reported Telelink has made important difference in their lives; significant correlations were found for those living alone, older, and female</p> <p>Satisfaction: on 10-pt scale, 45% scored 9; 37% scored between 7 and 8; 18% scored 6 or below</p> <p>Reasons for leaving: lack of convenience; listening is too effortful; perceived poor compatibility with group; prefer face-to-face discussions; boredom</p>
<p><i>Study: White & Dorman²⁰</i></p> <p>N = 1015 (potential) Alzheimer Mailing List subscribers, including CGs, clinicians, and researchers (no further description)</p> <p>1 group: (1) mailing list subscribers (total possible N=1015)</p>	<p>Analysis of 532 Internet mailing list messages, sampled from the first five days of four months (March, June, September, and December) in 1998</p> <p>Duration: 10 months</p>	<p>Knowledge</p> <p>Social support</p> <p>Access to experts</p>	<p>Information</p> <p>Psychosocial health</p>	<p>-Content analysis, identifying topic groups and numbers of messages per group</p> <p>Analysis: qualitative</p>	<p>Message topics and number of messages:</p> <ul style="list-style-type: none"> -Personal experience: 229 -Information-giving: 203 -Encouragement: 135 -Personal opinion: 104 -Information-seeking: 76 -Humor: 74 -Thanks: 56 -Miscellaneous: 34 -Prayer: 27
<p><i>Study: Mahler & Kulik²⁰ (ret)</i></p> <p>N=592: 226 male and</p>	<p>Spouses in (1) received only</p>	<p>Knowledge</p>	<p>Information</p>	<p>-Patient physical status and</p>	<p>Patient outcomes:</p>

Sample + design	Intervention + methods ^a	Proximal goals	Mediating mechanism	Measures	Outcomes ^b
<p>70 female first-time CABG recipients (aged 41-80, M=63.2; 79.4% Caucasian) and their 296 spouses/partners (aged 28-89, M=60.79) 3 groups:[*]</p> <p>(1) usual care (N=101)</p> <p>(2) usual care + mastery tape (N=93)</p> <p>(3) usual care + coping tape (N=101)</p> <p>[*]Total N differs considerably from participant group and outcomes numbers; this is not addressed in the text.</p>	<p>usual care and discharge instructions after CABG. Spouses in (2) viewed "mastery" videotape, depicting couples after CABG appearing calm, confident, and optimistic about recovery. Spouses in (3) viewed "coping" tape, depicting same couples describing effortful but ultimately successful difficulties encountered in CABG recovery process. Narration was provided for both tapes by the same cardiothoracic nurse specialist. Tapes designed to provide procedural (e.g., lifting) and sensory (e.g., emotional) information.</p> <p>Duration: 6 months</p> <p>4 assessments: baseline 1 month post-discharge 3 months post-discharge 6 months post-discharge</p>	<p>Access to experts</p>	<p>Physical health Psychosocial health</p>	<p>postoperative complications -Abbreviated Dyadic Adjustment Scale -Positive and Negative Affect Schedule -3-item feeling-of-preparedness measure (5-point scale; spouse only) -14-item questionnaire concerning emotional difficulties (7-point scale; spouse only)</p>	<p>-Physical status: > over time, with < surgery problems and < medical consultations. However, (1) > (2), (3) for females in number of health problems and 1st-month rehospitalizations -Positive and negative affect: both > over time. Females reported > negative mood than males. Spouse outcomes: -Feeling of preparedness: (2), (3) > 1 -Positive and negative affect: both highest at discharge; both < over time. Females reported > negative mood than males. -Emotional difficulties: < over time; females reported > than males at 1 and 3 months</p>

CG = caregiver N = number of participants reflected in analysis.

(rc) = randomized, controlled trial (tt) = intent-to-treat analysis

(tc) = treatment completed analysis

^aIntervention technology appears in bold type.

^bFor studies that conducted statistical analyses, significant outcomes only appear on table. > = reflects positive perception / improvement, or larger value at p < .05 or less. < = reflects negative perception/decline or smaller value at p < .05. Qualitative outcomes are also reported on table.

Outcome measures employed across studies:

Abbreviated Dyadic Adjustment Scale⁴³

*Activities of Daily Living Scale⁴⁴

- ^bActivities of Daily Living Scale⁴⁵
Beck Depression Inventory⁴⁶
Brief Symptom Inventory (BSI); short form of Symptom Checklist⁴⁷
Burden Interview (BI)⁴⁸
Caregiver Anger Interview⁴⁹
Caregiver-Elder Relationship Scale⁵⁰
Center for Epidemiological Studies Depression Scale (CES-D)⁵¹
Clinical Dementia Rating Scale⁵²
Clock Face Test (CFT)⁵³
Decision confidence scale (modified by the authors from Saunders & Courtney)⁵³
Geriatric Depression Rating Scale (GDRS)⁵⁴
Group Health Association of America Consumer Satisfaction Survey⁵⁵
Impact of Caregiving Scale⁵⁰
Instrumental Activities of Daily Living Scale⁵⁶
Instrumental and Expressive Social Support Scale⁵⁷
Interpersonal Support Evaluation List (ISEL)⁵⁸
Life Satisfaction Index (LSI-Z)⁵⁹
Loneliness scale⁶⁰
Memory and Behavior Problem Checklist (MBPC)⁶¹
Mini-Mental State Examination (MMSE)⁶²
Perceived Social Support for Care giving and Social Conflict²⁰
Perceived Social Support Scale⁶³
Philadelphia Geriatric Center Morale Scale (PGC)⁶⁴
Physical health and daily hassles measure (adapted from Murrell & Norris)⁶⁵
Pine Ridge Indian Hospital—Mayo Clinic Demonstration Project Questionnaire⁶⁶
Positive and Negative Affect Schedule (PANAS)⁶⁷
Rand Mental Health Index (38-item)⁶⁸
Rational Problem-Solving (RPS) Inventory subscale of the Social Problem-Solving Inventory Revised (SPSI-R)⁶⁹
Resource-based value relative scale reimbursement system⁷⁰
Revised Caregiving Self-Efficacy Scale⁷¹
Revised Memory and Behavior Problem Checklist⁷²
Short Form 36 (SF-36)⁷³
Social network measure (adapted by the authors from Vaux & Harrison)⁷⁴
Symptoms of Dementia Screener⁷⁵
UCLA Loneliness Scale⁷⁶
Website Analysis and MeasureMent Inventory (WAMMI-Q 2.5)⁷⁷
3-item management assessment⁷⁸
7-item mastery scale⁷⁸