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National study of chronic disease self-management: 6-month and 12-month findings among cancer survivors and non-cancer survivors

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Abstract

***Objective*: This study examined the applicability of the Stanford Chronic Disease Self-Management Program (CDSMP) for cancer survivors and compared outcomes among cancer survivors and participants with other chronic diseases (non-cancer survivors).**

***Methods*: Participants were older adults ($n = 1170$) enrolled in the National Study of CDSMP. Detailed information about physical and psychosocial health status and health and healthcare behaviors was collected from participants ($n = 116$ cancer survivors and $n = 1054$ non-cancer survivors) via self-report before CDSMP participation and at 6-month and 12-month follow-ups. Linear and generalized linear mixed models were used to assess baseline-to-6-month and baseline-to-12-month changes.**

***Results*: Among cancer survivors, general health, depression, and sleep significantly improved from baseline to 6 months. These significant changes were sustained at 12 months. Communication with physician, medication compliance, pain, days in poor physical health, days in poor mental health, and days kept from usual activities and physical activity also improved significantly from baseline to 12 months. Among non-cancer survivors, all outcomes except medication compliance and stress improved significantly from baseline to 6 months. At 12 months, medication compliance also improved significantly.**

***Conclusions*: Findings suggest that participation in CDSMP, an evidence-based chronic disease self-management intervention not specifically tailored for cancer survivorship, may significantly improve physical and psychosocial health status and key health and healthcare behaviors among cancer survivors. Additional research is needed to elucidate cancer survivors' unique needs and examine the benefits of tailored versions of CDSMP. Nevertheless, CDSMP, available at scale nationally and internationally, is a promising intervention for cancer survivors and should be considered a valuable component of survivorship care.**

Introduction

Within the next decade, the number of cancer survivors living in the USA will increase from approximately 13.7 million to almost 18.0 million [1,2]. The rapidly growing number of cancer survivors underscores the urgency for low-cost, accessible cancer survivorship care and interventions that will effectively address the late and long-term effects of cancer diagnosis and treatment and also promote healthier survivorship. Even after primary treatment for cancer has concluded, many cancer survivors are left to deal with physical and psychosocial problems such as fatigue, pain, functional limitations, anxiety, depression, decreased quality of life, and non-cancer survivor concerns [3]. Cancer survivors are also tasked with managing the ongoing surveillance and treatment for primary and secondary cancers and/or non-cancer survivor chronic illnesses precipitated by chemotherapy and other treatment.

Self-management interventions, defined as 'the systematic provision of education and supportive interventions by health care staff to increase patients' skills and confidence in managing their health problems, including regular assessment of progress and problems, goal setting, and problem-solving support' (IOM, 2003), are increasingly being viewed as promising, low-cost models for meeting the physical and psychosocial needs of cancer survivors (IOM, 2008). A recent review of randomized controlled trials of self-management interventions across the cancer continuum by McCorkle *et al.* concluded that self-management interventions can improve some of the physical and psychosocial problems associated with cancer

survivorship and suggested that self-management programs for cancer survivors may be particularly beneficial during the transition period from primary treatment to longer-term survivorship [4]. Although only a few studies have assessed the effectiveness of self-management at this critical period, those that have suggested that self-management interventions implemented at this juncture may significantly improve cancer survivors' fatigue, reduce cancer-related distress, and improve health behaviors such as physical activity [4].

This study examined the effectiveness of the Stanford Chronic Disease Self-Management Program (CDSMP), an evidence-based chronic disease self-management intervention, among a national sample of adults who were cancer survivors and non-cancer survivors. In contrast to the self-management interventions reviewed by McCorkle *et al.* [4], CDSMP was not designed specifically for cancer survivors. CDSMP is a general program designed to assist people with an array of health issues and self-management behaviors common to different chronic diseases. While CDSMP has been widely studied and previous translational studies indicate the potential applicability of the program to a wide range of chronic diseases, to date, the program has not been specifically studied with cancer survivors. The widespread availability of this program makes it a potentially valuable self-management intervention for cancer survivors. It remains to be determined, however, whether CDSMP will prove to be as effective among cancer survivors as it has been among persons with other chronic diseases who are not cancer survivors.

To these ends, the objectives of this study were to (a) describe the baseline demographic and health status characteristics of cancer survivors who participated in a national study of CDSMP and compare these with the characteristics of participants who were not cancer survivors, (b) examine 6-month and 12-month changes in physical and psychosocial health status and health and healthcare behaviors, and (c) compare outcomes of cancer survivors and non-cancer survivor participants.

Methods

Study design

Data used in this study originated from the National Study of CDSMP (National Study), a pre-longitudinal and post-longitudinal effectiveness study of CDSMP outcomes funded under the American Recovery and Reinvestment Act. Data were collected from participants at 22 organizations licensed to deliver CDSMP in 17 US states immediately prior to the first CDSMP workshop (baseline) and at 6-month and 12-month follow-ups. More information about the National Study is available in prior publications [5–7].

Participants

Participants were middle-aged and older adults who enrolled in CDSMP workshops at the 22 organizations licensed to deliver CDSMP from August 2010 to April 2011. To be eligible, participants had to (a) have at least one self-reported chronic condition or disease, (b) attend at least one of the first two CDSMP workshops, and (c) not have previously participated in CDSMP. Approval for the study was obtained from the Institutional Review Boards at two collaborating institutions: Stanford University and Texas A&M University. Informed consent was obtained from all study participants.

Intervention

CDSMP is one of the most widely and successfully disseminated and scaled-up chronic disease self-management interventions [8]. The program is currently used in all US states and has been adapted for use in 25 countries worldwide. Since 2010, the program has reached more than 150,000 people in the US alone. CDSMP has a large evidence base and has been described in detail in previous publications [8]. Briefly, CDSMP is based on self-efficacy theory and is designed to enhance personal efficacy (i.e., confidence in one's ability to manage different aspects of one's health functioning) through skills mastery, reinterpretation of symptoms, modeling, and social persuasion [9]. CDSMP is composed of community-based, peer-led, and small group (8–16 participants) workshops [8]. Over the course of 6-weekly small group workshops, peer leaders guide participants through goal setting, problem solving, and action planning across a range of topics including (a) cognitive symptom management techniques, (b) physical activity, (c) use of medications, (d) communication with health professionals and others, and (e) nutrition and other related topics. Table 1 provides a summary of the topics covered in the 6-weekly CDSMP workshops.

Data collection

Outcomes were measured via self-report immediately prior to the intervention (baseline) and 6 and 12 months after the final CDSMP workshop. Participants filled out the baseline questionnaires at the first CDSMP workshop. Follow-up questionnaires were mailed to participants. Questionnaires were available in both English and Spanish. Workshop leaders tracked program participation.

Measures

Multiple validated measures were used to assess changes in physical and psychosocial health status and healthcare behaviors. All measures have been used in previous studies of CDSMP.

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Table 1. Overview of chronic disease self-management program content

	Week					
Topics covered	**1**	**2**	**3**	**4**	**5**	**6**
Self-management and chronic health overview	✓					
Making an action plan	✓	✓	✓	✓	✓	✓
Relaxation/cognitive symptom management	✓		✓	✓	✓	
Feedback/problem solving		✓	✓	✓	✓	✓
Anger/fear/frustration		✓				
Fitness/exercise		✓	✓			
Better breathing			✓			
Fatigue			✓			
Nutrition				✓		
Advance directives				✓		
Communication				✓		
Medications					✓	
Making treatment decisions					✓	
Depression					✓	
Informing the healthcare team						✓
Working with your healthcare professional						✓
Future plans						✓

Adapted from Lorig *et al.* [10].

Physical and psychosocial health status

Self-rated general health was assessed with a single item from the National Health Interview Survey [11]. Possible responses ranged from 1 ('excellent') to 5 ('poor'). Lorig *et al.*'s four-item social and role limitation scale was used to measure the extent that participants perceived their health to have interfered with daily activities (i.e., normal social activities, hobbies and recreational activities, household chores, and errands and shopping) during the past week [12]. Possible responses ranged from 0 ('not at all') to 4 ('almost totally'). An average social and role limitation score (range: 0–4) was calculated from the four individual items; higher-scale scores indicate a higher level of interference in daily activities. Depression was measured with the eight-item personal health questionnaire depression scale [13]. Scores range from 0 to 24 with higher scores indicating higher levels of depression.

Quality of life was measured using an 11-point visual numeric scale [14]. Responses ranged from 0 ('very poor quality') to 10 ('excellent quality'). Visual numeric scales were also used to measure fatigue, pain, sleep problems, and stress. Participants indicated the extent of each symptomatology during the past week on 11-point scales. Responses ranged from 0 ('no' symptomatology) to 10 ('severe' symptomatology). Three separate items from the Centers for Disease Control and Prevention Healthy Days measure [15] were used to assess the number of unhealthy days that participants experienced during the past month due to physical health and mental health and to assess the number of days in the past month that participants were kept from doing usual activities (i.e., self-care and recreation) due to poor physical or mental health.

Health and healthcare behaviors

Communication with physicians was assessed using a three-item scale by Lorig *et al.* [12]. Participants indicated on a six-point Likert scale how often they prepared a list of questions for their physician, asked their physician questions, and discussed personal problems related to treatment with their physician [12]. Higher scores (average of the three items) indicate better communication with physicians. A four-item scale by Morisky *et al.* was used to assess medication compliance [16]. Participants indicated whether they ever forget to take their medicine, ever have problems remembering to take their medicine, sometimes stop taking their medicine when they feel better, and sometimes stop taking their medicine when they feel worse. Higher scores (the average of the four items) indicate better medication compliance.

Weekly minutes of physical activity was assessed by asking participants the total minutes in the past week to that they were physically active or exercising for at least 30 min, such as brisk walking, running, dancing, bicycling, and water exercise, which may cause faster breathing or heartbeat, or feeling warmer.

Sociodemographic characteristics

Standard sociodemographic questions were used to assess sex, age, race, and highest level of education completed. Participants indicated if they had any chronic conditions and if so, which ones from a list of 12 possible responses.

Statistical analysis

Baseline characteristics were compared between cancer survivors and non-cancer survivor participants using χ^2 tests for categorical variables and two sample *t*-tests for continuous variables. Two types of analyses were conducted to examine changes from baseline to follow-up assessments (i.e., 6 and 12 months), varying by types of outcome variables. Linear mixed models (using Stata *xtmixed* procedure) with participant-level random intercepts were performed for continuous outcome variables controlling for age, gender, race, education, and number of chronic conditions. Generalized linear mixed models with Poisson distribution and participant-level random intercepts (using Stata *xtpoisson* procedure) controlling for age, gender, race, education, and number of chronic conditions were fitted to assess changes in count outcome measures. These types of mixed effects models used likelihood-based approaches to provide unbiased estimates of the intervention effects assuming that responses are missing at random. The physical activity variables were severely skewed and zero inflated; thus, multi-level two-part mixed effects models (using Stata *gllamm* procedure)

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[17] were utilized to assess change for those variables from baseline-to-6-month and baseline-to-12-month follow-ups. These three types of mixed effects models are likelihood-based approach that used all available data in model estimation and provide unbiased estimates of the intervention effects under the assumption of missing at random.

Effect sizes (d = [posttest mean − pretest mean]/pretest standard deviation) using estimates of changes from the mixed effects models were computed. Effect sizes of $d = 0.2$ were considered small, $d = 0.5$ medium, and $d = 0.8$ large [18].

Results

Participant characteristics

Table 2 presents the baseline characteristics of National Study participants for the total sample ($n = 1170$) and by cancer survivorship status ($n = 116$ cancer survivors and $n = 1054$ non-cancer survivors). Overall, the response rates for this community-based national study were excellent at both the 6-month and 12-month follow-ups with a 77% ($n = 903$) response rate and a 71% ($n = 825$) response rate, respectively. At 6 months, participants who completed the survey were significantly more likely to be non-Hispanic White than those who did not. At both time points, participants who completed the survey were significantly older and had significantly higher workshop attendance. Overall, participants were largely women (82.7%), non-Hispanic White (55.2%), and a mean age of 65.3 years. The majority (81.9%) participated in the English version of CDSMP. On average, participants had three comorbidities. More than half of participants reported having hypertension (58.9%) and arthritis (53.5%). Seventy-nine percent of participants overall completed four or more CDSMP sessions.

Cancer survivor participants differed significantly from non-cancer survivor participants in several ways (Table 2). Compared with non-cancer survivor participants, cancer survivors were less likely to be women (83.5% vs 75.0% for non-cancer survivor participants and cancer survivors, respectively), more likely to be non-Hispanic White (53.0% vs 75.0%), older (mean = 64.6 vs 72.2 years),

Table 2. Baseline characteristics of chronic disease self-management program participants for total sample and by cancer survivorship status

	Total (*N* = 1170) *N* (%)	**Cancer survivor participants (*N* = 116) *N* (%)**	**Non-cancer survivor participants (*N* = 1054) *N* (%)**	***p*-value***
Women	967 (82.7)	87 (75.0)	880 (83.5)	0.022
Race/ethnicity				<0.001
Non-Hispanic White	645 (55.2)	87 (75.0)	558 (53.0)	
African American	187 (16.0)	9 (7.8)	178 (16.9)	
Latino/Hispanic	260 (22.3)	12 (10.3)	248 (23.6)	
Asian/Pacific Islander	34 (2.9)	4 (3.5)	30 (2.9)	
American Indian/Alaska native	8 (0.7)	1 (0.9)	7 (0.7)	
Other	34 (2.9)	3 (2.6)	31 (3.0)	
Language				0.005
English	958 (81.9)	106 (91.4)	852 (80.8)	
Spanish	212 (18.1)	10 (8.6)	202 (19.2)	
Comorbidities[§]				
Type I diabetes	35 (3.0)	2 (1.7)	33 (3.1)	0.569
Type II diabetes	364 (31.1)	32 (27.6)	332 (31.5)	0.460
Asthma	154 (13.2)	15 (12.9)	139 (13.2)	1.000
Arthritis	625 (53.5)	65 (56.0)	560 (53.2)	0.624
COPD	144 (12.3)	15 (12.9)	129 (12.2)	0.768
Hypertension	689 (58.9)	61 (52.6)	628 (59.6)	0.164
Heart disease	210 (18.0)	35 (30.2)	175 (16.6)	0.001
Depression	324 (27.7)	33 (28.5)	291 (27.6)	0.828
Lung disease	26 (2.2)	6 (5.2)	20 (1.9)	0.038
Mental health issue	216 (18.5)	28 (24.1)	188 (17.8)	0.102
Other	407 (34.8)	48 (41.4)	359 (34.1)	0.307
Attended four or more workshop sessions	925 (79.1)	98 (84.5)	827 (78.5)	0.130
	Mean (±SD)	Mean (±SD)	Mean (±SD)	*p*-value[¶]
Age in years (range: 19–80)	65.3 (±14.3)	72.2 (±10.0)	64.6 (±14.5)	<0.001
Years of education (range: 1–23)	12.9 (±3.8)	14.1 (±3.7)	12.8 (±3.8)	<0.001
Number of comorbidities (range: 1–12)	3.0 (±1.7)	4.1 (±1.9)	2.8 (±1.6)	<0.001

SD, standard deviation; COPD, chronic obstructive pulmonary disease.

*p-value for chi-squared test comparing the participants who reported having cancer and who did not.

[§]Fisher's exact test.

[¶]p-value for two-sample t-test comparing the participants who reported having cancer and who did not.

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and more likely to have more education (mean = 12.8 vs 14.1 years). Cancer survivors were significantly more likely to participate in the English language version of CDSMP (91.4%) than their non-cancer survivor counterparts (80.8%). Cancer survivors had significantly more comorbidities (mean = 4.1 vs 2.8), more heart disease (30.2% vs 16.6%), and more lung disease (5.2% vs 1.9%) than non-cancer survivor participants. With the exception of fatigue, which was significantly greater at baseline among cancer survivors (mean = 5.4 vs 4.8, $p = 0.03$, data not shown), there were no significant differences in physical or psychosocial health status or healthcare behaviors between cancer survivors and non-cancer survivors at baseline. Furthermore, program completion (i.e., four or more CDSMP sessions) was similar between cancer survivors (84.5%) and non-cancer survivor participants (78.5%).

Outcomes among cancer survivors

Table 3 presents the adjusted baseline-to-6-month and baseline-to-12-month changes in outcome variables for cancer survivor participants. At 6 months, cancer survivors who participated in CDSMP experienced significant improvements in self-rated general health, depression, and sleep. At 12 months, these three outcomes and six additional outcomes (communication with physician, medication compliance, pain, the number of days spent in poor physical health, the number of days spent in poor mental health, and the number of days kept from usual activities) improved significantly. Effect sizes for improved outcomes ranged from 0.21 to 0.28 at 6 months and from 0.14 to 0.33 at 12 months. There were no significant improvements observed in role function, quality of life, stress, or physical activity among cancer survivor participants at either time point.

Outcomes among non-cancer survivor participants

Table 4 presents the adjusted baseline-to-6-month and baseline-to-12-month changes for non-cancer survivor participants. At 6 months, non-cancer survivor participants experienced significant improvements in all but two outcomes (medication compliance and stress). At 12 months, all but one outcome (i.e., stress) improved significantly. Effect sizes for improved outcomes ranged from 0.08 to 0.24 at 6 months and from 0.10 to 0.29 at 12 months.

Discussion

The current study examined the applicability of the Stanford CSDMP to cancer survivors and assessed the extent to which cancer survivors could benefit from an evidence-based chronic disease self-management intervention that was not specifically tailored for cancer survivorship. Study results are promising. Findings indicate that cancer survivors who participated in CDSMP experienced significant improvements in several physical and psychosocial health outcomes and healthcare behaviors. Specifically, cancer survivors who participated in CDSMP experienced significant improvements in self-rated general health, depression, and sleep 6 months after baseline that persisted at the 12-month follow-up. By the 12-month follow-up, cancer survivors reported significant improvements in health symptoms (i.e., reduced pain). At 12 months, cancer survivors also reported spending significantly fewer days in poor physical and mental health than baseline. They also experienced reductions in the number of days during which poor health kept them from doing usual activities. Important healthcare behaviors such as communication with physician and medication compliance also improved significantly among the cancer survivors who participated in the National Study of CDSMP. Although the odds of any physical activity improved among cancer survivors at both 6 and 12 months, these improvements were not statistically significant.

Our findings indicate some similarities in program response between cancer survivors and other National Study participants (i.e., non-cancer survivors). While fewer significant baseline-to-6-month changes were observed among cancer survivors than non-cancer survivor participants (3 vs 13 outcomes, respectively), the effect sizes of baseline-to-6-month changes for all observed outcomes were, in most cases (except fatigue and pain), similar between the two groups. By 12 months, the number of significant changes among cancer survivors and non-cancer survivor participants was more similar (9 vs 14 outcomes, respectively). Furthermore, at 12 months, the intervention effect sizes for many outcomes were larger for the cancer survivors than the comparison of non-cancer survivor population, suggesting stronger outcomes for cancer survivors. For example, at 12 months, the effect of CDSMP participation on medication compliance among cancer survivors was 0.23 versus 0.10 for non-cancer survivors. Similarly, larger effect sizes were detected among cancer survivors for illness symptomatology often associated with cancer such as pain (0.33 vs 0.19 for non-survivors) and days spent in poor physical health (0.28 vs 0.13 for non-survivors). While not significant, the effect of CDSMP on quality of life and fatigue also appears to be much greater among cancer survivors at 12 months than non-survivors.

Specific comparisons of our study results with non-cancer survivor self-management interventions that have been tailored for cancer survivors are difficult because of the diversity of measures used across studies. More attention is needed to the development of a common language for measuring outcomes of self-management interventions among cancer survivors [4]. Nevertheless, our study revealed comparable health and quality of life improvements for cancer survivors as in non-cancer survivor studies [19]. Additionally, the Stanford CDSMP mirrors

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Table 3. Adjusted[a] changes or ratios between baseline and follow-up means and effect sizes among cancer survivor participants

	Mean (±SD)			Adjusted baseline-to-6-month change			Adjusted baseline-to-12-month change		
	Baseline[b] (*n* = 116)	6 months[b] (*n* = 105)	12 months[b] (*n* = 85)	Adjusted change or ratio change[c]	*p*-value	Effect size *d*	Adjusted change or ratio change[d]	*p*-value	Effect size *d*
General health (1–5)↓	3.36 (±0.96)	3.16 (±0.86)	3.12 (±0.97)	−0.19	0.010	0.21	−0.17	0.031	0.25
Role function (0–4)↓	1.57 (±1.18)	1.48 (±1.15)	1.44 (±1.19)	−0.05	0.603	0.07	−0.04	0.703	0.11
Depression (0–24)↓	7.24 (±5.51)	5.76 (±5.44)	5.66 (±5.19)	−1.26	0.006	0.27	−1.12	0.023	0.29
Communication with doctor (0–5)↑	2.81 (±1.27)	3.02 (±1.32)	3.13 (±1.56)	0.22	0.072	0.17	0.32	0.018	0.25
Medication compliance (0–1)↓	0.22 (±0.26)	0.20 (±0.28)	0.16 (±0.24)	−0.02	0.331	0.08	−0.07	0.007	0.23
				Mean ratio[e]			Mean ratio[f]		
Quality of life (0–10)↑	6.28 (±2.05)	6.55 (±1.93)	6.92 (±1.80)	1.04	0.471	0.13	1.09	0.140	0.31
Fatigue (0–10)↓	5.44 (±2.60)	5.40 (±2.64)	4.67 (±2.75)	1.00	0.944	0.02	0.88	0.061	0.30
Pain (0–10)↓	4.97 (±2.86)	4.70 (±2.85)	4.02 (±3.02)	0.96	0.510	0.09	0.86	0.031	0.33
Sleep (0–10)↓	4.94 (±3.13)	4.06 (±2.64)	4.15 (±3.05)	0.83	0.004	0.28	0.86	0.037	0.25
Stress (0–10)↓	4.22 (±2.99)	4.39 (±2.88)	3.82 (±2.86)	1.07	0.296	0.06	0.94	0.405	0.13
Days in poor physical health (0–30)↓	10.12 (±10.40)	9.40 (±10.12)	7.18 (±9.00)	0.92	0.062	0.07	0.77	<0.001	0.28
Days in poor mental health (0–30)↓	6.66 (±9.22)	6.12 (±8.35)	5.39 (±8.43)	0.97	0.626	0.06	0.87	0.028	0.14
Days in health kept from usual activities (0–30)↓	6.59 (±9.46)	5.98 (±9.07)	4.62 (±8.07)	0.98	0.668	0.06	0.84	0.008	0.21
Two-part models	Mean (±SD) or %	Mean (±SD) or %	Mean (±SD) or %	Odds ratio[g] or mean ratio[h]			Odds ratio[i] or mean ratio[j]		
Weekly minutes moderately active									
Any time moderately active ↑	65.5%	75.0%	78.6%	1.75	0.092	NA	2.05	0.059	NA
Minutes moderately active per week (0–1000) ↑	235.1 (±263.1)	187.0 (±145.9)	168.2 (±160.5)	0.71	<0.001	NA	0.65	<0.001	NA

SD, standard deviation; NA, not applicable.

The range and desired direction are specified for each outcome. An upward arrow indicates that a higher value is desirable, and a downward arrow indicates that a lower value is desirable.

[a]All changes, ratios, and *p*-values are adjusted for gender, age, race/ethnicity, education, and number of comorbidities.

[b]Raw means and standard deviations at each of the assessments.

[c]Adjusted changes between baseline and 6 months from linear mixed regression models.

[d]Adjusted changes between baseline and 12 months from linear mixed regression models.

[e]Adjusted ratio of baseline and 6-month mean from random intercept Poisson regression models.

[f]Adjusted ratio of baseline and 12-month mean from random intercept Poisson regression models.

[g]Adjusted odds ratio of any physical activity at 6 months versus baseline from the logistic regression part of two-part multi-level mixed regression model.

[h]Adjusted ratio of 6 months versus baseline mean minutes of physical activity among those who had physical activity from the gamma regression part of two-part multi-level mixed regression model.

[i]Adjusted odds ratio of any physical activity at 12 months versus baseline from the logistic regression part of two-part multi-level mixed regression model.

[j]Adjusted ratio of 12 months versus baseline mean minutes of physical activity among those who had physical activity from the gamma regression part of two-part multi-level mixed regression model.

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Table 4. Adjusted[a] changes or ratios between baseline and follow-up means and effect sizes among non-cancer survivor participants

	Mean (±SD)			Adjusted baseline-to-6-month change			Adjusted baseline-to-12-month change		
	Baseline[b] (*n* = 1054)	6 months[b] (*n* = 798)	12 months[b] (*n* = 740)	Adjusted change or ratio change[c]	*p*-value	Effect size *d*	Adjusted change or ratio change[d]	*p*-value	Effect size *d*
General health (0–5) ↓	3.21 (±0.94)	3.04 (±0.94)	3.00 (±0.93)	−0.13	<0.001	0.17	−0.17	<0.001	0.21
Role function (0–4) ↓	1.37 (±1.15)	1.17 (±1.14)	1.17 (±1.15)	−0.18	<0.001	0.17	−0.19	<0.001	0.17
Depression (1–24) ↓	6.54 (±5.23)	5.29 (±4.90)	5.01 (±5.07)	−1.06	<0.001	0.24	−1.41	<0.001	0.29
Communication with doctor (0–5) ↑	2.58 (±1.37)	2.86 (±1.40)	2.87 (±1.38)	0.21	<0.001	0.20	0.21	<0.001	0.21
Medication compliance (0–1) ↓	0.25 (±0.29)	0.23 (±0.28)	0.22 (±0.28)	−0.01	0.207	0.07	−0.03	0.008	0.10
				Mean ratio[e]			Mean ratio[f]		
Quality of life (0–10) ↑	6.56 (±2.13)	6.96 (±1.98)	6.95 (±2.00)	1.06	0.001	0.19	1.06	0.002	0.18
Fatigue (0–10) ↓	4.83 (±2.88)	4.35 (±2.93)	4.32 (±2.85)	0.91	<0.001	0.17	0.90	<0.001	0.18
Pain (0–10) ↓	4.60 (±3.16)	4.03 (±3.02)	4.09 (±3.06)	0.90	<0.001	0.18	0.90	<0.001	0.19
Sleep (0–10) ↓	4.51 (±3.32)	3.77 (±3.15)	3.70 (±3.15)	0.85	<0.001	0.23	0.83	<0.001	0.25
Stress (0–10) ↓	4.22 (±3.12)	3.98 (±3.03)	3.94 (±2.94)	0.98	0.479	0.08	0.96	0.090	0.09
Days in poor physical health (0–30) ↓	8.49 (±10.00)	7.35 (±9.39)	7.24 (±9.65)	0.90	<0.001	0.11	0.86	<0.001	0.13
Days in poor mental health (0–30) ↓	6.65 (±9.08)	5.93 (±8.40)	5.57 (±8.44)	0.95	0.013	0.08	0.88	<0.001	0.12
Days in health kept from usual activities, past month (0–30) ↓	5.74 (±8.79)	4.76 (±8.11)	4.63 (±8.29)	0.87	<0.001	0.11	0.82	<0.001	0.13
Two-part models	Mean (±SD) or %	Mean (±SD) or %	Mean (±SD) or %	Odds ratio[g] or mean ratio[h]			Odds ratio[i] or mean ratio[j]		
Weekly minutes moderately active									
Any time moderately active ↑	66.2%	74.4%	71.0%	1.73	<0.001	NA	1.35	0.020	NA
Minutes moderately active per week (0–1000) ↑	158.3 (±151.1)	180.2 (±162.8)	174.4 (±170.1)	1.20	<0.001	NA	1.09	<0.001	NA

SD, standard deviation; NA, not applicable.

The range and desired direction are specified for each outcome. An upward arrow indicates that a higher value is desirable, and a downward arrow indicates that a lower value is desirable.

[a]All changes, ratios, and *p*-values are adjusted for gender, age, race/ethnicity, education, and number of comorbidities.

[b]Raw means and standard deviations at each of the assessments.

[c]Adjusted changes between baseline and 6 months from linear mixed regression models.

[d]Adjusted changes between baseline and 12 months from linear mixed regression models.

[e]Adjusted ratio of baseline and 6-month mean from random intercept Poisson regression models.

[f]Adjusted ratio of baseline and 12-month mean from random intercept Poisson regression models.

[g]Adjusted odds ratio of any physical activity at 6 months versus baseline from the logistic regression part of two-part multi-level mixed regression model.

[h]Adjusted ratio of 6 months versus baseline mean minutes of physical activity among those who had physical activity from the gamma regression part of two-part multi-level mixed regression model.

[i]Adjusted odds ratio of any physical activity at 12 months versus baseline from the logistic regression part of two-part multi-level mixed regression model.

[j]Adjusted ratio of 12 months versus baseline mean minutes of physical activity among those who had physical activity from the gamma regression part of two-part multi-level mixed regression model.

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successes found in evaluations of other cancer-specific self-management programs, such as the telephone-based Taking CHARGE Program [20], which are also designed around self-regulatory principles, reinforcing the universality of social cognitive approaches across different delivery systems. Contrary to a meta-analysis of CDSMPs for older adults that found clinically trivial differences in pain for individuals with osteoarthritis, our study indicated robust 12-month improvements in perceived pain for cancer survivors, reflecting the importance of pain and pain amelioration among cancer survivors [21].

A major strength of this study is that as an effectiveness trial, our findings are indicative of CDSMP outcomes that can be achieved in 'real world' implementation. Although our study population is not nationally representative, the sociodemographic characteristics of our cancer survivor participants are fairly similar to those of cancer survivors in the United States. Study limitations include the absence of a randomized controlled design and the relatively small size of the cancer survivor sample, which may have limited the detection of significant differences in outcomes. Additionally, because the National Study was not focused on cancer survivors, there was limited information available about the cancer survivors (i.e., stage of survivorship, type of cancer, and years since diagnosis). This limited our ability to investigate the importance of such factors on determining differential response to the intervention. Collecting more detailed cancer-related and survivorship-related information in future studies will further strengthen our understanding of CDSMP's applicability to and impact on specific subgroups of survivors. Additionally, the limited size of our cancer survivor sample precluded our ability to study possible variations in program response between men and women, across race/ethnicity and language, and other contextual factors. Investigation of such factors in future studies will prove valuable for assessing CDSMP's generalizability to the diverse population of cancer survivors as well as better understanding of how we may tailor self-management programs to maximize their impacts with diverse populations.

Nonetheless, because CDSMP is very widely available throughout the U.S. and Canada, our study findings are extremely promising for cancer survivor care. Results suggest that participation in CDSMP, a low-cost, relatively brief intervention, may improve cancer survivors' physical and psychosocial health (i.e., general health, pain, depression, and number of healthier days) and assist them in changing key behaviors (i.e., medication compliance and communication with physicians) critical to their ongoing care for cancer and other conditions.

Randomized controlled trials of CDSMP with larger samples of cancer survivors are needed to confirm these promising findings and to more fully understand the applicability of CDSMP to the diverse and growing population of cancer survivors. In light of the demonstrated cancer disparities and the very limited availability of scaled-up, evidenced-based interventions for racially/ethnically and culturally diverse cancer survivors, research that more fully examines the potential benefits of Tomando Control de su Salud (Spanish language for CDSMP) and other culturally centered version of CSDMP for cancer survivors should also be undertaken. Moreover, comparative effectiveness trials of CDSMP and self-management programs tailored specifically for cancer survivors will prove useful for identifying the most effective program or combination of programs for meeting the needs of the growing population of cancer survivors.

The cancer thriving and surviving program (CTS), a cancer-specific adaptation of CDSMP originally developed by MacMillan Cancer Support in the UK and recently modified by the Stanford Patient Education Research Center, is a self-management program tailored specifically for cancer survivors that is based on the general CDSMP we investigated in this study. CTS was adapted to include restoration of self-confidence, adjustment to changed self, and confidence to self-manage cancer-related problems to promote successful coping and recovering of well-being following a cancer diagnosis [22]. Six-month outcomes from a randomized controlled study of CTS ($n = 200$) conducted by Risendal *et al.* found statistically significant changes over time among participants in the intervention in provider communication, depression, and sleep-related and stress-related problems [22]. Similar changes over time were observed in all of these outcomes with the exception of depression among lagged controls who did not receive the intervention, although to a lesser extent among most outcomes [22]. Future studies that examine the benefits of CTS with diverse samples and that compare this cancer-tailored program with the general CDSMP and other chronic disease self-management programs are needed. Such studies will help to advance understanding of how self-management interventions can improve health-related and quality of life-related outcomes among cancer survivors.

Conclusion

Although self-management interventions have been increasingly recognized as an important part of cancer survivorship care, few studies to date have documented the benefits of self-management among cancer survivors. This study, which used data from a national effectiveness trial of a widely disseminated, low-cost chronic disease self-management program, provides evidence that cancer survivors can achieve substantial improvements in physical and psychosocial health status and healthcare behaviors by participating in an intervention not specially tailored for cancer survivorship. CDSMP, which is already scaled up and widely available in clinical and community settings across the nation and the world, may be an important resource for the growing population of cancer survivors as

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well as a valuable component of cancer survivorship care plans. We suggest that cancer survivors and their healthcare providers be made aware of its availability in their communities.

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Conflict of interest

Kate Lorig receives royalties from the book used by participants in CDSMP.

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