Computer Intervention: Illness Self–Management/ Quality of Life of Rural Women

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The Women To Women project, a computer–based support and educational research intervention, was designed to help rural women better understand and manage their chronic illnesses. Its impact on psychosocial adaptation has been reported elsewhere. This article reports on the effect of a computer intervention on chronic illness self–management skills and quality of life. Using a parallel 2–group study design, the researchers randomized 309 middle–aged rural women with chronic conditions to either a computer–based intervention or a control group. They collected data on self–management of chronic illness and quality of life indicators at baseline and at the end of the intervention. Women in the inter-vention group reported significantly more self–efficacy in managing their chronic disease than those in the control group and the observed effect was of moderate size. Women in the intervention group also reported statistically signif-icant gains in quality of life; effect sizes were small but consistent. Select chronic illness self–management skills and quality of life can be positively influenced by a well–designed computer intervention.

Keywords: computer–based intervention, chronic illness self–management, rural, women, quality of life

Résumé

L'intervention par ordinateur : l'autogestion de la maladie/la qualité de vie chez les femmes en région rurale

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Le projet « Women To Women », une initiative de soutien par ordinateur et de recherche en intervention éducative, a été conçu pour aider les femmes en région rurale à mieux comprendre et gérer les maladies chroniques dont elles souffrent. Son impact sur l'adaptation psychosociale a été rapporté dans une publication antérieure. L'article qui suit fait état de l'effet d'une intervention par ordinateur sur les capacités d'autogestion de maladies chroniques et de la qualité de vie. Menant une étude parallèle auprès de deux groupes, les chercheurs ont randomisé 309 femmes d'âge moyen vivant en région rurale et atteintes de maladies chroniques, les assignant à un groupe bénéficiant d'une intervention par ordinateur ou à un groupe de contrôle. Ils ont recueilli des données sur les indicateurs d'autogestion des maladies chroniques et de la qualité de vie au début et à la fin de l'intervention. Les femmes du groupe ayant eu accès aux interventions ont dit être beaucoup plus efficaces en ce qui a trait à la gestion de leurs maladies chroniques, comparativement à celles du groupe de contrôle, et l'effet observé était d'ampleur modérée. Les femmes du premier groupe ont aussi signalé des gains statistiquement significatifs quant à la qualité de vie; les valeurs des effets observés étaient faibles mais cohérentes. Une intervention par ordinateur bien conçue peut exercer une influence positive sur les habiletés d'autogestion de maladies ciblées et sur la qualité de vie.

Mots clés : intervention par ordinateur, autogestion des maladies chroniques, région rurale, femmes, qualité de vie, adaptation psychosociale

Background

Living life to the fullest is a universal goal of nearly all human beings. However, when faced with chronic illness — that is, a long-lasting health disorder that impacts physical, emotional, intellectual, vocational, social, or spiritual functioning (Mosby, 2009) — individuals may find their sense of self and security, and, ultimately, their quality of life, dramatically challenged. At the same time, they must deal with psychological/physical discomfort, prolonged medical treatment, and increasing interference in the performance of their daily activities (Livneh & Antonak, 1997). Meeting these challenges requires an ability to adapt to the illness-imposed changes, and key to successful adaptation is the ability to self-manage the health condition (Lorig & Holman, 2000).

To manage well, individuals must become experts and take responsibility for their day-to-day care. In response to this expectation, psychoeducational interventions are being designed to promote self-management practices that will facilitate adaptation (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002). The goal of education programs for chronic illness self-management is to provide the problem-solving skills people need in order to enhance their quality of life (Von Korff, Gruman, Schaefer, Curry, & Wagner, 1997).

It is a particular challenge to design and provide meaningful, useful self-management education programs for women with chronic conditions who live in rural areas. The unique social and environmental characteristics that make up rural daily life require those with chronic conditions to adapt their self-management strategies to the constraints imposed by these characteristics (Hill-Briggs, 2003).

Health–Care Access for Rural Women
With Chronic Illness in the United States

There are more than 28 million women over 18 years of age living in rural/frontier America who need access to quality health services, and more than four million of these are identified as having a disability (Bennett, Lopes, Spencer, & van Hecke, 2013). Limited access to quality health care is related to the geographic barriers, distance, lack of transportation, and inadequate funding that are inherent in the broad sociocultural and lifestyle factors that typify rural life (Mulder et al., 2000). Significant health disparities exist between rural and urban women, with poorer health outcomes for rural dwellers (National Center for Health Statistics, 2011). For this population, the difficulties in obtaining quality care are compounded by the long-term nature and accompanying disabilities of their conditions. Finding assistance with learning to self-manage their chronic illnesses in a resource-limited environment is an added challenge.

Chronic Illness Self-Management

Chronic illness self-management education has the potential to foster positive perceptions of self, health, and functional ability and to greatly enhance quality of life (WHOQOL Group, 1994). In their classic work, Corbin and Strauss (1988) list the tasks of managing well: medical or behavioural management of the condition; maintaining, changing, and creating new life roles; and learning to deal with the emotional sequelae. Programs that address these self-management tasks have been shown to change behaviours, health status, and health–care utilization (Barlow et al., 2002). Chronic illness self-management strategies should allow individuals to identify problems and could provide techniques to help them make decisions, take appropriate action, and alter their actions as they encounter changes in circumstances or illness (D'Zurilla, 1986).

Quality of Life and Chronic Illness

Chronic illnesses are subject to myriad consequences (Harris & Wallace, 2012). Individuals trying to cope with an ongoing illness may be frightened by symptoms that do not subside, given unfounded hope by remissions, frustrated by the illness's unpredictability, and debilitated by the illness's progression (Helgeson & Reynolds, 2002). All these challenges are assaults on one's quality of life.

There is some agreement that quality of life is a multidimensional concept, encompassing aspects of perceived psychological, social, and physical well–being (Snoek, 2000). Quality of life is defined as individuals' perceptions of their overall well–being within the context of the culture and value systems in which they live, as related to their goals, expectations, standards, and concerns (WHOQOL Group, 1994). Happiness is considered a necessary component of quality of life (Hajiran, 2006). If individuals are assisted, through effective interventions, to self-manage their chronic illnesses well, and consequently adapt effectively, it is likely that their quality of life will be enhanced. One approach to providing such interventions is through the use of health information technologies.

Health Information Technologies

Initially, chronic illness self-management interventions were designed and implemented in specific locations that required in-person contact. In recent years, however, successful outcomes have been demonstrated with computer outreach education programs for the self-management of chronic illness (Lorig, Ritter, Laurent, & Plant, 2008). Such telehealth programs are used primarily with urban residents but can also be of value

to those in underserved rural communities. The increased emphasis on chronic disease management, health promotion, and disease prevention presents opportunities for growth and innovation in the delivery of health information technology (HIT) programs that fall in the nursing domain (Effken & Abbott, 2009). Thus, such programs need not be limited to those who live in physical proximity to health centres. In fact, according to the American College of Preventive Medicine (2007), health-care providers have a responsibility to offer convenient, quality programs to those with chronic illnesses who live distant from health centres, to assist them in becoming successful self-managers and achieving the best possible quality of life.

Women To Women Project

History

The vision for nurses to become involved in HIT-based interventions was realized as early as 1995 when rural nurse researchers at Montana State University developed and launched the research-based Women To Women (WTW) computer intervention (Weinert, 2000). Their approach was influenced by the pioneering work of Brennan, Ripich, and Moore (1991) with persons with AIDS and that of Gustafson et al. (1993), who designed a HIT program for women with breast cancer. The research was conducted over a 15-year period in three phases (1995–2000, 2002–05, and 2006–10) to give women the self-management education and support they needed to adapt to living with chronic illness in a rural environment.

Aims and Conceptual Base

The overall aim was to use HIT as an intervention modality to provide health information and mutual support to middle-aged rural women living with chronic illness. In Phase One of the development and implementation, the conceptual focus was *social support*. This was expanded in Phases Two and Three to a more comprehensive *adaptation to illness* model. The major constructs of the Women To Women Conceptual Model for Adaptation to Chronic Illness that ultimately evolved were (a) environmental stimuli, (b) psychosocial response, and (c) illness management (Weinert, Cudney, & Spring, 2008).

> The basic tenets of the model are that people are bombarded with environmental stimuli (such as chronic illnesses) that evoke psychosocial responses which, in turn, can be either a positive or negative influence on their perception of their ability to self-manage their health condition. Based on the literature and the experience of the investigators, the psychosocial adaptation empirical indicators, previously reported, were:

social support, self-esteem, acceptance of illness, stress, depression, and loneliness. (Weinert, Cudney, Comstock, & Bansal, 2011, p. 84)

The empirical indicators of chronic illness management, reported on in this article, were self-efficacy, forming partnerships, and resource utilization, along with the empirical indicators of quality of life and happiness.

The Study

Purpose

In an earlier article we reported on the impact of the WTW computer-based intervention on the psychosocial response construct of our conceptual model (Weinert et al., 2011). It was found that the intervention significantly affected five of the six psychosocial domains measured. In addition, the conceptual model that guided the study included the construct of illness management, which consisted of two concepts: chronic illness self-management and quality of life. The purpose of this article is to report on the influence of participation in the WTW intervention on the women's perceptions of their self-management abilities and quality of life.
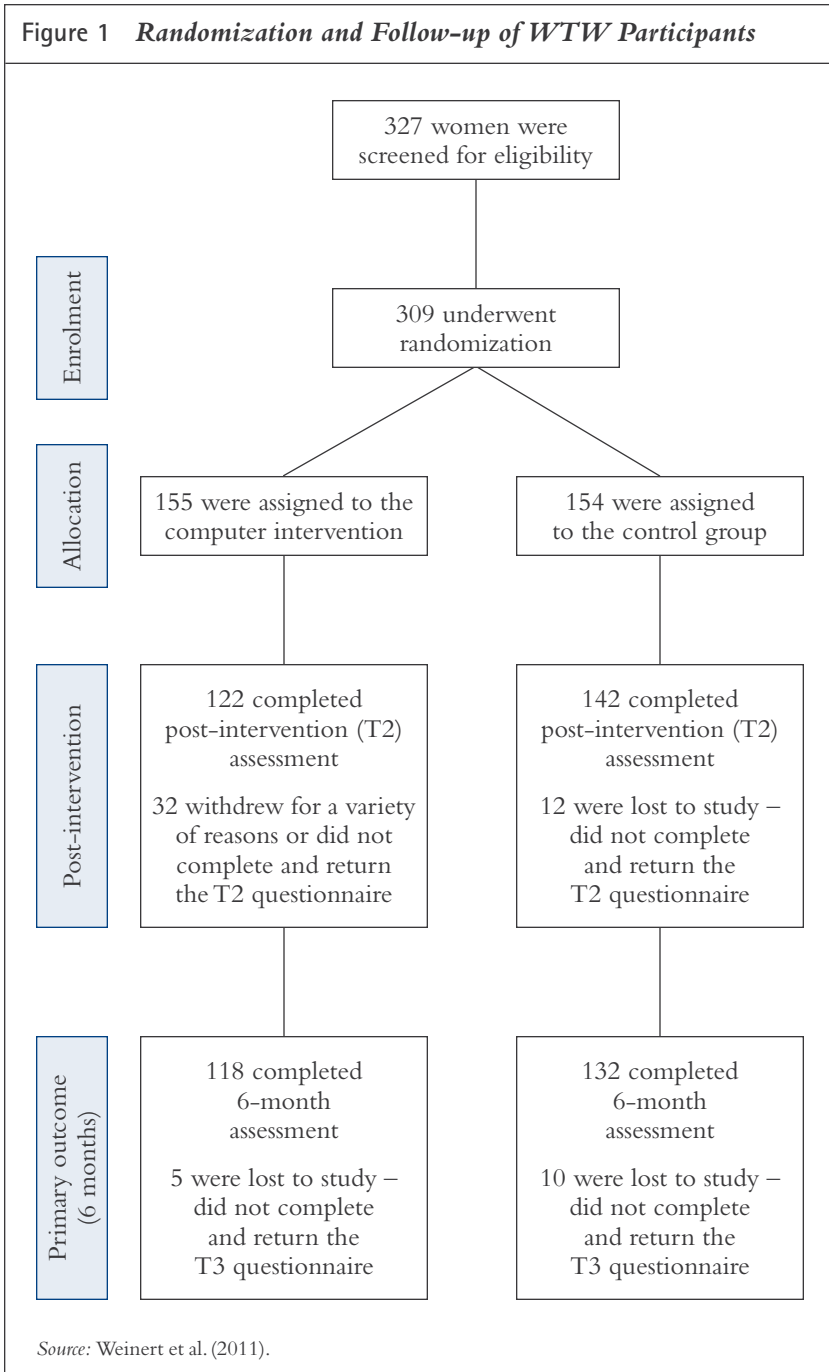
Methods

While the WTW program was carried out in three phases between 1995 and 2010, with minor evolutionary revisions in design over time, this article is based on the data generated in Phase Three. A detailed description of the intervention and protocol has been published elsewhere (Weinert, Cudney, & Winters, 2005; Weinert et al., 2011); therefore, a limited review will be presented here.

Design

From 2006 to 2010 (Phase Three), 309 women were randomized to one of two groups, intervention and control, within eight cohorts of approximately 20 women each (see Figure 1). For 11 weeks, the intervention group had 24-hour computer access, through a WebCT platform, to (a) a peer-led virtual support group (Sharing Circle) where feelings and life experiences were exchanged, support was given and received, issues were discussed related to the self-study health teaching units, and discoveries were shared related to pertinent Internet-based health information; (b) chronic illness self-management teaching units in a self-study format that incorporated the self-management skills proposed by Lorig and Holman (2000) — problem-solving, decision-making, resource utilization, forming partnerships with health-care providers, and taking action; and (c) Internet-based health information.

Figure 1   *Randomization and Follow–up of WTW Participants*

327 women were
screened for eligibility

Enrolment

309 underwent
randomization

Allocation

155 were assigned to the
computer intervention

154 were assigned
to the control group

Post-intervention

122 completed
post-intervention (T2)
assessment

32 withdrew for a variety
of reasons or did not
complete and return
the T2 questionnaire

142 completed
post-intervention (T2)
assessment

12 were lost to study –
did not complete
and return the
T2 questionnaire

**Primary outcome
(6 months)**

118 completed
6-month
assessment

5 were lost to study –
did not complete
and return the
T3 questionnaire

132 completed
6-month
assessment

10 were lost to study –
did not complete
and return the
T3 questionnaire

Source: Weinert et al. (2011).

There were nine online health teaching units. The first addressed the use of Web skills and the remainder were self-management teaching units: keeping a health record; becoming a self-manager; using resources; health-care provider relationships; managing emotions, symptoms, and physical changes; maintaining wellness; managing finances; and relating to others. Each unit was presented within 1 week, with a "break" week midway in the intervention to allow for catch-up and review and a concluding wrap-up week.

The control group's sole task was to complete the mail questionnaires. Incentives for members of both groups who completed all activities associated with the study were $75 and a copy of the book *Living a Healthy Life With Chronic Conditions,* by Lorig and colleagues (2006).

Candidates

Candidates were women aged 35 to 65 with one or more chronic diseases — for example, an arthritic condition, diabetes, multiple sclerosis, cancer — living on ranches/farms or in small towns at least 25 miles from a town/city of 12,500 people or more in Idaho, Iowa, Montana, Nebraska, North Dakota, Oregon, South Dakota, Washington, or Wyoming. Recruitment was conducted through newspapers, newsletters of agencies and service organizations, and word of mouth. Prior to randomization, women were screened via a telephone interview, gave their verbal consent to participate, and completed the baseline questionnaire. Written consent was obtained after randomization. The study was approved by the University Institutional Review Board for the Protection of Human Subjects.

Measures

The task was to determine how the women's participation in the project influenced their perceived ability to self-manage their health condition and, ultimately, their quality of life. Measures that were considered amenable to change by the intervention were selected. These included three indicators related to the middle-range concept of *chronic illness self-management* — self-efficacy, client/health-care provider partnerships, and resource utilization — as well as measures for the concept of *quality of life* (Murphy, Herrman, Hawthorne, Pinzone, & Evert, 2000) and an indicator of quality of life, subjective happiness (Lyubomirsky & Lepper, 1999). A mail survey covering perceptions of illness self-management and quality of life was administered to both groups at baseline, at week 12, and at 6 months (week 24).

Self-Efficacy for Managing Chronic Disease (SEMCD) scale. To determine perceived self-management ability, *self-efficacy for managing chronic disease* was targeted. Self-efficacy is individuals' belief that they are

capable of organizing and executing the courses of action required to influence events that affect their lives (Bandura, 1997). People with a strong sense of self-efficacy set challenging goals for themselves and maintain a strong commitment to these goals, thus guiding them to effective performance (Bandura, 1993). In this case, the performance was that of self-managing chronic illness. Self-efficacy was measured using Lorig's SEMCD scale (Lorig, Sobel, Ritter, Laurent, & Hobbs, 2001). Participants estimated their self-management confidence on six items — for example, "How confident are you that you can do the . . . activities needed to manage your health condition . . . ?" Each item was rated from 1 *(not at all confident)* to 10 *(totally confident),* with a total score calculated as the average of the six items. The study alpha was .89.

Perceived Efficacy in Patient–Physician Interactions (PEPPI) questionnaire. The 10-item PEPPI questionnaire (Maly, Frank, Marshall, DiMatteo, & Reuben, 2003) was developed to measure confidence in ability to effectively communicate information during physician visits. A typical question was "How confident are you in your ability to get doctors to pay attention to what you have to say?" Each item was rated on a scale of 1 *(not at all confident)* to 5 *(very confident),* with the summed total score ranging from 10 to 50. The study alpha was .96.

Brief Chronic Illness Resources Survey (BCIRS). The 29-item BCIRS (Glasgow, Strycker, Toobert, & Eakin, 2000) was developed to examine participants' views of the importance of health-care resources in managing illness. Each item was rated on a scale of 1 *(not at all)* to 5 *(a great deal).* All items were averaged for the score. The study alpha was .86.

Quality of Life (WHOQOL-BREF). The WHOQOL instruments were tested and validated worldwide (Murphy et al., 2000). The WHOQOL-BREF is a 26-item questionnaire abbreviated from its 100-item predecessor. Single items addressing quality of life in the last 2 weeks and satisfaction with health in the last 2 weeks were rated on a five-point scale. The remainder of the scale contains 24 items, each rated on a scale of 1 to 5, with higher scores denoting higher perceived quality of life. The alpha for the total scale was .92. Using items from the overall scale, four subscales are calculated: psychological health (6 items), physical health (7 items), social relationships (3 items), and environment (8 items).

Subjective Happiness Scale (SHS). The SHS is a four-item measure of happiness (Lyubomirsky & Lepper, 1999) — for example, "In general, I consider myself: 1 *(not a very happy person)* to 7 *(a very happy person)."* An overall score is calculated by averaging the responses across the four items. The study alpha was .87.

Statistical Analyses

To examine differences between the intervention and control groups in terms of illness management outcome measures, we fit separate analysis of covariance (ANCOVA) models for each outcome measured at 12 weeks. ANCOVA is an efficient and powerful method for estimating the effect of an intervention in a randomized controlled study where the baseline (pre-intervention) measure of outcome is available (van Belle, Fisher, Heagerty, & Lumley, 2004). In each model, we adjusted for the treatment group as the independent variable of interest, the pre-intervention value of the outcome measure, and any baseline factor or covariate found to significantly differ ($p < 0.05$) between intervention groups using t tests for continuous measures and chi-squared tests for categorical variables. To account for potential correlation of outcome measures among participants in the same cohort, we also adjusted for an indicator of cohort as a fixed effect covariate. To assess the impact of the intervention relative to the control in an unbiased manner, we used an "intent-to-treat" approach, whereby women's scores were analyzed in accordance with the group to which they were assigned, regardless of how closely they adhered to the assigned intervention. In the absence of established minimally clinically important differences on the scales used in this study, effect sizes were evaluated using Cohen's d statistic (Cohen, 1988), where statistics below 0.3 represent small effect sizes, statistics between 0.4 and 0.8 denote moderate effect sizes, and statistics above 0.8 are considered large.

There was a differential proportion of drop-out by group, with women in the intervention group having a greater probability of dropping out than women in the control group. Missing outcome data can bias results if they are not completely independent of the outcome (Little & Rubin, 1987). We conducted sensitivity analyses to assess whether a woman's illness management, quality of life, or other characteristics at baseline had any bearing on whether she followed through with the intervention. We fit separate logistic regression models with all available demographic and illness-management variables as predictors of missing data at 12 weeks, with drop-out status indicator as the outcome. These analyses were repeated for each group separately by including an interaction term between intervention group assignment and the baseline variable. Lastly, we imputed missing 12-week outcome measures using the last-value-carried-forward — for example, baseline measures — and re-ran all primary regression models with the imputed data to assess the impact on intervention effectiveness (van Belle et al., 2004). All statistical analyses were performed using Stata, version 10 (StataCorp, 2007), and R statistical software, version 2.10.1 (R Development Core Team, 2008). Reported p values were two-sided, with statistical significance taken to be p value < 0.05 and no adjustment for multiple testing.

Results

Participant Characteristics

The group was primarily Caucasian (91%) with a mean age of 55.5 years and had dealt with one or more chronic illnesses for an average of 16.5 years. Nearly 77% (76.9%) were married and a similar proportion (77.7%) had no children in the home. Mean years of education was 14.7 and 53% were employed outside the home. The baseline demographics/characteristics are summarized, by study group, in Table 1.

Of the 309 rural women who began the study, 250 (80.9%) completed and provided data at all three time points. By the conclusion of data collection, 37 of 155 women (23.8%) in the intervention group had dropped out and 22 of 154 (14.3%) in the control group had dropped out. Attrition of these 59 participants (19.1%) was attributed to several factors: failure to return a questionnaire (29), increased family responsibilities (9), exacerbation of illness (8), non-participation in the intervention (6), inability to relate well to using the computer (4), irresolvable computer or Internet problems (2), and death (1).

Outcomes

The results for each chronic illness self-management and quality of life outcome measured at 12 weeks are shown in Table 2. In general, the direction and strength of the changes at 12 weeks persisted at the 24-week measurement.

Chronic illness self-management outcomes. Women randomized to the intervention group reported significantly greater self-efficacy (SEMCD) in managing their chronic disease at 12 weeks relative to those in the control group (0.8; 95% CI: 0.5, 1.2; $p < 0.001$). The observed difference between groups was moderately large (Cohen's d: 0.48). However, while the intervention group had higher scores for confidence in communicating with physicians (PEPPI) and the importance of health-care utilization (BCIRS), the differences were small and were not significantly different statistically from those of the control group.

Quality of life outcomes. Women in the intervention group reported statistically significant gains compared to those in the control group in three out of four domains of the WHOQOL-BREF questionnaire. Effect sizes in psychological ($d = 0.30$; $p = 0.003$), social relationship ($d = 0.24$; $p = 0.038$), and environmental ($d = 0.29$; $p = 0.010$) quality of life domains were found to be small but consistent, while the intervention effect size on the physical health quality of life domain was smaller and not statistically significant ($d = 0.19$; $p = 0.089$). Subjective happiness did not change noticeably in either group over 12 weeks, with women reporting 12-week changes of 0.1 (intervention) and 0.0 (control) points out of a possible 1 to 7 scale ($d = 0.17$; p value = 0.073).

Table 1 *Participant Characteristics*

Characteristic	Intervention N = 155	Control N = 154	p value
Age, years[a]	56.1 (7.7)	55.0 (9.1)	0.25
Caucasian[b]	144 (93%)	137 (89%)	
Marital Status[b]			
Married, common law, or living together	126 (81%)	118 (77%)	
Divorced or separated	19 (12%)	24 (16%)	
Other	9 (6%)	12 (8%)	
Education, years[a]	14.8 (2.4)	14.5 (2.6)	0.33
Income[b]			
Under $15,000	18 (12%)	25 (16%)	
$15,000 to $34,999	45 (29%)	54 (35%)	
$35,000 to $64,999	59 (38%)	50 (32%)	
Over $65,000	28 (18%)	23 (15%)	
Homemaker[b]	74 (48%)	69 (45%)	
Hours/week worked outside home[a]	29.5 (14.6)	28.0 (16.0)	0.56
Years since onset of symptoms – median (IQR[c])	13 (8, 23)	13.5 (7, 23.75)	0.86
Years since diagnosis – median (IQR[c])	10 (5, 16)	9 (4, 16)	0.36
Primary health condition[b]			
Arthritis	31 (20%)	25 (16%)	
Diabetes	24 (15%)	19 (12%)	
Multiple sclerosis	24 (15%)	26 (17%)	
Fibromyalgia	22 (14%)	22 (14%)	
Lupus	11 (7%)	1 (1%)	
Cancer	6 (2%)	8 (5%)	
Other	37 (24%)	53 (34%)	
Difficulty: vision, hearing, mobility, pain, fatigue, coordination[a]	10.7 (5)	10.3 (5.1)	0.56
Computer skills[a,d]	6.2 (2.0)	5.7 (2.6)	0.03
Computer comfort[a,d]	7.3 (2.4)	6.6 (2.9)	0.02

[a] Presented as mean (*SD*); p value obtained from two-sample *t* test
[b] Presented as frequency (%); p value obtained from chi-square test
[c] IQR presented as the 25th, 75th percentiles; p value obtained from Wilcoxon rank rum test
[d] Rated on a scale of 0 *(no skills)* to 10 *(expert)* or, similarly, for the social relationships subscale
  (p value 0.038), 0 *(not at all comfortable)* to 10 *(very comfortable).*

Table 2 *Impact of Intervention on Illness Management and Quality of Life Variables at 12 Weeks*

Outcome Measure	Intervention Mean (SD)			Control Mean (SD)			Intervention Effect[a]	Cohen's d	p value
	Baseline	12 Weeks	Change at 12 Weeks	Baseline	12 Weeks	Change at 12 Weeks			
Chronic illness self-management									
SEMCD (1–10)	5.6 (2.1)	6.4 (1.7)	0.7 (1.6)	5.5 (2.1)	5.5 (2.0)	−0.1 (1.4)	0.8 (0.5, 1.2)	0.48	<0.001
PEPPI (10–50)	39.7 (7.4)	40.8 (6.9)	1.0 (5.6)	37.7 (8.7)	38.7 (7.7)	1.2 (6.1)	0.6 (−0.6, 1.9)	0.29	0.305
BCIRS (1–5)	3.0 (0.5)	3.0 (0.5)	0.0 (0.4)	3.0 (0.7)	2.9 (0.6)	−0.1 (0.4)	0.1 (0.0, 0.2)	0.18	0.305
Quality of life									
WHOQOL– BREF (4–20)									
Physical health	12.3 (3.4)	13.0 (2.9)	0.6 (2.5)	12.3 (3.4)	12.4 (3.5)	0.1 (2.2)	0.5 (−0.1, 1.0)	0.19	0.089
Psychological	13.5 (3.3)	14.0 (2.9)	0.4 (2.3)	13.4 (3.2)	13.1 (3.1)	−0.3 (2.2)	0.8 (0.3, 1.3)	0.30	0.003
Social relationships	13.4 (3.9)	14.0 (3.6)	0.5 (3.6)	13.3 (3.8)	13.1 (3.9)	−0.4 (2.7)	0.7 (0.0, 1.4)	0.24	0.038
Environment	14.8 (2.5)	15.2 (2.3)	0.2 (1.8)	14.7 (2.8)	14.5 (2.5)	−0.3 (1.8)	0.5 (0.1, 0.9)	0.29	0.010
SHS (1–7)	5.0 (1.2)	5.1 (1.1)	0.1 (0.8)	4.9 (1.2)	4.9 (1.3)	0.0 (0.8)	0.2 (0.0, 0.4)	0.17	0.073

[a] Estimate (95% confidence interval) from ANCOVA model adjusting for the outcome measured at baseline, baseline level of comfort with the computer, baseline PEPPI, and cohort number. Intervention effects are coded such that a positive value favours the intervention.

Sensitivity Analysis

More women dropped out of the intervention group ($p = .024$) compared to the control group, potentially impacting the reliability of the intervention effects observed and reported at 12 and 24 weeks. In separate univariate models, all baseline characteristics displayed in Table 1 as predictors of missing data at 12 weeks were assessed, both overall and separately for each treatment group. Divorcees and homemakers were almost twice as likely as the other women to drop out.

To adjust for women with missing data at 12 weeks, each of the models for the illness-management outcome measures was reassessed by imputing missing data using the last known value. For 22 women in the control group and 37 women in the intervention group, the 12-week outcomes were imputed using the outcomes measured at baseline. For five additional women in the intervention group and 10 additional women in the control group, outcome measures collected at baseline were used. Using last-value-carried-forward imputation for women who dropped out of the study, the same outcomes remained statistically significant, with p values < 0.05. However, the intervention effects presented in Table 2 were reduced by approximately 20% to 30%.

Discussion

The question to be answered was whether a HIT-based intervention can positively influence the confidence of rural women in their ability to be effective self-managers in order to adapt to living with chronic conditions. This question was important, because if the women showed a strong sense of self-efficacy in ability to self-manage their illnesses, it could be expected that they would be guided towards effective self-management behaviour (Bandura, 1993). Participants in the intervention were expected to have significantly higher scores on measures of self-efficacy, confidence in communicating with health-care providers, importance of chronic illness resources, and quality of life than those in the control group. The achievement of one of the main aims of the intervention, *to foster perceived ability to self-manage one's chronic illness,* was seen in the statistically significant improvement of self-efficacy in managing their disease. These reported effects were sustained for as long as 24 weeks.

Moderate, though not statistically significant, improvement in confidence in patient/physician interactions and perceived importance of chronic illness resources was demonstrated. The absence of a significant increase in perceived importance of resources was unexpected, since the health teaching activities of the intervention incorporated identification and utilization of health resources. It is also surprising that there was little measureable effect on overall quality of life and subjective happiness.

Because the effect size for only three of the quality of life subscales was deemed significant, one could be led to conclude that the intervention had little impact. However, a closer look may shed some light on this apparent deficiency. The four quality of life subscales were physical health, psychosocial health, social relationships, and environment. Of these, only physical health did not show significant change that could be considered least likely to be impacted by the nature of this intervention. Psychosocial health, a major focus of the intervention, was significant, with a $p = .003$, and the effect sizes were also significant for the social relationships subscale ($p = .038$) and the environment subscale ($p = .010$). Given the support component of the intervention, the impact on psychosocial health and social relationships is a logical conclusion. However, it is not as easy to understand the positive impact of the intervention on the environment subscale.

The sensitivity analysis revealed that women who were married and women who worked outside the home tended to stay with the study. Divorced women and stay-at-home homemakers were twice as likely to drop out, a phenomenon that is discussed in detail in a related article (Weinert et al., 2011).

As with any study, these results are subject to limitations. The theoretical model that evolved from and guided our research is new and not fully tested. A second consideration that may bias the findings is the rate of missing data, specifically the fact that there were more missing data for the intervention group than for the control group. Furthermore, sensitivity analyses demonstrated that women with certain characteristics had a greater likelihood of dropping out. These women may have had more severe illnesses or barriers to participating in the intervention. These limitations, and the fact that the sample was age-bound and included only rural woman from a particular part of the country, place restrictions on the generalizability of our findings.

Conclusion

The pioneering work of Lorig and colleagues (Lorig & Holman, 2000; Lorig et al., 2001, 2008) in the field of self-management interventions was designed to assist primarily urban populations in self-managing their conditions. We sought to determine whether a similar computer-based intervention could positively influence the illness management of *rural* women with chronic illnesses. Given their impressive improvement in self-efficacy in illness management and their modestly increased confidence in patient/physician interactions and social relationships, there is evidence that our intervention can enhance the abilities of rural dwellers to manage chronic illness.

As part of an examination of the impact of the WTW computer-based intervention on rural women's adaptation to chronic illness, a discussion of the constructs of adaptation within the framework of the Women To Women Conceptual Model for Adaptation to Chronic Illness has been ongoing. In a previous report, we described the success of the WTW computer-based intervention on the indicators of the construct of psychosocial response (Weinert et al., 2011). In this article, we have expanded the discussion to include the impact of the intervention on perceived ability to self-manage chronic illness and quality of life. The WTW intervention has been demonstrated to have a positive impact on psychosocial adaptation among rural women with chronic illnesses. We have now found evidence of an impact on perceived self-management ability and quality of life, but not as strong as that on psychosocial adaptation. Future research will explore the associations and interrelationships among the WTW constructs as we strive to better understand the parameters of rural women's adaptation to chronic illness.

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