ORIGINAL INVESTIGATION

Self-management Education Programs in Chronic Disease

A Systematic Review and Methodological Critique of the Literature

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Background: Self-management programs have been widely reported to help patients manage symptoms and contain utilization of health care resources for several chronic conditions, but to date no systematic review across multiple chronic diseases has been reported. We evaluated the efficacy of patient self-management educational programs for chronic diseases and critically reviewed their methodology.

Methods: We searched MEDLINE and HealthSTAR for the period January 1, 1964, through January 31, 1999, then hand searched the reference section of each article for other relevant publications. We included studies if a self-management education intervention for a chronic disease was reported, a concurrent control group was included, and clinical outcomes were evaluated. Two authors reviewed each study and extracted the data on clinical outcomes.

Results: We included 71 trials of self-management education. Trial methods varied substantially and were suboptimal. Diabetic patients involved with self-management education programs demonstrated reductions in glycosylated hemoglobin levels (summary effect size, 0.45; 95% confidence interval [CI], 0.17-0.74); diabetic patients had improvement in systolic blood pressure (summary effect size, 0.20; 95% CI, 0.01-0.39); and asthmatic patients experienced fewer attacks (log rate ratio, 0.59; 95% CI, 0.35-0.83). Although we found a trend toward a small benefit, arthritis self-management education programs were not associated with statistically significant effects. Evidence of publication bias existed.

Conclusions: Self-management education programs resulted in small to moderate effects for selected chronic diseases. In light of evidence of publication bias, further trials that adhere to a standard methodology would help clarify whether self-management education is worthwhile.

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More than 100 million people in the United States have a chronic disease, and more than $650 billion is spent managing chronic diseases each year.[1] Because of the nature of chronic disease, management varies over time, with treatments adjusted according to changes in patient symptoms and fluctuations in the disease process. Consequently, the patient plays an integral role in the management of chronic disease.[2,3] The Institute of Medicine report entitled *Crossing the Quality Chasm: A New Health System for the 21st Century* acknowledged self-management education as an important aspect of quality care.[4] However, such programs have typically received less scrutiny than other types of health care interventions.

Self-management programs facilitate acquisition by the patient of preventive or therapeutic health care activities, often in collaboration with health care providers.[5] Self-management education programs emphasize the role of patient education in preventive and therapeutic health care activities and usually consist of organized learning experiences designed to facilitate adoption of health-promoting behaviors. Such programs usually are separate from clinical patient care, but are often run in collaboration with health care professionals.[3] Self-management education programs exist for many chronic conditions, including arthritis, asthma, diabetes, and hypertension. Previous reviews have been limited to a specific chronic disease and have suggested small benefits.[6-8]

We conducted a structured review of trials of self-management education programs for chronic diseases to examine their efficacy. We critically reviewed their methodology and assessed whether specific features of education programs from across the selected chronic diseases were associated

with better clinical outcomes. We hypothesized that the effects of self-management education programs would vary by disease, but that common characteristics of programs across diseases would correlate with effect size.

METHODS

IDENTIFICATION OF LITERATURE

We searched MEDLINE and HealthSTAR for English-language publications from January 1, 1964, through January 31, 1999, with the following medical subject headings: self-management, self-care, demand management, patient education, self-efficacy, social learning theory, arthritis, osteoarthritis, rheumatoid arthritis, diabetes, hypertension, asthma, hypertension, congestive heart failure, and chronic disease. Screening the reference lists of each of the articles identified additional relevant publications.

Each article obtained through the search strategy was reviewed by two of us (A.W. and D.H.S.) to determine whether the article met the inclusion criteria. Articles were considered for review if (1) the intervention contained a self-management education component, (2) a concurrent control group was included, and (3) clinical outcomes were evaluated. Included articles were not limited to randomized trials and included some nonrandom studies. We were concerned about the heterogeneity of studies and thus excluded studies that (1) exclusively reported outcomes such as knowledge, compliance, self-efficacy (confidence in one's ability to perform self-management activities), satisfaction, or use of health care services; (2) exclusively assessed generic outcomes such as quality of life or coping skills; (3) focused on chronic emotional disorders such as depression, postacute care (eg, for myocardial infarction), obesity, or smoking cessation programs; or (4) exclusively involved physical or psychosocial therapies, such as biofeedback, relaxation techniques, exercise, and group therapy. Studies that integrated such therapies into an educational program were included. These exclusion criteria were applied across all chronic disease to improve the comparability of studies.

DATA ABSTRACTION

Articles that met the inclusion criteria were independently reviewed by 2 of 3 authors (A.W., P.S.W., and D.H.S.) using a structured abstraction form (available upon request). We examined each study to determine recruitment procedures, whether and how subjects were randomized, patient demographics, noncompletion (dropout) rates, educational methods, and clinical outcomes. We assessed sample sizes before and after dropout. Several studies reported only the total sample size, not the size for each treatment arm. In these instances, the total sample size was evenly divided between the number of treatment groups. When trials involved multiple treatment arms, we combined the groups that included self-management education. The dropout rate was calculated using the following formula:

$$[(1-\text{Number of Patients at Follow-up})/\text{Number of Patients at Start}] \times 100\%.$$

We abstracted information regarding the following characteristics specific to the educational program: the duration of education, number of educational sessions or education contacts, background training of educators (eg, medicine, nursing, social work, health education), setting of the educational program (inpatient vs outpatient), educational format (group vs individual), method of education (written, audiotape, videotape, telephone, or face-to-face), and use of a formal syllabus. Follow-up duration was defined as the period beginning with the baseline assessment through the last follow-up. We also reviewed each study to ascertain whether a behavioral science model was used in designing the educational program. Two common frameworks included cognitive behavior therapy[9] and social cognitive theory, in which self-efficacy is an important construct.[10]

After reviewing all articles, we determined the clinical outcomes studied most frequently for each chronic disease. These outcomes included pain and disability for arthritis; systolic and diastolic blood pressures for hypertension; glycosylated hemoglobin and fasting blood glucose levels for diabetes; and forced expiratory volume in 1 second and frequency of attacks for asthma, including emergency department visits, hospitalizations for asthma, and physician visits for asthma. For other conditions, or if none of these outcomes was measured, we recorded the primary end point reported by the author.

ANALYSIS

Effect sizes are unitless measures of a treatment effect used for pooling the results of trials that may use different outcome measures. If an intervention's effect is equal to that of placebo, then the effect size is 0. Effect sizes of less than 0.2 are considered small; those of 0.2 to 0.5, moderate; and those of greater than 0.5, large. We calculated summary effect sizes for each end point described in the preceding section. The effect size was defined as the final end point value of the control group minus that value for the experimental group, divided by the standard deviation of the end point in the control group.[11] Dichotomous outcomes, such as reaching the goal for blood glucose level, were converted to effect sizes using the method of Chinn.[12] No validated method was available for conversion of count data, such as the number of admissions to the emergency department for asthma; these results were separately calculated as rate ratios.[13] Review of the trials' methodologies suggested substantial heterogeneity; therefore we decided a priori to use a random-effects model for the primary analyses.[14] We formally assessed heterogeneity using the Q statistic[9] and reanalyzed the data using a fixed-effects model.

We then fit a metaregression model across chronic diseases to identify which variables were associated with greater clinical benefits. The metaregression model assumed a random-effects linear relationship and weighted for the effect measured in each study. As some studies contributed 2 correlated outcome measures to the regression model (such as pain and disability for an arthritis study), we used a generalized estimating equation correction for correlation within studies.[15] The dependent variable was the pooled effect size across all chronic diseases. Each chronic disease and its end point were represented as indicator variables. Other independent variables included were the percentage of dropouts, number of educational sessions, program duration, program format, education mode, and reference to a behavioral model. We also ran linear regression models assuming the fixed-effects weighting. All regression analyses were performed using the GENMOD procedure in SAS (version 8.0; SAS Institute Inc, Cary, NC).

We assessed for the possibility of publication bias by generating funnel plots. These plots typically graph the effect size of a study on the horizontal axis and the sample size of the study on the vertical axis. If no publication bias exists, studies with larger sample sizes will have smaller variations in effects, and the effects of smaller studies will range equally above (to the right) and below (to the left) this value; therefore, the plot would take on the shape of an inverted funnel. However, in the presence of bias against publishing results that are null or negative, the funnel plot would be asymmetric, with fewer values populating the left side of the funnel. We first created funnel plots by disease type and outcome, and then generated a plot for all the trials in-

Table 1. Demographic Attributes of Populations of All Studies Included in the Meta-analysis

Source	Study Design*	Total No.	% Dropout	Mean Age, y	% Female	Recruitment Site
Arthritis						
Applebaum et al,[16] 1988	RCT, block	18	44	62	11	Clinic
Barlow and Wright,[17] 1998	RCT, patient	95	12	58	81	NA
Barlow and Barefoot,[18] 1996	RCT, patient	58	10	42	42	Clinic
Bradley et al,[19] 1987	RCT, patient	68	22	51	81	Clinic
Burckhardt et al,[20] 1994	RCT, patient	99	13	47	100	Clinic
Cohen et al,[21] 1986	RCT, patient	96	10	66	78	Clinic, ads
Fries et al,[22] 1997	RCT, patient	1099	26	64	72	Clinic
Keefe et al,[23,24] 1990	RCT, patient	99	6	64	72	Clinic
Lindroth et al,[25] 1995; Lindroth et al,[26] 1989	Nonrandom	196	53	61	71	Clinic
Lorig et al,[27] 1989; Lorig et al,[28] 1985	RCT, block	854	18	64	84	Print ads
Lorig et al,[29] 1986	RCT, patient	100	15	65	73	Print ads
Maggs et al,[30] 1996	RCT, block	162	7	57	69	Clinic
Maisiak et al,[31] 1996	RCT, block	405	6	61	NA	Clinic, newspaper
Mazzuca et al,[32] 1997	Nonrandom	211	22	62	85	Clinic
Neuberger et al,[33] 1993	RCT, patient	98	46	53	66	Clinic
Nicassio et al,[34] 1997	RCT, block	94	9	53	88	Clinic
Parker et al,[35] 1988	RCT, patient	83	0	61	4	Clinic
Radojevic et al,[36] 1992	RCT, patient	65	9	54	76	Clinic
Riemsma et al,[37] 1997	RCT, block	249	13	58	66	Clinic
Shearn and Fireman,[38] 1985	RCT, patient	105	23	56	76	Clinic
Simeoni et al,[39] 1995	Nonrandom	175	29	66	81	Clinic
Strauss et al,[40] 1986	RCT, patient	57	23	54	81	Clinic
Vlaeyen et al,[41] 1996	RCT, patient	131	45	44	88	Clinic
Weinberger et al,[42] 1989	RCT, patient	439	11	62	88	Clinic
Asthma						
Bailey et al,[43] 1990	RCT, patient	267	16	45	66	Clinic
Bolton et al,[44] 1991	RCT, patient	241	30	38	66	ED
Clark et al,[45] 1986	RCT, patient	310	17	9	36	Clinic
Evans et al,[46] 1987	RCT, block	239	33	9	41	School
Fireman et al,[47] 1981	Nonrandom	26	0	7	19	Clinic
Ford et al,[48] 1997	RCT, block	241	41	37	66	Clinic
Garrett et al,[49] 1994	RCT, patient	500	10	NA	58	ED
Hilton et al,[50] 1986	Nonrandom	339	19	NA	NA	Clinic
Ignacio-Garcia and Gonzalez-Santos,[51] 1995	RCT, patient	94	26	42	54	Clinic
Jones et al,[52] 1995	RCT, patient	121	40	29	63	Clinic
Lahdensuo et al,[53] 1996	RCT, block	122	6	42	63	Clinic
LeBaron et al,[54] 1985	RCT, patient	43	28	11	26	Clinic
Snyder et al,[55] 1987	RCT, patient	79	5	28	55	Clinic, newspaper
Verver et al,[56] 1996	RCT, patient	48	0	53	40	Clinic
Wilson et al,[57] 1993	RCT, block	323	14	NA	NA	Clinic
Yoon et al,[58] 1993	RCT, patient	76	26	32	74	Inpatient

(continued)

cluded in the metaregression. Because each chronic disease had a different pooled summary effect size, to standardize across different diseases we plotted the residual values of each study from the weighted linear regression model on the horizontal axis and the random-effects weight on the vertical axis.[13]

RESULTS

Our search identified 305 potentially eligible trials. We subsequently excluded trials without a control group (n=38), without clinical outcomes (n=37), without a clear self-management education component (n=68), that did not focus on any of the included chronic diseases (n=11), or that did not include primary data (n=80). The analysis therefore included the 71 trials presented in **Table 1** and **Table 2** categorized into the following 5 disease groups: arthritis (n=24); asthma (n=16); diabetes (n=16); hypertension (n=10); and miscellaneous chronic diseases (n=5). This last group included venous thromboembolism requiring long-term anticoagulation therapy, coronary artery disease, and chronic cancer pain. The population in the 71 trials had a mean age of 48 years, and 54% were female. The average dropout rate was 17% across all diseases, ranging from 20% in the arthritis self-management education trials to 16% in the diabetes trials.

We first assessed the methods used for conducting and reporting each trial. Eleven (15%) of the 71 trials did not randomize subjects but rather used a convenience sample of concurrent controls. Of the randomized controlled trials, 20 (33%) randomized at the level of the clinic or the physician. Blocked randomization such as this allows for the possibility of a center effect, which was not assessed in any of the trials. Seventeen (24%) of the trials did not describe a formal syllabus for the education program. Program duration and time of final assessment varied from 1 to 72 weeks. There were 8 analyses (11%) con ducted using an

Table 1. Demographic Attributes of Populations of All Studies Included in the Meta-analysis (cont)

Source	Study Design*	Total No.	% Dropout	Mean Age, y	% Female	Recruitment Site
Diabetes						
Anderson et al,[59] 1989	RCT, patient	70	14	13	53	Clinic
Bloomgarden et al,[60] 1987	RCT, patient	302	12	58	72	Clinic
Falkenberg et al,[61] 1986	RCT, patient	45	27	66	55	Clinic
Gilden et al,[62] 1992	Nonrandom	32	NA	68	0	Clinic
Kaplan et al,[63] 1985	RCT, patient	21	10	8	62	Clinic
Kaplan et al,[64] 1987	RCT, block	76	8	58	58	Newspaper
Korhonen et al,[65] 1983	RCT, patient	77	0	33	45	Clinic
Kronsbein et al,[66] 1988	Nonrandom	127	22	64	60	Clinic
Malone et al,[67] 1989	RCT, patient	203	10	NA	NA	Clinic
Mazzuca et al,[68] 1986	RCT, block	542	44	58	79	Clinic
Mulhauser et al,[69] 1987	RCT, block	300	8	26	43	Inpatient
Raz et al,[70] 1988	RCT, block	51	4	52	35	Clinic
Rettig et al,[71] 1986	RCT, patient	471	21	52	75	Inpatient
Starostina et al,[72] 1994	Nonrandom	181	9	29	55	Inpatient
Vinicor et al,[73] 1987	RCT, block	246	44	57	79	Clinic
Wilson and Pratt,[74] 1987	RCT, location	79	0	68	80	Senior centers
Hypertension						
Cupples and McKnight,[75] 1994	RCT, patient	688	10	63	41	Clinic
Garcia-Vera et al,[76] 1997	NA	43	9	45	NA	Clinic
Gonzalez-Fernandez et al,[77] 1990	RCT, patient	59	17	59	36	Inpatient
Iso et al,[78] 1996	RCT, block	111	30	59	52	Community center
Martinez et al,[79] 1990	RCT, patient	722	NA	61	59	Clinic
Levine et al,[80] 1979; Morisky et al,[81] 1980; Morisky et al,[82,83] 1982; Morisky et al,[84] 1983	Randomized factorial design	100	28	54	76	Clinic
Mulhauser et al,[85] 1993	RCT, block	200	20	51	55	Clinic
Sawicki et al,[86] 1995	Nonrandom	91	4	36	47	Clinic
Stahl et al,[87] 1984	RCT, patient	396	32	47	58	Clinic
Watkins et al,[88] 1987	RCT, block	414	0	NA	59	Clinic
Miscellaneous						
Ansell et al,[89] 1995	Nonrandom	43	7	46	42	Clinic
Clark et al,[90] 1992	RCT, patient	324	24	70	41	Clinic
de Wit et al,[91] 1997	RCT, block	209	22	54	59	Clinic
Oldenburg et al,[92] 1995	RCT, block	91	5	59	9	Inpatient
Sawicki,[93] 1999	RCT, patient	179	8	55	30	Clinic

Abbreviations: ED, emergency department; NA, not applicable or not available; RCT, randomized controlled trial.
*Randomization occurred by patient or in blocks, usually by location, ie, randomized by clinics.

intention-to-treat method. Two (3%) of the 71 interventions were conducted by investigators independent of the developer of the self-management education program.

Summary effect sizes for each predetermined end point of interest are presented in **Table 3**. Significant heterogeneity was noted within end points (Q statistic $P<.10$ for 4 of 8 end points). The analysis indicated that overall summary effect sizes for self-management education programs were small to modest (range, 0.01-0.46 for random-effects models). Such programs were associated with significant improvements only in glycosylated hemoglobin levels for persons with diabetes (summary effect size, 0.46; 95% confidence interval [CI], 0.17-0.74) and systolic blood pressure for those with hypertension (summary effect size, 0.20; 95% CI, 0.01-0.39). Summary effect sizes were similar for fixed- and random-effects models, so we present only the random-effects results. We conducted a separate analysis on the rate ratio scale frequency of asthma attack that included the count data. This showed a large reduction in asthma attacks associated with self-management education programs (log rate ratio, 0.59; 95% CI, 0.35-0.83). Although there was a trend toward a small benefit, arthritis self-management education programs were not associated with statistically significant effects.

All end points from all diseases were included in a metaregression. After adjusting for all variables listed as well as the diseases and end points, the only variable associated with improved outcomes was face-to-face education (β population regression coefficent, 0.15; 95% CI, 0.03-0.42). Program duration, number of educational sessions, format, and use of a behavioral science model were not significantly associated with improved efficacy. The funnel plot presented in the **Figure** suggests that there may have been some publication bias against reporting null or negative trials of self-management education programs. Individual plots by disease category suggested that this bias existed most clearly in the reporting of glycosylated hemoglobin levels in trials with diabetic patients and systolic and diastolic blood pressures in patients with hypertension.

COMMENT

To our knowledge, this is the largest structured review to date of trials testing self-management education

Table 2. Methodological Attributes of All Studies Included in the Meta-analysis

Source	Formal Syllabus	No. of Contacts	Program Duration, wk	Program Format	Education Mode*	Program Facilitator†	Behavioral Model
Arthritis							
Applebaum et al,[16] 1988	Yes	10	8	NA	F	MH	CBT
Barlow and Wright,[17] 1998	No	1 Leaflet	1	GP	W	NA	SCT
Barlow and Barefoot,[18] 1996	Yes	12 h	1	IND	F, W	NA	SCT
Bradley et al,[19] 1987	Yes	15	15	GP, IND	F, W	MH	SCT
Burckhardt et al,[20] 1994	Yes	6	6	GP	F	PT	SCT
Cohen et al,[21] 1986	Yes	6	6	GP	F, W	OT, PT, RD, MD	SCT
Fries et al,[22] 1997	Yes	2-3 Mailings	26	IND	W, V	NA	SCT
Keefe et al,[23,24] 1990	Yes	10	10	GP	F, W, T, A	RN, MH	CBT
Lindroth et al,[25] 1995; Lindroth et al,[26] 1989	Yes	6	6	GP	F	HE	SCT
Lorig et al,[27] 1989; Lorig et al,[28] 1985	Yes	6	6	GP	F, W	LE	SCT
Lorig et al,[29] 1986	Yes	6	6	GP	F, W	LE, PT, MD	SCT
Maggs et al,[30] 1996	No	1	1	IND	F, W	OT	None
Maisiak et al,[31] 1996	Yes	11	36	IND	T	MD	RT
Mazzuca et al,[32] 1997	Yes	3	4	IND	F, T	RN	None
Neuberger et al,[33] 1993	Yes	Maximum 4	16	IND	W	RN	SCT
Nicassio et al,[34] 1997	Yes	10	10	GP	F, V, W	MH, PT, MD	CBT
Parker et al,[35] 1988	Yes	1-wk Hospital visit, group visit every 1-3 mo	52	GP	F, W, V	NA	CBT
Radojevic et al,[36] 1992	Yes	6	6	GP	F, V	MH	CBT
Riemsma et al,[37] 1997	Yes	Education packet of video, audio, book, and passport	24	IND	W, V, A	RN, PT, MD	SCT
Shearn and Fireman,[38] 1985	No	10	10	GP	F	MH	None
Simeoni et al,[39] 1995	No	6	6	GP	F, W	HE	SCT
Strauss et al,[40] 1986	No	12-24	12-24	GP	F, A	MH	None
Vlaeyen et al,[41] 1996	Yes	6	6	GP	F, W, A	MH, PT	CBT
Weinberger et al,[42] 1989	Yes	Monthly telephone calls and clinic visits up to 44 wk	44	IND	F, T	LE	None
Asthma							
Bailey et al,[43] 1990	Yes	1 Individual session, home study, support group, and telephone call	4	GP, IND	F, T	LE	None
Bolton et al,[44] 1991	Yes	3	3	GP	F, A, W	RN	None
Clark et al,[45] 1986	Yes	6	36	GP	F	HE	None
Evans et al,[46] 1987	Yes	6	3	GP	F, W	HE	SCT
Fireman et al,[47] 1981	No	4 h Individual instruction, 2 group sessions, and telephone contact	52	GP, IND	F, W, T	RN	SCT
Ford et al,[48] 1997	Yes	3	1	GP	F, W	HE	None
Garrett et al,[49] 1994	Yes	No set No. of sessions; patients discharged when all topics were covered	NA	GP, IND	F, W	HE	None
Hilton et al,[50] 1986	Yes	3 Physician visits, treatment cards, audio, booklets	NA	IND	F, W, A	MD	None
Ignacio-Garcia and Gonzalez-Santos,[51] 1995	No	4	36	IND	F, W	MD	None
Jones et al,[52] 1995	Yes	5	26	IND	F, W	RN, MD	None
Lahdensuo et al,[53] 1996	Yes	1	1	IND	F, W	RN, PT	None
LeBaron et al,[54] 1985	Yes	4	16	IND	F	RN	None
Snyder et al,[55] 1987	Yes	2	12	GP	F, V, W	RT	SCT
Verver et al,[56] 1996	Yes	2	2	IND	F, W	HE	None
Wilson et al,[57] 1993	Yes	3-5, Plus workbook	4	GP, IND	F, W	RN	SCT
Yoon et al,[58] 1993	Yes	1	1	GP	F, V	NA	None

(continued)

Table 2. Methodological Attributes of All Studies Included in the Meta-analysis (cont)

Source	Formal Syllabus	No. of Contacts	Program Duration, wk	Program Format	Education Mode*	Program Facilitator†	Behavioral Model
Diabetes							
Anderson et al,[59] 1989	Yes	4	18	GP, IND	F, T	RN, MH, RD	None
Bloomgarden et al,[60] 1987	Yes	9	72	GP	F, V, A, W	RD, RA	None
Falkenberg et al,[61] 1986	Yes	8	12	GP	F, W	RN, RD, MD	Problem-orientated participatory education
Gilden et al,[62] 1992	No	24	72	GP	F	MH, RD, MD	None
Kaplan et al,[63] 1985	No	15	3	GP	F, V, A	MH, RD, MD	SCT
Kaplan et al,[64] 1987	Yes	10	10	GP	F	RD, PT	None
Korhonen et al,[65] 1983	No	15	1	GP, IND	F, W	RN, RD, MD	None
Kronsbein et al,[66] 1988	Yes	4	4	GP	F, W	HE, MD	None
Malone et al,[67] 1989	Yes	1	1	GP	F, W, V	MD	None
Mazzuca et al,[68] 1986	Yes	3	8	GP	F, T, V, A	RN, RD	None
Mulhauser et al,[69] 1987	Yes	5-d Inpatient education	1	GP	F	RN	None
Raz et al,[70] 1988	No	3 Weekly lessons every 4 mo	52	GP	F	RN, RD, PT, MD	None
Rettig et al,[71] 1986	No	12 Visits	34	IND	F, W	RN	None
Starostina et al,[72] 1994	Yes	5-d Inpatient education	1	IND	F, W	MD	None
Vinicor et al,[73] 1987	Yes	NA	8	IND	F, T, W	RN, RD	None
Wilson and Pratt,[74] 1987	No	10	16	GP	F	RD, HE	None
Hypertension							
Cupples and McKnight,[75] 1994	No	4	16	IND	F, W	HE	None
Garcia-Vera et al,[76] 1997	Yes	7	7	IND	F, V, A, W	MH	Behavioral biofeedback
Gonzalez-Fernandez et al,[77] 1990	No	4	1	GP	F	HE, MD, RD	None
Iso et al,[78] 1996	Yes	8	72	GP, IND	F, T, W	RN, MD, RD	None
Martinez et al,[79] 1990	No	2	8	GP, IND	F, V, A	RN, MD	None
Levine et al,[80] 1979; Morisky et al,[81] 1980; Morisky et al,[82,83] 1982; Morisky et al,[84] 1983	Yes	6 Sessions, group session, and interview	3	GP, IND	F, W	LE, MH, RN	None
Mulhauser et al,[85] 1993	Yes	4	4	GP, IND	F	PA	None
Sawicki et al,[86] 1995	Yes	4	4	GP	F	HE	None
Stahl et al,[87] 1984	Yes	1	1	IND	F	RN	None
Watkins et al,[88] 1987	Yes	Educational pack	1	IND	W	HE	None
Miscellaneous							
Ansell et al,[89] 1995	No	2	2	IND	F, T	RN	None
Clark et al,[90] 1992	Yes	4	4	GP	F, V	HE	SCT
de Wit et al,[91] 1997	Yes	Individual inpatient session, educational pack, diary, and video	1	IND	F, T, A	RN	SCT
Oldenburg et al,[92] 1995	Yes	8	52	GP	F	RN, PT, MH	SCT
Sawicki,[93] 1999	Yes	3	3	GP	F, T	RN, MD	SCT

Abbreviations: A, audiocassettes; CBT, cognitive behavioral therapy; F, face-to-face contact; GP, group sessions; HE, health educators; IND, individual sessions; LE, lay educators; MD, physicians; MH, mental health workers; NA, not applicable or not available; OT, occupational therapists; PT, physical therapists; RD, registered dieticians; RN, registered nurses; RT, reality therapy; SCT, social cognitive therapy; T, telephone contacts; V, video programming; W, written materials.

*The primary mode of education is listed first.

†The primary program facilitator is listed first.

programs for selected chronic diseases. We found that the methods for conducting such trials were suboptimal. Calculations of summary random- and fixed-effects size indicate that these programs yield only small to moderate benefit in interventions for diabetic patients and patients with hypertension. These statistically significant effects might be compared with dietary sodium restriction for patients with hypertension.[94] Frequency of asthma attacks was also reduced with self-management education when count data were included. However, the magnitude of reduction was much smaller than a standard treatment for asthma such as oral corticosteroids.[95] We found no significant improvement associated with self-management educational interventions for arthritis. In a metaregression, we found that interventions involving face-to-face contact were associated with better outcomes; no other trial characteristics were associated with improved outcomes. A fun-

nel plot for all trials suggested the presence of bias against publishing negative or null trials.

We found that the methodology used in conducting and reporting trials of self-management education programs varied widely. The lack of standard methods may hinder interpretation of summary data across diseases and programs, such as ours. Although some would suggest that this heterogeneity precludes a meta-analysis, we believe that these programs are much more similar than different and that an attempt to summarize the findings quantitatively is valuable. We applied rigorous inclusion and exclusion criteria to limit the heterogeneity of patient populations and interventions. By reducing the heterogeneity of studies, we may have limited the number of studies with extreme results. We were interested to see whether common aspects of programs across diseases were associated with the effect sizes. We found that interventions that incorporated face-to-face education were more effective; this observation should be considered when developing future educational programs.

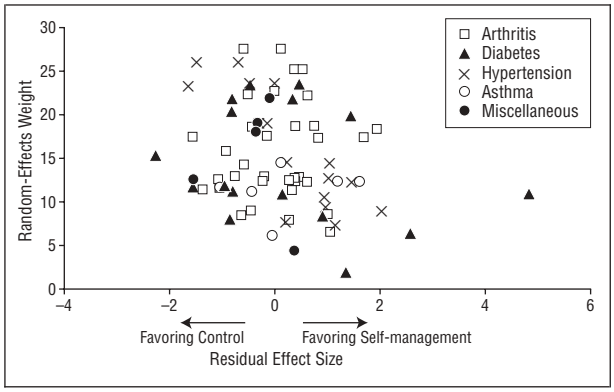
We had hypothesized that self-management education may be effective only for certain chronic diseases, and our results support that conjecture. Self-management education had small to moderate benefit on important intermediate end points (glycosylated hemoglobin levels and systolic blood pressure) for diabetes and hypertension. These are 2 diseases in which patients can be taught the goals of therapy, such as optimizing fasting blood glucose levels and blood pressure, and effective means of achieving these goals, such as compliance with the medication regimen and diet. In addition, patients can learn to monitor these outcomes in an objective fashion. Patients with asthma can also be taught to monitor disease activity and adjust therapy using the peak flow meter; results for the asthma trials that include the count data suggest a benefit. However, the pooled effects of arthritis self-management education interventions did not suggest a significant benefit. One previous meta-analysis focusing on arthritis found small benefits but did not account for heterogeneity between studies.[4] One might imagine that the goals of arthritis self-management education are less easy to define than those of achieving an optimal fasting blood glucose level or blood pressure. Also, chronic diseases such as arthritis that may not respond fully to many treatments may be less affected by self-management education programs. Part of the rationale to combine studies across chronic diseases was to examine whether specific behavioral theories used in developing self-management education programs accounted for their success. Few researchers described an underlying behavioral science model, and programs that referenced a specific behavioral framework were not associated with better outcomes.

This structured review was limited partly by the difficulty in interpreting the included trials. Several important variables that might contribute to the success of an educational program were not accounted for in these analyses, because investigators rarely reported them. These include patient attributes such as educational level, disease duration, disease severity, social supports, and the level of confidence in one's ability to perform self-management (self-efficacy). Self-management education programs might be more effective in specific patient subgroups. Thus, future studies that include information on specific patient subgroups might help to elucidate whether certain patients benefit more from these programs. In addition, the authors did not adequately describe medication effects. An interesting observation was the increased effect of self-management education programs in diabetic and hypertensive populations where self-management education is associated with improved medication compliance. This may suggest why there was a difference in the effect of self-management programs across chronic diseases.

Table 3. Summary Statistics by Chronic Disease

Chronic Disease, End Point	No. of Studies	Total No.	Random-Effects Model Results: Summary ES	95% CI	*P* Value
Arthritis					
Pain	16	3665	0.12	0.00 to 0.24	.06
Disability	12	3518	0.07	0.00 to 0.15	.05
Asthma					
FEV_1	3	242	0.26	–0.15 to 0.68	.21
FOA	4	798	0.01	–0.19 to 0.22	.89
Diabetes					
HbA_{1c}	13	2036	0.45	0.17 to 0.74	.002
FBG	4	943	0.11	–0.05 to 0.28	.17
Hypertension					
SBP	7	1606	0.20	0.01 to 0.39	.04
DBP	8	2002	0.10	–0.06 to 0.26	.23

Abbreviations: CI, confidence interval; DBP, diastolic blood pressure; ES, effect size; FBG, fasting blood glucose level; FEV_1, forced expiratory volume in 1 second; FOA, frequency of attack (continuous end point); HbA_{1c}, glycosylated hemoglobin level; SBP, systolic blood pressure.



Funnel plot to assess potential for publication bias. Each study included in the meta-analysis (N=71) is represented on the graph.

CONCLUSIONS

This structured review suggests that self-management education programs had small to moderate benefits for several but not all chronic illnesses. The methods of conducting and reporting these trials were heterogeneous, and there was evidence of publication bias. We propose that a statement based on the CONSORT (Consolidated Standards of Reporting Trials) recommendations[96] be developed for trials of self-management education programs. This would allow for a better assessment of the

value of such programs. In addition, to facilitate testing of programs by independent investigators, we propose to create an electronic clearinghouse for the descriptions of self-management educational programs. This would facilitate testing of interventions by investigators other than the developers of individual programs. While self-management education programs are conceptually appealing, and while there has been a growing interest in them as a means of empowering patients, improving outcomes, and reducing health care costs, the findings of this review suggest that not all self-management education programs for all diseases are effective.

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