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Best Practice & Research Clinical Rheumatology

journal homepage: www.elsevierhealth.com/berh



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Cost implications of self-management education intervention programmes in arthritis

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Keywords:

Cost-effectiveness analyses
Self-management education
Self-management support
Arthritis Self-Management Program
Chronic Disease Self-Management Program

The purpose of this review is to examine cost implications, including cost-effectiveness analyses, cost-savings calculated from health-care utilisation and intervention delivery costs of arthritis-related self-management education (SME) interventions.

Methods: Literature searches, covering 1980–March 2012, using arthritis, self-management and cost-related terms, identified 487 articles; abstracts were reviewed to identify those with cost information.

Results: Three formal cost-effectiveness analyses emerged; results were equivocal but analyses done from the societal perspective, including out-of-pocket and other indirect costs, were more promising. Eight studies of individual, group and telephone-delivered SME calculated cost-savings based on health-care utilisation changes. These studies had variable results but the cost-savings extrapolation methods are questionable. Meta-analyses of health-care utilisation changes in two specific SME interventions demonstrated only one significant result at 6 months, which did not persist at 12 months. Eleven studies reported intervention delivery costs ranging from \$35 to \$740 per participant; the variability is likely due to costing methods and differences in delivery mode.

Conclusions: Economic analysis in arthritis-related SME is in its infancy; more robust economic evaluations are required to reach

Abbreviations: ACR, American College of Rheumatology; AoA, Administration on Aging; ARRA, American Recovery and Reinvestment Act; ASMP, Arthritis Self-Management Program; CDSMP, Chronic Disease Self-Management Program; EPP, Expert Patient Programme; EQ-5D, EuroQol-5 Dimension; ER, emergency room; ES, effect size; HeiQ, health education impact questionnaire; MCS, mental component score; NCOA, National Council on Aging; OA, osteoarthritis; OA Agenda, A National Public Health Agenda for Osteoarthritis; OARSI, Osteoarthritis Research Society International; PCS, physical component score; QALY, quality adjusted life years; RCT, randomised controlled trial; SF-36, medical outcomes study short form-36; SME, self-management education; SMS, self-management support; UK, United Kingdom; US, United States; VAS, visual analogue scale.

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1521-6942/\$ – see front matter Published by Elsevier Ltd.

<http://dx.doi.org/10.1016/j.berh.2012.09.001>

sound conclusions. The most common form of analysis used changes in health-care utilisation as a proxy for cost-savings; the results are less than compelling. However, other value metrics, including the value of SME as part of health systems' self-management support efforts, to population health (from improved self-efficacy, psychological well-being and physical activity), and to igniting patient activation, are all important to consider.

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As the United States (US) struggles to come to grips with the epidemic of chronic disease, self-management support (SMS) strategies are receiving increased attention for their impact on both health-care delivery and quality of life. SMS is a core element of the patient-centred medical home [1], and a key goal in the US Department of Health and Human Services strategic framework for addressing multiple chronic conditions [2]. Although SMS is important in all chronic diseases, nowhere is supporting patient self-management more essential than in the management of arthritis. In rheumatoid and other systemic inflammatory forms of arthritis, the biologic medications offer the possibility of altering the course of the disease [3], but only if the patient takes the medication appropriately – a key self-management decision. In all forms of arthritis, there is a multitude of daily self-management decisions – such as should I exercise today? How much of this medication should I take? Does this symptom or side effect warrant a consultation with my doctor? – all of which influence arthritis symptoms and the impact arthritis has on quality of life.

In the US, patient self-management, and SMS is also addressed in *A National Public Health Agenda for Osteoarthritis 2010* [OA Agenda] [4], a strategic document designed to catalyse public health action to reduce the burden of osteoarthritis (OA). The OA Agenda modified the Institute of Medicine [5] definition slightly and defined SMS as the systematic provision of education and supportive interventions by health-care or other providers to strengthen patients' skills and confidence in managing their health problems. This includes regular assessment of progress and problems, goal setting and problem-solving support [4]. Although there are a variety of strategies used to support patient self-management [6], self-management education (SME) is the most well developed. The OA Agenda defines SME as interactive educational interventions specifically designed to enhance patient self-management, and focussed on building generalisable skills such as goal setting, decision making, problem solving and self-monitoring [4]. The interactive nature of SME, as well as the focus on problem solving and action planning, is what distinguishes SME from traditional patient education [7].

The importance of SME in arthritis is recognised internationally in the clinical arena by its inclusion in clinical guidelines. For example, the American College of Rheumatology (ACR) guidelines for management of OA of hand, hip and knee conditionally recommend self-management interventions including psychosocial interventions [8]; guidelines issued by the Osteoarthritis Research Society International (OARSI) in 2008 for management of hip and knee OA specify that patients should have access to lifestyle information and education with an initial focus on self-help and patient-driven treatments rather than passive therapies delivered by health-care professionals [9]. The arthritis objectives in *Healthy People 2020*, the health blueprint for the US, includes a specific objective to increase the proportion of adults who have had effective, evidence-based arthritis education as an integral part of the management of their condition [10].

While a variety of SME programmes have been developed and some have been evaluated, the most extensively developed and widely disseminated arthritis SME intervention is the Arthritis Self-Management Program (ASMP) developed at Stanford University in the mid-1980s [11]. This intervention was originally known as the Arthritis Self-Help Course in the US [12], and Challenging Arthritis in the United Kingdom (UK) [13]; organisations in 10 countries are licenced to provide ASMP (<http://patienteducation.stanford.edu/organ/asmpsites.html>; accessed 8 August, 2012). More recently, a sister intervention, the Chronic Disease Self-Management Program (CDSMP), is becoming more widely

available in the US, in part due to a \$27 million investment of American Recovery and Reinvestment Act (ARRA) economic stimulus funds by the Administration on Aging (AOA) in 2010 (http://www.aoa.gov/AoARoot/AoA_Programs/HPW/ARRA/; accessed 8 August, 2012). CDSMP has also been used internationally; organisations in at least 28 countries are licenced to provide CDSMP (<http://patienteducation.stanford.edu/organ/cdsites.html>; accessed 8 August, 2012); the National Health Service adapted CDSMP for delivery in the UK, and titled it the Expert Patient Programme (EPP) [14].

Both ASMP and CDSMP were designed to enhance patient self-efficacy, or confidence in their ability to manage their condition, and use trained lay leaders to deliver the intervention in community and clinical settings to small groups of 12–15 participants following a structured protocol. Both involve interactive learning activities to develop problem solving, decision making and action planning skills; as well as address health behaviours such as exercise, stress reduction and communication with health-care providers [15]. Both ASMP and CDSMP have been disseminated internationally. Online interactive groups are available for both ASMP and CDSMP; a self-study version of ASMP is also available [15]. Culturally relevant Spanish versions of ASMP and CDSMP are available [15], as well as translations into other languages; formal translations of the CDSMP textbook are published in Chinese, Danish, Dutch, Japanese, Norwegian, Swedish and Welsh (<http://patienteducation.stanford.edu/materials/>; accessed 8 August, 2012). While all participants in ASMP have arthritis, participants in CDSMP may have a variety of chronic health conditions including arthritis, diabetes, heart or lung disease [16]. It is appropriate to consider both ASMP and CDSMP in this review of SME because large numbers of people with arthritis are participating in CDSMP. For example, of the 106,706 US participants in the ARRA-funded disseminations of CDSMP between 31 March 2010 and 5 July 2012, arthritis was reported by 40%, second only to hypertension (43%) (Personal communication; K. Kulinski, National Council on Aging Analysis of CDSMP National Database 31 March, 2010 to 5 July, 2010).

Interest in the potential of SME interventions to produce cost-savings was stimulated by the early report of reductions in health-care utilisation produced by ASMP [17]. In this study, data were collected from two distinct study groups of ASMP participants 4 years after participation; some respondents had been randomised to a second set of ASMP classes in the interim. The study of 4-year results was uncontrolled, but compared to normative results from the literature and a comparison population. Others have criticised this report, emphasising the methodologically weak design that used a retrospective comparison of arthritis patients who had volunteered for ASMP participation with a group of patients with no explicit interest in self-management [18,19]. A separate cost-effectiveness analysis was conducted using the summary benefits and utilisation reductions found in the original Lorig et al. study [20]. This decision-model method of cost-effectiveness analysis, based on a single methodologically weak study, has been challenged by other investigators [19,21].

A limited number of previous studies have tried to synthesise information on cost factors in SME. In 2005, Richardson and colleagues published a systematic review of interventions to support self-care, broadly defined [21]. This review identified 39 economic evaluations of self-care support interventions. Three of the papers reviewed were specific to arthritis, and an additional five were related to chronic disease broadly. The investigators concluded that the significant heterogeneity in conditions, settings and geography made it inappropriate to synthesise the data, and the poor quality of the papers made it difficult to make robust inferences from the studies reviewed. They critiqued the generally narrow focus on health-care costs rather than the more broad societal perspective, short follow-up periods and inappropriate comparison groups and costing methodologies.

Foster and colleagues did a meta-analysis of randomised controlled trials (RCT) of lay-led SME programmes published between 1986 and July 2006 [22]. This analysis was not an examination of cost-effectiveness, but did examine changes in health-care utilisation from the 17 studies included in their review. The analysis included five investigations of ASMP and seven investigations of CDSMP or EPP. In this meta-analysis, nine studies examined changes in physician/general practitioner visits; no significant differences were found. Six studies examined days or nights in the hospital; again, no significant differences were found.

A 2012 systematic review examined cost-effectiveness of non-pharmacologic interventions for hip or knee OA [23]. These investigators concluded that none of the four studies evaluating lifestyle programmes (which included two individualised education programmes, ASMP and a diet and exercise

intervention) was cost-effective when quality adjusted life years (QALYs) were the measure of benefit, but results were contradictory when using other measures of benefit such as disability scores.

The purpose of this review is to focus on arthritis-specific or arthritis-appropriate SME interventions, and examine the current state of knowledge on cost-effectiveness analyses, and cost-savings calculated from health-care utilisation data; it will also review the limited information available on intervention delivery costs.

Materials and methods

Two literature searches were conducted. Specific to this review, Medline and Web of Science were searched for the period 1980 to March 2012 using terms related to arthritis (juvenile, reactive, rheumatoid, psoriatic and osteoarthritis), self-management education (psycho-educational, patient education, self-care and educational programmes) and economic (costs, cost analyses, cost utility, cost-benefit, cost-savings and cost effective). The abstracts of the 190 articles identified through this search were reviewed to locate articles that reported cost-related information on SME interventions. Results of an earlier literature search were also reviewed. That earlier search examined eight databases including CINAHL, Embase, Medline and PsychINFO for the period 1984 to September 2009, using search terms related to chronic disease, self-management, psycho-educational and behavioural interventions. The abstracts of the 297 articles identified were also reviewed to locate cost-related information.

Results

Three formal cost-effectiveness analyses emerged from the literature review. Eight studies calculated cost-savings by converting changes in health-care utilisation into estimated costs. Finally, a larger number of studies did not perform any cost analyses, but reported changes in health-care utilisation as a proxy for health-care cost savings. Intervention delivery costs, estimated through a variety of methods, were reported in 11 studies. [Table 1](#) provides additional details by study.

Formal cost-effectiveness analyses

The most relevant formal economic analysis for this review was conducted by Patel and colleagues who evaluated the cost-effectiveness of ASMP at 12 months from a 2007 RCT of adults with knee or hip OA in the UK [19]. Their analyses examined cost-effectiveness from two perspectives: the health and social care perspective (including costs of healthcare, social care and medications) and the societal perspective (incorporating health and social care costs as well as the patient and family out-of-pocket expenses, informal care, lost pay, time off work and receipt of social security benefits). All data were collected by self-report, and cost data were restricted to arthritis-related resource use. Four health outcomes were used in the cost-effectiveness analyses: Medical Outcomes Study Short Form (SF-36) Physical Component Score (PCS), SF-36 Mental Component Score (MCS), QALYs based on the EuroQOL (EQ-5D) and the EuroQOL Visual Analogue Scale (VAS) of overall health status.

Patel et al. reported that at 12-month follow-up, the intervention group had total health and social care costs of £101 (approximately \$157 US at July 2012 exchange rate) greater than the control group, which the investigators attributed to the costs of ASMP not being offset by costs savings elsewhere [19]. Societal costs were numerically, but not statistically, lower in the intervention group. Note: to aid comprehension, foreign currency is converted to US dollars at the July 2012 rate (<http://www.poundstodollars.co.uk/>; accessed 30 July, 2012).

From the perspective of health and social care costs, Patel et al. concluded that ASMP was unlikely to be considered cost-effective [19]. At a willingness-to-pay threshold of greater than £30 000 (approximately \$47,000) per QALY gain, the cost-effectiveness acceptability curve showed a 2% likelihood of being cost-effective. Analyses using the PCS and VAS outcomes also suggested that the ASMP was unlikely to be cost-effective even at very high thresholds of willingness to pay (£1000, \$1571). Analyses using the MCS outcome were slightly more promising; the intervention was likely to be cost-effective if

the willingness-to-pay threshold was set fairly high (£300, \$470), per MCS point gained. The authors noted that a one-point gain in MCS is of questionable clinical significance.

From the societal perspective, however, Patel et al. concluded that ASMP had a high probability of being cost-effective for the PCS and MCS outcomes, even at low thresholds for willingness-to-pay

Table 1
Arthritis-related self-management education cost analyses.

Study (date)	Intervention study design sample size	Cost findings	Estimated delivery costs per participant	Delivery cost calculation method
<i>Cost-effectiveness analyses</i>				
Clarke and McGowan (1998) [26]	RCT of ASMP in British Columbia N = 458 Data collected by self-report	Cost-Effectiveness analysis suggested 4.17 unit increase in SF-36 mental health subscale, 2 unit increase SF-36 MCS, and 0.62 unit increase in SE-Pain with no increase in marginal costs. Cost benefit analysis: initial analysis revealed no difference, but changing assumptions lead to suggestion of increased productivity estimated at \$506.	\$35 Canadian	Not described
Patel et al. (2009) [19]	ASMP N = 812 All self-report data	Health and social care costs £101 (\$158) higher than control. Unlikely to be cost-effective from health and social care perspective; high likelihood of cost effectiveness from the societal perspective: 80% likelihood of being cost-effective at willingness to pay threshold of £1000 (\$1571)	£165 (approximately \$259 at 2012 conversion rates)	Allocation of amount paid to course sponsor divided by number of participants
Richardson et al. (2008) [24]; more complete analysis of Kennedy et al. (2007) [25]	CDSMP, called Expert Patient Programme (EPP) in UK Economic analysis of data from a waitlist controlled RCT of EPP as delivered in 28 strategic health authorities in England. N = 629; all self-report data	0.02 QALY gain in intervention group compared to control £27 (\$42) reduction in cost in the EPP group. When QALY value is £20 000, EPP has 94% probability of being cost effective.	£250 (\$392)	Included estimated cost of managing program, leader training, delivery, and facilities

(continued on next page)

Table 1 (continued)

Study (date)	Intervention study design sample size	Cost findings	Estimated delivery costs per participant	Delivery cost calculation method
<i>Cost-savings calculated from healthcare utilization changes</i>				
Groessler and Cronan, (2000) [27]	RCT comparing 3 self-management support interventions (education, support group, and combined education/support group) with usual care control. N = 363 people with OA. Utilization gathered from medical records	Control group significantly increased utilization each of the three years of study, while intervention groups did not. Cost-benefit ratio estimated to be \$7.46 saved for each \$1 spent on intervention.	Costs for 3 interventions combined \$155. Costs differed by intervention group: Education-\$193 Social support-\$109 Combined Education / support-\$ 159	Based on 1995 estimates of actual services (including personnel), office space, and materials.
Fu et al. (2003) [33]	RCT of CDSMP in Shanghai N = 954 All data self-report	Intervention group had significantly fewer hospitalizations (0.12) which was equated to cost savings of 727 yuan (\$114)	83 yuan (\$13)	Included leader training and stipends, marketing, course materials and administrative costs
Lord et al. (1999) [30]	Controlled trial of a 4 session educational program conducted by a research nurse. N = 170 Data collected from patients and GP notes.	Increased utilization costs of £239 (\$374); however intervention did not produce any positive health outcomes	£240 (\$372)	
Lorig et al. 1999 [16]	RCT of CDSMP N = 952 All data-self report	Cost savings of \$820 calculated based on significant 0.8 reduction in nights in hospital. After subtracting estimated cost of program, costs-savings estimated to be \$750.	\$70 per participant	Leader training, leader stipend, course materials, and administrative costs. Costs for facilities not included
Lorig et al., (2001) [31]	Longitudinal follow-up of participants in original CDSMP validation study. N = 831 All data self-report	Savings based on utilization changes estimated at \$590, although underlying calculations are unclear. Cost savings after subtracting program delivery costs estimated at between \$390-\$520.	\$70-200 depending on economies of scale.	
Lorig et al. (2001) [32]	Longitudinal study of CDSMP conducted with Kaiser Permanente patients. N = 489 All data self-report	Cost savings of \$990 calculated based on non-significant utilization changes and data inconsistent with reported results.	\$200 per participants	Leader training, materials, and administration
Mazzuca et al. (1999) [28]	Controlled trial of individualized self care instruction provided by an arthritis nurse, compared to an attention control. N = 211 patients with knee OA			

Table 1 (continued)

Study (date)	Intervention study design sample size	Cost findings	Estimated delivery costs per participant	Delivery cost calculation method
Nunez et al. (2005) [29]	Longitudinal study of intervention combining 2 group sessions with 4 follow-up phone calls. <i>N</i> = 100 people with musculoskeletal conditions in Spain; utilization data derived from computerized hospital records	Average costs per year declined from £235 (\$364) at baseline to £114 (\$177) at 12 months, £43 (\$67) at 24 months, and £36 (\$56) at 36 months but no information provided on how cost calculations were done.		
<i>Additional estimates of intervention delivery costs</i>				
Allen et al. (2010) [55]	RCT of telephone-based self-management education <i>N</i> = 515 adults with symptomatic knee OA		\$118	Includes inputted labour and non-labour costs
Griffiths et al. (2005) [56]	RCT of CDSMP with Bangladeshi patients in the UK <i>N</i> = 476 All data from interviewer administered questionnaires		£123 (\$193)	Leader and administration costs
National Council on Aging (NCOA) (Personal communication, S Lachenmayr and M. Walsh, June 1, 2012)	Report of AoA grantees estimated of costs of CDSMP delivery using the NCOA cost calculator State A State B State C State D		\$57 \$740 2011 costs (including state infrastructure) \$455; 2010 costs without state infrastructure: \$375 \$306	Licensing, leader stipend, course materials, supplies, food Includes course costs and costs of state infrastructure 2011 estimate includes state infrastructure including training, technical assistance, books, website and toll free information number

(greater than 80% likelihood of cost-effectiveness at willingness-to-pay of approximately £150 (\$236) or less) [19]. Results based on QALYs and VAS outcomes were less positive: 20% likelihood of cost-effectiveness at £30,000 (approximately \$47,000) per QALY gain, and no likelihood of cost-effectiveness at willingness-to-pay threshold of £1000 (\$1571) for VAS gain.

Richardson and colleagues conducted a similar formal economic evaluation on the health outcomes and cost data gathered in an RCT of the EPP as delivered by 28 strategic health authorities in England [24,25]. The authors report that their analysis approximates a societal perspective by including costs to patients; however, these appear to be out-of-pocket costs but not indirect costs. Calculation of QALYs was based on the EQ-5D, with the most change seen on the self-care, and anxiety/depression dimensions, and used the 6-month follow-up data. Participants in the EPP had a variety of chronic conditions, but musculoskeletal disorders were the most common in this sample (34%). Results showed

a small but significant 0.02 difference in QALYs between the intervention and wait-list control group. Small non-significant reductions were found on the majority of the resource use variables. In total, a non-significant reduction of £27 (\$42) in resource utilisation was seen in the EPP group, although patient out-of-pocket costs were greater in that group. The investigators concluded that the EPP had a 94% probability of being cost-effective when the value of a QALY (or willingness-to-pay threshold) was £20,000 (\$31,420); this probability increased to 97% if patient costs were excluded. While a QALY difference of 0.02 is small, the investigators estimated that a 0.02 difference in QALY is equivalent to one extra week of perfect health per year.

In a 1998 analysis, Clarke and McGowan reported conducting cost-effectiveness analyses using results from an RCT of ASMP among seniors in Canada; the analyses utilised direct medical costs (including over-the-counter medications and assistive devices) and indirect costs (including employment, days lost from labour market, household help, non-market activities and time lost by caregivers) [26]. Outcome evaluation demonstrated significant differences between ASMP and control participants in self-efficacy for pain management and the mental health subscale of the SF-36. In both direct medical costs and indirect costs, the control group had higher costs at baseline and showed a trend towards decreased resource utilisation at 1-year follow-up. However, there were no significant differences in direct or indirect costs between ASMP and control groups at 1-year follow-up; therefore, the authors concluded that ASMP produced a 4.2 unit increase in SF-36 mental health subscale, a 2 unit increase in SF-36 MCS and a 0.62 unit increase in self-efficacy for pain management without any increase in marginal costs.

Because there was no difference in direct or indirect costs between the ASMP and control groups, Clarke and McGowan initially concluded that the net benefit based on the cost–benefit analysis would be zero [26]. However, the investigators believed that their methodology for calculation of indirect costs, particularly in the area of lost productivity, likely resulted in underestimated potential improvements. They believed that ASMP participants' increased self-efficacy and improved mental health status likely led to greater productivity expectations and consequently greater self-reports of lost productivity. After correcting for these assumed raised expectations using age- and sex-matched controls, a recalculation led investigators to conclude that ASMP can produce a \$506 increase in productivity, although no details are provided on how the \$506 was estimated.

Calculated cost-savings based on health-care utilisation data

Without doing a formal economic evaluation, some authors have tried to shed light on cost-savings by examining changes in health-care utilisation then calculating costs-savings by assigning average costs to specific health-care resources such as physician visits, ER visits and hospitalisations. A variety of modes of delivering SME have been examined in this manner, including individual educational sessions, telephone follow-up, small group sessions led by either a health professional or a lay leader, and combinations of these methods.

Groessler and Cronan conducted a cost-analysis of three forms of self-management support (education groups, social support groups and education/support group combination) used among older adults with osteoarthritis belonging to an HMO [27]. They analysed the effects of the three intervention groups combined, and compared them to a usual care control group. All three intervention groups involved attending weekly 2-h meetings for the first 10 weeks, followed by monthly 2-h meetings for 1 year. The education sessions focussed on self-management-oriented interactive discussions while the support groups involved unstructured group discussion. Medical records were used to assess utilisation. Data collection occurred at 1, 2 and 3 years after baseline. At 1-year follow-up, the health-care costs had increased significantly for the control group, but not the three intervention groups; the control group continued to have significantly increased health-care costs in years 2 and 3, while the intervention groups did not. The authors estimated that utilisation costs-savings in year one was \$315,588, but do not provide details on how they reached that estimate. Based on that estimate, and the programme delivery costs of \$42,300, they estimate a cost–benefit ratio of \$7.46 for each \$1 spent on intervention.

Two studies evaluated interventions that combined an educational session with telephone follow-up. Mazzuca and colleagues evaluated a relatively brief individualised intervention consisting of

a 30–60-min individual educational session with an arthritis nurse, followed by follow-up telephone calls at 1 week and 1 month [28]. The control group received a 20-min videotape on arthritis. Their participants were inner-city residents with knee OA. Utilisation data were collected from the computerised medical record system of services and charges (medical clinic, lab and pharmacy), and supplemented by patient diaries of costs paid outside the medical centre. Intervention participants had one fewer primary care visit in the year following intervention than did controls, and a cost-savings of \$76, directly attributable to reduction in clinic visits. Costs of speciality care and ancillary services were not significantly different.

Nunez and colleagues also conducted a combination in-person and telephone intervention, but their year-long intervention, conducted in Spain, combined two weekly small group education sessions with telephone follow-up conducted quarterly by a health educator [29]. This longitudinal study of 100 people with various musculoskeletal disorders demonstrated significant reductions in pain and disability and increases in competence in disease-specific management. The number of medical consultations and costs were derived from computerised hospital records; medical consultations showed significant reductions at 24 and 36 months while estimated costs declined at 12, 24 and 36 months. Total costs were estimated to decline from £235 (\$364) at baseline to £36 (\$56) at 36 months. The article's discussion section reported reduced costs were due to both reductions in medical visits and non-steroidal anti-inflammatory drugs but no information was provided on how costs were derived or cost calculations performed.

In the UK, Lord and colleagues investigated a relatively brief group-based intervention for adults with knee OA—four 1-h sessions conducted within the primary care practise by a research nurse [30]. The economic analysis collected data for the 1 year before- and after-intervention; data were collected via self-report and general practitioner notes. Costs were excluded from the analysis if they were clearly unrelated to knee OA. The cost analysis demonstrated a significant increase in costs for participants in the education group (mean difference £239; (\$371)), and no evidence that the intervention costs were offset by reduction in other utilisation. It is noteworthy that the intervention also did not produce any significant improvements in knowledge, self-efficacy or health outcomes either.

Lorig and colleagues published three reports on CDSMP that included extrapolated cost-savings based on self-report of health-care utilisation. In the original CDSMP validation study, they found that at 6-month follow-up CDSMP participants reported significantly fewer hospitalisations and spent an average of 0.8 fewer nights in the hospital than did controls [16]. Utilising an estimate of \$1000 per hospital day they calculated cost-savings of \$820 per participant; reduced to \$750 when costs of programme delivery were subtracted. Lorig et al. also reported changes by primary disease category in this study, although no tests of significance were conducted. Among people with arthritis, the control group reported a decrease in combined physician and ER visits of more than twice the decline in the CDSMP group (−1.69 and −0.67, respectively); change in number of hospital stays was fairly equivalent between participants and controls (−0.04 and −0.03, respectively), and the participants had a −0.44 decline in nights in the hospital while the control group increased by 0.21 [16].

In a longitudinal follow-up of participants from the original CDSMP validation study, Lorig et al. reported that the combined total of physician and ER visits declined at both 1- and 2-year follow-up among 831 participants from the original study [31]. The decline from baseline was −0.69 visits in year 1 analysis and −0.56 in year 2 analysis, with both changes being statistically significant. These 1- and 2-year changes in number of visits were based on self-report of number of physician or ER visits in the past 6 months. Changes in times hospitalised or days in hospital in past 6 months were not significant at 1- or 2-year follow-up.

In the discussion, the Lorig et al. summarised the change in combined physician and ER visits as 2.5 over the 2-year follow-up period [31]; the authors did not specify how that 2.5 visit change was calculated, but it appears that they doubled the 0.69 change for the last 6 months in year 1 and the 0.56 change in the last 6 months of year 2, and summed them to reach 2.5 visit change over 2 years. Cost-savings were calculated based on the Medicare reimbursement rate at the time, or \$40 for a return visit, and were estimated at \$100 based on the summarised 2.5 visit decrease over the 2 years [31].

This \$100 dollar estimated savings in physician and ER visits was combined with an estimated \$490 in hospitalisation costs for a total \$590 per year in cost reductions. After subtracting the estimated \$70–200 cost participant (differences attributed to economies of scale) the health-care cost-savings

was estimated between \$390 and \$520. However, the hospitalisation costs reduction in this longitudinal follow-up was a creative extrapolation that estimated a 0.49 day decline in hospitalisation by combining a 0.15 day decline at 6 months among CDSMP participants in the original study, with a purported 0.34 day increase among control subjects in the same study; the data these extrapolations were based on were not shown, and appeared to be inconsistent with the original study [31].

Finally, in a longitudinal study of 489 Kaiser Permanente patients participating in CDSMP, Lorig et al. calculated a cost-savings of \$990 per patient in 1 year [32]. The study reported a significant 0.1 visit decline in Emergency Room (ER) visits between the 6 months preceding baseline and the 6 months preceding 1-year follow-up; and slight reductions in physician visits and days in the hospital (both findings non-significant). Unfortunately, the cost-savings calculation reported in the discussion included utilisation changes that were not statistically significant and data used to estimate utilisation change from baseline to 6-month follow-up were not shown.

Fu and colleagues evaluated CDSMP in Shanghai among 954 adults with a variety of chronic diseases; 32% of the treatment and 29% of the control groups reported arthritis [33]. Their results showed that the participants had 0.12 fewer hospitalisations than controls, for a cost savings of 727 Chinese yuan (\$114). Changes in physician visits, ER visits and nights in the hospital were all non-significant.

Changes in health-care utilisation as a proxy for cost-savings

The most frequently used method for considering cost-savings in arthritis-related SME was reporting changes in health-care utilisation, and concluding, based on those changes, that the intervention did or did not produce cost-savings. This method was used in at least 14 studies in ASMP, and 14 studies in CDSMP. As in any other research, basing conclusions on a select sample of studies is likely to be misleading, but because of the volume of studies in ASMP and CDSMP, meta-analysis can be used to statistically combine results across studies to provide a more robust understanding of intervention effects.

Brady and colleagues conducted a meta-analysis of the 24 ASMP studies conducted in English-speaking countries between January 1984 and September 2009; 14 reported changes in visits to physicians [34]. This analysis combined RCTs with good internal validity and longitudinal studies with good external validity to obtain more robust estimates of effect sizes (ES). As shown in Table 2, the overall 4–6-month ES of the small group English intervention on physician visits was quite small (ES = -0.005) and non-significant. Four ASMP studies examined changes in physician visits at 9–12 months, and the ES remained small and non-significant (ES = -0.08). Physician visits is the only utilisation variable reported consistently in ASMP studies. Other modes of programme delivery (small group conducted in Spanish or other languages, online and self-study) each had one to two studies; exploratory meta-analysis showed no significant ES for these other delivery modes.

Brady and colleagues conducted a parallel meta-analysis on the 23 CDSMP studies conducted in English-speaking countries between January 1999 and October 2009 [35]. This analysis also combined

Table 2
Arthritis Self-Management Program and Chronic Disease Self-Management Program Health Care Utilization Effect Sizes based on Meta-analysis [34,35].

	Overall analysis			
	4–6 Months overall		9–12 Months overall	
	N of study arms	Effect size (95% CI)	N of study arms	Effect size (95% CI)
Arthritis Self-Management Program				
Physician visits	16	$-0.005 (-0.26, 0.25)$	4	$-0.08 (-0.26, 0.09)$
Chronic Disease Self-Management Program				
Physician visits	9	$-0.04 (-0.08-0.02)$	4	$-0.08 (-0.17-0.01)$
ER visits	4	$-0.02 (-0.08-0.05)$	2	$-0.10 (-0.22-0.02)$
Times hospitalized	7	$-0.01 (-0.06-0.05)$	4	$-0.003 (-0.12-0.12)$
Days/nights hospitalized	8	$-0.09^{**} (-0.15-0.02)$	3	$-0.04 (-0.09-0.02)$

N = number of study arms included in analysis; CI = confidence interval.

* $p < 0.05$; ** $p < 0.01$.

the strong internal validity of RCTs and the strong external validity of longitudinal studies in calculation of overall effect sizes. As shown in Table 2, effect sizes were non-significant for changes in physician visits, ER visit, and times hospitalised in the 4–6-month and 12-month analyses of the small group English intervention. There was a small but significant reduction in self-report of number of days/nights in the hospital at 4–6 months ($ES = -0.09$), but this change was non-significant in the 12 month analysis. There were no significant differences in the 4–6-month comparison of RCT and longitudinal ES. As with ASMP, exploratory meta-analysis of the one to two studies for each alternative delivery mode revealed no significant ES.

Intervention delivery costs

An essential element of any considerations of the cost implications of arthritis SME is cost of intervention delivery. Limited information is available on the costs of intervention delivery, and, where available, a wide variety of methods for estimating delivery costs have been used. Table 1 reports estimated arthritis-related SME delivery costs and methods used to estimate those costs as reported in the literature. Costs are highly variable and range from \$35 to \$740; these differences are likely due to both the various methods used to estimate costs as well as real differences in costs based on intervention designs such as intervention duration (less than an hour to 15 h), who delivers the intervention (health professionals or lay leaders) and mode of delivery such as telephone or in-person.

Discussion

The three formal cost-effectiveness analyses reviewed focussed on either ASMP or CDSMP. Results are equivocal. Patel et al. concluded that ASMP was not cost-effective when examined from the perspective of health and social care costs, but had a high probability of being cost-effective when examined from the societal perspective incorporating not only patient out-of-pocket costs but also informal care, lost productivity and caregiver costs and productivity losses [19]. Clarke and McGowan also examined ASMP and initially concluded that ASMP was not cost-effective from the perspective of direct medical or indirect costs, but upon re-calculations, with changed assumptions about lost productivity, concluded that ASMP would likely increase productivity, based on positive impacts on self-efficacy and mental health factors [26]. Richardson and colleagues concluded that CDSMP produced a small but significant increase in QALYs and had a high likelihood of being cost-effective; changes in the self-care and anxiety/depression dimensions were the greatest contributors to the QALY value [24].

The results of these formal cost-effectiveness analyses are consistent with the results of the ASMP and CDSMP meta-analyses. In the meta-analysis, ASMP did not produce significant changes in physician visits, the only utilisation variable measured, but did produce significant changes in psychological factors and select health behaviours [34]. Similarly, CDSMP produced one small significant change in health-care utilisation (days/nights in hospital) at 6 months that did not persist to 12 months, but had persistent improvements in psychological factors and select health behaviours [35]. The other health-care utilisation variables analysed in the CDSMP meta-analysis, physician visits, ER visits and times hospitalised were all non-significant at 4–6-month and 12-month follow-up.

The various types of SME that were evaluated with cost-saving calculations based on health-care utilisation changes also showed variable results. Both interventions combining education sessions with telephone follow-up showed cost reductions that were attributed to reduced physician visits [28,29]. Lord and colleagues' group education within primary care clinics showed no evidence that costs of the intervention were offset by reductions in utilisation [30], while CDSMP studies by Lorig et al. used modest and sometimes non-significant utilisation changes to calculate cost-savings [16,31,32]. It is not clear if the methods used in these studies to extrapolate cost-savings from utilisation changes would withstand scrutiny by economic analysts.

The data on intervention delivery costs differed widely but cost allocation methods were so variable that it is difficult to draw conclusions. All investigators concluded that most forms of SME are relatively low-cost interventions.

From this review it is clear that the field of economic analysis of SME used in arthritis is in its infancy. Most of the papers reviewed here are likely to have many of the same weaknesses that

Richardson and colleagues highlighted in their 2005 review of economic evaluations of self-care support interventions [21]. Most were narrowly focussed on costs from the healthcare, rather than societal perspective, very few examined follow-up periods of greater than 1 year, and comparison groups and costing methodologies were quite variable in the studies in this review. A further weakness is that most analyses rested on self-report of health-care utilisation; a few used hospital-based administrative data but acknowledged these data are likely incomplete. More robust economic evaluations are required to reach any conclusions about the cost implications of SME in arthritis.

However, we need not be blinded by the appealing possibility of cost-saving due to reductions in health-care utilisation; other value metrics are important as well. The business case for SME does not rest solely on reductions in health-care utilisation, and some authors have argued that a successful outcome is 'appropriate', not necessarily reduced, utilisation [18,36]. However, SME can bring other value to health systems. As the US health-care system moves away from fee-for-service health-care reimbursement models, health-care provider organisations are likely to wrestle with the need to enhance their ability to provide self-management support; offering SME is one way of meeting NCQA's criteria for certification as a patient-centred medical home [1]. Health-care payer organisations can use supporting SME as a competitive market advantage, similar to how some use exercise programmes, gym memberships and select medications on formularies as member recruitment or retention strategies, or to increase patient satisfaction. Non-profit hospitals can use delivery of SME as part of their services used to meet Internal Revenue Service regulations for community benefit [37].

A second perspective on SME value is the population health perspective. Rappange and colleagues cautioned that overly optimistic assumptions about the effects of lifestyle interventions and other prevention programmes on reducing health-care utilisation may cause disappointment when the prevention programme fails to meet those expectations; they argue that the debate needs to shift from 'do these programmes save money' to 'do these programmes offer good value' [38]. They further argue that our focus as a nation needs to be on the most cost-effective ways of producing population health.

The health outcomes produced by SME may have sizeable population health impact at a relatively low cost. The most extensively researched SME programmes are ASMP and CDSMP, which produced fairly consistent health outcome improvements in psychological factors such as self-efficacy, anxiety and depression, energy and select behaviours including physical activity [35]. Many non-pharmacological arthritis interventions focus on enhancing self-efficacy because of its relationship with health status and health behaviours. In both RA and OA, self-efficacy has been correlated with current measures of pain, function and psychological wellbeing [39,40], as well as changes in pain, function and depression [40]. Adherence with medications and other health recommendations has also been associated with self-efficacy [41,42]. Depression and anxiety are common co-morbidities with arthritis [43], and can complicate the management of chronic disease; the ASMP/CDSMP meta-analyses documented persistent improvements in psychological factors [35]. These meta-analyses also document changes in physical activity, an essential element of disease management.

A third value perspective is the use of SME programmes as a 'turning point' or essential building block in a patient's evolution from passive recipient of clinical care to an activated self-manager. In a small qualitative study, Hamnes and colleagues explored patient expectations prior to participating in a self-management programme [44]. Their findings revealed that patients expected the programme to be a turning point in their lives; to empower them to assume more responsibility for their health, to help them achieve acceptance, gain new knowledge and provide a forum for sharing experiences. Wagner and colleagues' chronic care model rests on the interaction of prepared, proactive practise teams and informed, activated patients [45]; SME, and particularly the self-efficacy produced by most SME interventions, can ignite the patient activation process. Nolte and colleagues used the Health Education Impact Questionnaire (HeiQ) to evaluate the results of 142 self-management education courses in Australia; 66% of the included classes were CDSMP, 15% are ASMP [46]. Their results indicated that substantial improvements (defined as an $ES \geq 0.5$) were reported by 49% in techniques to manage their health, 41% in self-monitoring and 35% in healthy behaviours – all characteristics of activated patients.

SME may also create value when combined with other clinical interventions. In a prospective RCT in Taiwan, Huang and Chen evaluated a preoperative rehabilitation education programme with total knee arthroplasty patients and found that the study group had a shorter hospital length of stay and fewer hospitalisation-related medical expenses than in the control group, despite no differences in functional

outcomes [47]. Hurley and colleagues evaluated the cost-effectiveness of an exercise-based rehabilitation programme that integrated exercise, education and self-management strategies in an RCT conducted in the UK, and found that 30 months after completing the programme, participants had better physical function, lower community-based health-care costs, medication costs and total health and social care costs [48]. Jessup and colleagues compared the same programme to outpatient physical therapy and found clinical outcomes equivalent, a lower health-care utilisation cost among participants in the integrated exercise and SME programme [49]. In Hong Kong, Yip and colleagues found a significant decrease in the number of unplanned arthritis-related medical consultations among participants in an intervention that combined ASMP with an exercise programme [50,51].

Much of the emphasis on examining health-care utilisation changes produced by SME has been driven by the hope of obtaining health-care reimbursement; but it is important not to overlook other organisations and funding sources already supporting SME. In the US national database monitoring dissemination of CDSMP and related programmes since March 2010 (primarily funded by AoA), 24% of sites offering CDSMP were senior centres, and 16% of sites were health-care organisations. However, there were a large number of community-based sites that are outside the health-care delivery system, some of whom have their own funding sources; 11% of the sites were faith-based organisations, 6% were multi-purpose social service organisations, 3% were libraries, 3% were recreation organisations, 2% were educational institutions including land-grant university extension agents and community adult education organisations and 1% were worksites (Personal communication; K. Kulinski, National Council on Aging Analysis of CDSMP National Database 31 March 2010 to 25 July 2010). Although these percentages are small, they demonstrate that in addition to health-care resources, other community resources, including funds used to support recreation, libraries, adult education and faith-based programmes, have also supported SME in the community. Barlow and colleagues also reported dissemination of ASMP through the adult education system in the UK [52]. A small investigation of US organisations that embedded these types of community-based programmes into their routine operations identified several key motivations: decision makers in these organisations became passionate about the work after witnessing the benefits participants experienced, and recognised the interventions as a way of achieving their mission and compatible with other programme efforts [53]. This diversity of sites that have offered SME exemplifies the synergy that can be achieved by collaboration between the health-care sector and the community to achieve population health [37].

As is evident in this review, more robust economic evaluations of arthritis SME, from both the health-care and societal perspective, are necessary to give a clear understanding of the economic value of SME. There are other future research needs as well: examination of health-care utilisation changes from complete administrative databases rather than self-report data, identifying which patients are most likely to benefit from SME to allow more targeted use of these interventions, and identifying the appropriate time horizon to be examining the benefits of SME – while some benefits may emerge in the short term, other benefits may emerge as a person becomes more successful in managing their condition. Comparative effectiveness studies could be useful to determine the relative effectiveness of various modes of providing SME. Finally, although a few investigators [19,29] tried to examine the impact of SME on work, they reported that too few people in their studies were employed at the time of participation, so additional research is needed to examine effects of SME on workforce participation.

In summary, the most common form of economic analysis done in arthritis SME has been estimating cost-savings from changes in health-care utilisation, and the results have been less than compelling. The few studies that entailed a formal economic evaluation from the societal perspective, including not just health-care costs but also patient out-of-pocket costs and lost productivity, have been more encouraging about the cost-effectiveness of SME interventions. However, most studies do show improved health outcomes and most investigators agree that many forms of SME are relatively low cost to deliver. The value of SME becomes more clear as we move from valuing SME only from the perspective of health-care utilisation, and recognise other value metrics inherent in supporting patient self-management, as well as recognising the multiple organisations and funding sources that can play a role in supporting SME. Good health is the foundation necessary to create a meaningful and satisfying life [54]; becoming a successful self-manager is an essential ingredient in health for anyone with a chronic disease, and SME may be a crucial building block in the journey to becoming a successful self-manager. As we pursue more robust cost-effectiveness analyses of SME, it is imperative that costs and

benefits are calculated from a wide societal perspective to get a more complete picture of the role of SME in improving the lives of people with arthritis.

Conflict of interest statement

The author reports no financial or personal relationships that could influence this work.

Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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