

Online supplementary material. Data abstraction of the included studies. The data were categorized according to country context, type of economic evaluation analysis and its design, perspective, time horizon, study population, alternatives compared, outcomes, costs, ICER, and QHES score. Prices were adjusted to 2012 International dollars (Int\$). ICERs that are 1) bolded indicates it is within the WTP threshold reported in that study; 2) marked * indicates the intervention is dominant. ICERs that are not bolded does not mean that intervention is cost-effective.

Main author, Year, Country context	Economic evaluation analysis design (Trial-based/Modeling), Type of economic evaluation	Perspective, Time horizon	Study population	Alternatives compared	Results of the economic evaluation			QHES score(s) (%)
					Outcomes	Costs	ICER (unless indicated otherwise)	
Bolton M. B., 1991, United States of America (30)	Trial-based, CCA	Not specified, 12 months	241 patients aged 18 to 70 years who were seen in the emergency department and regardless discharged or warded thereafter.	<p>Intervention group vs. control group.</p> <p>Intervention consisted of 3 one-hour groups sessions conducted by a specially trained registered nurse; first session was about asthma and relaxation exercise, second session on asthma medications, inhaler techniques, and relaxation exercise, third session reviewed asthma trigger factors. Smoking cessation was emphasized.</p> <p>Control group did not receive any intervention, but both groups continued with their usual sources of care.</p>	<p>The days of limited activity due to asthma in the control group were more than that in the intervention group. The difference was statistically significant for the first four months.</p> <p>The same pattern of outcome for ED visits in the first four months.</p> <p>No significant differences in the number of physician visits and hospitalizations between the two groups.</p>	<p>The estimated development cost was Int\$14200.</p> <p>The continuing cost of the Intervention was Int\$22900 per year.</p> <p>If the developing cost was spread over five years of the program's operation, then the cost per patient in the intervention group would be Int\$143.</p> <p>Significant difference in the cost per patient for ED visits between the two groups; Intervention group cost was Int\$1060 lower than control group cost.</p> <p>No significant difference in the cost per patient for physician visits and hospitalizations.</p>	NA.	81.4

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Drummond N., 1994, United Kingdom (74)	Trial-based, CCA	Not specified, 12 months	712 patients aged 16 and above with a diagnosis of asthma confirmed by a chest physician, and have shown pulmonary function reversibility of at least 20% on treatment.	<p>Integrated asthma care vs. conventional outpatient care</p> <p>Integrated asthma care involved chest physicians' review every 3 months through computer based patient record system along with patients' GPs.</p> <p>Conventional outpatient care group were seen at their regular outpatient clinic.</p>	<p>Lung function FEV₁ and PEFR did not significantly differ between the two groups after 12 months.</p> <p>Total number of prescriptions for bronchodilators, GP visits, and hospitalizations did not significantly differ between the two groups.</p> <p>There were also no significant differences in reported sleep disturbances and restriction of activity due to asthma between the two groups.</p> <p>After 12 months, patients who did not possess a peak flow meter at the beginning of the study had a significantly higher mean number of hospitalizations if they were under Integrated care than did those in conventional care. Those who already owned a peak flow meter were more likely to report no disturbed nights if receiving Integrated care.</p>	<p><i>The unit and total costs of the Intervention and medical were not explicitly shown.</i></p> <p>Savings per patient per year for hospital: Int\$5 For GPs: Int\$4 For patients: Int\$61</p>	NA.	64.4
Taitel M.S., 1995, United States of America (35)	Trial-based, CBA	Not specified 24 months	76 asthma patients who were generally under medical control.	<p>Before vs. after 7 weeks adult asthma self-management program that included education regarding asthma and its medications, acute attack prevention and management.</p>	<p>Significant cost decrease in hospitalizations (\$16950) and income lost due to asthma (\$7004), after program was started.</p> <p>No significant changes in the costs in physician visits, laboratory fees, travel, or miscellaneous expenses.</p> <p>Average benefit was Int\$716 per patient.</p>	Total program cost per patient: Int\$313	CBR = 1:2.28	59.5

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Neri M., 1996, Netherlands (62)	Trial-based, CEA & CBA	Societal, health program policy makers 24 months	80 patients with mild, moderate, or severe asthma, diagnosed according to the International Consensus Report on Diagnosis and Treatment of Asthma 1992.	<p>1. Complete program (CP) (peak flow monitoring, educational booklet with 6 one-hour asthma school lessons – 5 during first 2.5 weeks, then 1 after 3 months) vs. reduced program (RP) (no asthma school lessons, otherwise the same as CP), during the years before and after enrolment</p> <p>2. Separately in CP and RP, during the year before vs. that after enrolment</p>	<p>Significant difference in number of urgent medical examinations between before and after enrolment, and between CP and RP after enrolment.</p> <p>Significant differences in number of asthma attacks and admission days between before and after enrolment of CP.</p> <p>No significant differences in number of asthma attacks, admission days, and working days lost between CP and RP after enrolment.</p> <p>No significant difference in number of working days lost before and after CP enrolment.</p> <p>Significant increase of drugs cost used before and after the RP and CP started, but no significant difference of that between RP and CP.</p>	<p>The program cost per patient:</p> <ul style="list-style-type: none"> CP: Int\$1070 RP: Int\$1010 <p>The morbidity savings (cost of before <i>minus</i> after program enrolment)</p> <ul style="list-style-type: none"> CP: Int\$2850 (societal), Int\$2030 (policymaker) RP: Int\$2560 (societal), Int\$1960 (policymaker) <p><i>The salary per day of work lose (indirect costs) was estimated according to the monthly gross salary indicated in the national statistics.</i></p>	<p><i>ICER was not stated for which perspective.</i></p> <p>Int\$18 per number of asthma attacks prevented, Int\$52 per urgent medical examinations prevented, Int\$33 per working days lost prevented.</p> <p>CBR for Complete Program = 1:2.66 (society perspective) and 1:1.89 (healthcare payer perspective)</p> <p>CBR for Reduced Program = 1:2.53 (society perspective) and 1:1.94 (healthcare payer perspective)</p>	CEA: 81.0 CBA: 85.5

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Doan T., 1996, United States of America (31)	Trial-based, CCA	Not specified, 2 years	9 patients aged 45 or younger, with the diagnosis of potentially fatal asthma and had previously required intubation.	Before vs. after Intervention. Intervention included patient education, specialist care, regular scheduled outpatient visits, and access to the emergency call service for asthma. Patient education consisted of the knowledge on disease and diagnosis, allergen avoidance, smoking cessation, asthma medications, inhaler technique, preparation for surgery and travel instruction, and importance of compliance with office visits and therapy.	At year end, all 9 patients were still alive and none had required intubation whilst in hospitalization. The mean number of hospitalization in the year before Intervention was 1.5, while that in the year after Intervention was 0.2.	The costs for hospitalization and emergency services were lower in the year after Intervention, Int\$3150 and Int\$1020 when compared with the year before, Int\$65900 and Int\$1280, respectively.	NA.	72.3
Levenson T., 1997, United States of America (33)	Trial-based, CCA	Not specified, Not specified	8 patients aged 2 to 19 years with malignant potentially fatal asthma; had a well-documented history of noncompliance but not necessarily had intubation before.	Before vs. after enrollment to treatment program that consisted of patient education regarding corticosteroids and allergen avoidance, regular clinic visits with the same attending physician and physician in training, simplified medical regimens, and a 24-hour call number for medical emergencies including exacerbations.	The number of hospitalizations and ED visits decreased for each patient.	The intervention cost per patient was not stated. The mean cost (hospitalization and ED visits) per patient per year before intervention was \$32900, and after intervention was \$1580. This difference was statistically significant.	NA.	60.1
Westley C. R., 1997, United States of America (36)	Trial-based, CCA	Not specified, 2 years	70 patients aged 3 to 70 years with moderate to severe asthma as outlined by NHLBI.	Before vs. after allergy/asthma referral to an allergist consultant.	Sick office visits, ED visits, and hospitalizations were significantly reduced after the Intervention.	The Intervention cost per patient was not stated. The costs of savings per patient for <ul style="list-style-type: none"> • Sick office visit: Int\$194 • Emergency visit: Int\$532 • Hospitalization: Int\$2250 	NA.	66.0

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Watanabe T., 1998, Japan (72)	Trial-based, CCA	Not specified, 12 months	176 asthma patients	<p>Pharmaceutical care vs. no pharmaceutical care.</p> <p>Pharmaceutical care included education about environmental factors at home, taking of patient's drug history, telephone consultation, use of peak flow meter, information about prescribed medication therapy, drug interactions.</p>	There were significant differences in the ED visits and plasma theophylline concentration (as a compliance indicator of asthma medications) before and after pharmaceutical care.	<p>The Intervention cost per patient was not stated.</p> <p>The mean total medication cost of pharmaceutical care group was Int\$234 as compared with Int\$111 in the other group.</p>	NA.	60.1
Ghosh C. S., 1998, India (69)	Trial-based, CCA	Not specified, 12 months	276 asthma patients aged 10 to 45 years with either a greater than 15% improvement in the predicted value of FEV ₁ or diurnal variation in PEF _R of more than 20%, had at least one hospitalization or emergency visit in the year before, and being on drug therapy at least half a month.	<p>Asthma Self Management Training (SMT) plus usual physician care vs. usual physician care only.</p> <p>SMT is a systematic program for the control and management of asthma. The Intervention included 4 sessions of two hours each of SMT education and training sessions during the first month. Patients were taught on peak flow meter and its interpretation; based on the PEF_R patient were to adjust their own treatment appropriately.</p>	Mean PEF _R was significantly improved in the Intervention group. It also had 48.5% fewer productive days lost. Hospitalizations and ED visits reduced in the Intervention group.	<p>The Intervention cost (training sessions, transportation for sessions and indirect cost), per patient was Int\$751.</p> <p>The total cost per patient (direct and indirect) was significantly lower in the Intervention group (Int\$24700) than the control group (Int\$31700).</p> <p><i>The indirect costs were estimated by multiplying the number of productive days lost by the minimum wage paid for a daily worker for all patients.</i></p>	NA.	78.7

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Kauppinen R., 1998, Finland (58)	Trial-based, CEA & CBA	Not specified, 12 months	162 newly diagnosed asthmatic patients (over 16 years old) according to the criteria of the American Thoracic Society, and had not previously used inhaled anti-inflammatory asthma medication.	3 monthly patient education (by chest physician, respiratory nurse, physiotherapist) plus supervision for the self-management of mild asthmatic patients vs. once only patient education plus non-supervised self-management A peak-flow meter was given to both groups at the first year.	Significant improvement in FEV ₁ between baseline and 12 month in the Intervention group, and between Intervention group and control group at 12 month. Significant improvement in quality of life between baseline and 12 month in both Intervention and control group, but no significant difference in that between the groups at 12 month.	Total implementation cost per patient: Int\$3140 Total annual cost per patient <ul style="list-style-type: none"> Intervention group: Int\$4380 (including implementation cost) Control group: Int\$3740 <i>The total working time lost (for indirect cost) due to sickness and time required for Intervention visits was valued at the average daily gross wage rate in Finland, including social security contributions.</i> Significant difference in direct costs and total cost between the two groups.	Int\$137per unit of increased FEV ₁ <i>This calculation for this value was not explicitly shown.</i> NMB = -Int\$645 per patient	CEA: 73.5 CBA: 73.5
Kauppinen R., 1999, Finland (59)	Trial-based, CEA Actual type: CCA, because no ICER was conducted.	Not specified, 3 years	162 newly diagnosed asthmatic patients (over 16 years old) according to the criteria of the American Thoracic Society, and had not previously used inhaled anti-inflammatory asthma medication.	3 monthly patient education (by chest physician, respiratory nurse, physiotherapist) plus supervision for the self-management of mild asthmatic patients vs. once only patient education plus non-supervised self-management Intervention only occurred in the first year, A peak-flow meter was given to both groups at the first year, thereafter the patients had to purchase themselves.	The PEF _R and FEV ₁ were significantly better in the Intervention group than the control group. Quality of life scores improved significantly in both groups but no significant differences between them. The Intervention group had a total of 104 sickness days and the control group had 273 days. More than half of those days occurred during the first year.	The average total costs per patient were Int\$737 and Int\$758 for Intervention and control group respectively. Mean net saving: Int\$19	NA.	72.3

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Greineder D. K., 1999, United States of America (32)	Trial-based, CCA	Not specified, 24 months	57 patients aged 1 to 15 years with the diagnosis of asthma based on the usual clinical practice criteria that were continuously enrolled in a staff-model health maintenance organization for a period of at least 2 consecutive years.	Intervention group vs. control group. Both groups were given a single intensive asthma education. The Intervention group: asthma outreach program (AOP), was then followed-up by an asthma case management nurse. The control group was not. The AOP consisted of an experienced allergy nurse, an allergy nurse practitioner, and an allergist. The one-on-one education included asthma and its medications, use of inhalers and peak flow meters, adherence, and environmental control. An asthma action plan was also provided to the patient.	ED visits were significantly reduced by 39% in the control group, 73% in the AOP group. Hospitalization was significantly reduced by 43% in the control group and 84% in the AOP group. Significant differences in the reductions of ED visits, hospitalizations, and outside-plan use (money spent on hospitalization, ED visits, outside referrals, homecare, and durable medical equipment) in the AOP group compared with the control group. Total outside-plan use was significantly reduced by 28% in the control group, and 82% in the AOP group.	The Intervention cost per patient was approximately Int\$258. The outside-plan use per patient in the control group during <ul style="list-style-type: none"> • Before: Int\$3120 • After: Int\$2260 The outside-plan use per patient in the AOP group during <ul style="list-style-type: none"> • Before: Int\$3710 • After: Int\$649 	NA.	71.3

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Rossiter L.F., 2000, United States of America (34)	Trial-based, CCA	Medicaid, 21 months	Moderate or severe asthma patients that had any service claim (physician office visits, hospital outpatient visits, hospital ED visits, asthma drugs).	<p>Intervention communities vs. comparison communities.</p> <p>In the Intervention communities, volunteered physicians were trained on using state-of-the-art asthma medications according to national guidelines, effective communication with asthma patients, and hands-on practice with asthma tools such as peak flow meter and inhalers. The objectives of this training were to reduce the ED visits and increase the appropriate use of asthma medications. 48 physicians were sent feedback reports from Medicaid about their patients. 17 physicians did not have feedback reports. There were also non-participating physicians in the Intervention communities.</p> <p>The physicians in the comparison communities were not involved in this training.</p>	<p>Significant reduction in ED visits between the two communities.</p> <p>The number of ED visits for two quarters fell 40.7% when compared to the same quarters in the previous year, for trained physicians that received feedback reports. But for those who did not, the reduction was 23.2% only.</p> <p>The use of albuterol inhalers and nebulizers increased significantly when compared with comparison communities. However, the use of inhaled corticosteroids did not change much.</p> <p>The claims received for physician office visits were the same as before the Intervention started.</p> <p>In the Intervention communities, there were 1684 emergency visit claims before Intervention, and 1583 claims after Intervention began.</p>	<p>Inpatient hospital ED visits and urgent care ED visits cost Int\$720 for each claim.</p> <p>Estimated savings from Intervention: $(1684 - 1583) * \text{Int}\\$720 = \text{Int}\\$72720$ But if all the physicians in the Intervention communities had participated, the estimated savings would have been Int\$291000.</p> <p>The Intervention yielded an estimated savings for Medicaid of Int\$1120 per physician trained.</p> <p>Each dollar spent in training another physician generated savings of Int\$4.</p>	NA.	60.1

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Suh D.C., 2000, United States of America (50)	Trial-based, CCA	Third-party payer 21 months	5527 patients with asthma as their primary or secondary diagnosis for at least 12 months prior to the time of Intervention.	Intervention group vs. control group. Intervention consisted of drug utilization review measures, mailing of written educational materials providing information on asthma management, ensuring physicians comply with the prescription practice guidelines for asthma, and compliance on the program itself. The educational materials were sent out every 3 months; including asthma and its medications, inhaler techniques, adherence to medications, asthma and allergy attacks, and prevention on acute attacks at school.	There were significant improvements in the number of ED visits, physician's office visits, and asthma prescriptions filled in the Intervention group. There were no significant improvements in the number of hospitalizations after the Intervention in both groups.	The Intervention cost per patient was not stated. The average cost of hospitalization decreased Int\$642 per patient in the Intervention group, but increased Int\$169 in the control group.	NA.	69.1

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Kauppinen R., 2001, Finland (60)	<p>Trial-based Claimed: CEA & CBA</p> <p>Actual: CCA instead of CEA, because no ICER was conducted <i>due to statistically insignificant differences of costs and outcomes.</i></p>	<p>Not specified</p> <p>5 years</p>	<p>162 newly diagnosed asthmatic patients (over 16 years old) according to the criteria of the American Thoracic Society, and had not previously used inhaled anti-inflammatory asthma medication.</p>	<p>3 monthly patient education (by chest physician, respiratory nurse, physiotherapist) plus supervision for the self-management of mild asthmatic patients vs. once only patient education plus non-supervised self-management</p> <p>Intervention was only for the first 12 months. A peak-flow meter was given to both groups at the first year, there after the patients had to purchase themselves.</p>	<p>Significant improvement in FEV₁ between baseline and 5 year in the Intervention group. However, no significant changes of that between the two groups over 5 years.</p> <p>Significant improvement in quality of life between baseline and 5 year in both groups, but not between these two groups.</p> <p>Intervention group patients had 152 sickness days due to asthma during the 5 years, whilst the control group patients had 398 days of that (not statistically significant different).</p>	<p>Total implementation cost per patient: Int\$350</p> <p>Total cost per patient</p> <ul style="list-style-type: none"> Intervention group: Int\$3030 (direct, indirect, Intervention) Control group: Int\$3630 (direct, indirect) <p><i>The total working time lost (for indirect cost) due to sickness and time required for Intervention visits was valued at the average daily gross wage rate in Finland, including social security contributions.</i></p> <p>Significant difference in unscheduled healthcare costs between the two groups</p> <ul style="list-style-type: none"> Intervention group: Int\$261 Control group: Int\$415 <p>No significant difference in the total costs between the two groups.</p>	<p>NMB = Int\$605 per patient</p>	<p>CCA: 72.3 CBA: 74.0</p>

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Lucas D.O., 2001, United States of America (44)	Trial-based, CCA	Not specified, 2 years	110 patients aged 14 and above, with a diagnosis of asthma.	<p>Before vs. after Asthma Self-Management Program (ASMP).</p> <p>ASMP was an educational and behavioral change program for people with asthma, regardless of disease severity. It consisted of 8 weeks of classroom training and 2 years of follow-up. It trained patients on proper inhalation technique, peak flow meter, identification and avoid trigger factors, medications, development of asthma action plan, and communication skills with healthcare provider.</p> <p>As part of the program, patients received a peak flow meter, diary, a relaxation tape, educational booklet, and a manual containing all the taught concepts.</p>	<p>Significant reduction of nighttime awakenings due to asthma and number of productivity loss days from baseline to 2-year.</p> <p>The generic quality of life scores increased for all domains from baseline to 2-year.</p> <p>The number of hospitalizations, length of stay in hospital, number of ED visits, number of urgent care and scheduled visits were all reduced from baseline to 2-year. Significant reductions in the number of emergency and urgent visits.</p>	<p>The Intervention cost per patient was Int\$583.</p> <p>The savings from hospitalizations, length of stay in hospital, ED visits, urgent care and scheduled visits were Int\$2070 per patient.</p> <p>Net savings per patient: Int\$1480</p> <p>ROI: 254%</p>	NA.	61.7

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Gallefoss F., 2001, Norway (56)	Trial-based, CEA	Societal, 12 months	78 patients aged 18 to 70 years with mild to moderate asthma being diagnosed and treated at the outpatient clinic.	<p>Intervention group vs. control group.</p> <p>Intervention group consisted of education program then followed by their GPs. The education program consisted of 2 two hour group sessions and one to two hours of individual counseling by a nurse and a physiotherapist on asthma, its medications, and individualized self-management plan. The group also received a booklet comprising of the information during educational sessions.</p> <p>Control group did not have education program, just usual care by their GPs.</p>	<p>Significant differences in quality of life and FEV₁ between the two groups.</p> <p>Significantly higher symptom free days and nights in the Intervention group than that in control group.</p>	<p>The Intervention cost per patient for the Intervention group was Int\$2260, including the program and peak flow meter.</p> <p>The mean direct cost per patient for</p> <ul style="list-style-type: none"> Intervention group: Int\$7030, including the Intervention cost Control group: Int\$4770 <p>The mean indirect cost (including patient time fir education program, patient time for doctor visits, and production loss) per patient for</p> <ul style="list-style-type: none"> Intervention group: Int\$5480, 32% of the total cost Control group: Int\$14200, 75% of the total cost <p><i>The cost of time for those employed was set equal to the national hourly wage rate. The number of days absent from work due to asthma was valued according to the national average daily wage rate.</i></p>	<p>*-Int\$4050 per 10 unit improvement in quality of life total score</p> <p>*-Int\$5360 per 5% improvement in FEV₁</p>	89.0

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Bratton D. L., 2001, United States of America (38)	Trial-based, CCA	Not specified, 3 years	90 patients aged less than 19 years with a primary diagnosis of severe asthma refractory to routine medical treatment.	<p>Before vs. after admission to the National Jewish Pediatric Day Program for an average of 21.8 days.</p> <p>The Day Program included intensive medical, nursing, psychosocial, rehabilitation, and dietary and individualized multidisciplinary therapeutic program.</p>	<p>Patients' quality of life significantly improved from before admission to the first year after admission, but insignificant improvement for the second year.</p> <p>There were significant decrease in number of sick visits, ED visits, oral corticosteroid use, and length of hospitalizations between pre and post-1 year of admission, but insignificant decrease for the second year. The longer the stay in the program, the larger decreases in these healthcare utilizations.</p> <p>Events like respiratory arrests, intubations, and seizures were also reduced at the first and second year.</p>	<p>The Intervention cost per patient was not stated.</p> <p>The total cost of utilization (sick visits, ED visits, oral corticosteroid use, and length of hospitalizations) per patient</p> <ul style="list-style-type: none"> • Before: Int\$253 • After 1 year: Int\$34 • After 2 years: Int\$14 	NA.	66.5

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Schermer T. R., 2002, Netherlands (64)	Trial-based, CEA & CUA	Societal 2 years	193 patients aged 16 to 60 years who were to be treated with inhaled steroids according to national guidelines, had smoking history of less than 15 pack-years, and were not currently treated by a chest physician.	<p>Guided self-management (education and training of skills – 4 visits within 3 months) by family physician vs. family physician usual care.</p> <p>Self-management using peak-flow meter and treatment dosage adjustments were taught to the patients in the self-management group.</p>	<p>The mean number of successfully treated weeks (successful means any given week with modified Borg scale score lower than the individual's median score) in 2 years was 81 for self-management group and 75 for usual care group. No significant differences for total quality of life score.</p> <p>No asthma-related ED visits or hospitalizations were reported.</p>	<p>Total implementation cost: Int\$315 per patient</p> <ul style="list-style-type: none"> Family physician time for education sessions 60% Peak flow meters 16% Preparation for family physicians 9% Patient time for education sessions 8% Educational and self-management aids 7% <p>Total cost per patient</p> <ul style="list-style-type: none"> Self management (implementation direct healthcare, productivity): Int\$1810 Usual care (healthcare, productivity): Int\$1830 <p>Productivity cost (limited activity days) was much higher in usual care group (Int\$498) than self-management group (Int\$143).</p> <p>Significant reduction of the productivity cost from the first to the second year for self-management group, but not for usual care. Total cost per patient was also lower in the self-management group during the second year due to minimal implementation cost spent.</p>	<p>If productivity cost is excluded, Int\$22100 per QALY gained</p> <p>Int\$55 per successfully treated week gained.</p> <p>If productivity cost is included, guided self-management is dominant. <i>However, the probability of being cost-effective is only 52% regardless of the societal WTP.</i></p>	CEA: 75.0 CUA: 79.5

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					Outcomes	Costs	ICER (unless indicated otherwise)	
Sullivan S. D., 2002, United States of America (7)	Trial-based, CEA	Medicaid payer 2 years	961 English- or Spanish-speaking children aged 5 to 11 years, living in inner-city urban areas with physician-diagnosed mild to moderate asthma.	Masters-level social workers (asthma counselors) Intervention plus usual physician-provided care vs. usual physician-provided care only. Intervention ceased after 1 year.	Difference in SFDs between the two groups was an average of 26.6 days, in favor of asthma counselor Intervention. This improvement for the latter was similar in both years even though it was not available in the 2 nd year. There were no significant differences between groups in the rate of scheduled and unscheduled physician visits, hospital admissions, and ED visits.	Intervention cost (personnel, medical devices, asthma control devices (peak flow metre, mattress cover, pillow covers, Aerochamber), skin tests, and cockroach extermination visits): Int\$508 per child Direct medical cost (scheduled and unscheduled physician visits, hospital admissions, and ED visits) per child in <ul style="list-style-type: none"> • Asthma counselor Intervention: Int\$ 3900 • Usual care: Int\$ 3530 	Int\$14 per SFD gained (95% CI, - Int\$19 - Int\$83) <i>The probability of being cost-effective is 50% at this ICER.</i>	92.5
Tschopp J.M., 2002, Switzerland (67)	Trial-based, CCA	Not specified, 24 months	66 patients above age 16 years with moderately severe asthma treated on an outpatient basis that had not had an asthma attack during the 30 days preceding entry o the study.	Before vs. after Intervention. Intervention consisted of a bilingual Self-Management Education (SME) booklet developed by primary care physicians, medical specialists, pharmacists, and staff nurses. Each patient also received an educational Intervention by a physiotherapist that included asthma and its medications, inhalation techniques, peak flow measurements, and the use of asthma action plan. They also received a personal follow-up diary with written, individualized objectives.	Significant improvements in quality of life and asthma-induced sleep disturbances. There were also improvements (but significance was not statistically tested) in hospitalizations, emergency consultations, and workdays lost.	The Intervention cost per patient was not stated. Direct costs (hospitalization) per patient: Int\$2310 Indirect costs (lost workdays) per patient: Int\$3560 <i>The average cost of a day's hospital stay or a lost workday is based on Federal Statistics Office averages.</i> Cost saving per patient: Total of indirect (workdays lost) and direct (hospitalizations) costs = Int\$5870	NA.	59.0

Main author, Year, Country context	Economic evaluation analysis design (Trial-based/Modeling), Type of economic evaluation	Perspective, Time horizon	Study population	Alternatives compared	Results of the economic evaluation			QHES score(s) (%)
					Outcomes	Costs	ICER (unless indicated otherwise)	
Lindberg M., 2002, Sweden (61)	Trial-based, CCA	Not specified, 27 months	152 asthmatic patients aged 18 years and above.	<p>Asthma nurse practice (ANP) vs. non-ANP.</p> <p>Asthma nurse informed patients about asthma prevention, inhalation techniques and medication, gave written prescriptions and/or an asthma action plan. Lung function measurement tools were also used. With the exception of ED visits and the yearly follow-up visit to their physician all visits were made to the asthma nurse.</p> <p>Non-ANP group visited a GP for their asthma, according to requirements or for predetermined appointments, as they were used to.</p>	<p>Significant differences in patient-reported asthma-related symptoms (more than two asthma attacks, night-time awakening due to asthma, limitation in physical activity) between the 2 groups.</p> <p>No significant difference in the use of beta agonist between the 2 groups.</p> <p>No significant differences in the generic quality of life scores between the 2 groups.</p>	<p>The Intervention cost per patient was not stated.</p> <p>The total direct costs (inpatient and outpatient care) per patient for:</p> <ul style="list-style-type: none"> • ANP: Int\$1610 • Non-ANP: Int\$2550 <p>The total cost (direct and indirect costs (productivity loss was the sick days loss due to asthma)) per patient:</p> <ul style="list-style-type: none"> • ANP: Int\$3670 • Non-ANP: Int\$4480 <p>The costs (based on patient-reported outcomes questionnaire) for inpatient care, outpatient care, and total direct costs were lower for ANP group than non-ANP. The indirect costs were 7% higher in the ANP group due to absence from work because of asthma.</p>	NA.	62.2
Johnson A. E., 2003, United States of America (42)	Trial-based, CCA	Not specified, 12 months	1114 asthma Medicaid members aged 1 to maximum 82 years.	<p>Medicaid members who were referred and participated in the McKesson Health Solutions (MHS) vs. members who were referred but did not participated vs. members who were not contacted or referred at all.</p> <p>MHS is a disease management program to Medicaid members, which delivered an individualized approach to patient monitoring, education and counseling.</p>	<p>Hospitalization, ED visits, and outpatient office visits were reduced 50%, 28%, and 6% respectively, after program implementation, in the participating group.</p> <p>In the non-participating group, hospitalization was increased, but reduced for emergency and outpatient office visits.</p> <p>In the non-referred group, both hospitalization and ED visits were increased, but reduced for outpatient visits.</p>	<p>The estimated Intervention cost for the program: Int\$125000</p> <p>Total savings: Int\$164000</p> <p>ROI: 131%</p>	NA.	71.3

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					Outcomes	Costs	ICER (unless indicated otherwise)	
McLean W., 2003, Canada (45)	Trial-based, CCA	Not specified, 12 months	242 patients with uncontrolled asthma.	<p>Enhanced pharmaceutical care (EC) vs. usual care (UC)</p> <p>EC was scheduled every 2 to 3 weeks for at least 3 appointments, and then follow-up at least every 3 months, delivered by a pharmacist in a private counseling area. EC involved asthma and its medications, trigger identification and avoidance, inhalation technique, asthma action plan, PEFR monitoring. and use of spacer devices.</p> <p>UC's frequency of care was determined by the patient's needs for prescription refills. It involved proper inhaler technique and the pharmacist would answer any questions regarding asthma.</p>	<p>There were significant differences in PEFR, asthma specific quality of life score, and medical visits in previous month between the two groups. The number of hospitalizations, ED visits, and days off of school or work were insignificantly reduced between the two groups.</p>	<p>The Intervention cost per patient was not stated, but the pharmacist fees per patient</p> <ul style="list-style-type: none"> • EC: Int\$732 • UC: Int\$181 <p>The total cost (medical and ED visits, hospitalizations, prescription drugs, pharmacist fees, days off of school or work) per patient</p> <ul style="list-style-type: none"> • EC: Int\$366 • UC: Int\$857 <p><i>The cost for days off of school or work was not detailed.</i></p>	NA.	81.9
Tinkelman D., 2004, United States of America (52)	Trial-based, CCA	Not specified, 18 months	Medicaid members with a diagnosis of asthma	<p>National Jewish Medical and Research Center Disease management Program for Asthma (NJDMP) vs. no program</p> <p>NJDMP activities included physician education, patient education, and case management. Physician and patient education was provided in different ways and included many topics. Case management was delivered by a team of specialized respiratory nurses using telephone calls. Physicians were to provide asthma action plan for patients.</p>	<p>In the Intervention group,</p> <ul style="list-style-type: none"> • The use of anti inflammatory medications had improved 12.6% from baseline. • The nighttime symptoms were also reduced as much as 75% from baseline. • The ED visits decreased from 253 at baseline to 36 at Intervention period. 	<p>The Intervention cost per patient was Int\$51 per month.</p> <p>The total cost (ED visits and hospitalizations) for the Intervention group was Int\$218, and Int\$305 for the control group, per patient per month.</p> <p>The savings for Intervention group was 37.3% whilst that for control group was 30.7%.</p>	NA.	70.2

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					Outcomes	Costs	ICER (unless indicated otherwise)	
Kamps A.W.A., 2004, Netherlands (57)	Trial-based, CCA	Not specified, 12 months	73 patients aged 2 to 16 years with mild, moderate, or severe asthma referred by their GP because of insufficient asthma control.	<p>Followed-up by asthma nurse vs. paediatrician.</p> <p>Before randomization, all patients and their caregivers received asthma education by the asthma nurse, including information about the mechanisms and triggers of the disease, asthma medications, management of acute symptoms, and recommendations for environmental avoidance. Comprehensive inhalation instruction was given, and the patients' inhalation technique was repeatedly checked until correct. The initial visit to the clinic was concluded with the paediatrician discussing medical treatment with the patient and caregivers.</p> <p>Patients were followed-up by the same healthcare provider throughout the study. The asthma nurse could consult the paediatrician for medical queries but only for patients under their follow-up. Those under paediatrician follow-up were not allowed to have consultations by the asthma nurse.</p>	<p>There were no hospitalizations, ED visits, and productivity loss from both groups during 1 year follow-up.</p> <p>No significant differences in medications and extra visits to GP between the 2 groups.</p>	<p>The Intervention cost per patient was not stated.</p> <p>The overall healthcare costs per patient in each group was not significantly different; Int\$362 for paediatrician group and Int\$347 for asthma-nurse group.</p> <p>The asthma nurse follow-up group was cost-saving from 1.8 follow-up visits onwards.</p>	NA.	70.2

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					Outcomes	Costs	ICER (unless indicated otherwise)	
Chan ALF., 2004, Taiwan (68)	Trial-based, CCA Comments: Although this study attempted to calculate ICER, the type of economic evaluation does not deserve a CEA because the formula used was the difference between the average cost-effectiveness ratio, instead of incremental cost-effectiveness ratio.	Not specified, 3 months	55 patients aged 17 to 53 years, with moderate to severe asthma (as classified by the American Thoracic Society Guidelines).	Before Intervention vs. After pharmacist Intervention (explanatory booklet about asthma, brochure on asthma medications, inhalation technique, peak flow monitoring). Peak flow meter was given for free to the patients.	Significant improvements in asthma knowledge and quality of life. Significant reduction in the mean peak expiratory flow variation, frequency of use of inhaled beta agonist and corticosteroids.	Total implementation cost was not stated. Total cost per patient • before Intervention: Int\$101 • after Intervention: Int\$59 Mean drug cost per Intervention visit • before Intervention: Int\$19 • after Intervention: Int\$14	NA.	59.0
De Asis M. L. B., 2004, United States of America (40)	Modeling Claimed: CEA & CBA Actual: Not a full/true CBA, because no monetary value on health outcomes.	Third-party payers e.g. Medicaid, Medicare, other health insurers 6 months	Adult and adolescent men or women with moderate to severe asthma requiring daily inhaled corticosteroids and a history or requiring urgent treatment for asthma at a clinic or hospital ER or hospitalization for asthma in previous 12 months.	Asthma education by nurse educator plus peak flow-based self-management plan vs. asthma education plus symptom-based self-management plan vs. asthma education plus usual care/no self-management plan Peak flow meters were given to patients in peak flow-based self-management plan.	<i>The values of outcomes used in the analysis were based on the results of a randomized controlled trial as the key parameter of the model.</i> • Peak flow plan: 91% reduction in ED visits, 84% reduction in hospitalizations • Symptom-based plan: 0% reduction in ED visits, 13% reduction in hospitalization	Total implementation cost per patient • Peak flow plan: Int\$77 • Symptom-based plan: Int\$43	Int\$74 per ER visit averted (peak flow plan vs. usual care) Int\$284 per ER visit averted (symptom-based plan vs. usual care).	CEA: 79.5

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					Outcomes	Costs	ICER (unless indicated otherwise)	
Anderson M. E., 2004, United States of America (37)	Trial-based, CCA	Not specified, 6 years	54 asthma school children.	<p>Children attending Kunsberg who received primary care at Denver Health vs. matched children who also received primary care at Denver health but did not attend Kunsberg.</p> <p>The Kunsberg School enrolled children with chronic diseases, including asthma, o a daily program of school-based disease management. Staff in the school included a nurse administrator, two nurses, a social worker, and teachers who were familiar with the children's medical conditions.</p>	<p>In the Kunsberg group, the number of hospitalizations and ED visits reduced about 50% after enrollment, but the control group's number of those remained stable.</p> <p>The Kunsberg group also had significantly lower ED visits and follow-up asthma visits per year than the control group.</p>	<p>The Intervention cost per patient was not stated.</p> <p>In the Kunsberg group, the annual cost (hospitalization, ED visits, follow-up visits) decreased Int\$9560 per patient (80%) after enrollment.</p> <p>In the control group, the annual cost decreased Int\$789 per patient (19%) at the post period.</p>	NA.	62.8

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					Outcomes	Costs	ICER (unless indicated otherwise)	
Shelley D. C., 2005, United States of America (49)	Trial-based, CCA	Not specified, 24 months	18 patients aged 3 to 18 years with moderate to severe asthma diagnosed by their physicians according to the National Heart, Lung, and Blood Institute guidelines.	<p>Before vs. after implementation of an implementation of an in-home Asthma Disease Management Program (ADMP) by a respiratory therapist.</p> <p>ADMP consisted of 8 weekly home visits, each lasted for 1 to 2 hours; physical assessment of the patient, environmental assessment and recommendations, monitoring of peak expiratory flow rate and oxygen saturation, administration of prescribed respiratory therapy treatments, and instruction and reinforcement on the proper use of inhalers, peak flow meters, nebulizers, and other equipment as prescribed.</p> <p>Asthma education was provided to patients and their parents. Asthma symptom and peak flow diary were also provided for each patient. Adequate supplies of spacers, nebulizers, peak flow meters, mattress and pillow covers were also provided.</p>	Significant improvements in the number of hospitalizations, hospital length of stay, number of ED visits, number of doctor's office visits, and school days missed.	<p>The Intervention cost per patient was not stated.</p> <p>Decrease in cost per patient of</p> <ul style="list-style-type: none"> Hospitalizations: Int\$8300 ED visits: Int\$1490 Doctor's office visits: Int\$255 <p>The average total savings per patient per year: Int\$10000.</p>	NA.	63.8
Tschopp J.-M., 2005, Switzerland (66)	Trial-based, CBA	Not specified 12 months	66 mild and stable asthma patients aged 16 to 78 years, living in the alpine area, with good French or German fluency.	Usual care by physician vs. personalized educational booklet (including education and action plan for self-management) and interdisciplinary follow-up (local family physicians, specialists, pharmacists, and nurses – 2 GP visits and 2 specialist visits quarterly)	Significant improvements in hospitalizations, emergency visit, and work absenteeism, asthma severity, and quality of life. There was no change in FEV ₁ .	<p>Cost of interdisciplinary education program: Int\$102000.</p> <p>The interdisciplinary education program resulted in a net cost reduction of Int\$200000.</p> <p><i>The monetary valuation of work absenteeism was not detailed.</i></p>	CBR = 1.96	71.0

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					Outcomes	Costs	ICER (unless indicated otherwise)	
Kattan M., 2005, United States of America (43)	Trial-based, CEA	Stakeholder 2 years	800 children aged 5 to 11 years, living in urban areas with asthma diagnosed by a physician and had at least 1 positive skin test response to an indoor allergen. The child also had to have at least 1 hospitalization or 2 unscheduled asthma visits in the 6 months before (to ensure that severe asthmatics were enrolled), and should reside at one address for at least 5 nights per week to ensure consistent exposure to the same household environment.	High-school graduates from community (environmental counselor) Intervention vs. no Intervention at all (control group)	Significant differences in unscheduled clinic visits and number of reliever inhalers between the two groups. No significant differences in scheduled medical visits, ED visits, hospitalizations, and number of anti-inflammatory medications between the two groups. SFDs for Intervention group was 566.6 days, control group was 528.8 days.	Total direct medical cost per child <ul style="list-style-type: none"> Intervention group: Int\$6100 Control group: Int\$4750 	Int\$36 per SFD gained (95% CI, Int\$10 – Int\$87) <i>The probability of being cost-effective is 50% at this ICER.</i>	88.0
Sullivan S. D., 2005, United States of America (51)	Trial-based, CEA	Healthcare payer 2 years	638 children aged 3 to 17 years with mild to moderate persistent asthma.	Peer leader-based physician education Intervention (PLE) plus usual physician-provided care vs. planned asthma care Intervention (PACI) by asthma nurse plus PLE plus usual physician-provided care vs. usual physician-provided care only.	PLE vs. usual care: 6.5 SFDs gained per year PACI vs. usual care: 14.4 SFDs gained per year Usual care: Increased in 14.8 SFDs per year The average number of physician visits: <ul style="list-style-type: none"> PLE 3.12 PACI 4.70 Usual care 3.24 No significant differences between these 3 groups in the ED visits and hospitalizations.	Total Intervention cost per patient <ul style="list-style-type: none"> PLE: Int\$113 (implementation), Int\$107 (maintenance) PACI: Int\$442 (implementation), Int\$682 (maintenance) Total costs per patient <ul style="list-style-type: none"> PLE: Int\$695 PACI: Int\$1780 Usual care: Int\$531 	Int\$25 per SFD gained for PLE vs. usual care. (95% CI, Int\$7 – dominated) Int\$94 per SFD gained for PACI vs. usual care. (95% CI, Int\$51 - Int\$497) <i>At a threshold of Int\$103 per SFD gained, the probability that PLE is cost effective is 84.5% and that for PACI is 57.4%.</i>	86.0

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					Outcomes	Costs	ICER (unless indicated otherwise)	
Tagaya E., 2005, Japan (71)	Trial-based, CCA	Not specified, 6 months	43 patients aged 6 to 67 years with mild to moderately severe asthma diagnosed according to the criteria of the Asthma Prevention and Management Guidelines, Japan. None had previously received any organized asthma education.	Self-management group vs. control group. Self-management group patients were given a peak flow meter, an asthma diary, and an educational booklet on asthma. They were advised on how and when to increase, decrease, or maintain their current treatment based on the symptoms and PEFr. It was not stated explicitly on what was in control group.	The peak flow values increased 9.3% from baseline, and the values remained high until 6 months. Significant decrease on the frequency of GPs visits, ED visits, and hospitalizations in self-management group than control group.	The Intervention cost per patient was not stated. Direct cost (medical expenses) per patient was Int\$281 and Int\$403 for self-management group and control group respectively, at 6 month. Mean costs were decreased by 30% in self-management group, but increased by 15% in control group. These changes were not statistically significant.	NA.	65.4

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					Outcomes	Costs	ICER (unless indicated otherwise)	
Ng D.K.K., 2006, Hong Kong (70)	Trial-based, CCA	Not specified, 3 months	100 patients aged 2 to 15 years who were admitted with an acute asthmatic attack as diagnosed by the attending paediatrician.	<p>Standard (program A) vs. intensive (program B) asthma education program.</p> <p>Program A: An asthma nurse acted upon physician referral 1 to 2 days after admission. Patients were given written information on asthma and action plan, and an asthma diary, and a 30 minutes teaching and discussion about asthma, medications, inhalation technique and diary keeping.</p> <p>Program B: An asthma nurse acted within 24 hours of admission. A booklet with the same information as in Program A was given, but with cartoon figures to increase patients' and parents' understanding. Asthma diary was also given. In addition to the 30 minutes teaching similar to Program A, a 20 minutes video session was delivered regarding triggers and compliance. Prior to discharge, patients were reviewed again and a telephone follow up was performed 1 week after discharge.</p>	<p>There were significant differences in ED visits and hospitalizations between the two groups.</p> <p>There were no significant differences in unscheduled visits to GP, number of nocturnal asthma symptoms, episodes of asthma attack, and days of school absences between the two groups.</p> <p>There were significant differences in level of compliance on medication prescribed, but not in that on environmental control measures.</p>	<p>The Intervention cost per patient was not stated.</p> <p>One extra nursing hour per patient in Program B cost Int\$392.</p> <p>Hospitalization costs incurred per patient in</p> <ul style="list-style-type: none"> • Program A: Int\$10100 • Program B: Int\$8140 <p>Net saving per patient: Int\$1580</p>	NA.	62.8

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					Outcomes	Costs	ICER (unless indicated otherwise)	
Bunting B. A., 2006, United States of America (39)	Trial-based, CCA	Not specified, 5 years	207 asthma patients aged 19 and above.	<p>Before vs. after Intervention.</p> <p>Intervention was a one-on-one asthma education provided by a certified asthma educator in one or two sessions for 60 to 90 minutes and a pharmacist chosen to be patient's care manager. The care manager provided an asthma action plan, and assessed medications, inhalation technique, symptoms and PEFs. Recommendations were made to patients' physicians.</p>	<p>Comparing pre-post severity classifications, 55% of patients improved, 8% worsen, and 37% unchanged. For FEV₁, 70% improved, 24% worsen, and 6% unchanged.</p> <p>Patients' severity scores were significantly improved regardless they were being followed-up by a specialist or a primary care physician.</p> <p>Significant reductions in all specific asthma symptoms.</p> <p>ED visits and hospitalizations were reduced. Patients with an emergency visit and/or hospitalization decreased from an average of 13.9% annually before the program to 3.2% after the program.</p>	<p>The Intervention cost per patient was not stated.</p> <p>Direct costs (medications and medical claims) savings: Int\$905 per patient per year.</p> <p>Indirect costs (patient-reported missed workdays and hours or lost productivity due to asthma) savings: Int\$1530 per patient per year. <i>This value was estimated from the hourly average rate provided by their employers.</i></p> <p>The annual net savings: Int\$2440 per patient per year</p>	NA.	72.3
Runge C., 2006, Germany (63)	Trial-based, CBA	Third-party payers, societal 12 months	Asthma patients aged 8 to 16 years, diagnosed for at least a year.	<p>Standardized patient management program (SPMP) vs. SPMP plus Internet-based education program (IEP) vs. Control group (CG).</p> <p>SPMP: 5 two-hour educational sessions on asthma knowledge and self-management skills.</p> <p>IEP: A web-based educational module with an asthma-related quiz and an interactive adventure game incorporating numerous virtual asthma related situations that have to be managed adequately. A repetition section on SPMP, individual medication plan, scheduled chats with experts, and an online peak flow protocol were also included.</p> <p>CG: Not involved in asthma education program yet.</p>	<p>Mean adjusted benefit per patient from payer perspective = Int\$431 for SPMP vs. CG; Int\$662 for SPMP plus IEP vs. CG.</p> <p>Mean adjusted benefit per patient from societal perspective = Int\$397 for SPMP vs. CG; Int\$590 for SPMP plus IEP vs. CG.</p> <p>Significantly lesser physician consultations, emergency treatments, and days off school in SPMP compared with CG.</p> <p>Significant reduction from baseline in days off school and average daily use of rescue medications in IEP.</p>	<p>Intervention cost per patient = Int\$779 for SPMP; Int\$843 for SPMP plus IEP.</p> <p>Cost savings from payer perspective = Int\$433 for SPMP; Int\$665 for SPMP plus IEP; Int\$2.23 for CG.</p> <p>Cost savings from societal perspective = Int\$480 for SPMP; Int\$673 for SPMP plus IEP; Int\$82 for CG.</p>	Benefit-cost ratio = 0.55 from payer perspective; 0.51 from societal perspective.	94.0

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Polisena J., 2007, Canada (46)	Trial-based, CCA	Societal, 12 months	879 patients aged 1 to 18 years, living in urban or suburban areas with any diagnosed asthma severity and on at least one asthma medication.	<p>Asthma action plan vs. No asthma action plan. The asthma action plan group received asthma action plan in the previous 6 months and were assumed to have also received asthma education that includes two information sessions given by an asthma educator and written materials.</p> <p>The no asthma action plan group did not receive asthma action plan, but received either partial (education by family physicians, pediatricians, school or community health nurses, pharmacists, community organizations, teachers, or internet) or full (education by respiratory specialists, asthma educators, or respiratory therapists) asthma education.</p>	Lower proportion (but not significantly different) of the action plan group had ED visits, hospitalizations, and unscheduled clinic visits, compared to the no asthma action plan group.	<p>Total annual cost per patient</p> <ul style="list-style-type: none"> asthma action plan: Int\$9630 no asthma action plan: Int\$8520 <p>Adjusted cost showed that higher costs were associated with more severe disease, higher household income, more nights with symptoms, longer asthma duration, children of parents of European or other non-North American ethnicity.</p> <p>Indirect costs due to parental productivity losses were 63% of the total annual cost per patient for asthma action plan group, and 64% of that for no asthma action plan group. Asthma action plan group spent Int\$230 more per patient per year for asthma medications.</p>	NA.	94.7
Franco R., 2007, Brazil (55)	Trial-based, CEA	Healthcare provider, patient's family 24 months	81 patients aged 12 to 75 years, living in the metropolitan area with severe asthma (as classified by GINA) for more than 1 year, non smokers or have a smoking history of less than 10 pack/years.	<p>Usual asthma care vs. Programme for Control of Asthma and Allergic Rhinitis (ProAR). ProAR is a program that involved collaboration among chest physician, allergist, pediatrician, nurse, pharmacist, social workers, and psychologist. Asthma education sessions, free inhaled corticosteroids combined with long acting bronchodilators were given to all patients enrolled under ProAR.</p>	Significant improvements in emergency/unscheduled visits, hospitalizations, quality of life, and asthma control. Increased use of inhaled corticosteroids, in scheduled specialist visits and spirometries performed.	<p>Costs included families and government (healthcare provider)</p> <p>Usual care: Int\$198000</p> <p>ProAR : Int\$64100</p> <p>Significant reduction of total annual government costs of treatment and total family costs (asthma expenses and losses for patient and companion).</p>	*- Int\$1590 per one hospitalization avoided (ProAR dominates)	82.5

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					Outcomes	Costs	ICER (unless indicated otherwise)	
Gordois A., 2007, Australia (75)	Modeling, CUA	Healthcare provider 5 years	Patients who satisfied at least one of the criteria, in the last 4 weeks: <ul style="list-style-type: none"> used reliever medication more than 3 times per week woken with cough or chest tightness during the night or in the morning had asthma-related absences from work or study experienced any asthma symptoms such as cough or breathlessness had not been reviewed by a physician in the last 6 months 	Community pharmacist asthma care program (education on asthma and medications, trigger factors, use of inhalers and medication adherence, goal setting, monitoring and review with collaboration with GPs (GPs)) vs. no program (community pharmacist usual care)	A health benefit gain of 0.131 QALYs is estimated to be realized in patients who receive the pharmacist asthma care program compared with usual care.	<p>Total program delivery cost</p> <ul style="list-style-type: none"> Annual review scenario: Int\$785 No annual review scenario: Int\$529 <p>Total cost</p> <ul style="list-style-type: none"> Annual review scenario Intervention group: Int\$2210 Usual care group: Int\$1570 No annual review scenario Intervention group: Int\$1960 Usual care group: Int\$1570 	Int\$3200 (annual review scenario), Int\$1930 (no annual review scenario) per QALY	92.5
Steuten L., 2007, Netherlands (65)	Modeling, CUA	Societal 5 years	Patients aged 18 years and above with a GP diagnosed asthma.	<p>Disease management program (DMP) vs. usual care</p> <p>DMP consisted of pulmonologist, GPs, and respiratory nurse specialists (RNSs). Patient with intermittent or mild asthma were assigned to GP, moderate persistent asthma to RNSs, and severe persistent asthma to the pulmonologist. RNS had several tasks including educator and as a liaison between primary and secondary care.</p> <p>Usual care had no RNS involved. Coordination of care is between patients and their GPs only)</p>	<p>The probability of moving o one of the exacerbation states is lower in the Intervention group. The probability for moving back toward the health state "successful control" is higher compared to usual care. Overall, costs for routine consultations and regular medication increased after implementation of the DMP. Costs for unscheduled consultations, emergency medication, hospitalization, and productivity loss decreased. QALY gained for</p> <ul style="list-style-type: none"> DMP: 3.4±0.8 Usual care: 2.7±0.2 <p>DMP by RNS was associated with a gain in QALY (+1.2±0.5) at a higher cost (+Int\$657±531). DMP by GP and pulmonologist had lower QALY gained and at lower costs.</p>	<p>Annual overhead costs amounted to €101 per patient.</p> <p>With productivity costs, the total cost for</p> <ul style="list-style-type: none"> DMP: Int\$3580±266 Usual care: Int\$4240±453 	*DMP dominates.	84.0

Main author, Year, Country context	Economic evaluation analysis design (Trial-based/Modeling), Type of economic evaluation	Perspective, Time horizon	Study population	Alternatives compared	Results of the economic evaluation			QHES score(s) (%)
					Outcomes	Costs	ICER (unless indicated otherwise)	
Donald K.J., 2008, Australia (73)	Trial-based, CCA	Healthcare payer , 12 months	60 patients aged 18 to 55 years who were hospitalized with a primary diagnosis of asthma.	<p>Intervention group (face-to-face, telephone follow-up and usual care by GP) vs. control group (face-to-face and usual care by GP).</p> <p>Both groups had a one face-to-face session with an asthma nurse educator and received asthma management advice on asthma and its medications, known triggers, and self-management. Patients were provided with a written asthma action plan.</p> <p>Intervention was 6 follow-up telephone calls (one call each week for the first 4 weeks, one at 3 and 6 months) to the patients, asking and giving advice on their current asthma symptoms and management.</p> <p>Control group patients were encouraged to continue with asthma self management and usual GP care after the face-to-face session.</p>	<p>Although not statistically significant different, the number of readmission for patients in Intervention group was lower (1) than in the control group (20).</p> <p>There was clinically important difference in the asthma quality of life scores for the Intervention group in the 12 months study, but not for the control group.</p>	<p>The cost of face-to-face sessions per patient was Int\$73, based on the time spent by the educators, administration, postage and call costs, and a peak flow meter given before the face-to-face session.</p> <p>The mean Intervention cost per patient was Int\$47, based on the time spent by the educators on calls and the cost of 6 calls.</p> <p>The total cost of hospital readmission was Int\$1690 and Int\$33900, for Intervention and control group respectively.</p>	NA	71.8

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Shelledy D.C., 2009, United States of America (48)	Trial-based, CCA	Not specified, 6 months	159 patients aged 18 to 64 years with moderate to severe asthma treated in the emergency department or hospitalized for and acute exacerbation of asthma.	<p>In-home asthma management program (AMP) by respiratory therapists (RT) vs. AMP provided by nurses (RN) vs. usual care (UC) provided by the patient's physician.</p> <p>AMP was a 5 week program; the content of the program is the same as Shelledy et al. 2005.</p> <p>All patients from the 3 groups were instructed to return to their regular physicians for routine follow-up.</p>	<p>Significant difference in peak expiratory flow rate between AMP-RT and UC group.</p> <p>Significant differences in number and length of stay during hospitalizations between both AMP groups and UC group.</p> <p>No significant differences in the mean number of ED visits or clinic visits among the three groups.</p> <p>Significant higher quality of life scores in both AMP groups when compared with UC group.</p>	<p>The Intervention cost per patient was not stated.</p> <p>Hospitalization cost in</p> <ul style="list-style-type: none"> • AMP-RT: Int\$216 • AMP-RN: Int\$0 • UC: Int\$1140 <p>Emergency visit cost in</p> <ul style="list-style-type: none"> • AMP-RT: Int\$78 • AMP-RN: Int\$233 • UC: Int\$335 <p>AMP-RN and AMR-RT costs in hospitalization per patient were significantly less than UC.</p>	NA.	73.4

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D'Souza A.O., 2010, United States of America (41)	Trial-based, CCA	Stakeholder, 24 months	764 asthma patients aged 4 to 64 years.	<p>Intervention group vs. control group.</p> <p>Intervention group patients received a copayment reduction for selected asthma controller medications, and three mailings of educational materials for asthma management including medication guides, asthma myths, action plan, asthma triggers, acute asthma management strategies, and the Asthma Control Test.</p> <p>Those who met the inclusion criteria but did not provide informed consent comprised the control group.</p> <p>Before till after the study ended, both groups patients were eligible for a 24/7 patient-focused service to help them improve their health outcomes and manage their healthcare cost.</p>	<p>Significant higher adherence in Intervention group when compared with the control group.</p> <p>Only 1 patient from each group had 1 hospitalization.</p> <p>6 patients in the control group and 2 patients in the Intervention group had 1 emergency visit.</p> <p>No significant difference in the mean number of physician visits between the 2 groups.</p> <p>No significant differences in the number of short acting beta agonist inhalers before and after Intervention and between two groups.</p>	<p>The Intervention cost per patient was not stated.</p> <p>Total pharmacy costs significantly different</p> <ul style="list-style-type: none"> Intervention group: Int\$191 Control group: Int\$131 <p>Total medical costs significantly different</p> <ul style="list-style-type: none"> Intervention group: Int\$179 Control group: Int\$241 <p>Total overall costs were not statistically different</p> <ul style="list-style-type: none"> Intervention group: Int\$381 Control group: Int\$355 	NA.	80.3

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					Outcomes	Costs	ICER (unless indicated otherwise)	
Xu C., 2010, Australia (76)	Trial-based, CCA	Health care provider, 18 months	121 patients aged 3 to 16 years with doctor-diagnosed asthma who had either had hospitalization in the previous 12 months or had acute asthma requiring oral steroid rescue in the previous 12 months.	Interactive voice response (IVR) systems vs. Nurse Support group vs. control group. All groups had the same initial asthma education with the same Specialist Nurse. In the IVR group, the patients received an automated telephone call made through the system twice a week on their home phone or mobile phone. The Nurse Support group received regular follow-up calls from one Specialist Nurse every 2 weeks that offered education and advice on asthma. The control group received regular GP or hospital outpatient care.	There were no significant differences in the number of oral steroid rescue, ED visits, hospitalizations, school days lost, parents workdays lost, and asthma specific quality of life between the 3 groups.	The Intervention cost per patient for <ul style="list-style-type: none"> • IVR: Int\$139 • Nurse Support: Int\$16 The IVR and Nurse Support groups were cost-saving in relative to the control group with lower health care costs of Int\$233 and Int\$467per patient.	NA.	81.4

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van der Meer V., 2011, Netherlands (8)	Trial-based, CUA	Healthcare provider, societal 12 months	200 patients aged 18 to 50 years, with physician diagnosed asthma according to the international Classification of Primary Care, prescribed inhaled corticosteroids for at least three months in the previous year, access to internet at home, and mastery of the Dutch language.	Internet-based self-management (weekly monitoring of lung function, education, online communication with specialized asthma nurse) plus usual physician-provided care vs. usual physician-provided care alone	There were no significant differences in utilities according to EQ-5D, QALYS, and utilities according to visual analogue scale between the two groups. There was also 16 hours difference in absenteeism between the two groups.	Total implementation cost of internet based self-management per patient: Int\$281 <ul style="list-style-type: none"> • Software support was the highest: Int\$8770 per unit (one unit was used in the study) • Patient's time costs for monitoring: Int\$59 • Patient's time costs for attending education sessions: Int\$ 56.50 Total societal costs per patient in <ul style="list-style-type: none"> • Internet group: Int\$6960 • Usual group: Int\$6250 The difference in total health care costs was Int\$41.	Int\$29600 (societal), Int\$1660 (healthcare) per QALY <i>From societal perspective, the probability of being cost-effective is 62% at Int\$55400 per QALY and 74% at Int\$111000 per QALY.</i> <i>From healthcare perspective, the probability of being cost-effective is 82% at Int\$55400 per QALY and 86% at Int\$111000 per QALY.</i>	81.5

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Wood M. R., 2011, United States of America (53)	Trial-based, CCA	Not specified, 12 months	50 asthma patients aged 5 to 12 years.	<p>50 patients from the original study of African American Parents'/Guardians' Health Literacy and Self-Efficacy and Their Child's Level of Asthma Control vs. local and state data from the Ohio Department of Health information most closely related to the study population age demographic and diagnostic category.</p> <p>In the original study, asthma education was available at the time of the office visit or discharge from the hospital, delivered by nurses and clinical nurse specialists. Written materials and asthma action plan were supplied according to the patients' level of understanding.</p>	Significant reductions in number and length of stay of physician, hospital, and ED visits were found in comparison to state and local population.	The study population had 54% less mean cost of hospitalization and ED visits, Int\$108.20 per patient than the compared population.	NA.	65.4
Rhee H., 2012, United States of America (47)	Trial-based, CCA	Not specified, 9 months	91 patients aged 13 to 17 years, with asthma for at least 1 year and currently experiencing persistent asthma (as defined by the National Heart, Lung, and Blood Institute guidelines). Those with other chronic diseases or emotional disorders were excluded.	<p>Peer-led program (peer leaders themselves were asthmatic for at least 1 year and were on one of control medications) vs. adult-led program (led by a physician and two nurse practitioners).</p> <p>The one day program had similar contents for both groups: education about asthma, medications, and self-management including asthma action plan.</p>	<p>Significant differences in acute primary care physician visits between both groups; the peer-led group had fewer visits than the adult-led group, up to 82% less.</p> <p>No significant differences in specialist visits, primary care physician visit for routine check-up of asthma, ED visits, and hospitalizations between the two groups.</p>	<p>Program cost per patient</p> <ul style="list-style-type: none"> • Peer-led: Int\$115 • Adult-led: Int\$67 <p>Average cost per patient</p> <ul style="list-style-type: none"> • Peer-led: Int\$184 • Adult-led: Int\$173 <p>The difference of cost of acute visits per patient between the two groups: -Int\$17.</p> <p>Net cost saving per patient: Int\$5</p>	NA.	79.3

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					Outcomes	Costs	ICER (unless indicated otherwise)	
Woods E.R., 2012, United States of America (54)	Trial-based, CCA	Societal , 12 months	283 asthma patients aged 2 to 18 years living in urban areas that had a recent emergency visit or hospitalization.	Before vs. after Intervention Intervention included <ul style="list-style-type: none"> nurse case management and coordination of care with primary care and referral services nurse or nurse-supervised Community Health Worker home visits for asthma education, environmental assessment, remediation materials (HEPA vacuum, bedding encasements, and Integrated Pest Management (IPM) materials tailored to the needs of the family) and connection to community resources referral to an IPM exterminator or Inspectional Services when indicated 	There were significant reduction in ED visits, hospitalizations, days of limitation of physical activity, child missed school days, and parental missed work days after 12 months of the Intervention.	The cost of program per patient: Int\$2880 The savings in ED visits and hospitalizations per patient for the Intervention group over 2 years follow-up: Int\$4360 ROI = 1.46 When compared with another similar population but had not had the Intervention, the cost of ED visits and hospitalizations was significantly lower at 2 years.	NA.	71.3

CCA = cost-consequences analysis; CEA = cost-effectiveness analysis; CBA = cost-benefit analysis; CUA = cost-utility analysis; NA = not applicable; QALY = quality-adjusted life years; SFD = symptom free day; FEV1 = forced expiratory volume in 1 second; PEFR = peak expiratory flow rate; ED = emergency department; GP = general practitioner; ICER = incremental cost-effectiveness ratio; CBR = cost benefit ratio; NMB = net monetary benefit; WTP = willingness-to-pay.

