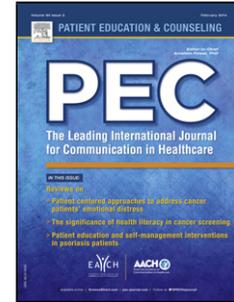


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Title: Health Economic Evaluations of Patient Education Interventions A Scoping Review of the Literature

Authors: Una Stenberg, Andre Vågan, Maria Flink, Vibeke Lynggaard, Kari Fredriksen, Karl Fredrik Westermann, Frode Gallefoss



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Title

Health Economic Evaluations of Patient Education Interventions
A Scoping Review of the Literature

Author names and affiliations

Una Stenberg^a

una.stenberg@mestring.no

Andre Vågan^a

andre.vaagan@mestring.no

Maria Flink^b

maria.flink@ki.se

Vibeke Lynggaard^c

viblyn@rm.dk

Kari Fredriksen^d

kari.fredriksen@sus.no

Karl Fredrik Westermann^a

karl.fredrik.westermann@gmail.com

Frode Gallefoss^e

frode.gallefoss@sshf.no

- a) Norwegian National Advisory Unit on Learning and Mastery in Health, Oslo University Hospital, Oslo, Norway;
- b) Medical Management Centre, LIME and Department of Social Work, Karolinska University Hospital, Stockholm, Sweden;
- c) Cardiovascular Research Unit, Department of Cardiology, Regional Hospital West Jutland, Herning, Denmark
- d) Learning and Mastery Center, Stavanger University Hospital, Stavanger, Norway
- e) Department of Pulmonary Medicine, Sorlandet Hospital, Kristiansand S, Norway

Corresponding author

Una Stenberg, PhD, MSW

Norwegian National Advisory Unit on Learning and Mastery in Health, Oslo University Hospital, Pb 4959 Nydalen, 0424 Oslo, Norway

Cellphone: +47 952 17 206

Highlights

- Patient education programs are an effective tool to reduce costs
- 82% of the studies found positive health economic impact
- **This review can be used as guidance in providing cost-effective patient education**

Abstract

Objectives

To provide a comprehensive overview of health economic evaluations of patient education interventions for people living with chronic illness.

Methods

Relevant literature published between 2000 and 2016 has been comprehensively reviewed, with attention paid to variations in study, intervention, and patient characteristics.

Results

Of the 4693 titles identified, 56 articles met the inclusion criteria and were included in this scoping review. Of the studies reviewed, 46 concluded that patient education interventions were beneficial in terms of decreased hospitalization, visits to Emergency Departments or General Practitioners, provide benefits in terms of quality-adjusted life years, and reduce loss of production. Eight studies found no health economic impact of the interventions.

Conclusions

The results of this review strongly suggest that patient education interventions, regardless of study design and time horizon, are an effective tool to cut costs. This is a relatively new area of research, and there is a great need of more research within this field.

Practice Implications

In bringing this evidence together, our hope is that healthcare providers and managers can use this information within a broad decision-making process, as guidance in discussions of care quality and of how to provide appropriate, cost-effective patient education interventions.

1. Introduction

Chronic illness is one of the major health challenges of this century. The humanitarian, social and economic consequences experienced all over the world are particularly devastating in poor and vulnerable populations[1]. The number of persons affected by chronic conditions is substantial, and according to the World Health Organization chronic conditions cause 70% of all deaths[1]. The term chronic illness is defined as a process of long duration and generally slow progression that requires ongoing health- and self-care management over years. The four main types of chronic illness are cancer, cardiovascular diseases, chronic respiratory conditions and diabetes[1].

Living with a chronic illness is a complex, dynamic, cyclic and multidimensional process[2, 3]. In order to manage their own illness and take responsibility for their own health, people need knowledge and skills[4]. Finding the best management strategy for chronic illness is crucial to deal effectively with increasing numbers of patients and escalating **health-care related** costs[4]. Thus, greater attention is provided to interventions that support self-managing one's health[5].

A growing number of interventions have been developed to support self-management, e.g., knowledge transfer, illness management, adjustment to changed conditions and maintenance of quality of life. These are commonly referred to as patient education or self-management interventions. Below, we will use the term patient education interventions when referring to these activities. Overall, the aim of patient education is to support and enable people to manage their lives with illness, and optimize their health and well-being[6, 7]. Patients' values and preferences, and the principle of shared decision making are increasingly accepted in healthcare, and has moved the trend from traditional paternalistic care toward more collaborative care in which patients, informal caregivers and healthcare providers work together to achieve the best possible management[4, 7]. Patient education interventions can be offered in various forms, and are described as complex interventions[8, 9]. They can be led by laypersons and/or by professionals, be generic or disease-specific, and **can be given to groups or to individuals alone**. Understood broadly, patient education as an interactive learning process offered to patients and family caregivers encompasses a wide range of educational activities, such as provision of knowledge, programs for health promotion and/or behavioral and lifestyle change, psychoeducation, cognitive behavioral therapy, individual counseling, sharing of experiences among patients, motivational discussions, exercise counseling, and self-help courses[7].

To evaluate patient education interventions are challenging, partly because the interventions often have multiple objectives which include improving information and helping individuals to make decisions. Still, there is evidence from several reviews that patient education interventions have been beneficial for the participants in terms of less distress from symptoms, greater knowledge of illness, improved health related quality of life, greater awareness of one's condition, improved self-management strategies, peer support, learning and feeling of hope[9-12].

The significance of some outcomes or changes that participants experience during and after participation in patient education interventions might not be adequately captured in the traditional survey measures. Further, several measurement instruments are likely to be too insensitive to pick up changes resulting from a patient education intervention, and/or there is a lack of relevant outcome measures[12]. **Many benefits may also come in other forms or at another time. To date, there exists no single method or measure that captures the full range of potential benefits from patient education interventions. In addition to yielding benefits to individuals there may be other consequences of patient education interventions.**

To be able to make clinical and policy decisions in healthcare, policy-makers and health decision-makers need information about the effectiveness and costs of patient education interventions and various other preventive interventions[12, 13]. Such information can help researchers, healthcare professionals and managers to choose between competing alternatives. Further, in order to develop guidelines as well as innovative frameworks and instruments for evaluation, we need more knowledge on the health economic consequences of participating in patient education interventions in healthcare.

Health economics can enable us to draw conclusions about the best ways to allocate resources. Economic evaluation may be defined as: “*the comparative analysis of alternative courses of action in terms of both their costs and their consequences*”[14]. Full economic evaluations can be categorized **in terms of** cost-effectiveness analysis, cost-utility analysis, and cost-benefit analysis[13]. Cost-effectiveness analyses are relevant when the consequences of different interventions may vary, and the health consequences are measured in a single natural unit. Cost-utility analyses are relevant when the interventions we compare produce different consequences. Then health outcomes are measured in a comprehensive unit representing quantity and quality of life (such as quality-adjusted life years; QALY). Cost-benefit analyses are often relevant when both input and consequences of different interventions are expressed in monetary units. Commonly, an intervention is considered cost-saving when it is more effective and cheaper than usual care (control).

The findings from a few relevant systematic reviews[15-19] indicate that patient education interventions for people diagnosed with diabetes, arthritis, depression, heart failure or chronic obstructive pulmonary disease (COPD) give positive results that outweigh the costs associated with the interventions. **However, the investigators** conclude that there is a need for more robust evaluations to reach reliable conclusions. To date, no review has addressed the full scope of studies that have investigated the health economic impact of patient education interventions. To provide a systematic evaluation of patient education interventions in Norwegian healthcare, we are **currently** conducting several reviews with different scopes. *This* review aims to give a comprehensive and systematic overview of published economic evaluations and the potential health economic impact of patient education interventions for people living with chronic illness.

More specifically, the following questions are addressed:

1. What are the characteristics of the studies, participants and patient education interventions described in the literature?
2. How are health economic outcomes described or measured, as reported in the literature?
3. What health economic impact is associated with patient education interventions, as reported in the literature?

2. Methods

Since research on the health economic impact of patient education interventions is a relatively new field of research, the research questions were best answered by including different study designs. Thus, a scoping review was considered appropriate. Scoping reviews “*aim to rapidly identify the key concepts underpinning a research area and the main sources and types of evidence available, and can be undertaken as stand-alone projects in their own right, especially where an area is complex or has not been reviewed comprehensively before*”[20]. Scoping reviews are relevant to disciplines with emerging evidence, because the researchers can incorporate a range of study designs, and generate findings that can complement the findings of clinical trials [21]. This review followed the five-stage framework proposed by Arksey and O`Malley **that has been** further enhanced by Levac[21, 22].

The first step was to define the inclusion criteria. The objectives of the overview of patient education interventions prompted the following specifications:

- Population: target population includes all persons (both adults and minors) who are living with any type of chronic illness.
- Intervention: any kind of face-to-face patient education intervention within healthcare.
- Comparisons: usual care/treatment, different types of interventions, or no comparisons (post- and pretest).
- Outcomes: health economic outcomes (for example QALY, hospitalization, number of visits to General Practitioner).

Relevant studies were identified based on the research questions and the purpose of this study. To provide a sufficient sample size, we had to include studies published over a relatively long period of time. For this scoping review, we conducted a systematic search of the following electronic databases from 01 January 2000 to 31 December 2016: MEDLINE, EMBASE, PsychINFO, AMED, CINAHL, SweMed+, ERIC and Cochrane Library Online. In each database, we searched for every term listed below in the database thesaurus and used the free text/key word method. A wide variety of different search terms are used for chronic illness and patient education in different databases. In order to capture as many relevant studies as possible, the literature search was conducted according to the PICO principles combined with and 'OR' within-group and subsequently combined with an 'AND' between-groups:

- Diagnosis/health: asthma, arthritis, cancer, cardiovascular disease, chronic disease/illness, COPD, diabetes mellitus, fatigue, fibromyalgia, heart failure, HIV infections, hypertension, irritable bowel syndrome, lung disease/illness, mental disorders, myocardial ischemia, neoplasms, obesity, osteoporosis, pain, pulmonary, stroke, syndrome.
- Intervention: group support program/intervention, group-based education, health promotion, learning and mastery course, learning and coping, patient education, patient education course/program/intervention, rehabilitation, self-management program/education/group, peer-groups.
- Health economic evaluation: benefit-to-cost, costs, cost-benefit analysis, cost containment, cost control, costs and cost analysis, cost-effective, cost-effectiveness analysis, cost of illness, cost minimization analysis, cost-utility analysis, economics, economic aspect, economic evaluation, healthcare costs, healthcare economics, health economics, quality-adjusted life years, societal cost perspective.

Inclusion criteria included articles written in English, Norwegian, Swedish or Danish in peer-reviewed journals that had investigated: the health economic impact (1) of individual and/or group-based patient education interventions (2) for people living with any type of chronic illness (3). Interventions mainly based on use of technology were excluded, as capturing the breadth of e-health patient education interventions would have required another search strategy.

The search strategy was developed by the study group, and our discussions helped clarify the inclusion and exclusion criteria. **Initially, we deliberately carried out a broad search, and we searched the databases with no restrictions.**

The search of the online databases yielded 4693 articles (Fig. A). Of these, 4538 articles were excluded **as they did** not meet the inclusion criteria. The remaining 155 articles were obtained in full text and read (by the first author and one co-author). Subsequently, 99 articles were excluded, as inclusion criteria were not met. **Any** disagreements about article inclusion were resolved by discussion in the study group to reach consensus. The interventions were

often poorly described. **Furthermore**, interventions with the same name (for example cognitive behavioral therapy), could be very different in content. Therefore, every intervention was screened before inclusion, and 64 articles were excluded because the aim or content of the patient education intervention did not meet the criteria. Ultimately, 56 articles were retained for analysis. A quality assessment of all included articles has been conducted by at least two independent reviewers in parallel (US, KF, AV and VL) (Appendix A in Supplementary material)[23]. All included articles were also assessed for the source of funding and conflicts of interest.

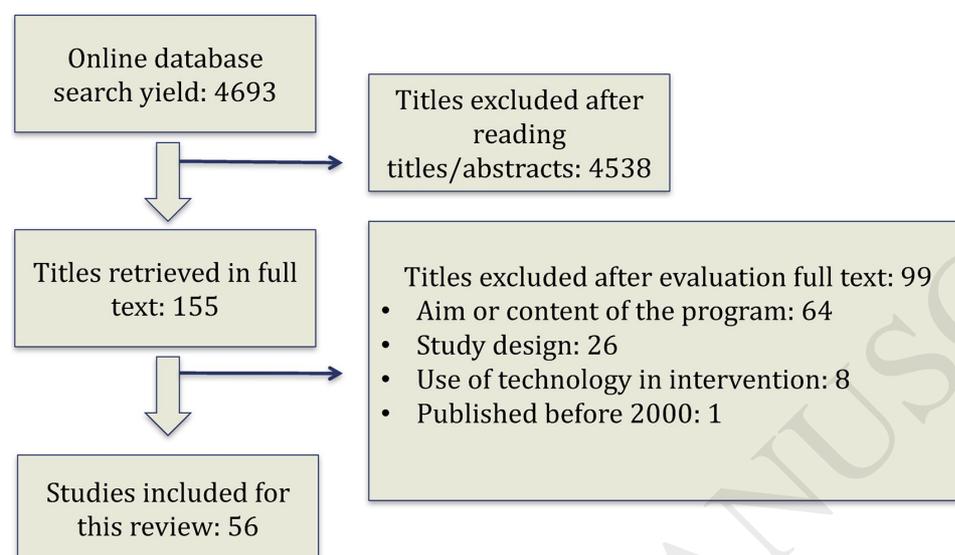


Figure A. Inclusion and exclusion of studies.

In an iterative process, the first author extracted information from each relevant publication about the design, aim, population, intervention, outcome, methods, results, and the authors' conclusion. Information about study characteristics, descriptions of interventions and outcomes was collected on data extraction forms and reported separately for each study in evidence summary tables (Table A-C). There were large differences in types of interventions, designs and outcome measures. However, in order to find some similarities and patterns in the material, all study results were compared according to type of patient education intervention, diagnosis, and type of outcome measured. The data summarization was mainly carried out by the first author (US), and validated by all the co-authors.

3. Results

3.1. Characteristics of the studies

The 56 published articles were conducted in 14 different countries (Table A).

Country	Number of articles
United States of America	16
United Kingdom	11
Netherlands	6
Norway	5
Canada	4
Denmark	3
Sweden	3

China	2
Argentina	1
Finland	1
South Africa	1
Spain	1
Germany	1
France	1
Total	56

Table A. Country and number of articles.

Among the total of 56 studies, 38 used quantitative methods with an experimental design; randomized controlled trials (RCTs), and 17 had an observational analytic design (cohort or case-control studies). One study had a combined experimental and observational design. Most of the studies (49/56; 87.5%) compared the outcomes between patients participating in different types of patient education interventions with a control group of patients. In 40 of these studies, participants in the control groups received usual care and treatment. In nine studies, different kinds of patient education interventions were compared with each other, or with rehabilitation interventions or more therapeutic interventions. All the studies reported changes over time, before and after participating in a patient education intervention. Nine of the studies reported changes that had been measured between three and six months, 29 studies between seven and 12 months, eight studies between 13 and 24 months, and ten studies reported changes from more than two years after participation.

3.2 Participant characteristics

A total of 18201 participants were included in the studies for this review (Table B). The mean age of adult participants was 54.5 years (excluding the studies that did not list mean age or age at all 7/56; 12%). Six of the studies included children between 2 and 15 years [26-29, 31, 34]. Four of these studies reported mean age of the study participants (14.6 years, 14 years, 5.5 years and 7.6 years, respectively).

Participant Characteristics	Number of participants (%)
Total sample	18201 (100%)
Gender	
Women	6734 (37%)
Men	6176 (34%)
Not reported	5291 (29%)
Age	
Mean age adults, years	54.5

Table B. Participant Characteristics.

3.3 Characteristics of the patient education interventions

Of all the patient education interventions in primary or specialized healthcare, 23 (41%) were group-based, 16 (29%) **had an individual approach**, **16 (29%) combined individual and group-based approaches**, and one study compared a group-based intervention with an individual intervention. Most of the interventions were delivered by multidisciplinary teams (26/56; 46.4%), or by one healthcare provider, most often a specialized nurse or

physiotherapist (21/56; 42.9%). A few interventions were delivered by healthcare providers and participant peers in collaboration (4/56; 7.1%), or were peer-led (2/56; 3.6%). One study compared an intervention delivered by a health educator with a multidisciplinary intervention, and two studies provided no information on how the intervention was delivered. As follows from the inclusion criteria, all the interventions in these studies were face-to-face, but some of them were supplemented with written or multimedia material (11/56; 19.7%), and/or phone calls (14/56; 25%). In one study, two interventions were compared: one face-to-face intervention and one face-to-face intervention supplemented with phone calls. The duration of the interventions was poorly described, or not described at all in many of the studies (17/56; 30.4%). In the studies with a more thorough description (39/56; 69.6%), the duration of the interventions varied from 1-3 sessions (6/39; 15.4%), to 4-8 sessions (23/39; 59%) to 9 sessions or more (10/39; 25.6%).

Diagnose/ condition	Study Design (time- span of study – months)	Patient Education Intervention	Description of Health Economic Outcomes	Conclusion of stu
Across conditions	Longitudinal (12), control group: patients on waiting list	Intervention: Chronic Disease Self- Management Program <i>Description:</i> evidence-based program aimed at empowering participants to develop skills necessary for medical, social role, and emotional management of chronic conditions <i>Mode:</i> group <i>Personnel:</i> peer-led <i>Delivery method:</i> face-to-face <i>Duration:</i> six sessions over six weeks	<ul style="list-style-type: none"> • Emergency Department visits • Hospitalization 	<ul style="list-style-type: none"> • Significant reduction in Emergency Department visits (5%) at baseline, 6-month and 12-month assessments • Significant reduction in hospitalizations over 6 months
Across conditions (heart disease, lung disease, stroke or arthritis)	Longitudinal (24), control group: no	Intervention: Chronic Disease Self- Management Program <i>Description:</i> evidence-based program aimed at empowering participants to develop skills necessary for medical, social role, and emotional management of chronic conditions <i>Mode:</i> group <i>Personnel:</i> peer leaders (trained) <i>Delivery method:</i> face-to-face <i>Duration:</i> seven weekly sessions of 2½-hours duration	<ul style="list-style-type: none"> • Outpatient visits • Emergency Department visits • Hospitalization 	<ul style="list-style-type: none"> • Emergency Department visits and outpatient visits declined significantly during 2 years, with a decrease in increase in hospitalizations and hospital days
Asthma	Longitudinal (6), control group: no	Intervention: Asthma Case Management Program <i>Description:</i> the program is based on the concept of self-management. It involves patient education, a home treatment plan, and physician/nurse follow-up <i>Mode:</i> individual and group <i>Personnel:</i> Pediatric or family practice physicians or nurse practitioners <i>Delivery method:</i> face-to-face and telephone <i>Duration:</i> beginning 1 week after initial visit, each patient received one follow-up phone call every 3 months	<ul style="list-style-type: none"> • Hospitalization • Family practice clinic visits • Emergency department visits 	<ul style="list-style-type: none"> • All measured parameters showed favorable outcomes after intervention • A combined intervention consisting of patient education, a coordinated self-monitoring program, patient follow-up, and telephone care associated with improved clinical care and economic outcomes in this population

Asthma	RCT (12), control group: followed by General Practitioner	<p>Intervention: Asthma education program <i>Description:</i> elementary pathophysiology of asthma, asthma drug mechanisms, how to cope with asthma and principles for self-management were covered. An individual self-management plan aimed at encouraging early change of medication during episodes of asthma attacks was issued. <i>Mode:</i> individual and group <i>Personnel:</i> nurse and physiotherapist <i>Delivery method:</i> face-to-face and written material <i>Duration:</i> two 2-h group sessions and 1–2 h of individual counseling</p>	<ul style="list-style-type: none"> • Costs 	<ul style="list-style-type: none"> • The present study indicates that patient education in mild to moderate asthma improved health the same time saved in a 12-month follow-up • A 10-unit improvement in St. George's Respiratory Questionnaire total score and a 5% improvement in forced expiratory volume in one second in the intervention group associated with a cost saving of \$377,78 and 500 minutes respectively, compared to the control group in a 12-month follow-up • The Number Needed to Educate to make one person symptom free was 2.2 and for each person becoming symptomatic after patient education there was a cost saving of \$1,355. The study way sensitivity analysis indicated satisfactory robustness of the conclusions
Asthma	RCT (9), 3 groups, control group: no	<p>Intervention 1: Asthma Education Group <i>Description:</i> the education included information on basic asthma pathophysiology, recognition of triggers, principles of therapy including review of medications and the difference between rescue and controller medications, and the use of an asthma treatment plan <i>Mode:</i> individual <i>Personnel:</i> asthma educator <i>Delivery method:</i> face-to-face <i>Duration:</i> one 20 to 30-minute session</p> <p>Intervention 2: Reinforced Education Group <i>Description:</i> participants and their caregivers received the same initial asthma education as group 1. However, their education was reinforced as needed and participants in this group were encouraged to call the asthma educator if they had questions <i>Mode:</i> individual <i>Personnel:</i> asthma educator <i>Delivery method:</i> face-to-face and telephone <i>Duration:</i> minimum during the monthly data collection telephone calls (after the data had been collected)</p>	<ul style="list-style-type: none"> • Emergency Department visits • Hospitalization • Productivity (days missed school) 	<ul style="list-style-type: none"> • All intervention participants improved dramatically and significantly below baseline and follow-up year on all of the assessed regard to study group • The average decline in utilization of health resources across all groups was substantially roughly 81% for hospitalizations, 64% for Emergency Department visits, and 58% for visits. As a result savings associated with the intervention were considerable • The improvement in three groups suggest even the most basic intervention, in a one-time, case-study

		<p>Intervention 3: Case Management and Reinforced Education Group</p> <p><i>Description:</i> participants received the same reinforced asthma education as did those in group 2. However, group 3 participants also had case management services available to them. A nurse practitioner/case manager completed an initial case management evaluation on all group 3 participants. The nurse practitioner/case manager worked collaboratively with the family to identify problems and needs and to devise a solution action plan. Generally, the health educator supported the family in carrying out the case management plan</p> <p><i>Mode:</i> individual</p> <p><i>Personnel:</i> asthma educator and nurse practitioner/case manager</p> <p><i>Delivery method:</i> face-to-face and telephone</p> <p><i>Duration:</i> not reported</p>		<p>one-on-one asthma education sessions. A trained lay health educator, can improve asthma control and reduce health care costs in disadvantaged children with severe asthma.</p> <ul style="list-style-type: none"> • While there were no statistically significant differences in outcomes between study groups, the trend of group 3 participants improved to a greater degree than group 1 or group 2 participants was consistent across all outcomes
Asthma	Longitudinal (12), control group: usual care	<p>Intervention: Asthma Disease Management</p> <p><i>Description:</i> the main activities that took place within the intervention group were physician education, patient education, and case management. Based on the needs and previous patterns of healthcare access of this population, we focused on 3 areas: (1) increasing the use of anti-inflammatory medications, (2) having the participants telephone our reactive care line early in an attack instead of going to an emergency department, and (3) decreasing nighttime symptoms, the most frequent time for emergency services. Physician and patient education was provided in different ways and included many topics.</p> <p><i>Mode:</i> individual and group</p> <p><i>Personnel:</i> physicians and specialized respiratory nurses</p> <p><i>Delivery method:</i> face-to-face and telephone</p> <p><i>Duration:</i> six months period</p>	<ul style="list-style-type: none"> • Costs • Hospitalization • Emergency Department visits 	<ul style="list-style-type: none"> • The net savings above the cost of program were 9% greater for the intervention group. The control group differences were not statistically significant and found to be different
Asthma	RCT (24), control group: usual care	<p>Intervention: Inner city asthma intervention for children</p> <p><i>Description:</i> focus on encouraging the family to get an asthma care plan from their primary care physicians, developing improved communication skills for the family with their primary care provider, and providing and facilitating referrals to appropriate community resources for smoking cessation, psychologic counseling, problems with housing, and health insurance needs. Social counselors worked with the child and caretaker to identify asthma triggers, to improve access to care, and to assist families and children in understanding the primary physician's asthma care plan. The intervention included an invitation to the study subjects' caretakers to attend 2 adult group asthma sessions based on the A+ Asthma</p>	<ul style="list-style-type: none"> • Costs 	<ul style="list-style-type: none"> • A multifaceted asthma intervention program reduced symptoms and was cost-effective in inner-city children with asthma. In children with more severe disease, the intervention was substantially more effective and reduced health care costs compared with the control children.

		<p>program. Children were invited to attend 2 child-only group sessions that provided the same information as that given to the care givers but delivered at an age-appropriate educational level</p> <p><i>Mode:</i> individual and group <i>Personnel:</i> master social workers <i>Delivery method:</i> face-to-face <i>Duration:</i> began within 2 months after baseline assessments, lasted for 12 months</p>		
Asthma	RCT (24), control group: usual care	<p>Intervention: Asthma self-management <i>Description:</i> self-management patients received education and training of skills <i>Mode:</i> individual <i>Personnel:</i> family physician <i>Delivery method:</i> face-to-face and written material <i>Duration:</i> four visits to the practice scheduled within a period of three months</p>	<ul style="list-style-type: none"> • Costs • QALY 	<ul style="list-style-type: none"> • Based on these results, the authors concluded that guided self-management was a safe and efficacious alternative approach compared with usual care provided in Dutch primary care • When all costs were included, self-management was cost-effective in terms of outcomes. The probability that self-management was cost-effective relative to usual care in terms of QALYs was 52%
Asthma	RCT (3), control group: standard education	<p>Intervention: Intensive asthma education program <i>Description:</i> the program consisted of information and education on healthy environments, avoidance of triggers and compliance with medication <i>Mode:</i> individual <i>Personnel:</i> asthma nurse <i>Delivery method:</i> face-to-face, video material, telephone, booklet <i>Duration:</i> patients were contacted within 24 h of admission, follow-up by telephone one week after discharge</p>	<ul style="list-style-type: none"> • Emergency Department visits • General Practitioner visits • Hospitalization 	<ul style="list-style-type: none"> • The intervention had statistically significant reductions in the number of visits to the Emergency Department and the number of hospitalizations
Asthma	Longitudinal (42), control group: no	<p>Intervention: The Asthma Self-Management Program <i>Description:</i> the intervention was designed as an educational and behavioral change program for people with asthma, regardless of disease severity. The overall intent of the program was to increase participants' knowledge and self-efficacy, to improve self-management skills, and to enhance participants' quality of life. It was anticipated that improvements in self-management would lead to better control of the disorder and to a decrease in avoidable health care events, such as inpatient and emergency department visits <i>Mode:</i> individual and group <i>Personnel:</i> health care professionals <i>Delivery method:</i> face-to-face and telephone</p>	<ul style="list-style-type: none"> • Hospitalization • Emergency Department visits • Outpatient visits 	<ul style="list-style-type: none"> • These results showed improvements in health resource use (declined hospitalizations, number of Emergency Department visits, and scheduled physician and clinic visits) • In keeping with the educational/behavioral objectives of the program, participants' appropriate use of health care resources improved and was sustained for

		<i>Duration:</i> 8 weeks of classroom training and 2 years of scheduled follow-up surveys and phone calls		years after program completion
Asthma	RCT (5), control group: standard care and education	<p>Intervention: Intensive Patient Education</p> <p><i>Description:</i> the intervention included repetition of self-management instructions, principles of asthma treatment and use of drugs</p> <p><i>Mode:</i> individual and group</p> <p><i>Personnel:</i> nurses and physiotherapist</p> <p><i>Delivery method:</i> face-to-face</p> <p><i>Duration:</i> every third month during the first year</p>	<ul style="list-style-type: none"> • Costs • Productivity (risk for sickness days) 	<ul style="list-style-type: none"> • The unscheduled healthcare costs significantly higher in the control group than in the intervention group • The relative risk for sickness days due to asthma was lower in the intervention group than in the control group • However, because there was no significant difference between groups in any other variable or in total costs over 5 years, the increase in cost-effectiveness could not be calculated • The intervention showed a consistent tendency of being less costly in the long run
Asthma	Controlled Clinical Trial (12), control group: usual care	<p>Intervention: Comprehensive Intervention Program</p> <p><i>Description:</i> the teaching plan included recognition of asthma triggers, environmental control, symptoms and early warning signs, medication usage and side effects, use of spacer devices and peak flow meters if appropriate, and medical management of asthma exacerbations. Identification of specific triggers for each child was emphasized to the families, and use of holding chambers was reviewed at each visit. During follow-up visits, asthma education was reinforced by both the physician and the asthma outreach nurse. On a monthly basis, the asthma outreach nurse contacted each intervention family to inquire about the health status of the asthmatic child, review medication administration, refill prescriptions, schedule follow-up visits, and assist with transportation as needed</p> <p><i>Mode:</i> individual</p> <p><i>Personnel:</i> physician and the asthma outreach nurse</p> <p><i>Delivery method:</i> face-to-face and written material</p> <p><i>Duration:</i> individual education during the initial allergy clinic visit, and follow-up on a monthly basis</p>	<ul style="list-style-type: none"> • Emergency Department visits • Hospitalizations • Costs 	<ul style="list-style-type: none"> • In the year before the study, there were no significant differences between intervention and control children • Emergency Department visits (mean, 3.5 per patient), hospitalizations (mean, 0.6 per patient) and health care charges (\$2,969 per patient) • During the study, Emergency Department visits decreased by 1.7 per patient in the intervention group compared to controls, while hospitalizations decreased to a mean of 0.2 per patient in the intervention group and 0.5 in controls • Average asthma care charges decreased to \$721/child/year in the intervention group and \$178/patient/year in the control group

Chronic pain (low back pain)	RCT (36), control group: usual treatment in primary care	<p>Intervention: Early intervention with a light mobilization</p> <p><i>Description:</i> they were interviewed and examined by a treatment team. Special attention was given to the description of daily activities and the restrictions caused by low back pain, in addition to psychosocial conditions at home and at work. Unless symptoms and clinical findings indicated any serious spinal disease, the patients were informed about the good prognosis and the importance of staying active to avoid development of muscle dysfunction. They were encouraged to take daily walks. All the patients were advised and instructed individually by the physiotherapist. The patients were encouraged to contact the Spine Clinic whenever they wanted.</p> <p><i>Mode:</i> individual</p> <p><i>Personnel:</i> physician and physiotherapist</p> <p><i>Delivery method:</i> face-to-face</p> <p><i>Duration:</i> patients were invited to the clinic within week 12 of sick leave.</p>	<ul style="list-style-type: none"> • Costs • Productivity (sick days) 	<ul style="list-style-type: none"> • For patients with low back pain, a simple early intervention had economic gains for society. The effect occurred during the first year after intervention. • Over the 3 years of observation, the intervention group had significantly fewer sickness compensation days than the control group. This difference is caused by a more rapid return to work during the first year. • There was no significant difference for the second or third year.
Chronic pain (neck and back pain)	Observational study (84), control group: two matched control groups with usual care	<p>Intervention: Work-oriented rehabilitation Program 1)</p> <p><i>Description:</i> program 1 was based on orthopedic manual therapy, fitness exercise and job training at the workplace. The program was an individualized rehabilitation programme focusing on functional training and treatment, work-place visits, and job training at the workplace. The emphasis was on individual training programs, and on learning a functional use of the body. Appointment with a social worker was offered in the event of psychosocial problems.</p> <p><i>Mode:</i> individual</p> <p><i>Personnel:</i> physiotherapists trained in orthopedic manual therapy and social worker</p> <p><i>Delivery method:</i> face-to-face</p> <p><i>Duration:</i> average rehabilitation time was four-five months. Time taken per day varied from less than 1 h/day to full days. The total average time spent per patient was 42.5 h, added to 120 h of job training at the workplace</p> <p>Program 2)</p> <p><i>Description:</i> program 2 was focused on increasing function and developing coping strategies in accordance with cognitive-behavioral approaches. The physical training was to a great extent based on specific movements in the participant's professional work. The rehabilitation included individual functional training and treatment, work technique and ergonomics, body awareness training, exercise, back school, pain management and preventive care, self-efficacy training and relaxation.</p>	<ul style="list-style-type: none"> • Costs • Productivity (days of sickness) 	<ul style="list-style-type: none"> • Full-time work-oriented multidisciplinary program is a cost-effective form of rehabilitation for individuals suffering from non-specific neck pain. • Interventions should optimally be initiated within the first 2 weeks of sickness absence.

		<p><i>Mode:</i> group <i>Personnel:</i> multidisciplinary <i>Delivery method:</i> face-to-face <i>Duration:</i> the rehabilitation was introduced by a 4-week period, with scheduled activities 8 h a day, 5 days a week. This was followed by a period of about 5 months during which activities took place outside the clinic in the form of work, training or vocational training. The period was concluded by 2 days of monitoring at the clinic where the plans were checked.</p>		
Chronic pain (low back pain)	RCT (12), control group: usual care, followed by General Practitioner	<p>Intervention: Active Exercise, Education, and Cognitive Behavioral Therapy for Persistent Disabling Low Back Pain <i>Description:</i> the main features of the program included problem solving, pacing and regulation of activity, challenging distorted cognitions about activity and harm, and helping patients to identify helpful and unhelpful thoughts about pain and activity. This was achieved through group discussion, the use of case vignettes, and practical (physical) activities <i>Mode:</i> group <i>Personnel:</i> physiotherapists <i>Delivery method:</i> face-to-face <i>Duration:</i> eight 2-hour group sessions over a 6-week period</p>	<ul style="list-style-type: none"> • Costs • QALY 	<ul style="list-style-type: none"> • The cost of the intervention was an incremental cost-effectiveness ratio of \$8,650 per quality-adjusted life year • These results have shown that small improvements in general health were achieved, which, given the interventions were relatively inexpensive, prove to be cost-effective
Chronic pain (low back pain)	RCT (12), control group: usual care and some education (see description)	<p>Intervention: Back Skills Training Program (Best) <i>Description:</i> this cognitive behavioral intervention targeted behaviors and beliefs about physical activity and avoidance of activity. Training consisted of guided discovery, identifying and countering negative automatic thoughts, pacing, graded activity, relaxation, and other skills <i>Mode:</i> group <i>Personnel:</i> physiotherapists, nurses, psychologists, and occupational therapists <i>Delivery method:</i> face-to-face and written material <i>Duration:</i> individual assessment (up to 1.5 h duration) and six sessions of group therapy (1.5 h duration each)</p>	<ul style="list-style-type: none"> • QALY • Costs 	<ul style="list-style-type: none"> • A cognitive behavioral intervention package for low-back pain had a small but important and sustained effect at 1 year on disability from low back pain at a low cost per health-care provider • The additional QALYs gained from cognitive behavioral intervention were 0.099; the incremental cost per QALY was \$2,777.23 and the probability of cost-effectiveness was greater than 90% at a threshold of \$4,665 per QALY
Chronic pain (discectomy or lateral nerve root decompression surgery)	RCT (12), 3 intervention-groups, control group: usual care	<p>Intervention 1: <i>Description:</i> the rehabilitation program intervention consisted of an exercise program. The classes were standardized to a set agreed protocol with clear exercises and progression. They included general aerobic fitness work, stretching, stability exercises, strengthening and endurance training for the back, abdominal and leg muscles, ergonomic training, advice on lifting and setting targets, and self-motivation along with an open group discussion at the end of each</p>	<ul style="list-style-type: none"> • QALY • Costs 	<ul style="list-style-type: none"> • Cost-effectiveness evidence from this study does not support the use of a rehabilitation program over no rehabilitation program for the postoperative management of pain after spinal surgery from the perspective of the English National

		class where problems and concerns could be discussed with the therapist. <i>Mode:</i> group <i>Personnel:</i> physiotherapist <i>Delivery method:</i> face-to-face rehabilitation and booklet <i>Duration:</i> 12 1-hour classes run twice weekly, six to eight weeks after surgery Intervention 2: booklet only Intervention 3: rehabilitation only		Service Economic Evaluation Data
Chronic pain (musculo-skeletal-related pain)	Longitudinal (12), control group: usual care	Intervention: Multiprofessional work-related rehabilitation program for patients on long-term sick-leave <i>Description:</i> the objectives of the clinical rehabilitation program were: (i) return to work; (ii) increased activity level; and (iii) reduced pain intensity. The multiprofessional rehabilitation program included; information, education, pain management, social training, physical exercise, ergonomics and cognitive behavioral <i>Mode:</i> individual <i>Personnel:</i> multiprofessional group <i>Delivery method:</i> face-to-face <i>Duration:</i> 7.5 hours 5 days a week during an 8-week period	<ul style="list-style-type: none"> • Productivity (days of sick leave) • Costs 	<ul style="list-style-type: none"> • The benefit of the program was estimated to be \$5,536.84–10,956.84 per treated patient a year. The total cost of the program was estimated to be \$7878,96 per patient. • Since other studies indicate that a large proportion of the working after on also work after 3 years, we conclude this multiprofessional rehabilitation program most likely generate substantial net economic gains
Chronic pain (low back pain)	RCT (12), control group: usual treatment	Intervention: Cognitive patient education <i>Description:</i> themes: 1) perception of pain, 2) pain physiology, 3) continuation of pain after apparent recovery from initial injury, 4) draw any conclusion from the education and implement it in his or her own health behavior <i>Mode:</i> group <i>Personnel:</i> general practitioners and physiotherapists <i>Delivery method:</i> face-to-face <i>Duration:</i> four lessons	<ul style="list-style-type: none"> • QALY • Costs • Productivity (sick leave) 	<ul style="list-style-type: none"> • This study shows health economic as a result of add cognitive education program to usual treatment for patients with subacute and chronic low back pain
Chronic pain (lumbar spinal fusion)	RCT (12), control group: usual care	Intervention: Preoperative cognitive-behavioral patient education (CBT) <i>Description:</i> the program aimed to improve pain coping strategies. Each treatment session was standardized although some flexibility was allowed to meet the participants' needs <i>Mode:</i> group <i>Personnel:</i> multidisciplinary team <i>Delivery method:</i> face-to-face <i>Duration:</i> not reported	<ul style="list-style-type: none"> • QALY • Costs 	<ul style="list-style-type: none"> • One year after the intervention the QALY was significantly better for the CBT. There were no differences in costs. The intervention was cost-effective

COPD	Longitudinal (12), control group: usual care	<p>Intervention: COPD management program <i>Description:</i> program to improve patient screening, diagnosis, and treatment with supplemental education aimed to empowering patients with self-management skills, and thereby improving their quality of life <i>Mode:</i> individual <i>Personnel:</i> disease management nurse <i>Delivery method:</i> face-to-face, telephone, written material <i>Duration:</i> not reported</p>	<ul style="list-style-type: none"> • Hospitalization • Emergency Department visits • General Practitioner consultations • Costs 	<ul style="list-style-type: none"> • At the conclusion of the program, paid charges for the intervention were significantly lower (P<0.001) compared to the control group • Primary care physician visits were also significantly lower (P<0.05) greater in the intervention group than in the control group • Although not statistically significant, hospital admissions, bed-days, emergency department visits showed downward trends in the intervention group
COPD	Longitudinal (22), control group: no (pre- and posttest)	<p>Intervention: Integrated interdisciplinary care <i>Description:</i> the COPD nurse navigator sees patients with or without the physician depending on patient needs. She provides education to patients and their caregivers based on the 'Living Well with COPD' program and helps patients cope with their illness through partnered disease management. She is available to answer questions, assess the need for an action plan or arrange for further assessment. Central to the interdisciplinary program is the nurse-physician partnership based on collaboration and communication. The interdisciplinary team also includes a smoking-cessation counselor who is available during clinic hours <i>Mode:</i> individual and group <i>Personnel:</i> advanced practice nurse <i>Delivery method:</i> face-to-face, telephone, e-mail and written material <i>Duration:</i> not reported</p>	<ul style="list-style-type: none"> • Emergency Department visits • Hospitalization • Costs 	<ul style="list-style-type: none"> • Following nurse navigator intervention, significantly more patients experienced a decrease in the number of respiratory-care emergency department visits (P<0.05), number of respiratory hospitalizations, total hospital days, and respiratory admissions (P<0.001), number of hospitalizations, and total hospital admissions (P<0.05). Financial model estimated annual savings in excess of \$260,000.
COPD	RCT (6), control group: consultation or usual care	<p>Intervention: SPACE FOR COPD <i>Description:</i> self-management program for activity, coping and education. Acquisition of skills is promoted through goal-setting strategies, coping planning and case studies <i>Mode:</i> individual <i>Personnel:</i> physiotherapist <i>Delivery method:</i> face-to-face, telephone and written material <i>Duration:</i> 6 weeks, participants received two telephone contacts at 2 and 4 weeks into the program from the physiotherapist, with the aim of reinforcing skills and providing encouragement to progress</p>	<ul style="list-style-type: none"> • QALY • Costs 	<ul style="list-style-type: none"> • The results suggest that the intervention is not only less costly and more effective than usual care • The probability of the intervention being cost-effective was 97% at a willingness to pay threshold of \$27,866/QALY gained

COPD	RCT (12), control group: followed by General Practitioner	<p>Intervention: Patient education program <i>Description:</i> the main issues were the components of bronchial obstruction, prevention of attacks, the effects of anti-obstructive medication, self-assessment and self-management, treatment plans and physiotherapy <i>Mode:</i> individual and group <i>Personnel:</i> specially trained nurse and physiotherapist <i>Delivery method:</i> face-to-face and written material <i>Duration:</i> two 2-h group sessions on two separate days, 1 week apart</p>	<ul style="list-style-type: none"> • General Practitioner visits • Proportions in need of General Practitioner visits • Costs 	<ul style="list-style-type: none"> • Patient education the need for General Practitioner visits 85% (from 3.4 to 0.001) and kept a proportion independent of their General Practitioner during the 12-month follow-up, compared to no education (73% and 15%, respectively) • Patient education the need for relief medication from 125 Defined Daily Doses and improved patient satisfaction with handling of their General Practitioner • The control and intervention groups incurred mean total costs of \$2,952.52 and \$1,572.70 per patient, respectively. For every USD spent on patient education there was a saving of 4 Number Needed to Educate to make one person satisfied with their GP was 4.5 and a saving of \$1,572.70 with a concomitant saving of \$1,572.70
COPD	Longitudinal (12), control group: not participating in pulmonary rehabilitation	<p>Intervention: The Caritas Program <i>Description:</i> the program is grounded on 10 key components of rehabilitation: breathing exercises, education, endurance training, upper extremity conditioning, psychosocial support, adaptations in activities of daily living, relaxation techniques, nutritional counseling, inspiratory muscle conditioning, and interval training <i>Mode:</i> individual and group <i>Personnel:</i> respiratory therapists perform the major role with contributions by physiotherapists, recreation therapists, dieticians, pharmacists and pulmonary physicians <i>Delivery method:</i> face-to-face <i>Duration:</i> six weeks (three days a week) or eight weeks (two days a week). Each class has 12 enrollees and lasts 2 1/2 hours</p>	<ul style="list-style-type: none"> • HRQoL • Hospitalization • Emergency Department visits • Costs 	<ul style="list-style-type: none"> • Over one year, pulmonary rehabilitation was associated with a 50% reduction in health service utilization, reduced direct costs, and improved health status of COPD patients • The savings arose because of reduced Emergency Department visits and days spent in hospitals • Patients with mild symptoms experienced the largest benefits from rehabilitation program

COPD	RCT (24), control group: usual care	<p>Intervention: INTERdisciplinary COMMunity-based COPD management (INTERCOM)</p> <p><i>Description:</i> the core elements of the INTERCOM program were exercise training, education, nutritional therapy and smoking cessation counseling</p> <p><i>Mode:</i> individual and group</p> <p><i>Personnel:</i> physiotherapists, respiratory nurses, dietician</p> <p><i>Delivery method:</i> face-to-face</p> <p><i>Duration:</i> four months</p>	<ul style="list-style-type: none"> • QALY • Costs 	<ul style="list-style-type: none"> • The INTERCOM group gained 0.08 more QALYs per patient, but a high number of exacerbations (0.84) • Mean total 2-year costs were higher for INTERCOM than usual care, which resulted in an incremental cost effectiveness ratio of \$23.84 per additional patient with a respiratory improvement in 1 year • The cost per QALY was moderate, but within the range of that considered to be acceptable
COPD	RCT (12), control group: usual care	<p>Intervention: Self-management program</p> <p><i>Description:</i> the goal of the self-management education program was to increase the patients' self-efficacy to manage or avoid breathing difficulty while participating in certain activities</p> <p><i>Mode:</i> individual</p> <p><i>Personnel:</i> hospital pharmacist and nurse educator</p> <p><i>Delivery method:</i> face-to-face and telephone</p> <p><i>Duration:</i> 60-minute-long, one-on-one teaching before discharge and follow-up with a 20 min telephone call at 3 and 9 months, and a 30 min outpatient visit at 6 and 12 months</p>	<ul style="list-style-type: none"> • QALY • Costs • General Practitioner visits • Emergency Department visits • Hospitalization 	<ul style="list-style-type: none"> • The self-management education program was found to be highly effective compared to usual care • The mean difference in costs and effects of the self-management education program compared to usual care were -\$2,539.19 (95% CI: -\$109.19) and 0.000 (95% CI: 0.000-0.128) • Thus the intervention was the dominant strategy as it was both less costly and more effective than usual care. The probability of the intervention being cost-effective was 95% at a threshold of \$32,049.91/QALY
COPD	RCT (12), control group: usual care	<p>Intervention: COPE self-management program</p> <p><i>Description:</i> the self-management education course was primarily designed to achieve behavioral change and to acquire self-management skills using the Attitude, Social Support and Self-efficacy model as theoretical concept</p> <p><i>Mode:</i> group</p> <p><i>Personnel:</i> physiotherapist</p> <p><i>Delivery method:</i> face-to-face and written material</p> <p><i>Duration:</i> five two-hour group sessions. Four sessions were given with a one-week interval and the last (feedback) session was given three months after the fourth session</p>	<ul style="list-style-type: none"> • QALY • Costs 	<ul style="list-style-type: none"> • The self-management program is not a treatment option for moderate to severe COPD patients who rate their HRQoL relatively low • The program was not as expensive as usual care and had no measurable beneficial effects

COPD	Longitudinal (12), control group: usual care	<p>Intervention: Integrated care program <i>Description:</i> integrated care program that comprised two components: (i) a patient-centred intervention that provided three 1-h group sessions of self-management education; and (ii) an organization-based intervention involving case management. The educational content of these sessions was based on the seven modules of the 'Living Well with COPD'. Patients also received one motivational interview about adopting an active lifestyle, and were given a written action plan that they could use in the event of an exacerbation. Case management involved a nurse case-manager who: (i) referred patients to an optional COPD aftercare program; (ii) informed the primary physician, pulmonologist and pharmacist of the treatment plan; and (iii) provided patients with access to a telephone call center from where they would be given treatment advice in the event of worsening symptoms <i>Mode:</i> individual and group <i>Personnel:</i> specialist nurse <i>Delivery method:</i> face-to-face, telephone and written material <i>Duration:</i> two days prior to discharge from hospital</p>	<ul style="list-style-type: none"> • Hospitalization • Emergency Department visits 	<ul style="list-style-type: none"> • An integrated care program combining management education and case-management showed lower proportion of re-hospitalization • Subgroup analysis revealed that the integrated care program prevented more related hospitalizations in women compared to men
COPD	RCT (12), control group: usual care	<p>Intervention: Supervised exercise sessions combined with self-management education program <i>Description:</i> the program emphasized on the acquisition of self-management skills: to promote smoking cessation, encourage prompt management of acute exacerbation, ensure correct inhaler techniques, ensure right secretion removal techniques, optimize nutrition and promote active lifestyle (particularly exercise). After each educational session within the same group, participants performed the usual exercise program used in the laboratory <i>Mode:</i> group <i>Personnel:</i> health professional and exercise trainer <i>Delivery method:</i> face-to-face <i>Duration:</i> eight lectures to a rate of two sessions (i.e. 2 h per session) per week for four weeks</p>	<ul style="list-style-type: none"> • Costs 	<ul style="list-style-type: none"> • The present hospital-based intervention combining supervised exercise with self-management education provides significant decrease of COPD medication costs compared to usual care
COPD	RCT (Pilot) (6), control group: usual care	<p>Intervention: Better Living with Long term Airways disease <i>Description:</i> the intervention, was a new disease-specific adaptation of the generic Chronic Disease Self-Management Program. The course addressed five core self-management skills: defining the problem, decision making, finding and using resources, forming partnerships with healthcare providers, and taking action (making a short-term action plan and acting on it) <i>Mode:</i> group</p>	<ul style="list-style-type: none"> • QALY • General Practitioners visits • Emergency Department visits • Outpatient visits • Hospitalization • Costs 	<ul style="list-style-type: none"> • The results of this study suggest that a specific version of self-management course potentially cost effective • The costs of the intervention did not appear to be offset by decrease in the use of healthcare services over 12 months. However

		<p><i>Personnel:</i> two trained lay (peer) tutors (at least one of whom had COPD) and a small health professional component</p> <p><i>Delivery method:</i> face-to-face</p> <p><i>Duration:</i> 3-hour session once a week for 7 weeks</p>		<p>moderate benefit</p> <p>related quality of demonstrated health</p> <p>replicated in a large definitive study, intervention is highly likely to be cost effective using the threshold of \$31,683.85–47,000 per QALY</p>
Diabetes Type 2	Longitudinal (20 years estimate), control group: usual care	<p>Intervention: The University of Texas Community Outreach Intervention</p> <p><i>Description:</i> diabetes education and self-management program aimed at increasing participants' ability and self-efficacy to manage their diabetes</p> <p><i>Mode:</i> individual and group</p> <p><i>Personnel:</i> trained community health workers and nurse educator</p> <p><i>Delivery method:</i> face-to-face</p> <p><i>Duration:</i> Not reported</p>	<ul style="list-style-type: none"> • Costs • QALY 	<ul style="list-style-type: none"> • The incremental effectiveness ratio of the intervention ranged from \$10,995 to \$33,300 per QALY gained when compared with usual care • The intervention was particularly cost-effective for adults with high glycemic levels. These results are robust to changes in multiple parameters
Diabetes Type 2	RCT (42), 2x2 groups, control group: no patient education	<p>Intervention: The Diabetes Structured Education Courses for People with Type 2 Diabetes</p> <p><i>Description:</i> diabetes education and self-management program aimed at increasing participants' ability and self-efficacy to manage their diabetes</p> <p><i>Mode:</i> group</p> <p><i>Personnel:</i> trained educators</p> <p><i>Delivery method:</i> face-to-face and written material</p> <p><i>Duration:</i> four 90- to 120-min weekly teaching units and a reinforcement session at six months.</p>	<ul style="list-style-type: none"> • Hospitalizations • Drug consumption • Physician office visits 	<ul style="list-style-type: none"> • Maximal effect at low economic cost was achieved when education was delivered simultaneously to people with diabetes and their health care providers; i.e. when both sides share common goals • In a primary care setting, educational intervention combined with comprehensive coverage resulted in short-term improvement in clinical, metabolic, and psychological outcomes. This was the best cost-effectiveness ratio
Diabetes	Longitudinal (12), compared to reference group (usual care)	<p>Intervention: Multidisciplinary Intensive Diabetes Education Program (MIDEP)</p> <p><i>Description:</i> the program aims to empower patients to set and attain their own treatment goals. MIDEP highlights a range of diabetes-related topics and has sessions on self-management, diet, exercise, daily activities and employment, psychosocial aspects of diabetes and behavioral coping strategies</p> <p><i>Mode:</i> individual and group</p> <p><i>Personnel:</i> diabetes nurse specialist, an endocrinologist, a dietician, a social worker, a psychologist, a physiotherapist, an occupational therapist and an activity therapist</p> <p><i>Delivery method:</i> face-to-face</p> <p><i>Duration:</i> MIDEP comprises a core module of 10 whole days of group sessions and some</p>	<ul style="list-style-type: none"> • Costs 	<ul style="list-style-type: none"> • After 1 year the cost remained higher than the reference group, but the reduction in costs outweighed the intervention cost • Besides the immediate reduction in diabetes-related costs found in the present study, improved glycemic control may reduce future costs of diabetic complications

		individual support in a 10-week period. Follow-up visits take place at 6 and 12 weeks and 1 year after the core module		
Diabetes Type 2	RCT (12), control group: usual care	<p>Intervention: Diabetes group education program</p> <p><i>Description:</i> The program focused on: what is diabetes, lifestyle modification, understanding the medication, and avoiding complications. Each session was designed to be delivered in a guiding style that was derived from motivational interviewing. The sessions were structured in a way that encouraged an exchange of information while providing a comprehensive and systematic approach to the topics</p> <p><i>Mode:</i> group</p> <p><i>Personnel:</i> health communicators (trained)</p> <p><i>Delivery method:</i> face-to-face</p> <p><i>Duration:</i> four sessions each lasting up to 60 min</p>	<ul style="list-style-type: none"> • QALY • Costs 	<ul style="list-style-type: none"> • This structured education program is cost-effective • The incremental effectiveness ratio of the intervention, based on the assumption that the effect would recur even if not maintained, was 1.2 /QALY gained
Diabetes Type 2	Longitudinal (12), control group: patients on waiting list	<p>Intervention: The Disease Self-Management Education Program</p> <p><i>Description:</i> empowerment-based multidisciplinary diabetes self-management education. The aim was to improve the patient's self-management capacity</p> <p><i>Mode:</i> group</p> <p><i>Personnel:</i> nurses, dietitians, physiotherapists and general practitioners. An endocrinologist supported the team performing the role of consultant</p> <p><i>Delivery method:</i> face-to-face</p> <p><i>Duration:</i> three modules (totally 28 hours) covering a period of 12 months</p>	<ul style="list-style-type: none"> • Costs • General Practitioner visits 	<ul style="list-style-type: none"> • Number of visits to General Practitioner declined • The extra costs for the Disease Self-Management Education Program are minor such an intervention is most likely result in a change toward a saving situation, considered in a budget costing perspective
Diabetes Type 2	Longitudinal (4), control group: no	<p>Intervention: Integrating the Registered Nurse-Certified Diabetes Educator into the Patient-Centered Medical Home</p> <p><i>Description:</i> the intervention included a personalized assessment—including personalized health goals. Use of motivational interviewing—to identify patient needs and uncover potential barriers to improved outcomes</p> <p><i>Mode:</i> individual and group</p> <p><i>Personnel:</i> registered nurse-certified diabetes educator</p> <p><i>Delivery method:</i> face-to-face, telephone and e-mail</p> <p><i>Duration:</i> four patient-centered monthly group sessions, and four individual follow-up sessions</p>	<ul style="list-style-type: none"> • Costs 	<ul style="list-style-type: none"> • Results of the study indicated that including the registered nurse-certified diabetes educator in the patient-centered medical home is effective
Heart Disease	RCT (12), control group: usual care	<p>Intervention: Comprehensive hospital discharge and outpatient heart failure management program</p> <p><i>Description:</i> 1) Patient education: Prior to discharge, the research cardiac nurse had an in-depth interview with the patient and caregivers. Specifically, the nurse assessed the patient's knowledge of the disease, ability to identify signs</p>	<ul style="list-style-type: none"> • Costs • Hospitalization 	<ul style="list-style-type: none"> • The results show the intervention can significantly reduce the time to first event and hospital readmissions. Patients hospitalized and decompensated

		and symptoms of heart failure worsening, and the most common responses to the situations of deterioration. 2) A visit with the primary care physician was scheduled within 2 weeks of discharge. The aims of this visit were to monitor patients' clinical progress, identify incipient physical signs of decompensation, and reinforce the educational knowledge. 3) Regular follow-up outpatient <i>Mode:</i> individual <i>Personnel:</i> cardiologist, nurse, heart failure specialist, primary care physician <i>Delivery method:</i> face-to-face, written material and telephone <i>Duration:</i> prior to discharge, within two weeks of discharge, regular follow-up outpatient visits		failure, and reduced management
Heart disease (ischemic heart disease and heart failure)	RCT (5), control group: rehabilitation patients with standard education	Intervention: Learning and coping in cardiac rehabilitation <i>Description:</i> the program is a health pedagogical strategy that builds on situated and inductive teaching with high involvement of the participants. The educational tools rely on Illeris' learning triangle and motivational interviewing whereby the health professional focuses on the theories of coping, 'stages of change' and 'self-efficacy' <i>Mode:</i> individual and group <i>Personnel:</i> health care professionals and experienced patients <i>Delivery method:</i> face-to-face <i>Duration:</i> eight weeks and followed for additional three months. Three training sessions and one education session per week	<ul style="list-style-type: none"> • QALY • Costs 	<ul style="list-style-type: none"> • This study demonstrated that there were no significant differences either costs or outcomes between learning coping strategies and standard educational methods from a societal perspective during 18 months follow-up • The authors concluded that teaching learning coping strategies was cost-effective in the short term
Heart disease	RCT (6), control group: usual care	Intervention: Discharge Education <i>Description:</i> the nurse educator discussed heart failure-specific information that covered the basic principles of the causes of heart failure and rationale for pharmaceutical therapies. The role of dietary restriction of sodium and limitation of dietary free water intake was also covered. Additionally, the patient education session contained the rationale for self-care behaviors <i>Mode:</i> individual <i>Personnel:</i> nurse educator <i>Delivery method:</i> face-to-face and written material <i>Duration:</i> 60 minutes	<ul style="list-style-type: none"> • Hospitalization • Costs 	<ul style="list-style-type: none"> • Subjects randomized to receive the teaching session had fewer hospitalizations or deaths at follow-up than did control subjects • Costs of care, including the cost of the intervention, were lower in patients receiving the education intervention than in control subjects
Heart disease	RCT (12), control group: usual care, but also received the manual provided to the intervention group	Intervention: The Heart Failure Plan <i>Description:</i> the Heart Failure Plan is a cognitive behavioral self-management program. The first session covered an overview of the Heart Plan; introduction to the pocket diary; a discussion of the patient's risk factors, assessment of whether the patient had any cardiac misconceptions and a discussion of patient's medication. Participants selected which part of the program they wished to follow but were encouraged to select a	<ul style="list-style-type: none"> • QALY • Hospitalization 	<ul style="list-style-type: none"> • The addition of manual facilitation to a cognitive behavioral therapy program for patients with heart failure is associated with a significant effect on costs and effectiveness as measured by QALY

		relaxation and walking goal if appropriate for the first week. At the second and subsequent meetings at approximately one, three and six weeks later, a check would be made on the targets <i>Mode:</i> individual <i>Personnel:</i> nurse <i>Delivery method:</i> face-to-face, video and audio material <i>Duration:</i> six, structured one-to-one education sessions		
Heart disease (angina)	Observational (24), control group: no	Intervention: A cognitive-behavioral chronic disease management program <i>Description:</i> not reported <i>Mode:</i> group <i>Personnel:</i> not reported <i>Delivery method:</i> face-to-face <i>Duration:</i> not reported	<ul style="list-style-type: none"> • Emergency • Department visits • Hospitalization 	<ul style="list-style-type: none"> • This study shows cohort of patient complex, chronic implementation cognitive-behavioral chronic disease management program emphasizing rehabilitation significantly reduced hospitalization • The effects are in and sustained
Heart disease	RCT (36), control group: usual care	Intervention: Women Take PRIDE <i>Description:</i> the program sought to enhance overall disease self-management by aiding participants to be more self-regulating. The steps of the self-regulation process are contained in the acronym PRIDE and include: Problem identification; Researching one's routine; Identifying a management goal; Developing a plan to reach it; Expressing one's reactions and establishing rewards for goal achievement <i>Mode:</i> group <i>Personnel:</i> health educator and peer leader <i>Delivery method:</i> face-to-face <i>Duration:</i> 2 1/2 hours during 4 consecutive weeks	<ul style="list-style-type: none"> • Hospitalization • Emergency • Department visits • Costs 	<ul style="list-style-type: none"> • Program participants experienced significantly fewer in-patient hospitalizations and significantly lower patient costs than in the control group • No significant difference in Emergency Department utilization were
Heart disease (myocardial infarction or percutaneous coronary intervention)	RCT (24), control group: conventional therapy without exercise program	Intervention: Cardiac Rehabilitation Program <i>Description:</i> phases: 1) Inpatient ambulating program, 2) outpatient education and exercise program (in each session, there was a 1-hour education class focusing on prevention and treatment of coronary heart disease and risk factor modification, such as smoking cessation, controlling cholesterol and blood pressure, reducing weight, managing stress, and treating contributing medical illnesses such as diabetes and hypertension. This was followed by 2 hours of aerobic exercise training), 3) community-based home exercise program, 4) a long-term maintenance period <i>Mode:</i> individual and group <i>Personnel:</i> cardiologist, physiotherapist, occupational therapist <i>Delivery method:</i> face-to-face and telephone	<ul style="list-style-type: none"> • Costs • Hospitalization • QALY 	<ul style="list-style-type: none"> • The intervention highly cost effective net gain in QALY direct health care costs were reduced, were primarily related to reduction of the subsequent need for elective percutaneous coronary intervention

		<i>Duration:</i> phases: 1) from seven to 14 days, 2) twice-weekly lasting 8 weeks, 3) 3 months, 4) lasted until the end of the second year after recruitment		
Mental illness (panic disorder)	RCT (10), control group: routine care at general practitioner	<p>Intervention: Occupational therapy-led lifestyle approach</p> <p><i>Description:</i> the intervention was delivered in four stages:</p> <ol style="list-style-type: none"> 1. lifestyle review using self-report mood and lifestyle diaries; 2. education to increase patient awareness of the potential negative health effects of some lifestyle behaviours and the health benefits of other lifestyle; 3. specific lifestyle changes were negotiated between the therapist and the patient; 4. monitoring and review of the agreed lifestyle changes and any subsequent change in symptomatology <p><i>Mode:</i> individual <i>Personnel:</i> occupational therapists <i>Delivery method:</i> face-to-face <i>Duration:</i> up to ten intervention sessions over a 16-week period</p>	<ul style="list-style-type: none"> • QALY • Costs 	<ul style="list-style-type: none"> • The intervention is costly than routine practitioner care and 10 months. Significant differences in mental health were found • If the maximum willingness to pay for an additional QALY is \$46,341.06 then there is an 86% chance that the lifestyle intervention will be considered to be for-money over 10 years
Mental illness (bipolar disorder)	RCT (18), control group: comprehensive and longer individual cognitive-behavioral therapy intervention	<p>Intervention: The Life Goals manual</p> <p><i>Description:</i> the program manual includes a key psychoeducational component of 6 didactic sessions, with specific objectives and discussion points designed to elicit group member participation. Given the highly structured and detailed teaching, the group participation did not allow for the type of deep interpersonal sharing characteristic of classic group psychotherapy. Topics include illness recognition, treatment approaches, and coping strategies</p> <p><i>Mode:</i> group <i>Personnel:</i> 4 nurses, 2 psychotherapists, and 1 psychiatrist <i>Delivery method:</i> face-to-face <i>Duration:</i> 6 sessions of 90 minutes</p>	<ul style="list-style-type: none"> • Costs 	<ul style="list-style-type: none"> • Despite longer treatment duration and individualized treatment, cognitive-behavioral therapy did not significantly greater clinical benefit compared to group psychoeducation • Psychoeducation is expensive to provide and requires less clinical training to deliver, suggesting its cost attractiveness
Mental illness (bipolar disorder)	RCT (60), control group: unstructured group meetings with the therapists	<p>Intervention: Group Psychoeducation</p> <p><i>Description:</i> group psychoeducation (no further descriptions)</p> <p><i>Mode:</i> group <i>Personnel:</i> psychologists <i>Delivery method:</i> face-to-face <i>Duration:</i> 21 sessions of group psychoeducation (each session was 1.5 hours long)</p>	<ul style="list-style-type: none"> • Costs • Productivity (number of sick days) • Therapy sessions • Outpatient visits • Emergency Department visits • Number of medications • Hospitalization 	<ul style="list-style-type: none"> • This study demonstrates the importance of long-term overviews of cost versus benefits of adjunctive psychotherapy in bipolar disorders • If viewed only in the short term, the psychoeducation group used more health care resources without clear additional health gain • However, extended follow-up demonstrated

				term advantage psychoeducated individuals, such compared to an unstructured sup group interventi psychoeducation costly and more
Renal disease	Longitudinal (12), control group: standard education program (both group individual)	<p>Intervention: Comprehensive, multidisciplinary rehabilitation program <i>Description:</i> themes: information, theory, practice, physical exercise, stress management, behavior modification, coping, social counseling <i>Mode:</i> group <i>Personnel:</i> physician, physiotherapist, nutritionist, psychologist, social worker, dietary cook <i>Delivery method:</i> face-to-face <i>Duration:</i> 15 h (total)</p>	<ul style="list-style-type: none"> • Costs • Productivity (days in the work force, not at sick leave) 	<ul style="list-style-type: none"> • The intervention effective as well as costly for patients with mild limitation of function. • A comprehensive multidisciplinary rehabilitation program based on an interdisciplinary approach may be effective in keeping patients with mild renal impairment in the work force, when compared with a medically program
Rheumatic disease (osteoarthritis)	RCT (36), control group: receive newsletters	<p>Intervention 1: Social support intervention <i>Description:</i> the social support intervention involved unstructured group discussions prompted by a list of suggested weekly topics aimed at promoting empathy, cohesiveness, participation, and sharing of information and coping techniques between group members <i>Mode:</i> group <i>Personnel:</i> member of staff attended the first meeting <i>Delivery method:</i> face-to-face <i>Duration:</i> 10 weekly 2-hr meetings followed by 10 monthly 2-hr meetings</p> <p>Intervention 2: Education intervention <i>Description:</i> presentations contained information about preventive health behaviors and self-management strategies, in addition to information about when to see a health care provider for ailments related to osteoarthritis. The presentations emphasized appropriate health care usage, which is not always less health care usage. Participants were taught to recognize signs that indicate the need for quick medical attention to avoid future problems, in addition to learning to eliminate unnecessary health care utilization by developing self-management skills <i>Mode:</i> group <i>Personnel:</i> health educators and active involvement of participants <i>Delivery method:</i> face-to-face and written material</p>	<ul style="list-style-type: none"> • Costs • Emergency Department visits • Hospitalization • General Practitioner visits 	<ul style="list-style-type: none"> • Health care costs less in the intervention groups than in the control group • Cost analysis was able to demonstrate that the monetary savings from the intervention greatly outweighed the costs of conducting the intervention

		<p><i>Duration:</i> 10 weekly 2-hr meetings followed by 10 monthly 2-hr meetings</p> <p>Intervention 3: Combination of education and social support intervention <i>Description:</i> the combination intervention included an hour of the educational intervention and an hour of the social support intervention <i>Mode:</i> group <i>Personnel:</i> staff members attended the first hour, no staff members the second hour <i>Delivery method:</i> face-to-face <i>Duration:</i> 10 weekly 2-hr meetings followed by 10 monthly 2-hr meetings</p>		
Rheumatic disease (psoriasis)	RCT (6), control group: usual care	<p>Intervention: Supported Self-Management with Motivational Interviewing <i>Description:</i> the intervention is defined as a collaborative, conversation style for strengthening a person's own motivation and commitment to change <i>Mode:</i> individual <i>Personnel:</i> motivational interview counselor <i>Delivery method:</i> face-to-face, written material and telephone <i>Duration:</i> 45 minutes of motivation interview and 6 follow-up phone calls over the subsequent 12 weeks</p>	<ul style="list-style-type: none"> • QALY • Costs 	<ul style="list-style-type: none"> • The Motivational Interview approach is cost-effective • The intervention was a significant cost saving intervention was costly than treatment as usual • This study found a significant impact of Motivational Interviewing regarding QALY
Rheumatic disease (fibromyalgia)	RCT (12), two intervention-groups, control group: no treatment	<p>Intervention 1: Social support <i>Description:</i> the social support intervention involved group discussions prompted by assigned tasks aimed at promoting empathy and sharing of coping techniques between group members <i>Mode:</i> group <i>Personnel:</i> health professionals attended only the first meeting <i>Delivery method:</i> face-to-face <i>Duration:</i> 10 weekly meetings, followed by 10 monthly meetings, each meeting two hours</p> <p>Intervention 2: Social support and education <i>Description:</i> The social support and education intervention consisted of 1 hour of health education provided in lecture format by professional health educators, followed by 1 hour of social support. During the second hour, no staff members were present <i>Mode:</i> group <i>Personnel:</i> professional health educators <i>Delivery method:</i> face-to-face <i>Duration:</i> 10 weekly meetings, followed by 10 monthly meetings, each meeting two hours</p>	<ul style="list-style-type: none"> • Costs • Hospitalization 	<ul style="list-style-type: none"> • The study did not find a differential change in health care costs between participants in the experimental and control groups

Rheumatic disease (fibromyalgia)	Longitudinal (48), control group: usual care	<p>Intervention: A brief cognitive behaviorally based fibromyalgia treatment program</p> <p><i>Description:</i> group program with focus on stress management, relaxation, sleep hygiene, and difficult day planning. The physical therapist led a group session on the benefits of exercise and helped each participant plan a strategy for starting a stretching, strengthening, and aerobic conditioning program. The occupational therapist focused on activity modification principles of moderate pacing, proper body mechanics, frequent position changes, and appropriate rest/time management, and how to apply these to the home and work environments</p> <p><i>Mode:</i> group</p> <p><i>Personnel:</i> registered nurse, physiotherapist, occupational therapist</p> <p><i>Delivery method:</i> face-to-face</p> <p><i>Duration:</i> four sessions: a 2-hr registered nurse-led education session about fibromyalgia, a 2-hr registered nurse-led session on self-management strategies incorporating cognitive-behavioral principles, a 1-hr physical therapy session, and a 1-hr occupational therapy session</p>	<ul style="list-style-type: none"> • Costs 	<ul style="list-style-type: none"> • Patients with clinically diagnosed fibromyalgia incur direct medical costs about twice that of matched controls. The increased cost is due to the severity of the symptoms and was not impacted by participation in a brief cognitive behaviorally based fibromyalgia treatment program
Skin disease	RCT (6), control group: usual care	<p>Intervention: Coping with itch</p> <p><i>Description:</i> the nurses provide individual sessions at the dermatology outpatient department, while medical treatment by the dermatologists is continued as usual. The program consists of educational and cognitive behavioral interventions, such as individual patient education, awareness training and habit reversal, and relaxation exercises</p> <p><i>Mode:</i> individual</p> <p><i>Personnel:</i> dermatology nurses</p> <p><i>Delivery method:</i> face-to-face</p> <p><i>Duration:</i> not reported</p>	<ul style="list-style-type: none"> • General Practitioner visits • Outpatient visits • Hospitalization 	<ul style="list-style-type: none"> • Most of the expenses associated with the program were incurred during the first 3 months, but the benefits appeared to persist for 60 days with little increase beyond that, thus leading to a favorable incremental cost-effectiveness ratio • The intervention group paid more visits to the dermatology nurse than the control group • At 3 months, 70% of patients experienced favorable results, 70% of them had lower costs. At 9 months, 87% had favorable results, 87% of them had lower costs
Stroke	RCT (12), control group: same type of intervention in the outpatient clinic	<p>Intervention: Short period of rehabilitation in the home setting</p> <p><i>Description:</i> in the home group family or friends and helpers were involved and information was given to them and the patient about the stroke, its consequences and how to deal with them. An occupational therapist and a physiotherapist offered individually tailored training, based on the patient's needs and desires and with focus on activities in their natural context, a top-down</p>	<ul style="list-style-type: none"> • Costs 	<ul style="list-style-type: none"> • The program for the home group seems as good as or better than the outpatient program and the costs associated with the home programs speak for themselves

		<p>approach. The content varied from personal care to shopping and trying out leisure activities. <i>Mode:</i> individual <i>Personnel:</i> multiprofessional team <i>Delivery method:</i> face-to-face <i>Duration:</i> nine hours of training during three weeks</p>		
Stroke	RCT (12), control group: usual care	<p>Intervention: A community-based exercise and education scheme for stroke survivors <i>Description:</i> each session consisted of 1 hour of exercise followed by a short break, and 1 hour of interactive education <i>Mode:</i> group <i>Personnel:</i> local health professionals, volunteers and exercise instructor, supported by a physiotherapist <i>Delivery method:</i> face-to-face <i>Duration:</i> twice a week for eight weeks making a total of 16 sessions</p>	<ul style="list-style-type: none"> • Costs • General Practitioner visits 	<ul style="list-style-type: none"> • Mean cost per patient higher in the intervention group. The difference excluding inpatient care was \$457.23 (95% CI: \$495.85 to \$1410.61) • Fewer General Practitioner visits • The community-based intervention for stroke survivors was a low-cost intervention that was successful in improving physical integration and was maintained at one year when compared to standard care
Unexplained physical symptoms	Longitudinal (12) (data emerged from RCT, estimation over 4 years), control group: wait list	<p><i>Intervention:</i> Coping with the consequences of unexplained physical symptoms <i>Description:</i> the aim of the group training was to improve health-related quality of life <i>Mode:</i> group <i>Personnel:</i> not reported <i>Delivery method:</i> face-to-face <i>Duration:</i> weekly two-hour training was held over a three-month period</p>	<ul style="list-style-type: none"> • QALY • Costs 	<ul style="list-style-type: none"> • The cost-effectiveness of the intervention was estimated over a 30-month time horizon using a multivariable probit model. After 4 years, the group training had a positive effect on health-related quality of life and costs from a societal perspective than the wait-list control • The group training was a dominant strategy, being both more effective and cost saving compared to the wait-list control. At 30 months, the intervention was cost saving • If society is willing to pay \$33,312.66 per quality-adjusted life year (QALY), then the group training was cost saving after 18 months

Table C. Characteristics of interventions and outcomes of health economic evaluations

3.4 Health economic impact

Overall, 46/56 (82.1%) of the studies reported that patient education interventions **resulted in** impact or effects as measured by one or several health economic outcomes. Eight studies (14.3%) found no health economic impact of the interventions [39, 41, 50, 61, 70, 72-74]. In

addition, one study (1.8%) showed only small improvements in QALY[67] and one study (1.8%) found short term effects after 1 year, but no differences at the second and third year[35].

3.4.1 Characteristics of health economic evaluations

Outcome data were gathered from patients, their families, the medical records of hospitals and General Practitioners, health insurance companies, national cost databases, and health and death registries. **How costs were categorized and described in these studies varied greatly.** Direct healthcare costs were often described by using data on hospitalization, number of Emergency Department visits, General Practitioner visits, and **use of medication**, while indirect healthcare costs were measured as costs occurring during life years gained. Direct non-healthcare costs were measured in terms of travelling costs, and indirect non-healthcare costs were measured as loss of time, productivity or wages, or as the monetary value of informal care.

The most widely used health economic evaluations of patient education interventions in the reviewed studies can be classified as cost-utility analysis, often measured in terms of QALY, use of medical services, losses in productivity, direct and indirect healthcare and non-healthcare costs. Data on hospitalization (26/56; 46.4%) and visits to the Emergency Department (18/56; 32.1%) were commonly evaluated. Nineteen (33.9%) of the studies had investigated cost-utility as measured by QALY; several studies had measured visits to General Practitioners (10/56) or outpatient visits (5/56). Nine studies had evaluated loss of productivity, normally measured as days on sick leave. One study had included informal and unpaid care in the economic evaluation [48]. The most typical outcomes and measures are summarized in Table D.

Cost - utility	Quality-adjusted life-years (QALYs)	EuroQol (EQ-5D) Short Form Six Dimension (SF-6D)
Medical service use	Hospitalizations	Bed days/days/nights in the hospital Average length of stay Hospital readmission
	Outpatient visits	Scheduled/unscheduled clinic visits Time spent on outpatient visits
	Emergency Department Visits	Number of visits
	General Practitioner (GP) consultations	Number of visits
Losses in productivity	Sick leave	Days on sick leave
Cost	Direct and indirect healthcare and non-healthcare costs	Program costs Participation costs Hospitalization costs Medical costs Losses in productivity Informal care

Table D. Typical outcomes and outcome measures.

3.4.2 Health economic impact by chronic condition

A classification of the 56 studies by chronic condition is provided in Table E. Of the studies in this review, 20% focused on COPD (11/56), 18% on asthma (10/56), 14% on chronic pain (8/56), 13% on heart disease (7/56), 11% on diabetes (6/56), 7% on rheumatic disease (4/56) and 5% on mental illness (3/56). Two studies included participants across conditions, and two studies included people diagnosed with stroke. In addition, three of the studies included people living with unexplained symptoms, dermatological or renal disease.

Condition	Number of studies	References
Chronic obstructive pulmonary disease (COPD)	11	[43-50, 52, 53]
Asthma	10	[26-34, 79]
Chronic pain	8	[35-42]
Heart disease	7	[60-66]
Diabetes	6	[54-59]
Rheumatic diseases	4	[71-74]
Mental illness	3	[67-69]
Stroke	2	[76, 77]
Across conditions	2	[24, 25]
Skin disease	1	[75]
Renal disease	1	[70]
Unexplained physical symptoms	1	[78]
Total	56	

Table E. Classification of studies by chronic condition.

COPD

In 11 studies, the interventions targeted people living with COPD. Ten of these studies showed statistically significant effects[44-47, 49, 51, 52] or trends toward beneficial effects[43, 48] on outcomes as measured by QALYs, hospitalizations, reduced need for visits to the Emergency Department or the General Practitioner, or better medication compliance. One study found no beneficial effects of a pharmacy-led patient education intervention as measured in QALY[50], and in one study, the effects of the intervention (chronic disease self-management program) did not appear to be matched by a decrease in the utilization of healthcare services[53].

Asthma

Ten studies had investigated the health economic impact of patient education interventions for people (children and adults) diagnosed with asthma[26-34, 79]. All these interventions were cost-effective or had shown favorable effects on health economic outcomes such as declines in hospitalizations, and fewer visits to Emergency Departments, physicians or outpatient clinics. One study[33] found lower risk of sickness days among participants in intervention groups.

Heart disease

Six studies found clear effects in terms of lower costs and/or reduced hospitalization, hospital readmissions or Emergency Department visits for people diagnosed with different types of heart disease[25, 60, 62, 64-66]. Two studies found no significant differences in short term in

favor of the intervention[61, 63]. One of these studies compared education on learning and coping strategies with standard education in cardiac rehabilitation[61].

Chronic pain

Six of eight interventions for persons living with chronic pain were concluded to be cost-effective[35-38, 40, 42, 64]. Three of these studies employed productivity outcomes, and showed significantly fewer days of sick leave than usual care control groups one year after intervention[35, 36, 40]. Two studies found no benefits in terms of QALY[39] and number of days on sick leave[41].

Diabetes

Cost-effectiveness of patient education interventions for people diagnosed with diabetes was investigated in six studies. All these studies found the interventions to be cost-effective, particularly for adults with high glycemic levels [54-59]. Molsted et al.[58] also found that the number of General Practitioner visits declined over time. One of the studies included physician education with patient education in a randomized design in public health, with four structured group education interventions (control group, physician education, patient education and both physician and patient education group). The largest changes and long-term improvements in healthcare costs, clinical, metabolic and psychological outcomes were found in the group where both patients and physicians were educated[55].

Rheumatic disease

One education and social support intervention demonstrated that the **amount which** the intervention saved greatly outweighed the cost of conducting the intervention[71]. Two studies of group-based multidisciplinary patient education interventions for people diagnosed with psoriasis and fibromyalgia did not reveal any differential changes in healthcare costs that were associated with participation in the intervention[73, 74]. One individual intervention involving use of Motivational Interviewing, showed significant cost saving compared to usual care, but found no significant impact regarding QALY[72].

Mental illness

Findings from two studies with extended follow-up demonstrated a long-term advantage for psychoeducational interventions for persons diagnosed with bipolar disorder[68, 69]. Compared to an unstructured support group intervention and cognitive behavioral therapy, group psychoeducation was less costly and more effective over time. A study of an occupational therapy intervention for people diagnosed with panic disorder, found small differences in QALY and an 86% chance that the intervention may be considered to deliver value-for-money over 10 months[67].

3.4.3 Studies with no or short-term health economic impact

Eight of the ten studies with no or short-term health economic impact were RCTs, and two of the studies were longitudinal with control groups. All these interventions were tailored to adults, and six of the interventions were for people diagnosed with rheumatic disease or chronic pain conditions. Participants in two of the studies had a mean age of **65 years**, and in six studies the participants had a mean age between 38 and 47 years. One study did not report participants' age. Two studies had evaluated changes for more than 12 months. Four studies were conducted as part of comprehensive rehabilitation interventions[39, 61, 70, 72], and in two studies, different types of patient education interventions were compared. Six of these studies with no or only short-term health economic impact had measured QALY[39, 41, 50, 61, 67, 72].

4. Discussion and conclusion

4.1 Discussion

4.1.1 General discussion

The main aim of this review was to give a comprehensive and systematic overview of published economic evaluations and the potential health economic impact of patient education interventions for people living with chronic illness. The literature from 2000-2016 was reviewed. Most of the 56 included studies emanated from developed countries in Europe and North America, had an experimental design, and reported changes one-half to one year after intervention. A total of 18201 participants were included, the main diagnoses being COPD, asthma, chronic pain, heart disease and diabetes. Only two studies included participants across conditions.

The aim of patient education in general is more than knowledge transfer and disease control, as it also concerns enabling the participants to understand the illness process, to acquire skills related to medical and disease management, to adjust treatment to their condition and to maintain quality of life[6]. The included interventions in this review were face-to-face interventions. Most of them were group-based or a combination of group and individual interventions, **that were offered** by multidisciplinary teams or by one healthcare provider.

New health interventions are usually associated with increased costs compared with the treatment-as-usual alternative[14]. More than 80% of the studies reviewed found positive impact or effects of patient education interventions as measured by one or several health economic outcomes. The results show that patient education interventions were beneficial in terms of decreased hospitalization, visits to Emergency Departments or General Practitioners, increases in QALYs, or reduced loss of production. Some of this review's results regarding the health economic benefits from participating in patient education **interventions comply with the results of the** few reviews on patient education interventions tailored to patients with COPD, diabetes, arthritis, depression and heart failure[15-19]. These reviews also conclude that more robust evaluations are required to reach sound conclusions and more research is needed to validate the results. Ten studies found only short-term or no health economic impact of the interventions.

4.1.2 Strengths and limitations

This study shares the limitations that are inherent to scoping reviews in general, such as synthesizing studies with different study designs in the same review, and balancing between breadth and depth of analysis[80,81]. First of all, the motivation for conducting this review was to formulate a more standardized and systematic evaluation of patient education interventions in primary and specialized care for people living with chronic illness. The aim was to capture the breadth of studies that have evaluated health economic impact of patient education interventions for patients at any age and with any chronic condition, rather than weighting articles in regard to methods used or impact factor. Therefore we decided not to exclude studies on the basis of methodological characteristics. We adopted Arksey and O'Malley's definition for scoping reviews, and although we have conducted quality assessment of the included studies (Appendix A in Supplementary material), the heterogeneity of studies is a persistent limitation of economic evaluations of patient education interventions, generally acknowledged by researchers within this field, and also encountered in this review.

In this review, we have included studies on patient education interventions for patients with any type of chronic illness. In order to capture as many relevant studies as possible, a large number of synonyms were searched for in the databases; nonetheless, this list of search terms for chronic illness and patient education was not complete or exhaustive. In terms of data extraction, our definition of patient education interventions was intentionally broad, to allow

us to include a wide range of interventions. Several interventions were the topic of multiple papers, but the descriptions were rarely adequate, and the studies varied in terms of origin, target groups, modules and the ways in which healthcare and/or lay participants were involved. In addition, whereas some studies compared the effects or impact of different education interventions, most compared the effects of one intervention with those of “usual care”. The components of “usual care” were in most cases poorly described, which made it difficult to understand and describe the differences. Another limitation is the paucity of information in the published studies on the relationship between demographic characteristics and reported health economic outcomes. Much of what we know from these studies is based on people with western ethnicity. The success of any patient education intervention is likely to be determined by local factors and situations, which are often difficult to model and replicate. Therefore, the general transferability and applicability of the reported study results to clinical practice has not been specifically analyzed in this review.

We included studies published over a long period of time (2000-2016), otherwise not many studies would have been included. Most of the studies reported data related to health economic impact within one year after the intervention, rather than long-term outcomes, which are equally relevant, if not more so. This illustrates the need for additional well-designed studies within this field of research. This review may not have identified all relevant publications, despite our efforts to be as comprehensive as possible. Searches in other literature databases might have identified additional relevant studies, and relevant studies in languages other than English may have been missed. We must also take into account that the proportion of the included studies that reported significant effects of patient education interventions may be inflated due to publication bias. Lastly, given the breadth and comprehensiveness of the study inclusion criteria in this review, it was necessary to compromise and reduce the depth of analysis and validity assessment.

4.1.3 Recommendations for future research

To improve the comparability and interpretability of future studies, we recommend more thorough descriptions of the patient education interventions, the degree to which they were implemented, and of usual care conditions. The descriptions of patient education interventions could benefit from being described and structured according to applicable Medical Research Council guidelines or the Template for Intervention Description and Replication Checklist[82,84].

Researchers within the field of patient education recommend that outcomes should be defined stringently, tailored to the goal and content of the interventions, and to the patients’ needs[7]. In addition, studies should use more rigorous study designs to give a clear understanding of the impact and value of the interventions. To improve the transparency of these studies, improved reporting on the costs that are included in the economic evaluations is recommended. There is also a great need of studies that provide information about incremental healthcare costs. Most of the studies in this review have evaluated the economic impact within the healthcare sector. Many interventions **may have** impact outside healthcare, and a societal perspective in the studies would be relevant to policy makers.

There are other future research needs as well: identifying which patients in a socio-economic perspective that benefit most (or do not benefit) from participating in patient education interventions; examining the health economic impact of patient education interventions tailored to family caregivers, and of online interventions; **looking at** differences across age; identifying the appropriate time horizon on which to measure health economic impact; researching occurring interventions and how long-term benefits can be maintained; **investigating** societal effect of informal care; studying interventions that combine group and

individual counseling; and researching interventions intended for patients in need of more integrated and coordinated care.

4.2 Conclusion

This scoping review has given an overview of studies of various patient education interventions for people living with chronic illness, and has highlighted the health economic impact of these interventions. The results of this review strongly suggest that patient education interventions, regardless of study design and time horizon, are beneficial in terms of decreased hospital admissions, hospitalization, visits to Emergency Departments or General Practitioners, increases in QALYs, or reduced loss of production. Still, this is a relatively new area of research, and given the prevalence of chronic conditions and demand for effective interventions, there is a great need for more robust economic evaluations and more research on different types of patient education interventions.

Health economics has an important role to play in evaluation of patient education interventions, but research on this aspect can only be furthered if several relevant disciplines, user representatives and researchers work together to improve and harmonize the research methodology.

4.3 Practice implications

The results from this scoping review should give important input to political decision makers and health administrators. The most salient finding is that patient education has the power to reduce the cost of healthcare[25]. There is a **great** diversity of patient education interventions, and although evaluating complex, emergent interventions is a challenge, streamlining them merely to make them more amenable to standard cost-benefit evaluations are ill-advised. This, however, brings us back to the **difficulties concerning** what to measure and value. As Rogers and co-workers point out[83], it would be a destructive measurement error to reduce what we *do* to what we can *measure*. Instead we need more knowledge about how we can evaluate the health economic impact of patient education interventions, and we need to improve the quality of our measurements.

The clinical and policy implications of this review, which shows that patient education interventions for people living with chronic illness have favorable health economic impact, are that various types of these interventions should be implemented and reimbursed. Such implementation **will enable** patients to live a more complete life despite **their** chronic illness. Patient education interventions that work well, and do so at a reasonable cost, are of increasing interest among healthcare policy makers. In bringing all this evidence together, we hope that healthcare providers and managers can use this information as part of a broader decision-making process, for guidance in discussions of the quality of care and of how to provide appropriate and optimal cost-effective patient education interventions.

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