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# Interventions to Support Behavioral Self-Management of Chronic Diseases

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## Keywords

chronic diseases, disease management, disease self-management, health behavior, health care utilization, health outcomes

## Abstract

A majority of the US adult population has one or more chronic conditions that require medical intervention and long-term self-management. Such conditions are among the 10 leading causes of mortality; an estimated 86% of the nation's \$2.7 trillion in annual health care expenditures goes toward their treatment and management. Patient self-management of chronic diseases is increasingly essential to improve health behaviors, health outcomes, and quality of life and, in some cases, has demonstrated effectiveness for reducing health care utilization and the societal cost burden of chronic conditions. This review synthesizes the current state of the science of chronic disease self-management interventions and the evidence for their effectiveness, especially when applied with a systematic application of theories or models that account for a wide range of influences on behavior. Our analysis of selected outcomes from randomized controlled trials of chronic disease self-management interventions contained in 10 Cochrane systematic reviews provides additional evidence to demonstrate that self-management can improve quality of life and reduce utilization across several conditions.

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## INTRODUCTION

Chronic diseases<sup>1</sup> impose an enormous and growing burden on individuals, families, and society, as well as on health care systems in the United States and globally (37, 44, 58). They account for most deaths and are major contributors to disability and health care costs (19, 20, 30, 56). Overall US costs of chronic disease are projected to accumulate by 2030 to more than \$42 trillion, with medical outlays and productivity losses costing \$8,600 per person (98). Although innovation in biomedical research has produced clinical medical treatments that can slow progression and mitigate the impact of many chronic conditions, the management of these conditions increasingly involves partnering with patients to support efforts to undertake long-term adherence to a preventive or therapeutic regimen that can improve functional status and health outcomes (13, 14). This approach typically includes patients adopting and maintaining multiple lifestyle behavioral changes in dietary practices, exercise, and the use of prescribed medications, as well as managing complex communications with family and health care providers and systems. As a consequence, the development of intervention programs that can educate and assist people in adopting and maintaining long-term health behavior change, in their efforts to prevent further progression of disease and improve quality of life, is a continuing need (11, 99).

The traditional medical model, which historically has focused on managing a specific disease condition as opposed to managing the patient, has proven to be both expensive and ineffective in the treatment of chronic diseases because many people have more than one chronic condition and competing life circumstances that impair patients' capacity to self-manage their conditions. The limitations of the medical model have resulted in a new and evolving chronic disease treatment paradigm that requires a patient-provider partnership involving collaborative care and education in chronic disease self-management to ensure the best possible health outcomes for the patient (2, 12, 50, 57, 80, 101). A significant proportion of the unnecessary health care utilization costs and poor health outcomes associated with the treatment of chronic diseases result, in large part, from the failure of patients to effectively self-manage their conditions in response to recommended medical therapy (13). Thus, if the management of chronic diseases is to be advanced, health care providers and systems of care need to organize patient self-management into an integrated system of chronic illness care that can increase the capacity of patients by providing the knowledge, resources, and skills necessary to perform the multiple tasks necessary to self-manage their conditions better (114). This approach requires building on and tailoring what is already known to be effective and disseminating evidence-based programs and practices beyond the clinical setting to enable and support people in the context of their homes and diverse communities.

This review is organized into several parts. First, we examine the concept, theories, and intervention methods that underlie chronic disease self-management programs. Second, we summarize selected chronic disease self-management programs that have been tested—and in some cases scaled beyond clinical settings to population-level use—in high-prevalence chronic diseases. Finally, we synthesize the evidence for effectiveness and report the results of our own meta-analysis of selected outcomes from randomized controlled trials (RCTs) of chronic disease self-management interventions contained in 10 Cochrane systematic reviews.

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<sup>1</sup>Arthritis, asthma, cancer, chronic obstructive pulmonary disease, heart disease, HIV/AIDS, hypertension, stroke, type 2 diabetes, and obesity, as well as mental illness and other conditions.

## CHRONIC DISEASE SELF-MANAGEMENT: CONCEPT, THEORY, AND INTERVENTION METHODS

Research to develop and evaluate disease self-management programs dates back more than 40 years. While early chronic disease–management programs were oriented largely with respect to the role of the health provider, initial efforts to develop disease self-management for patients were designed to provide disease-specific information and improve compliance with prescribed medication. Since then, chronic disease self-management has matured and evolved to support and enable patients to develop a broad range of behavioral skills and other capacities that the available evidence shows can be effective in helping people to navigate a variety of disease-management tasks across a range of chronic conditions.

### Concept and Definition

Disease self-management has been variously defined (7) and is distinct from related concepts such as self-care (104), patient activation (55, 65), and patient-centered care (67, 92). Grady & Gough (50) have defined self-management “as the day-to-day management of chronic conditions by individuals over the course of an illness” (p. e26). According to Lorig & Holman (80), for the patient, self-management involves three separate but related sets of tasks: medical or behavioral management of the disease, role management, and emotional management. Bandura (6) has proposed that “[s]elf-management operates through a set of psychological sub functions. People have to learn to monitor their health behavior and the circumstances under which it occurs, and how to use proximal goals to motivate themselves and guide their behavior” (p. 151). Moreover, because managing a chronic condition constitutes a problem-based endeavor, six self-management skills—problem solving, decision making, resource utilization, the formation and long-term maintenance of a patient–provider partnership, action planning, and self-tailoring—are central to the successful self-management of chronic conditions (80). Healthy People 2020 (54) recommends that those with chronic conditions engage in disease self-management as a means by which to cope with problems and challenges.

### Theories and Mechanisms of Self-Management

Two theoretical perspectives from psychology have dominated chronic disease self-management intervention: self-regulation theory and social cognitive theory.

**Self-regulation theory.** In self-regulation theory, a person is motivated to self-regulate by a desired goal or behavioral end point. The power of the goal is associated with a value that the goal represents for the individual. The more salient the goal is, the more the person will engage in self-regulation behavior. The model also posits that engaging in any disease-management action (e.g., changing a behavior such as taking medication, diet, or physical activity) will be influenced by both internal and external factors. The self-regulation theory of disease management views individual self-regulation of health-related behavior as central to achieving the desired outcomes of treatment (27). One of the first theory-based models of chronic disease self-management was Clark & Starr-Schneidkraut’s (29) use of self-regulation theory in asthma control.

**Social cognitive theory.** Social cognitive theory (4) is a cornerstone of effective disease self-management interventions. According to Bandura (6), “This theory posits a multifaceted causal structure in which self-efficacy beliefs operate together with goals, outcome expectations, and

perceived environmental impediments and facilitators in the regulation of human motivation, behavior, and well-being” (p. 143). The construct of self-efficacy describes one’s confidence or personal agency to exercise control and is believed to be the common pathway through which psychosocial factors influence health functioning (5). Thus, self-efficacy is a core belief that underlies each of the basic processes of personal behavioral change: the extent to which one considers changing health habits, whether one mobilizes the motivation and perseverance required to succeed, whether one has the ability to overcome temporary setbacks and relapses, and the extent to which one can maintain new behavior (6). Self-efficacy is a significant predictor of psychological well-being, adherence to prescribed treatments, and pain coping mechanisms in arthritis (3).

## Intervention Methods

Three principal methods of intervention delivery characterize chronic disease self-management programs: small-group meetings, Internet-based and mHealth technologies, and printed materials.

**Small-group meetings.** Peer-led, small-group meetings comprise the basic intervention method of chronic disease self-management programs and have been used successfully across a wide spectrum of chronic conditions (80). This format provides for face-to-face engagement between and among participants as well as for individual attention, and it facilitates peer interaction, discussion, and social support, as well as an economy of scale in the delivery of educational programs. Program attendance and participation tend to be high, and small-group meetings have been widely evaluated for feasibility, acceptability, and impact on health care outcomes; however, attendance rates and completion may suffer owing to the need for patients to attend scheduled group sessions.

**Internet-based and mHealth technologies.** New information and communication technologies can reach large numbers of the population with disease self-management programs and permit standardizing and tailoring of health-related messages. In addition, the technology is mobile, it offers privacy and anonymity, and user interface can be made graphically engaging (95). Internet-based self-management has been implemented and evaluated in arthritis and fibromyalgia (83), osteoarthritis (111), and other chronic conditions (76). Mobile phone applications have been of recent interest; however, further research is needed to assess the acceptability, risks, and long-term cost-effectiveness (35).

**Printed materials.** Not all patients are able or willing to participate in small-group meetings or Internet-based chronic disease self-management programs, and thus printed materials that are distributed either through mail or in person present a feasible alternative intervention method. When mailed, such materials also offer some of the same advantages in delivery and use as do Internet-based formats and have demonstrated promise in improving health indicators while reducing physician visits among patients with arthritis and/or depression and among African Americans (74). Moreover, such materials provide reinforcement or clarification of valuable health information.

## CHRONIC DISEASE SELF-MANAGEMENT PROGRAMS

Substantial evidence of effectiveness has accumulated for several disease self-management programs. Interventions have sought to influence a broad range of outcomes, including health behaviors, medication adherence, health status, disease progression, quality of life, utilization of health

services, and health care costs. In the following section, we describe selected chronic disease self-management programs that have been evaluated and, in some cases, scaled and disseminated to population-level implementation.

## Disease-Specific Programs

Chronic disease self-management has focused largely on four prevalent disease-specific conditions where adherence to recommended medical regimens and behavioral change are essential to improving health outcomes and quality of life: arthritis, asthma, cardiovascular disease, and diabetes.

**Arthritis.** The Arthritis Self-Management Program (ASMP) was originally developed by Lorig (79), who is widely recognized as having codified and disseminated the first application of a disease-specific model of behavioral chronic disease self-management to arthritis (51). Grounded in Bandura's Social Cognitive Theory (4) and focused on developing patients' self-efficacy, the original ASMP comprised a six-week interactive program, consisting of weekly two-hour sessions guided by two trained instructors, that was designed to assist patients with arthritis in learning how to manage their condition (70). The ASMP covers topics and techniques to deal with problems associated with arthritis, appropriate exercise, appropriate use of medications, and effective communication with family, friends, and health care professionals. In addition, the program teaches pain management techniques, nutrition, and evaluation of new treatments (70, 91). The ASMP has been evaluated extensively and has demonstrated clinically significant outcomes showing that disease self-management in patients with arthritis yields sustained benefits while reducing health care costs (81). A 12-year review of RCTs of the ASMP concluded that the program improves behaviors, self-efficacy, and aspects of health status (81). In addition, it showed that the effects and long-term outcomes of the ASMP persist for as long as four years without formal reinforcement, with clinical improvement gains that produce cost savings.

**Asthma.** Asthma self-management programs date back to the 1970s (25, 26, 28) and have been recommended by asthma guidelines for both pediatric and adult care. Asthma self-management programs for children and adolescents and their families have demonstrated effectiveness in improving lung function and self-control, while reducing school absenteeism, number of days with restricted activity, number of emergency department visits, and number of disturbed nights (52). Self-management for asthma can reduce unscheduled care and improve asthma control, can be delivered effectively to diverse demographic and cultural groups, is applicable to a broad range of clinical settings, and does not significantly increase total health care costs (103). Two evidence-based adaptations have been scaled for use at the population level: the American Lung Association Open Airways For Schools® (1), a school-based curriculum that has been designed as an interactive education program for children to promote asthma self-management; and the National Heart, Lung, and Blood Institute Asthma Action Plan (94), which provides information on how to self-manage asthma on a daily basis. Dissemination of asthma self-management as an evidence-based practice has also been incorporated into the US National Asthma Education and Prevention Program's Guidelines for the Diagnosis and Management of Asthma (93) since 2007, as well as the Global Initiative for Asthma (45), and is one of the goals of the Merck Childhood Asthma Network (113).

**Cardiovascular disease.** Coronary heart disease is the leading cause of death attributable to cardiovascular disease (CVD), followed by stroke, hypertension, and heart failure (9, 21). Nearly 80%

of CVD deaths could be prevented through optimal management of risk factors, including smoking cessation and physical activity (117). Adults 20–39 years of age comprise the largest segment of the untreated adult population with poor to intermediate CVD risk profiles in the United States (106); thus, the American Heart Association (AHA) has adopted a life course approach to CVD risk factor management, emphasizing both primary prevention of CVD risk factors beginning in childhood and secondary prevention including provider and patient self-management in people with established CVD. The AHA has endorsed patient self-management of CVD as an effective means by which to manage the condition and improve outcomes (8), including patients with coronary heart disease (100), hypertension (17), and heart failure (115).

**Diabetes.** Numerous studies have demonstrated the impact of diabetes self-management on improving health status in people with type 2 diabetes. In a meta-analysis of 11 RCTs designed to evaluate the effectiveness of diabetes self-management education interventions delivered in conjunction with primary care among Hispanic adults with type 2 diabetes, Ferguson et al. (39) reported that primary care and self-management together were effective in improving glycemic control in Hispanic adults. In addition, two programs—the American Association of Diabetes Educators’ Diabetes Self-Management Education and Training (DSME/T) program and the Stanford Diabetes Self-Management Program—are considered evidence-based programs that have demonstrated effectiveness in helping patients with diabetes lower A1C and improve overall health status (73, 75, 77, 78). The Community Preventive Services Task Force recommends the use of diabetes self-management mobile phone applications, when implemented in health care systems, to improve blood glucose levels among patients with type 2 diabetes (31).

### **The Chronic Disease Self-Management Program**

The Chronic Disease Self-Management Program (CDSMP) is perhaps the most well-known program to assist people with a broad range of chronic conditions (82, 84, 85; <https://www.selfmanagementresource.com/>). This program was developed at Stanford University and is based on the original ASMP. The CDSMP is an effective self-management education program that teaches a range of skills useful for managing a variety of chronic conditions. The program has been endorsed by Healthy People 2020 (54) as an evidence-based approach that helps people with chronic conditions learn how to manage and improve their own health, while reducing health care costs. The CDSMP focuses on problems that are frequently encountered by individuals with any chronic condition, including pain management, diet and nutrition, exercise, and medication use, as well as coping with emotions and communicating with health care providers and family members. The six-week program is led by a pair of trained facilitators who have learned to live with chronic disease themselves. The workshops are offered to 10–20 participants in a group setting and cover 17 hours of material that focuses on imparting and building the skills that people with chronic disease need to manage their conditions, sharing experiences, and providing mutual peer support.

The CDSMP has produced significant measurable improvements in both health outcomes and quality of life. The CDSMP significantly improves exercise capacity, cognitive symptom management, and communication with physicians, as well as measures of health status at one year (84); it also significantly lowers health distress and improves disease-specific self-efficacy at two years (82). In addition, the CDSMP has been shown to reduce health care expenditures and pay for itself within the first year. Cost savings include significantly fewer emergency room visits at one year (84) and significantly lower inpatient and outpatient visits, fewer hospitalizations, and lower health care costs at two years (82). One study (49) found that in patients with arthritis and multiple comorbid conditions, the CDSMP may be more cost-effective than the Arthritis Self-Help Course. The

CDSMP has also demonstrated effectiveness across cultural groups and regions. A community-based Spanish-language version of the CDSMP—Tomando Control de su Salud—assists Latinos with managing chronic illness (<https://www.selfmanagementresource.com/programs/small-group-spanish/tomando-control-de-su-salud>), and a version of the CDSMP has been implemented in China across multiple chronic conditions and was found to improve health behavior, self-efficacy, and health status while reducing the number of hospitalizations six months after program participation (43). The CDSMP has been replicated in other diverse populations, both inside and outside the United States. It is estimated to have reached more than 100,000 Americans (96), having been disseminated widely across regions, including rural areas (107, 108), and across community settings, including the workplace (109). The CDSMP has also been adapted for online use in the Better Choices, Better Health® program of the National Council on Aging (<https://www.canaryhealth.com/bcbh-better-choices-better-health/>).

## WHAT IS THE EVIDENCE FOR EFFECTIVENESS OF SELF-MANAGEMENT INTERVENTIONS?

Evidence for the effectiveness of disease self-management has grown steadily in recent decades. The earliest evidence for effectiveness came from the Stanford Patient Education Research Center, which developed and evaluated several disease-specific programs in a series of RCTs and follow-up longitudinal studies. These include the ASMP (72, 81), the Spanish ASMP (71), and the CDSMP (84, 85).

### Systematic Reviews and Meta-Analyses

Numerous reviews have examined the conceptual and theoretical basis for self-management intervention (23, 24, 50). Previous systematic reviews and meta-analyses have examined medication adherence and self-management interventions (32, 53, 67, 105) and patient compliance with treatment across a range of conditions and outcomes. These have included self-management in arthritis (90), asthma (52, 102), chronic low-back pain (38), cancer-related fatigue (10), chronic obstructive pulmonary disease (18, 88), diabetes (39), heart failure (22, 97), hypertension (33, 34), osteoarthritis (66), and other conditions (7, 89). Other reviews have sought to assess self-management programs in relation to behavior change theory (88), quality of life (40), impact of self-monitoring on health care utilization (86), new technologies (95), the effectiveness of lay leaders (41), methodological issues in evaluating self-management intervention programs (116), and the effectiveness of various characteristics of self-management programs (16, 61–63). Although some reviews have produced inconsistent findings, the bulk of reviews have found that disease self-management has the potential to produce modest but clinically significant improvements in patient self-efficacy, health behaviors, health status, and quality of life. In addition, reductions in unnecessary health care utilization, hospitalizations, and health care costs have also been reported.

The *Cochrane Database of Systematic Reviews* contains numerous reviews that have assessed the quality of evidence for the effectiveness of self-management interventions across a range of disease conditions (see **Table 1**). We assessed the evidence for effectiveness contained in 10 of 35 eligible reviews that focused on disease-specific self-management programs or broader programs of disease management that included patient self-management. The range of outcomes of interest across studies of self-management interventions for multiple chronic conditions included health behaviors, health status, quality of life, and utilization of health care services. The quality of evidence for effectiveness ranged from low to moderate, and in several cases the evidence was insufficient or equivocal.

**Table 1 Characteristics and quality of evidence from systematic reviews of intervention studies of chronic disease self-management contained in the Cochrane Database of Systematic Reviews<sup>a</sup>**

Review investigators and reference	Cochrane editorial group	Search date <sup>b</sup>	Disease condition and/or focus <sup>c</sup>	Study designs included	Number of studies	Number of participants	Intervention	Primary outcomes of interest	Quality of evidence <sup>d</sup>
de Jongh et al. (35)	Consumers and communication	June 2009	Mobile phone messaging for facilitating self-management of long-term illnesses	RCTs, QRCs, CBAs, or ITs with at least three time points before and after the intervention	4	182	Mobile phone messaging applications designed to facilitate self-management of long-term illnesses	Health outcomes and patients' capacity to self-manage their conditions	Low to moderate
Foster et al. (41)	Consumers and communication	July 2006	Self-management education programs led by lay leaders for people with chronic health conditions <sup>e</sup>	RCTs comparing structured lay-led self-management education programs for chronic conditions against no intervention or clinician-led programs	17	7,442	Patient self-management and education	Health status, health behaviors, and health care utilization	Insufficient or equivocal evidence
Fryer et al. (42)	Stroke	August 2016	Self-management programs for people living with the long-term effects of stroke	RCTs of adults with stroke living in the community who received self-management interventions	14	1,863	Self-management interventions, including more than one component of self-management or targeted more than a single domain of change, or both	QoL, self-efficacy, activity or participation levels, impairments, health service usage, health behaviors (such as medication adherence or lifestyle behaviors), cost, participant satisfaction, or adverse events	Moderate evidence
Kelly et al. (64)	Airways	December 2017	Self-management for noncystic fibrosis bronchiectasis	RCTs of any duration that included adults or children with a diagnosis of noncystic fibrosis bronchiectasis assessing self-management interventions delivered in any form	2	84	Patient self-management for airway clearance, medication, exercise, and action plans for children and adults	QoL, hospital admissions	Insufficient or equivocal evidence
Kroon et al. (66)	Musculoskeletal	January 2013	Self-management education programs for osteoarthritis	RCTs of self-management education programs in people with osteoarthritis	29	6,753	Patient self-management education	Self-management skills, pain, osteoarthritis symptoms and function	Low to moderate
Lenferink et al. (68)	Airways	May 2016	Self-management interventions including action plans for patients with COPD	RCTs evaluating a self-management intervention for people with COPD published since 1995	22	3,854	Patient action plans	QoL, hospital admissions	Moderate to high

(Continued)



**Table 1 (Continued)**

Review investigators and reference	Cochrane editorial group	Search date <sup>b</sup>	Disease condition and/or focus <sup>c</sup>	Study designs included	Number of studies	Number of participants	Intervention	Primary outcomes of interest	Quality of evidence <sup>d</sup>
McCabe et al. (87)	Airways	November 2016	Smart technology for self-management of COPD	RCTs that measured effects of remote and Web 2.0-based interventions defined as technologies including PCs and applications for mobile technology, such as iPad, Android tablets, smart phones, and Skype, on behavioral change toward self-management of COPD	3	557	Smart technology to support self-management, and digital information and education about self-management	HRQoL	Insufficient evidence
Peytremann-Bridevaux et al. (102)	Effective practice and organization of care	June 2014	Chronic disease management for asthma	Individual or RCTs, NRCTs, and CBAs comparing chronic disease-management programs with usual care in adults over 16 years of age with a diagnosis of asthma	20	81,746	Various chronic disease management, including patient self-management education	Asthma-specific QoL, asthma severity, and lung function	Low to Moderate
Smith et al. (110)	Effective practice and organization of care	September 2015	Improving outcomes for people with multiple chronic conditions <sup>e</sup>	RCTs, NRCTs, CBAs, and ITSs evaluating interventions to improve outcomes for people with multimorbidity in primary care and community settings	18	NA	Interventions that involved changes to the organization of care delivery and patient-focused interventions	Clinical outcomes, health service use, medication adherence, patient-related health behaviors, health professional behaviors, and costs	Low to moderate
Zwerink et al. (118)	Airways	August 2011	Self-management for patients with COPD	RCTs and NRCTs published after 1994, assessing the efficacy of self-management interventions for individuals with COPD	29	3,189	Patient self-management training	QoL, hospital admissions, and improvement in dyspnea	Insufficient evidence

Abbreviations: CBA, controlled before-after; COPD, chronic obstructive pulmonary disease; CRCT, cluster-randomized controlled trial; HRQoL, health-related quality of life; ITS, interrupted time series; NA, not available; NRCT, nonrandomized controlled trial; PC, personal computer; QoL, quality of life; QRCT, quasi-randomized controlled trial; RCT, randomized controlled trial. <sup>a</sup>Reviews contained in the table were identified by searching the Cochrane Database of Systematic Reviews using the search term, “chronic disease self-management.” Of the 35 reviews identified as of May 15, 2018, 10 assessed the evidence for effectiveness of disease-specific self-management programs or broader programs of disease management that included patient self-management. <sup>b</sup>The date up to which studies were captured in the review. <sup>c</sup>Statement is drawn from the Cochrane authors’ “plain language summary” of the abstract. <sup>d</sup>Based on the Cochrane editorial group’s quality rating system. High quality: Further research is very unlikely to change confidence in the estimate of effect. Moderate quality: Further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate. Low quality: Further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate. Very low quality: Editorial Group is very uncertain about the estimate. Where a clear rating of the quality of evidence was not provided by the authors, we have indicated the quality of evidence as insufficient or equivocal. <sup>e</sup>Conditions included arthritis, diabetes, hypertension, and chronic pain.

While systematic reviews and meta-analyses can illuminate the collective effectiveness of interventions, the results should be viewed with some caution. The studies contained in such reviews frequently suffer from a number of methodological weaknesses. These include lack of (or inadequate) behavioral theory, failure to implement the interventions with fidelity to original design specifications, and short-term follow-up. Thus, effect sizes are modest and may not necessarily be indicative of true intervention impact. In addition, most studies included in systematic reviews and meta-analyses comprise RCTs, which focus on internal validity rather than external validity. Pragmatic trials and use of evaluative frameworks that emphasize external validity can provide greater insight into the effectiveness of self-management interventions and their clinical value. For example, several evaluations using the RE-AIM (reach, effectiveness, adoption, implementation, maintenance) framework have evaluated the reach and effectiveness of disease self-management programs in several areas (46–48, 59, 69, 112).

### Quality of Life and Health Care Utilization: Evidence of Effectiveness

We conducted meta-analyses for reviews across the Cochrane Airways editorial group (**Table 1**) that compare a self-management intervention to a control for the primary outcomes of health-related quality of life (HRQoL) and number of all-cause hospitalization days. The systematic reviews we used are deemed to be of sufficiently high quality to be included.

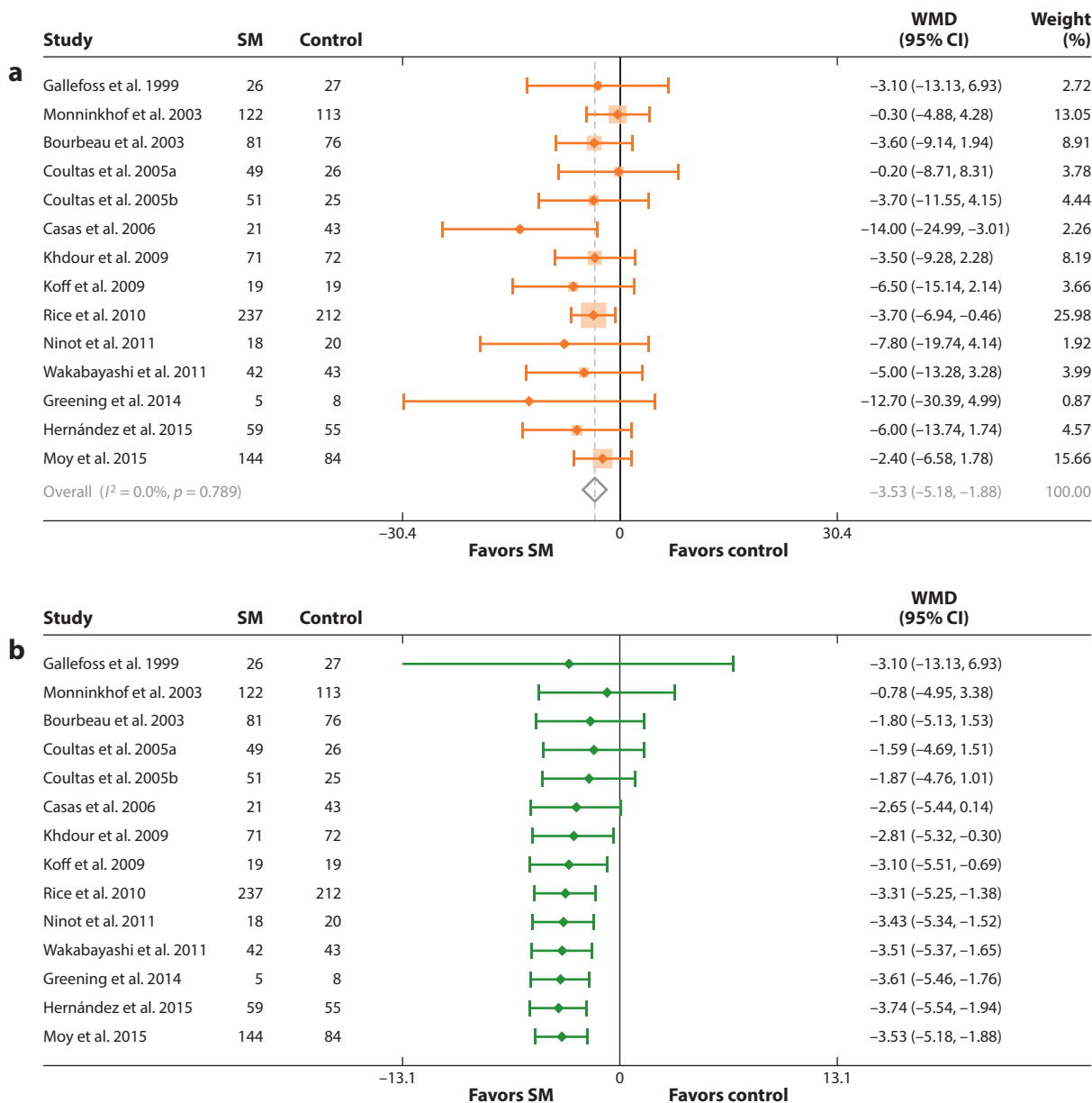
Two statistical models were employed in our meta-analyses. The fixed effects model assumes identical treatment effects in the studies (homogeneity of the true treatment effect), and the variances around each mean effect depend primarily on the size of each study (15). The random-effects model includes between-study differences in treatment effects in the calculation of the variances, leading to wider confidence intervals when a given level of heterogeneity in treatment effect is observed (36). We can also employ the meta-analysis methodology as a cumulative meta-analysis by updating the pooled estimate of the intervention effect each time the results of a new trial are published. In cumulative meta-analysis, the experiments are accumulated from the earliest to the latest, where each successive experiment includes a synthesis of all previous experiments. This chronological combining of the experiments will show if the results of consecutive studies demonstrate consistency and will indicate the point at which no further studies are necessary because the results continually favor one intervention.

Fixed effects meta-analyses for HRQoL are presented in **Figure 1a,b**. The meta-analysis uses the studies that include HRQoL from the systematic reviews across the Cochrane Airways editorial group that compare a self-management intervention to a control based on the St. George's Respiratory Questionnaire (SGRQ Total) (60) quality of life measure.<sup>2</sup> The meta-analyses of SGRQ Total revealed minimal heterogeneity ( $I^2 = 0.0\%$ ,  $p = 0.789$ ). Systematic reviews with other measures of HRQoL, such as the Chronic Respiratory Disease Questionnaire, are meta-analyzed in **Table 1**, but we combined only the common measure of SGRQ Total in the Airways group to ensure homogeneity. **Figure 1a** shows a significant increase in the HRQoL for the self-management intervention as compared with usual care [the pooled 95% confidence interval (CI) for the mean difference in the SGRQ is  $-5.182$ ,  $-1.875$ ;  $p = 0.000$ ]. The cumulative meta-analysis in **Figure 1b** reveals that this significant increase in the HRQoL for the self-management intervention appeared in the literature in 2009 and has remained stable in subsequent years.

Random effects meta-analyses for all-cause hospitalization days are presented in **Figure 2a,b**. This analysis uses systematic reviews across the Cochrane Airways editorial group that compare

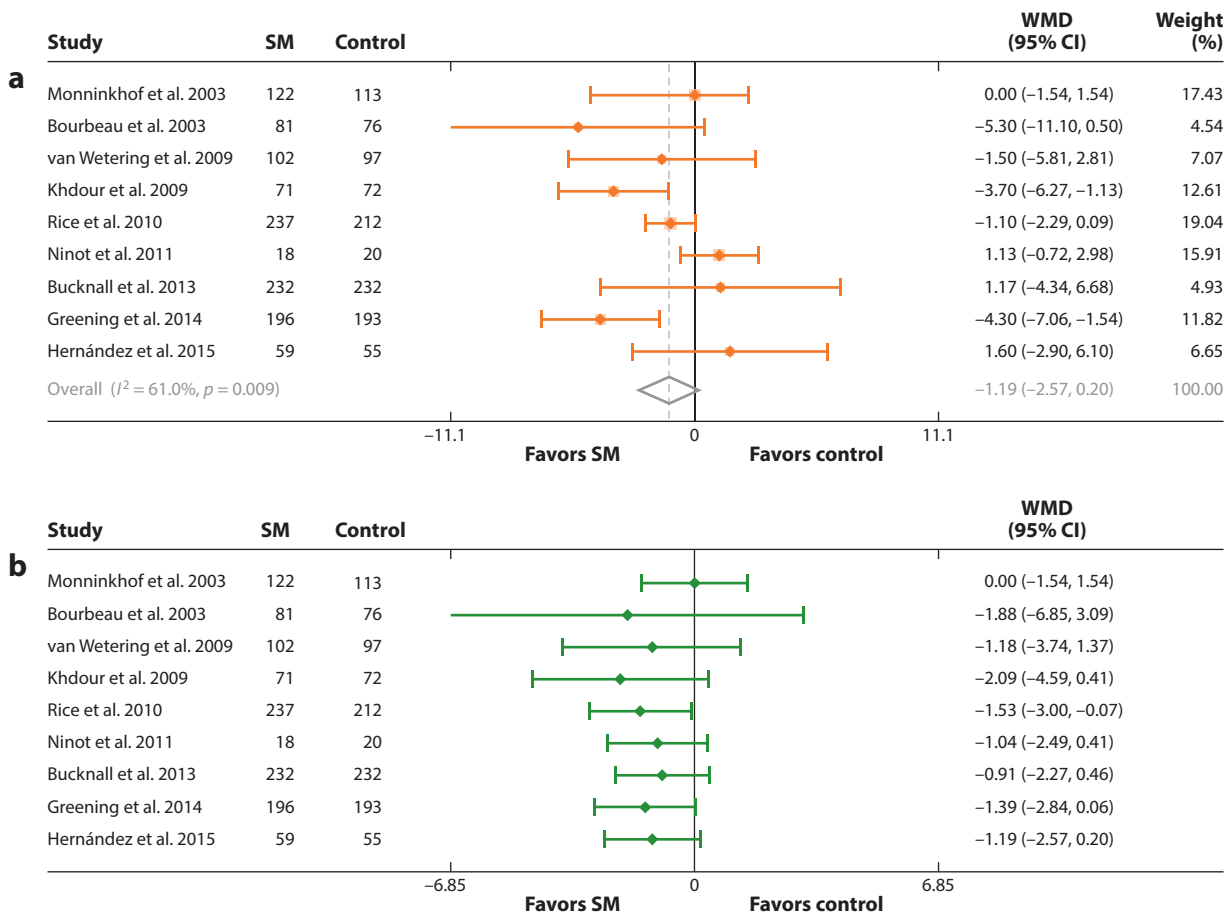
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<sup>2</sup>See Related Resources, below, for a list of the studies included in the HRQoL analysis.



**Figure 1**

(a) Fixed effects meta-analyses and (b) fixed effects cumulative meta-analyses for a self-management (SM) intervention versus a control from the systematic reviews from the Cochrane Airways group in **Table 1**, which includes the primary outcome health-related quality of life (HRQoL) assessed by St. George's Respiratory Questionnaire (SGRQ). Panel a shows the significant increase in the HRQoL for the SM intervention as compared with usual care. Panel b reveals that this significant increase in the HRQoL for the SM intervention appeared in the literature in 2009 and has remained stable in subsequent years. Data from Reference 60. Other abbreviations: CI, confidence interval; WMD, weighted mean difference.



**Figure 2**

(a) Random effects meta-analyses and (b) random effects cumulative meta-analyses for a self-management (SM) intervention versus a control from the systematic reviews from the Cochrane Airways group in **Table 1**, which includes the primary outcome all-cause hospitalization days. Panel *a* shows a marginally significant decrease in all-cause hospitalization days for the SM intervention as compared with usual care. Panel *b* reveals that this marginal significant reduction in the all-cause hospitalization days for the SM intervention appeared in the literature in 2010 and has remained stable in subsequent years. Other abbreviations: CI, confidence interval; WMD, weighted mean difference.

a self-management intervention to a control based on all-cause hospitalization days.<sup>3</sup> Systematic reviews with other measures of hospital utilization are provided in **Table 1**; however, we combined the common measure all-cause hospitalization days, rather than change from baseline or respiratory-related hospitalization days, or number of admissions, to ensure homogeneity. The meta-analyses of all-cause hospitalization days had significant heterogeneity ( $I^2 = 61\%$ ,  $p = 0.009$ ), so a random effects approach is used. From **Figure 2a**, there is a marginally significant decrease in all-cause hospitalization days for the self-management intervention as compared with usual care (the pooled 95% CI for the mean difference in the all-cause hospitalization days is  $-2.575, 0.201$ ;  $p = 0.094$ ). The cumulative meta-analysis in **Figure 2b** reveals that this marginal significant reduction in the all-cause hospitalization days for the self-management intervention as compared

<sup>3</sup> See Related Resources for a listing of the studies included in the hospitalization days analysis.

with usual care appeared in the literature in 2010 and has remained stable in subsequent years. Individual systematic reviews from **Table 1** found no statistically significant difference between self-management interventions and a control group.

## CONCLUSION

Over the last 50 years, considerable progress has been made in chronic disease self-management. Much of the empirical research and reviews that have been conducted on the reach and effectiveness of interventions such as the CDSMP and other programs have demonstrated small to moderate effects for changes in health behaviors, health status, and health care utilization for selected chronic conditions, with estimates of their cost benefit and their cost-effectiveness. Because published trials that have been included in most systematic reviews, to date, suffer from publication bias and a range of methodological limitations, future trials of self-management for chronic conditions would benefit from better descriptions of the intervention under study, common and standardized measures of outcome, and mixed-method designs. However, the current evidence for effectiveness suggests that chronic disease self-management is a mature science and can yield important benefits to patients, including improvements in quality of life and reductions in the utilization of health care resources. Identifying the most effective methods by which self-management programs can be delivered and scaled for use at the population level should continue to be a priority.

## DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

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## RELATED RESOURCES

### Studies in the HRQOL Analysis

#### From Kelly et al. (64)

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