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Computer-Mediated Patient Education: Opportunities and Challenges for Supporting Women with Ovarian Cancer

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Abstract

A majority of women with ovarian cancer will face recurrent disease despite receiving aggressive chemotherapy at the time of diagnosis. Given the complex medical and psychosocial needs of women with ovarian cancer and the time constraints within busy clinical settings, providing women with the necessary education related to their disease and treatments can be challenging. The advent of computers and web-based technologies has created new opportunities for educating cancer patients and supporting them to better cope with their disease. The purpose of this paper is to review prior studies of computer-based patient education interventions in order to identify key intervention components and other factors associated with improved patient outcomes. Opportunities for using computer-based technologies to support women with ovarian cancer are discussed and WRITE Symptoms (a *W*ritten *R*epresentational *I*ntervention *To E*ase *Symptoms*), a web-based, symptom management intervention for women with recurrent ovarian cancer is introduced.

Keywords

patient education; computer-based; ovarian cancer; symptom management

Patient education has been defined as "a combination of learning and motivation activities designed to educate patients and family members about disease states or procedures and appropriate methods for self-care" (CINAHL, 2009). It is a critical element of quality cancer care, essential for optimizing health outcomes and improving self-management (Gosselin, 1999). In particular, providing effective patient education has been recognized as a vital

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nursing role that has a meaningful impact on a patient's health and quality of life (Suter & Suter, 2008). Unfortunately, as cancer treatment becomes more complex and pressures to reduce costs increase, it becomes more and more difficult to meet patients' educational needs. Not surprisingly, cancer patients continue to report a lack of adequate information regarding their illness, treatment, and supportive services (Hordern & Street, 2007; Steele & Fitch, 2008; Thompson, Littles, Jacob, & Coker, 2006).

Data has clearly demonstrated that effective patient education requires more than the provision of information. Although studies have shown improvements in knowledge after information-focused interventions, few studies have demonstrated changes in patients' behaviors or improvements in self-management or quality of life outcomes (Craddock, Adams, Usui, & Mitchell, 1999; Dodd, 1988; Williams & Schreier, 2004). The goal of patient education is to not only increase patient knowledge, but to change behavior, such as improving use of self-care strategies, adherence to treatment recommendations, or communication with health care providers. These types of outcomes require educational activities that enhance learning and motivation for behavior change. The most successful cancer patient education programs have implemented interventions comprised of evidence-based information along with cognitive reframing and problem solving techniques (B. Given et al., 2002; C. Given et al., 2004; Rawl et al., 2002; Sherwood et al., 2005). Although combining patient education with strategies to affect behavioral change have proven effective in improving patient outcomes, these interventions often require multiple time-intensive nurse-patient interactions which may be impractical or unrealistic in the current health care climate (Keulers, Welters, Spauwen, & Houpt, 2007).

Meeting the comprehensive needs of women with ovarian cancer can be especially challenging for clinicians. The vast majority of women are diagnosed at advanced stages, when the chances of a cure are unlikely (Bhoola & Hoskins, 2006; Gadducci et al., 2007). Primary surgery and chemotherapy are often effective initially, but up to 80% of women ultimately experience a recurrence (Gadducci et al., 2007; Hauspy & Covens, 2007). Following recurrence, women receive second, third, and "subsequent" line therapies in an attempt to keep the cancer under control. In a study of 279 women with recurrent ovarian cancer, women had received an average of four different chemotherapeutic regimens (Donovan, Hartenbach, & Method, 2005), resulting in multiple symptoms and side effects. On average, women with recurrent ovarian cancer experience 10-12 concurrent disease- and treatment-related symptoms and higher numbers of concurrent symptoms have been associated with lower quality of life (Donovan, Ward, Sherwood, & Serlin, 2008; Portenoy, Thaler, Kornblith, Lepore, & et al., 1994; Wenzel et al., 2002). Effective symptom management education is essential to reduce negative outcomes in this patient population.

Patient education about managing multiple symptoms can be very complex, requiring patients to learn, integrate, and apply a large amount of information. There is evidence that efforts to accomplish this within the constraints of a typical clinic appointment can be overwhelming to ovarian cancer patients and clinicians. Up to 40% of patients do not discuss even their most bothersome symptoms during their clinic visit, and up to 50% do not recall receiving recommendations for managing their most bothersome symptoms (Donovan et al., 2005).

Computers and internet-based technologies have the potential to facilitate cost-effective delivery of symptom management interventions outside the traditional clinical setting. Each patient could process information at her own pace, review resources, reflect on recommendations, and work on program-specific recommendations. Computer-mediated symptom management education could take place at the patient's convenience without time pressures and the constraints of scheduling.

The purpose of this paper is to review research studies of computer-mediated patient education interventions in persons with cancer or other chronic diseases in order to identify 1) common components of interventions 2) evidence for the relative efficacy of different components, and 3) identify other factors associated with improved outcomes following computer-mediated patient education. Findings are discussed with respect to supporting women with ovarian cancer and specifically to the development and testing of WRITE Symptoms©, a web-based symptom management program for women with recurrent ovarian cancer.

SEARCH STRATEGY

Three of the authors (PD, KH, and HD) conducted an initial literature search on PubMed using the following search strategy: 1) Patient Education (MESH or keyword) OR Health Education (MESH or keyword) OR psychoeducation (keyword) = 98,323 results. 2) Computer-based (key word) OR Computer-Assisted Instruction (MESH or keyword) OR Telemedicine (MESH or keyword) OR Internet (MESH or keyword) or Internet-based (keyword) or web-based (keyword) = 48, 405 results. 3) Combined #1 AND #2 = 3542 results; 4) Limited 3 to RCT = 289. The following inclusion criteria were used to ensure relevance to the topic:

1. Patient education consisted of learning and motivation activities. Studies evaluating the effect of only information, social support, neurocognitive exercises, or telemonitoring with medication adjustment were excluded.
2. The patient education intervention required patient interaction or activity in response to computer generated education, or computer-mediated educational interactions with a trained interventionist. Examples include responding to questions, practicing skills, and/or problem-solving. Studies of read-only/view only education modules were excluded.
3. Educational programs targeted patients with cancer or chronic disease. Chronic disease was defined as an illness of long duration which could be controlled but not cured. Studies targeting primary prevention, cancer screening, smoking cessation, weight loss, alcohol misuse were excluded. Chronic disease was included because of the low number of articles focusing on cancer. In addition, patients with cancer and patients with chronic illnesses must all learn to develop a life-long focus on managing the illness, associated symptoms, and the impact of those symptoms on their lives.
4. Programs that were limited to a single symptom (e.g., insomnia or headache) or required a fundamentally different educational focus (e.g., schizophrenia, eating disorders, infertility) than cancer disease and symptom management were excluded.

Of the 289 articles, 29 randomized clinical trials met these criteria. In order to ensure that our search strategy captured all relevant articles, all references of eligible articles were reviewed and a search was conducted for articles which cited the eligible study. Through this process several key articles were found that were not identified in the original search, therefore a second broader search was conducted using the following criteria: Computer-Assisted Instruction (MESH or keyword) OR Computer-Assisted Therapy (MESH or keyword) OR Internet (MESH or keyword) OR Telemedicine (MESH or keyword) OR computer-based (keyword) OR Internet-based (keyword) OR web-based (key word). From 774 identified articles, 11 unique articles were discovered that met the same inclusion/exclusion criteria. In total, 40 randomized clinical trials of computer-mediated patient education for patients with cancer or chronic diseases were included in this review. The most common target populations for these studies were patients with diabetes (n=18) and depression (n=6). Three studies included patients with cancer.

FINDINGS

A. Common Components of Computer-Mediated Patient Education Interventions

Common components of interventions in the identified studies included provision of information, cognitive-behavioral approaches, skills training, peer support, expert advice, and communication training. Information was provided regarding the disease itself, associated symptoms, recommended treatments and/or management strategies. Cognitive behavioral approaches included formal cognitive behavioral therapy (CBT), as well as other theoretically guided components designed to enhance adoption of new behaviors. Common components in this category included goal setting, problem-solving, motivational interviewing, overcoming barriers, cognitive reframing, and self-management counseling. Skills training included practical “how to” information such as tips and skills for preparing nutritious foods, proper blood sugar monitoring techniques, and instructions on how to do relaxation or strengthening exercises. Peer support was another common component and included a variety of computer/internet tools to connect patients suffering from the same illness. Specific tools included chat rooms, discussion boards, e-mail systems, and peer coaching. Many studies included access to a health care expert as part of their intervention; this access ranged from providing as needed responses to patient-generated questions to conducting formal educational/counseling sessions at prescribed intervals. In some cases, computer-mediated activities with experts were supplemented by telephone or in-person contacts. Finally, several interventions specifically focused on improving patient-health care provider communication through self-advocacy or communication training. Table 1 provides a summary of the different categories of intervention components used in each of the reviewed studies. Information provision was the most common intervention component, followed by access to an expert, and teaching cognitive behavioral strategies.

B. Effectiveness of Computer-Mediated Patient Education Interventions

A wide range of outcomes were evaluated in the reviewed studies. For ease of synthesis, these outcomes were categorized as changes in: 1) knowledge and beliefs, 2) self-care behaviors, 3) social support, 4) patient health, and 5) health care utilization. Assessments of knowledge and beliefs included whether or not the patient retained provided information as well as the effect of interventions on concepts such as self-efficacy, barriers to change, and confidence. Measures of self-care behaviors were most common in studies of patients with diabetes and typically focused on assessments of dietary intake and physical activity. Other self-care behaviors that were measured included the use of stress management strategies and health care provider communication. Measures of patient health included both physical and emotional outcomes and varied by target population. Studies of diabetes focused on HbA1c, BMI, and cholesterol; depression studies focused on depression, anxiety, and functional outcomes; other studies included outcomes such as blood pressure, physical symptoms (pain and fatigue), disease-related distress, and quality of life. Few studies included assessments of perceived social support and health care outcomes. Table 1 includes a summary of the number of each type of outcomes that were *assessed* as well as the number of outcomes that were significantly *improved* in each of the studies. Healthcare utilization as an outcome is not included in the table, but is discussed in the following sections. Overall, computer-mediated interventions have been shown to be effective in improving both physical and mental health outcomes in persons with chronic health conditions, particularly when an expert interventionist is utilized. Exemplars of successful studies highlighting intervention components and delivery methods that were effective are provided in the following sections.

Diabetes—In diabetes, Shea and colleagues (2007) and Glasgow and colleagues (Glasgow, Boles, McKay, Feil, & Barrera, 2003; Glasgow et al., 1997; Glasgow et al., 2005; Glasgow et al., 2004; Glasgow et al., 2006; Glasgow & Toobert, 2000) evaluated two different approaches to computer-mediated patient education. To test the “Informatics for Diabetes and Education Telemedicine” (IDEATEL) intervention, Shea et al. recruited 1665 Medicare recipients with diabetes, aged 55 years or older, and living in federally designated medically underserved areas of New York. Over 75% of patients did not know how to use a computer and 93% reported a median income of <$20,000. Patients assigned to the intervention were provided with computers and telemedicine units in their homes and participated in a range of activities that included: 1) videoconferencing between patients and a nurse case manager; 2) remote glucose monitoring with electronic upload and integration with the patients electronic medical record; 3) access to a web portal that contained their own clinical data and secure web-based messaging with nurse case managers; and 4) access to an educational web site created for the project (regular and low literacy versions). One year post-intervention, participants in the IDEATEL intervention had significantly greater reductions in HbA1C, blood pressure, total cholesterol, and LDL cholesterol than those in the control group, who received standard care. Effects were strongest for participants who had HbA1c levels > 7 at baseline.

The authors noted that Medicare claims were higher in the intervention group compared to control – an issue that warrants further exploration. The authors hypothesized that providing patients in medically underserved areas with access to nurse case managers may have provided patients with the advice and encouragement to seek needed care that they had not previously been receiving. A particular strength of this project was the focus on an underserved patient population and the provision of computers to patients with no previous computer experience. Their findings provide important support for the generalizability of computer-mediated interventions, demonstrating that older, low income patients without computer experience are willing to use and can benefit from computer-mediated education and disease management.

The work of Glasgow and colleagues is noteworthy for the investigators’ efforts to create cost-effective studies that are highly generalizable. These researchers at the Oregon Research Institute (ORI) have developed a series of “practical clinical trials”. Practical clinical trials are designed with clinically relevant interventions as control conditions, include a diverse patient population (broad study inclusion criteria), and recruit from heterogeneous practice settings (Tunis, Stryer, & Clancy, 2003). The ORI studies have emphasized interventions that could move quickly to widespread adoption by virtue of being brief, fitting into the realities of clinic visits, and reducing demands on physician (Glasgow et al., 2004).

Glasgow and colleagues began their computer-mediated diabetes education programs in 1997 with an intervention that included two parts. The first was a brief (5- to 10- minute) computer based assessment and feedback on dietary patterns, key barriers for dietary self-management, and preferences for self-care strategies. Two printouts were generated, one for the patient that focused on problem situations to plan for in dietary management, and an assessment summary for the physician. The second part of the intervention was a 20 minute session with a research interventionist who assisted with patient-centered goal setting and problem solving with self-help materials. Participants repeated the program at their 3 month follow-up visit and received telephone reinforcements at 1 and 3 weeks and 6 months post baseline. At 1-year post-randomization, patients receiving the intervention had greater reduction in cholesterol and calories from fat, but no difference in HbA1c or BMI compared to the control group, who received computerized assessment and standard medical care only Costs were estimated at $137 per participant with an estimate of $8 per mg/dl reduction in serum cholesterol. The investigators argued that these costs are low compared to pharmacologic interventions.

Over the past decade, Glasgow and colleagues have compared other iterations of their diabetes self-management program, moving it out of the office setting to a web-based delivery system that helps patients complete a self-directed diabetes program providing self-management information, automated goal setting, and problem solving. In 2003, the group published results of a 3-arm trial (basic web-based program vs. web-based program + peer support vs. web-based program + expert self-management coaching) in which all three groups showed significant baseline to 10 month improvements on 11/14 outcomes. They concluded that the basic program is effective and that neither peer support nor tailored self-management coaching added to the benefits of the program. However, without the use of a control group, it is impossible to know whether changes are a result of the web-based intervention or a result of other factors.

Depression—Proudfoot and colleagues have developed and tested the Beat the Blues (BtB) web-based CBT program for depression (McCrone et al., 2004; Proudfoot et al., 2003; Proudfoot et al., 2004). Beating the Blues is an eight session self-help treatment program designed to be used by patients with no previous computer experience. Patients work through cognitive modules that help them to identify and challenge automatic thoughts that are counterproductive. Other modules focus on learning and practicing new behaviors such as activity scheduling, goal setting and problem solving, task breakdown, or sleep management. A final module helps the patient to work on action planning and relapse prevention. Beating the Blues includes a variety of approaches to engage users: interactive modules, animations and voice-overs and filmed case studies of fictional patients to model cognitive behavioral therapy. Although interaction with a clinician is not an explicit part of the program, it is designed to facilitate interactions by providing a printed summary of the patient's work to the clinician at the end of each session. Proudfoot and colleagues reported significant improvements in depression, anxiety, and work and social adjustment (Proudfoot et al., 2003; Proudfoot et al., 2004) at 1-, 3-, and 6- month follow-up compared to control patients receiving standard care as prescribed by their general practitioner. Beating the Blues was also found to be cost effective both in terms of cost per quality adjusted life year and lost employment costs (McCrone et al., 2004). As a result of this work, the BtB program is now considered standard of care for those with mild-moderate depression in Great Britain (National Institute for Health and Clinical Excellence, 2006). At the time of diagnosis, general practitioners can provide patients with free access to the BtB online program.

Other chronic illnesses—Lorig and colleagues (Lorig, Ritter, Laurent, & Plant, 2006, 2008) have conducted a series of studies that progressed from establishing the efficacy of face-to-face self-management programs for persons with chronic illness, to developing web-based programs using a similar model, to extending the program to different patient populations. The program includes content to help participants design individualized exercise programs; cognitive symptom management such as relaxation, visualization, distraction, and self talk; methods for managing negative emotions such as anger, fear, depression, and frustration; an overview of medications; strategies for improving patient-provider communication; healthy eating; fatigue management; action planning; feedback; and methods for solving problems that result from living with a chronic disease. Over six weeks, participants are asked to log on at least three times a week for a total of one to two hours and to participate in the activities for that week. Participants are asked to do several activities including reading the week's content on web pages, posting an action plan on the bulletin board, checking in with a buddy via e-mail, and participating in self-tests and activities. They can post problems for discussion on the bulletin board, which invites responses from other members of the group as well as health care moderators. Lorig and colleagues reported that at 1 year follow up, participants in the intervention group had significantly greater improvements in health related distress, pain, fatigue, and shortness of breath compared to those in the control group receiving standard care (2006).

Cancer—Gustafson and colleagues (Gustafson et al., 2001) at the University of Wisconsin were pioneers in the use of computers to enhance the care of patients with cancer. In 2001 they developed and tested the Comprehensive Health Enhancement Support System (CHESS) for women diagnosed with breast cancer. The web-based CHESS intervention was comprised of “Information Services” (answers to frequently asked questions; full articles on breast cancer; consumer guide to health services; referral directory to services); “Support Services” (peer discussion groups, Ask an Expert, and personal stories of how others facing breast cancer coped); and “Decision Services” (assessment of a person’s emotional status followed by coping advice; system for recording and tracking health changes; decision aid to learn about options, clarify values and understand consequences of choices; and goal setting and action planning). In this study, 246 women were randomly assigned to CHESS vs. care-as-usual (supplemented with Susan Love’s Breast Book). Participants in CHESS were given 6 months of access to the website. At 2 and 5 months follow-up, the study participants in CHESS scored significantly higher in social support and information competence than the control group. There were no significant difference between groups in four quality of life outcomes including social/family well-being, emotional well-being, functional well-being, and breast cancer concerns (Gustafson et al., 2001). The authors also reported significant interactions based on race, education, and lack of insurance such that women of color, those with less education, and those without insurance saw greater improvements as a result of CHESS in social support, information support, and participation in healthcare.

In summary, the use of theoretically guided components to enhance adoption of new behaviors (e.g. CBT, problem-solving, self-management, and counseling) seemed to improve multiple patient outcomes. In depression, computer-based CBT alone improved depression as long as efforts were included to ensure subjects used the site. For chronic diseases in which complex management or medication adjustment is necessary (e.g. diabetes, hypertension, CAD, cancer), expert medical advice or coaching was critical – few studies showed improved outcomes without providing contact with a trained expert.

Very few studies evaluated mechanisms underlying intervention effects. Those that did identified level of engagement in the intervention (those who used it more – had better outcomes) as a predictor of improved outcomes (McKay, King, Eakin, Seeley, & Glasgow, 2001). Additionally, self-efficacy seemed to be an important predictor of intervention effects. Patients who started with higher levels of self-efficacy or showed greater improvements in self-efficacy over time tended to have better outcomes (Lorig et al., 2006). Those who were at increased risk for negative outcomes (e.g. poorly controlled blood sugar, poorly managed hypertension) also tended to have more benefit (Grant et al., 2008; Owen et al., 2005). Finally, vulnerable patient populations (minorities, elderly, and those with low-incomes) seemed to gain the most benefit from computer-mediated patient education programs (Shea et al., 2005; Gustafson et al., 2001).

A common critique of Internet-based health intervention research is that non-computer literate users will not be able to participate. The findings from this review are counter to this critique. Other reviews of the use of computer-mediated interventions have found them to be feasible and acceptable to patients/subjects in a wide variety of clinical populations and using a variety of technologies (Krishna, Balas, Spencer, Griffin, & et al., 1997; Murray, Burns, See, Lai, & Nazareth, 2005). In an early and compelling call to ensure universal access to health information and support, Eng and colleagues (1998) argued that there is substantial data to show that members of underserved groups desire and will use health information technology, and that when barriers to access are removed and training is provided, underserved populations (including the elderly, residents of inner cities and rural areas, and racial and ethnic minorities) can all successfully use technology.

C. Development of a computer-mediated symptom management program for women with recurrent ovarian cancer: WRITE Symptoms©

Findings from this review suggest that computer-mediated interventions could be developed to support women with ovarian cancer. Results also provide important information on necessary intervention components as well as study design considerations. Based on these findings and the specific symptom management needs of women with ovarian cancer, Donovan and colleagues developed WRITE Symptoms© [Written Representational Intervention To Ease Symptoms]. WRITE Symptoms is a computer-mediated intervention that builds upon effective components of previous symptom management and computer-mediated interventions. It is based on the Representational Approach to patient education, a 7-element intervention aimed at facilitating conceptual change, which includes a comprehensive assessment of patient representations; explorations of gaps, concerns, or misconceptions; provision of evidence-based symptom management recommendations; assistance with goal setting and problem-solving, and follow-up and re-evaluation (Donovan & Ward, 2001; Donovan et al., 2007).

In its first iteration, WRITE Symptoms© was tested as a web-based delivery system through which patients were able to interact with a research nurse over their own private message boards. Using asynchronous postings, nurses led each patient through the WRITE Symptoms© intervention in order to develop individualized goals and strategies for improving symptom management. A pilot study of 65 women with recurrent ovarian cancer supported that the nurse-delivered WRITE Symptoms is a feasible, acceptable intervention, with preliminary evidence supporting baseline to 5- and 9- week improvements in symptom representation (severity, distress, and consequences) (Donovan et al., 2008).

A key question is whether individualization by nurses is critical to the success of the WRITE Symptoms© Intervention, or whether women can be guided through the program by a web-based, interactive computer module without assistance from a nurse (referred to as "*Self-directed WRITE Symptoms*"). In the second phase of intervention development, a web-based computer module was developed which leads patients through the same theoretical components as the nurse-delivered WRITE Symptoms intervention – guiding women through a self-assessment of their health problems, providing information on common concerns that women face when trying to manage multiple and complex symptoms, providing evidence based recommendations for symptom management, and guiding patients through a process of developing individualized goals and strategies to improve symptom management.

A three-arm RCT is currently underway, funded by the National Institute of Nursing Research (R01 NR010735NINR) and supported as a Gynecologic Oncology Group Protocol (GOG-259), to compare the efficacy of these two different web-based delivery systems (nurse-delivered via private web-based message boards vs. self-directed using a web-based computer module) vs. usual care in a sample of 480 women with recurrent cancer recruited from Gynecologic Oncology Group sites across the United States. Primary outcomes are symptom representation (severity, distress, consequences) and quality of life. By carefully examining critical components of WRITE Symptoms©, the mechanisms through which it is effective, and for which individuals it is most effective, this study has the potential to advance the science of computer-mediated patient interventions and enhance cancer symptom management across diverse patient populations.

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Table 1

Intervention Components Included in Computer-Mediated Patient Education Interventions and Outcomes Assessed and Improved as a Result of Interventions

Author Year	Intervention Components						Dependent Variables									
	Peer	Info	CBT	Skills	Expert	Comm	Belief		Behav		Social		Health		Total	
							A	I	A	I	A	I	A	I	A	I
Diabetes																
1. Smith, 2000 n=30	X	X			X						1	0	2	0	3	0
2. Gerber, 2005 n=244		X	X	X			3	1	1	0			4	0	8	1
3. Kim, 2006 * n=73		X	X	X	X				1	1			2	2	3	3
4. Jansa, 2006 n=40		X			X		1	0	1	0			4	0	6	0
Note: Control condition in this trial is 12 face-to-face interactions. No significant differences between conditions. Both groups showed improvements in beliefs, behavior, and 3 of 4 health outcomes. Computer intervention more cost-effective than face-to-face.																
5. Shea, 2007 * n=1665		X			X +								5	5	5	5
6. Grant 2008 * n=244		X				X			1	1			3	0	4	1
7. Wangberg, 2008 n=64		X	X	X			1	0	1	1					2	1
8. Quinn, 2008 n=30		X			X				4	3			1	1	5	4
9. Ralston 2009 n=83		X	X	X	X								5	2	5	2
Glasgow et al (Oregon Research Institute) Series																
10. Glasgow, 1997 n=206		X	X		X				1	1			3	1	4	2
11. Glasgow, 2000 n=320		X X^{+CR}	X X		X^{+TFU} X				3 3	1 0			3 3	0 0	6 6	1 0
Note: Control condition in this trial is the previously tested intervention in #10. Adding telephone follow-up (TFU) or community resources (CR) did not improve outcomes above the brief computerized intervention. All 3 groups showed improvements in fat intake, weight, and lipids. No significant																

Author Year	**Intervention Components**						**Dependent Variables**									
	Peer	**Info**	**CBT**	**Skills**	**Expert**	**Comm**	**Belief**		**Behav**		**Social**		**Health**		**Total**	
							A	**I**	**A**	**I**	**A**	**I**	**A**	**I**	**A**	**I**
impact on HbA1c or QOL.																
The Diabetes Priority Program (n=886)																
12. Glasgow, 2004		X	X		X				2	2			2	0	4	2
13. Glasgow, 2005		X	X		X				1	1			4	0	5	1
14. Williams, 2007		X	X		X		2	2							2	2
D-Net Program																
15. McKay, 2002 n=78	X	X			X				1	0			1	0	2	0
16. Barrera, 2002 n=160	X X	X X X	X X		X X						2 2 2	2 0 2			2 2 2	2 0 2
Note: Control group was a web-based information and automated goal recommendation program. Peer support improved perceptions of social support.																
17. Glasgow, 2003 n=320	X	X X	X		X		1 1	0 0	4 4	0 1	2 2	1 0	7 7	0 0	14 14	1 1
Note: Although there were not significant between group differences in this trial, the control group was a web-based diabetes information and automated target goal recommendation program. All three groups showed significant baseline to 10 month improvements on 11/14 outcomes leading group to conclude that the basic program is effective and that neither peer support nor tailored self-management coaching added to the benefits of the program.																
Tailored Self-Management Program (TSM)																
18. Glasgow, 2006* n=335		X	X		X				2	1			5	1	7	2
Depression																
19. Clarke,2002* n=299			X										1	0	1	0
20. Clarke, 2005* n=255			X										2	1	2	1
21. Andersson, 2005 n=117	X	X	X		X								4	3	4	3

Author Year	Intervention Components						Dependent Variables									
	Peer	Info	CBT	Skills	Expert	Comm	Belief		Behav		Social		Health		Total	
							A	I	A	I	A	I	A	I	A	I
Beating the Blues (BtB) Program																
22. Proudfoot, 2003 n=167		X	X										3	3	3	3
23. Proudfoot, 2004 and 24. McCrone 2004* n=274		X	X										3	3	3	3
Chronic Illness (un-specified)																
25. Lorig, 2006 n=958	X	X	X		X		1	1	4	1			7	4	11	5
26. Hill, 2006 n=120 (prelim analysis) 27. Weinert2008 n=176	X X	X X			X X		3 1	2 1	1	0	2	1	2	0	7 2	3 1
28. Leveille2008* n=241					X	X	1	0					5	0	6	0
Cancer																
29. Gustafson, 2001 n=246	X	X	X		X		2	0	3	2	3	3	4	0	12	5
30. Davison, 2002 n=749						X			1	0					1	0
31. Owen, 2005* n=62	X	X	X										6	0	6	0
CV																
32. Southard, 2003 n=104	X	X			X				2	0			11	2	13	2
33. Kwon, 2004 n=110		X		X	X								7	1	7	1

Author Year	Intervention Components						Dependent Variables									
	Peer	Info	CBT	Skills	Expert	Comm	Belief		Behav		Social		Health		Total	
							A	I	A	I	A	I	A	I	A	I
34. Johnson2006 n=1227		X	X						2	2					2	2
35. Green, 2008* n=778 Web Web+ Pharm-acist		X X	 X	X X	 X		1 1	0 0	3 3	1 2			5 5	1 3	9 9	2 5
Arthritis																
36. Van den Berg, 2006 n=160	X	X	X	X	X				1	1			3	0	4	1
37. Lorig, 2008 n=885	X	X	X	X		X	1	1	7	2			8	4	16	7
HIV																
38. Flatley-Brennan, 1998* n=57	X	X			X		2	0			1	1*	1	0	4	1*
Chronic																
39. Buhr-man, 2004 N=56		X	X	X			1	0	8	3			5	0	14	3
COPD																
40. Nguyen, 2008[15] n=50		X		X	X		1	0					4	0	5	0
Note: Control group was an established face-to-face dyspnea management program. While there were no significant between group differences, both web and face-to-face programs showed significant improvement on all 5 outcomes at 3 and 6 months.																

Intervention Components: Peer = Peer Support; Info = Disease/treatment information; CBT = Cognitive behavioral techniques; Skills = Skill Training; Expert = Clinician advice or coaching; Comm = Communication training.

Dependent Variables: A = Assessed; I = Improved as result of intervention Beliefs = Knowledge/Attitudes/Beliefs; Behav = Behavior; Social = Social Support Health = Health Outcomes

[*] Additional notes

[#3] Three arm trial, web-based (WB) + telephone nurse support vs printed material (PM) + telephone nurse support vs. usual care (UC). Both WB and PM >> UC for all 3 outcomes. WB=PM. Key issue may be whether the telephone support was essential.

[#5] Telemedicine with: 1) videoconferencing allowing patients to interact with nurse case managers; 2) remote monitoring glucose with electronic upload and integration with the EMR; 3) access to secure web-based messaging with nurse case managers; 4) access to an educational web site created for the project (regular and low literacy versions) improved all targeted clinical outcomes at 1 year. Computers and telemedicine units were provided to subjects. Supports proposition that patients without computer experience can use without difficulty.

[#6] Good baseline control of HbA1c may have affected outcomes. Trend for group differences in improvements when looking at subset of patients with HbA1c >7 at baseline.

[#18] Employed “practical” clinical trial design to enhance representativeness and external validity but may have reduced ability to detect between group differences.

[#19] High attrition rates of attrition and overall very low usage of site (median 2 sessions). Subgroup analyses showed intervention effect for those with mild depression (CES-D<16) at 16 and 32 weeks.

[#20] Same intervention as #19 + postcard OR telephone reminders to use program. Improved outcomes. In this f/u study, subgroup analyses showed greater improvements in depression for the group who had *higher* depression at baseline.

[#24] McCrone article describes healthcare utilization/cost effectiveness outcomes of the study: 4 assessed/4 showed cost utility/effectiveness, improved lost hours from work.

[#28] Nurse e-coaching focused solely on teaching patients to communicate more effectively - did not improve outcomes.

[#29] Underserved population derived greatest benefit from the intervention.

[#31] Broad inclusion criteria, and relatively high functioning of subjects at baseline may have limited findings. Those with poorer perceived health status at baseline showed greater treatment effects than those with better perceived health.

[#35] Addition of pharmacist led education and planning significantly improved number and strength of outcomes.

[#38] Social isolation was reduced through the intervention AFTER controlling for depression. Importance of assessing and controlling for depression in these types of interventions. Communication features (e-mail and public bulletin board) were the most used and valued features.