



EVIDENCE SUMMARY

Control Asthma

EVIDENCE-BASED INTERVENTION: PAYERS

1

Use the 2007 National Asthma Education and Prevention Program (NAEPP Guidelines) as part of evidence-based clinical practice and medical management guidelines.

KEY HEALTH AND COST INFORMATION FOR PAYERS AND PROVIDERS



PAYERS

Payers can continue to emphasize key components of the NAEPP in clinical practice guidelines.¹³

The use of ED and hospital claims data has been shown to improve the use of the NAEPP Guidelines have shown that those patients who have been treated according to NAEPP Guidelines recommendations have proportionately fewer ED visits and are hospitalized less often.¹⁴

Using claims data to improve asthma disease case management (for example, through directed provider training, audit, or feedback) has been shown to reduce asthma-related ED visits by up to 55% and hospitalizations by up to 56%.¹⁵

¹⁶ Return on investment has been reported as between \$2.40-\$4.00 per \$1.00 spent.^{17, 18, 19}

Providing ongoing NAEPP Guidelines-based medical education to primary care physicians has been shown to increase dispensing of asthma controller medication by 25%.²⁰



PROVIDERS

Studies of health care providers who follow the NAEPP Guidelines for medical management have shown that their patients had up to a 45% decrease in asthma-related ED visits, up to a 56% decrease in asthma-related hospitalizations, a 19% decrease in asthma-related outpatient visits, and up to a 59% reduction in asthma symptom days compared with non-intervention groups.²¹

^{22, 23, 24, 25, 26, 27, 28} Return on investment has been reported as \$2.40-\$4.00 per \$1.00 spent.^{29, 30, 31}

WHAT IS CDC'S 6|18 INITIATIVE?

The CDC is partnering with health care purchasers, payers, and providers to improve health and control health care costs. CDC provides these partners with rigorous evidence about high-burden health conditions and associated interventions to inform their decisions to have the greatest health and cost impact. This initiative aligns evidence-based preventive practices with emerging value-based payment and delivery models.

FAST FACTS

More than 24 million Americans have asthma, affecting 1 in 12 children and 1 in 14 adults.¹

People with low income are disproportionately affected by asthma compared with those with higher incomes.²

Most low-income children with asthma are enrolled in Medicaid or the Children's Health Insurance Program.³

Black Americans are 2-3 times more likely to die from asthma than any other racial or ethnic group.⁴

Each year, asthma accounts for more than 439,000 hospitalizations, 1.6 million emergency department (ED) visits, and 10.5 million physician office visits.⁵

Asthma was linked to 3,615 deaths (about 10 per day) in 2015,⁶ 13.8 million missed school days in 2013,⁷ and 14.2 million missed work days in 2008.⁸

The cost of treating asthma was estimated to be \$62.8 billion in 2009 by private insurance, Medicaid, Medicare, and other third-party sources.⁹

CURRENT PAYER COVERAGE (AS OF MARCH 2017)

MEDICARE

- ✓ Health plans vary in the degree to which components of the NAEPP Guidelines are used as part of their clinical practice guidelines.

MEDICAID

- ✓ The Centers for Medicare and Medicaid Services (CMS) encourages state Medicaid programs to accelerate widespread adoption of the NAEPP Guidelines. However, state programs vary in the degree to which components of the NAEPP Guidelines (such as assessing asthma severity, asthma control, medication dispensing appropriate to patients' asthma severity and control, and outpatient follow-up visits to conduct these assessments) are emphasized in clinical practice guidelines.^{10, 11} State programs and Medicaid managed care organizations also vary in the degree to which claims data are used to improve health care providers' or patients' adherence to NAEPP Guidelines-based medical management.

COMMERCIAL/PRIVATE

- ✓ Health plans vary in the degree to which components of the NAEPP Guidelines are emphasized as part of clinical practice guidelines.¹² Health plans also vary in the degree to which claims data are used to improve health care providers' or patients' adherence to NAEPP Guidelines-based medical management.

SUPPORTING HEALTH AND COST EVIDENCE: SCIENCE BEHIND THE ISSUE

A payer, provider, and nonprofit organization were partners in a multistate quality improvement project that included promoting guidelines-based medical management for asthma among primary care providers (PCPs). Payer data were used to identify clinics serving patients with asthma at higher risk for ED visits or hospitalizations and to track health outcomes. The project reduced asthma-related ED visits by 55% and asthma-related hospitalizations by 56%. Return on investment was \$2.40 per \$1.00 invested.³²



In a study involving more than 4,000 Medicaid recipients (adults and children) in a large metropolitan area, a program trained health care providers on the NAEPP Guidelines and used claims data to deliver provider-specific feedback at 6-month intervals. This program was shown to reduce asthma-related ED visits by 41%. Return on investment was \$3.00–\$4.00 per \$1.00 spent.³³



In a study of 3,298 urban children (primarily Medicaid or State Children's Health Insurance Program [S-CHIP] participants), when PCPs used the NAEPP Guidelines to determine asthma severity and then developed a written asthma plan with corresponding medications, participating children had 20% fewer symptom days, along with 13% fewer ED visits, compared with a control group. Program start-up costs in the first year were \$29 per child, but annual operating costs in years 2 and 3 decreased to about \$10 per child. For years 2 and 3, estimated return on investment for Medicaid managed care plans was \$3.58 per \$1.00 spent.³⁴



Among PCPs who participated in a citywide asthma management program for 3,748 urban children (89% were Medicaid or S-CHIP participants), provider adherence to NAEPP Guidelines for prescribing anti-inflammatory controller medication increased from 38% to 96%. Among participating patients, medication fills for inhaled corticosteroids increased by 25%. Asthma-related ED visits decreased by 27%, hospitalizations by 35%, and outpatient visits by 19%.³⁵



In 1998–2000, researchers conducted a randomized, controlled clinical trial involving 937 children (5 to 11 years old) with moderate or severe asthma (most of whom had Medicaid, Medicaid managed care, or were uninsured) from seven U.S. inner-city urban areas. This trial evaluated the effect of collecting information from children's caregivers about their children's asthma through bimonthly telephone calls and then communicating this information to their PCPs. PCPs received bimonthly, patient-specific, computer-generated letters summarizing each child's asthma symptoms, health care use, and medication use; if appropriate, the letters also provided recommendations regarding the appropriateness of changes in asthma medication regimens based on NAEPP Guidelines. Researchers observed a 24% drop in asthma-related ED visits with the intervention, saving \$337 per child in the first year.³⁶



In a randomized trial involving 870 children with asthma (more than 70% had commercial insurance) and 101 PCPs in 10 regions of the United States, researchers studied the effect of providing PCPs with two interactive seminar sessions (2.5 hours each) that reviewed NAEPP Guidelines, communication skills, and key educational messages. The study found that patients of physicians who received the intervention had a 46% decrease in days limited by asthma symptoms (8.5 versus 15.6 days), as well as a 45% decrease in asthma-related ED visits (0.30 versus 0.55 visits per year).³⁷



A randomized trial involving 546 people with asthma aged 12–20 years in multiple U.S. inner-city areas (>50% had annual household incomes <\$15,000) showed that medical management consistent with NAEPP Guidelines dramatically reduced asthma symptom days (5.6 vs. 2.3 days, a 59% reduction) within 3 weeks and also reduced asthma exacerbations by 49% over the course of the 1-year treatment period.^{38, 39}

EVIDENCE-BASED INTERVENTION: PAYERS

2

Promote strategies that improve access and adherence to asthma medications and devices.

KEY HEALTH AND COST INFORMATION FOR PAYERS AND PROVIDERS



PAYERS

Higher costs may result from better patient adherence to asthma medication regimens and device use, but these can be offset by savings from fewer asthma-related ED visits or hospitalizations.^{41, 42}

Payers are providing feedback to health care providers from pharmacy claims data on controller or rescue inhaler dispensing to identify patients who frequently use rescue inhalers or do not adhere to controller medication regimens.

Payers are permitting patients to obtain asthma devices such as spacers from pharmacies instead of durable medical equipment facilities, as well as reducing out-of-pocket medication costs for patients.^{43, 44, 45}



PROVIDERS

Evidence-based strategies to increase adherence to asthma medication regimens include shared decision making and asthma self-management education.^{46, 47} Providers can continue incorporating these strategies when developing treatment plans for patients with asthma.

CURRENT PAYER COVERAGE (AS OF MARCH 2017)

MEDICARE

- ✓ Medicare Part B (medical insurance) covers nebulizers (and some medications used in nebulizers if considered reasonable and necessary) as durable medical equipment for Medicare-enrolled providers. If the supplier accepts assignment, the beneficiary must pay 20% of the Medicare-approved amount, and the Part B deductible applies. Depending on the type of equipment, the beneficiary may have to rent or buy it.

MEDICAID

- ✓ All states provide drug coverage, but not all asthma medications and devices are covered.⁴⁰ Barriers to accessing asthma medications or devices include quantity limits, prior authorization requirements, and copayments. Some Medicaid managed care organizations require patients to obtain devices (e.g., spacers) from durable medical equipment vendors instead of pharmacies, which can also be a barrier to access because of the additional time and effort required to visit a separate location.

COMMERCIAL/PRIVATE

- ✓ Health plans may cover some (but not all) asthma medications, and plans have the option to charge copayments, require prior authorization, or specify quantity limits on both medications and spacers.

SUPPORTING HEALTH AND COST EVIDENCE: SCIENCE BEHIND THE ISSUE

An analysis of commercial claims data from 8,834 U.S. children revealed that higher out-of-pocket costs for asthma medications were associated with a reduction in medication use and higher rates of asthma hospitalization among children aged 5–18 years.⁴⁸



Review of pharmacy claims data from 2,023 patients enrolled in a health maintenance organization showed that first-time prescriptions for asthma medications were less likely to be filled (within 30 days of the prescription date) by patients with above-average copays (i.e., more \$12 in this study).⁴⁹



In an analysis of commercial claims data from 40,784 patients with asthma aged 12–64 years, those whose average monthly medication copayment costs increased by more than \$5 experienced a significant decline in average annual days of medication supplied. Furthermore, a copayment increase of more than \$5 per month was associated with more asthma-related outpatient and ED visits among persons with asthma who used leukotriene receptor antagonists or a combination of inhaled corticosteroids plus long-acting beta agonists than among those using similar medications whose copayments increased less than \$5 per month.⁵⁰



A systematic review of interventions at the patient, provider, or systems level to improve medication adherence among U.S. adults found that shared (provider-patient) decision making to produce treatment regimens that accommodated patients' goals and preferences could improve adherence.^{51, 52} Researchers identified asthma self-management education (including, but not limited to, the timing and use of asthma medications and how to handle signs and symptoms of worsening asthma) as an effective tool for improving adherence to medication regimens.⁵³



A systematic review of interventions to improve health care provider adherence to asthma treatment guidelines showed that prescriptions for controller medications could be increased by decision support (interventions designed to support health care provider decision-making), feedback and audit (providing performance data to health care providers about their quality of care), and clinical pharmacy support (targeting pharmacists' delivery of care).⁵⁴

EVIDENCE-BASED INTERVENTION: PAYERS

3

Expand access to intensive self-management education by licensed professionals or qualified lay health workers for patients whose asthma is not well-controlled with the medical management approach outlined in the NAEPP Guidelines.

KEY HEALTH AND COST INFORMATION FOR PAYERS AND PROVIDERS



PAYERS

Intensive asthma self-management education can improve adherence to medication regimens, reduce ED visits or hospitalizations, and yield a positive return on investment.^{66, 67}

National standards for asthma self-management education exist.⁶⁸ Physicians, nurses, respiratory therapists, certified asthma educators, and trained lay health workers, among others, can deliver asthma self-management education.⁶⁹

Certified asthma educators typically are licensed health care professionals with an additional certification in asthma education, but non-health care professionals can also become certified if they have at least 1,000 hours of relevant experience and pass the National Asthma Educator Certification Board Exam.⁷⁰

State Medicaid programs are considering several strategies for advancing reimbursement of asthma self-management education services or expanding the types of providers that can deliver such services (e.g., trained lay health workers). Strategies include “activating” relevant CPT codes (see CPT code list on page 9) and encouraging Medicaid managed care organizations through contractual agreements or quality-improvement projects to promote delivery of asthma self-management education (through trained in-house staff or contracts with external clinic or community educators).⁷¹

State Medicaid programs that are operating in a fee-for-service environment have obtained a Medicaid waiver or state plan amendment (SPA) from CMS to expand the types of providers (e.g., non-health care professionals) that can be reimbursed for providing asthma self-management education. This flexibility results from a CMS 2014 rule change that permits payment for preventive services to Medicaid/Children’s Health Insurance Program beneficiaries for services initially *recommended* by a physician or other licensed healthcare professional.⁷²

Health plans are using several strategies for improving access to intensive self-management education for patients whose asthma is not well-controlled with the medical management approach outlined in the NAEPP Guidelines. These strategies include employing certified asthma educators or trained lay health workers for their asthma disease management programs, training existing staff members to become certified asthma educators, and contracting with community organizations to provide asthma self-management education services.^{73, 74, 75, 76} Medicaid managed care plans are also working with state Medicaid programs to establish individual provider rates and reimbursable billing codes.^{77, 78}



PROVIDERS

Health care providers are investigating and considering payment mechanisms available to them to support their or their staff's delivery of asthma self-management education.

CPT codes to consider include the following:

CPT codes for individual patient education

98960 — Education and training for patient self-management by a qualified, non-physician health care professional using a standardized curriculum, face-to-face with the patient (could include caregiver/family); individual patient

99401 — Patient counseling and/or risk factor reduction intervention services; individual patient follow-up visit

99402 — Patient counseling and/or risk factor reduction intervention services; individual patient initial visit

94664 — Inhalation instructions: Demonstration and/or evaluation of patient utilization of an aerosol generator, nebulizer, metered dose inhaler, or intermittent positive pressure breathing (IPPB) device

CPT codes for group education

98961 — Education and training for patient self-management by a qualified, non-physician health care professional using a standardized curriculum, face-to-face with the patient (could include caregiver/family); 2–4 patients, initial or follow-up visit

98962 — Education and training for patient self-management by a qualified, non-physician healthcare professional using a standardized curriculum, face-to-face with the patient (could include caregiver/family); 5–8 patients, initial or follow-up visit

Health care providers can investigate and consider advising patients on existing asthma self-management education programs available through local health care systems, community organizations, or patients' health plans.^{79, 80}

CURRENT PAYER COVERAGE (AS OF MARCH 2017)

MEDICARE

- ✓ In 2015, Medicare began paying separately under the Medicare Physician Fee Schedule for Chronic Care Management (CCM) services for Medicare patients with multiple chronic conditions such as asthma or chronic obstructive pulmonary disease. Chronic Care Management services are defined as at least 20 minutes of clinical staff time directed by a physician, certified nurse midwife, clinical nurse specialist, nurse practitioner, and physician assistant per calendar month, with the following required elements:

- Patient has multiple (two or more) chronic conditions expected to last at least 12 months or until death.
- Chronic conditions place the patient at significant risk of death, acute exacerbation or decompensation, or functional decline.
- A comprehensive care plan has been established, implemented, revised, or monitored.⁵⁵

As asthma is considered one of the eligible chronic care conditions under CCM services, qualified health care professionals may bill and be reimbursed for asthma medication management and asthma self-management education. These asthma related services may be coordinated and delivered with community/social services as long as these asthma-related services under chronic condition management are documented in compliance with the CCM comprehensive care plan format.

MEDICAID

- ✓ Medicaid programs vary in whether Current Procedural Terminology (CPT) codes relevant to providing asthma self-management education services are reimbursable (98960-98962)^{56, 57, 58, 59, 60}; types of providers who can bill for providing such services also vary by state.⁶¹
- ✓ Medicaid managed care organizations vary in the degree to which they provide asthma self-management education either by in-house staff members (e.g., certified asthma educators within disease management programs) or by contracting with and reimbursing external educators in the clinic or community setting.^{62, 63}

COMMERCIAL/PRIVATE

- ✓ Health plans vary in the degree to which they provide asthma self-management education either by in-house staff members (e.g., certified asthma educators within disease management programs) or by contracting with and reimbursing care coordinators, community health workers, external educators, or community-based organizations in the clinic or community setting.^{64, 65}

SUPPORTING HEALTH AND COST EVIDENCE: SCIENCE BEHIND THE ISSUE

A review of the health and economic evidence for intensive asthma self-management education identified nine U.S. programs that provided this education and reported return on investment (ROI). Asthma self-management education was typically provided through one or more group sessions, but a few programs offered individual instruction either face-to-face or by telephone. Eight of the nine programs reported a positive ROI (i.e., more than \$1 return per \$1 invested) for all or some participants. Among these eight programs, one program achieved a positive ROI only among participants with more than one hospitalization, and one program achieved a positive ROI when its participants had more than two unscheduled asthma visits prior to program enrollment. Estimated time to achieve ROI ranged from 1 to 3 years. An additional 18 U.S. programs provided asthma self-management education and reported economic outcomes but not ROI.



A systematic review of interventions to improve adherence to self-administered medications found that asthma self-management education had the strongest evidence for improving adherence to medication regimens among the 10 chronic conditions studied.⁸²



A systematic review of asthma self-management education found that multifaceted interventions (i.e., those that explicitly addressed patient, provider, and organizational factors) most consistently improved clinical outcomes.⁸³ The authors highlighted the importance of patient education programs supported by regular reviews and ongoing evaluation of effectiveness.



A systematic review found that providing clinical decision-making support to health care providers or clinical pharmacy support (i.e., targeting pharmacists' delivery of care) could help increase health care providers' provision of asthma self-management education to patients.⁸⁴

EVIDENCE-BASED INTERVENTION: PAYERS

4

Expand access to home visits by licensed professionals or qualified lay health workers to provide both targeted, intensive self-management education and the reduction of home asthma triggers for patients whose asthma is not well controlled through use of both NAEPP Guidelines' medical management and asthma self-management education.

KEY HEALTH AND COST INFORMATION FOR PAYERS AND PROVIDERS

Home visits for asthma that target removal of asthma triggers and provide asthma self-management education can improve adherence to medication regimens, reduce ED visits or hospitalizations, and yield a positive return on investment, particularly in urban areas.^{93, 94, 95, 96, 97} Many non-physician health care providers, including nurses, respiratory therapists, certified asthma educators, and trained lay health workers, are utilizing asthma home visit services to

reduce home asthma triggers and provide asthma self-management education.⁹⁸ Certified asthma educators typically are licensed health care professionals with an additional certification in asthma education, but non-healthcare professionals (e.g., trained lay health workers) can also become certified asthma educators if they have at least 1,000 hours of relevant experience and pass the National Asthma Educator Certification Board Exam.⁹⁹



PAYERS

State Medicaid programs are utilizing several strategies for advancing reimbursement of asthma self-management education services or expanding the types of providers that can deliver such services (e.g., trained lay health workers or non-health care professionals who are certified asthma educators). Strategies include encouraging Medicaid managed care organizations through contractual agreements or quality improvement projects to promote delivery of home visit services for asthma, either by trained in-house staff or contracts with external clinic or community providers.¹⁰⁰

State Medicaid programs that are operating in a fee-for-service environment have obtained a Medicaid waiver or SPA from CMS to establish reimbursement for asthma-related home visits or expand the types of providers (e.g., trained lay health workers or non-health care professionals who are certified asthma educators) that can be reimbursed for providing home visits for asthma self-management education and asthma trigger reduction. This flexibility results from a CMS 2014 rule change that permits reimbursement for preventive services to Medicaid/Children's Health Insurance Program

beneficiaries for services initially *recommended* by a physician or other licensed healthcare professional.¹⁰¹

Health plans are using several strategies for expanding access to asthma home visit services or the types of providers that can deliver such services. Strategies include hiring or training staff members (health care professionals or lay health workers) to provide asthma home visit services or contracting with community organizations to provide such services.^{102, 103, 104}



PROVIDERS

Providers can continue to refer patients to asthma home visit programs available through local health care systems, community organizations, or patients' health plans.^{105, 106}

CURRENT PAYER COVERAGE (AS OF MARCH 2017)

MEDICARE

- ✓ Home visits by home and community-based clinical service providers that are directed and coordinated by a physician, certified nurse midwife, clinical nurse specialist, nurse practitioner, and physician assistant per calendar month, may be covered as part of Chronic Care Management Services.

MEDICAID

- ✓ States and Medicaid managed care organizations have varying policies on whether home visit services are available or reimbursable for patients with asthma.^{1,2} States also vary in their designation of which providers are eligible to be reimbursed for delivering such services.²⁶ Medicaid managed care organizations vary in the degree to which they provide home visit services for asthma, either by in-house staff members or by contracting with and reimbursing providers from health care or community organizations.^{3,4,5}

COMMERCIAL/PRIVATE

- ✓ Health plans vary in the degree to which they provide home visit services for asthma, either by in-house staff members or by contracting with and reimbursing external providers from health care or community organizations.^{6,7,8}

SUPPORTING HEALTH AND COST EVIDENCE: SCIENCE BEHIND THE ISSUE

A review of the health and economic evidence for asthma home visits identified 17 U.S. home visit programs that reported ROI.¹⁰⁷

Approximately one-third of these programs involved health plans; most were in urban areas. Fifteen of the 17 programs reported a positive ROI (i.e., more than \$1 return per \$1 invested) for all or some participants; among the programs that reported a positive ROI for participants, one program observed a positive ROI among children less than 6 years old. Median estimated time to achieve ROI was 3 years. An additional 25 U.S. home visit programs reported economic outcomes but not ROI.

Similarly, a systematic review of 13 cost-benefit or cost-effectiveness studies found that home-based, multi-trigger, multicomponent programs for treating asthma provide value (e.g., by reducing medical care costs or missed school and work days) for dollars spent on the interventions. Benefit-cost ratios ranged from \$5.30–14.00 per \$1.00 spent.¹⁰⁸

» For more information and resources, please visit <https://www.cdc.gov/sixteenteen/asthma/>.

REFERENCES

- ¹ Centers for Disease Control and Prevention. Most Recent Asthma Data. February 2017. Available at [Centers for Disease Control and Prevention. Most Recent Asthma Data](#). Accessed 27 March 2017.
- ² Centers for Disease Control and Prevention. Most Recent Asthma Data. February 2017. Available at [Centers for Disease Control and Prevention. Most Recent Asthma Data](#). Accessed 27 March 2017.
- ³ Centers for Disease Control and Prevention. Health Care Coverage among Children. Available at [Centers for Disease Control and Prevention. Health Care Coverage among Children](#). Accessed 27 March 2017.
- ⁴ Centers for Disease Control and Prevention. Asthma's Impact on the Nation: Data from the CDC National Asthma Control Program. Available at [Centers for Disease Control and Prevention. Asthma's Impact on the Nation: Data from the CDC National Asthma Control Program](#). Accessed 18 April 2017.
- ⁵ Centers for Disease Control and Prevention. Most Recent Asthma Data. February 2017. Available at [Centers for Disease Control and Prevention. Most Recent Asthma Data](#). Accessed 27 March 2017.
- ⁶ Centers for Disease Control and Prevention. Most Recent Asthma Data. February 2017. Available at [Centers for Disease Control and Prevention. Most Recent Asthma Data](#). Accessed 27 March 2017.
- ⁷ Centers for Disease Control and Prevention. Asthma-related Missed Schools Days among Children aged 5-17 years. Updated October 2015. Available at [Centers for Disease Control and Prevention. Asthma-related Missed Schools Days among Children aged 5-17 years](#). Accessed 18 April 2017.
- ⁸ Centers for Disease Control and Prevention. Asthma's Impact on the Nation: Data from the CDC National Asthma Control Program. Available at [Centers for Disease Control and Prevention. Asthma's Impact on the Nation: Data from the CDC National Asthma Control Program](#). Accessed 18 April 2017.
- ⁹ Jang J, Gary Chan KC, Huang H, Sullivan SD. Trends in cost and outcomes among adult and pediatric patients with asthma: 2000-2009. *Annals of Allergy, Asthma & Immunology*. 2013;111(6):516-22.
- ¹⁰ American Lung Association. State Medicaid Coverage for Contoller Medications. Available at [American Lung Association. State Medicaid Coverage for Contoller Medications](#). Accessed 3 October 2016.
- ¹¹ National Institutes of Health. National Heart Lung and Blood Institute. Asthma NIH Publication No. 12-5075. September 2012. Available at [National Institutes of Health. National Heart Lung and Blood Institute. Asthma NIH Publication No. 12-5075](#).
- ¹² National Institutes of Health. National Heart Lung and Blood Institute. Asthma NIH Publication No. 12-5075. September 2012. Available at [National Institutes of Health. National Heart Lung and Blood Institute. Asthma NIH Publication No. 12-5075](#).
- ¹³ National Institutes of Health. National Heart Lung and Blood Institute. Asthma NIH Publication No. 12-5075. September 2012. Available at [National Institutes of Health. National Heart Lung and Blood Institute. Asthma NIH Publication No. 12-5075](#).
- ¹⁴ Asthma Community Network. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs. Available at [Asthma Community Network. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs](#). Accessed 18 January 2017.
- ¹⁵ Asthma Community Network. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs. Available at [Asthma Community Network. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs](#). Accessed 18 January 2017.
- ¹⁶ Rossiter LF, Whitehurst-Cook MY, Small RE, et al. The impact of disease management on outcomes and cost of care: a study of low-income asthma patients. *Inquiry*. 2000;37(2):188-202.
- ¹⁷ Rossiter LF, Whitehurst-Cook MY, Small RE, et al. The impact of disease management on outcomes and cost of care: a study of low-income asthma patients. *Inquiry*. 2000;37(2):188-202.
- ¹⁸ Asthma Community Network. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs. Available at [Asthma Community Network. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs](#). Accessed 18 January 2017.
- ¹⁹ Cloutier MM, Grosse SD, Wakefield DB, Nurmagambetov T, Brown CM. The economic impact of an urban asthma management program. *American Journal of Managed Care*. 2009; 15(6): 345-51.
- ²⁰ Cloutier MM et al., Use of asthma guidelines by primary care providers to reduce hospitalizations and emergency department visits in poor, minority, urban children. *Journal of Pediatrics*. 2005; 146(5): 591-7.
- ²¹ Rossiter LF, Whitehurst-Cook MY, Small RE, et al. The impact of disease management on outcomes and cost of care: a study of low-income asthma patients. *Inquiry*. 2000;37(2):188-202.
- ²² Asthma Community Network. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs. Available at [Asthma Community Network. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs](#). Accessed 18 January 2017.
- ²³ Cloutier MM, Grosse SD, Wakefield DB, Nurmagambetov T, Brown CM. The economic impact of an urban asthma management program. *American Journal of Managed Care*. 2009; 15(6): 345-51.
- ²⁴ Cloutier MM et al., Use of asthma guidelines by primary care providers to reduce hospitalizations and emergency department visits in poor, minority, urban children. *Journal of Pediatrics*. 2005; 146(5): 591-7.
- ²⁵ Kattan M, Crain EF, Steinbach S, et al. A randomized clinical trial of clinician feedback to improve quality of care for inner-city children with asthma. *Pediatrics*. 2006;117(6):e1095-103
- ²⁶ Cabana MD, et al. Impact of physician asthma care education on patient outcomes. *Pediatrics*. 2006;117(6):2149-57.
- ²⁷ Szeffler S, Gergen P, Mitchell M, Morgan M. Achieving asthma control in the inner city: Do the National Institutes of Health Asthma Guidelines really work? *Journal of Allergy and Clinical Immunology*. 2010; 125(3):521-526.
- ²⁸ Szeffler SJ, et al. Management of asthma based on exhaled nitric oxide in addition to guideline-based treatment for inner-city adolescents and young adults: a randomised controlled trial. *Lancet*. 2008; 372(9643):1065-72.
- ²⁹ Rossiter LF, Whitehurst-Cook MY, Small RE, et al. The impact of disease management on outcomes and cost of care: a study of low-income asthma patients. *Inquiry*. 2000;37(2):188-202.
- ³⁰ Asthma Community Network. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs. Available at [Asthma Community Network. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs](#). Accessed 18 January 2017.
- ³¹ Cloutier MM, Grosse SD, Wakefield DB, Nurmagambetov T, Brown CM. The economic impact of an urban asthma management program. *American Journal of Managed Care*. 2009; 15(6): 345-51.
- ³² Asthma Community Network. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs. Available at [Asthma Community Network. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs](#). Accessed 18 January 2017.
- ³³ Rossiter LF, Whitehurst-Cook MY, Small RE, et al. The impact of disease management on outcomes and cost of care: a study of low-income asthma patients. *Inquiry*. 2000;37(2):188-202.
- ³⁴ Cloutier MM, Grosse SD, Wakefield DB, Nurmagambetov T, Brown CM. The economic impact of an urban asthma management program. *American Journal of Managed Care*. 2009; 15(6): 345-51.
- ³⁵ Cloutier MM et al., Use of asthma guidelines by primary care providers to reduce hospitalizations and emergency department visits in poor, minority, urban children. *Journal of Pediatrics*. 2005; 146(5): 591-7.
- ³⁶ Kattan M, Crain EF, Steinbach S, et al. A randomized clinical trial of clinician feedback to improve quality of care for inner-city children with asthma. *Pediatrics*. 2006;117(6):e1095-103
- ³⁷ Cabana MD, et al. Impact of physician asthma care education on patient outcomes. *Pediatrics*. 2006;117(6):2149-57.
- ³⁸ Szeffler S, Gergen P, Mitchell M, Morgan M. Achieving asthma control in the inner city: Do the National Institutes of Health Asthma Guidelines really work? *Journal of Allergy and Clinical Immunology*. 2010; 125(3):521-526.
- ³⁹ Szeffler SJ, et al. Management of asthma based on exhaled nitric oxide in addition to guideline-based treatment for inner-city adolescents and young adults: a randomised controlled trial. *Lancet*. 2008; 372(9643):1065-72.
- ⁴⁰ American Lung Association. State Medicaid Coverage for Contoller Medications. Available at [American Lung Association. State Medicaid Coverage for Contoller Medications](#). Accessed 3 October 2016.
- ⁴¹ Rossiter LF, Whitehurst-Cook MY, Small RE, et al. The impact of disease management on outcomes and cost of care: a study of low-income asthma patients. *Inquiry*. 2000;37(2):188-202.
- ⁴² Rust G, Zhang S, Reynolds J. Inhaled corticosteroid adherence and emergency department utilization among Medicaid-enrolled children with asthma. *Journal of Asthma*. 2013; 50(7): 769-775.
- ⁴³ Berger Z, Kimbrough W, Gillespie C, et al. Lower copay and oral administration: predictors of first-fill adherence to new asthma prescriptions. *American Health & Drug Benefits*. 2009;2(4):174-80
- ⁴⁴ Campbell JD, Allen-Ramey F, Sajjan SG, Maiese EM, Sullivan SD. Increasing pharmaceutical copayments: impact on asthma medication utilization and outcomes. *American Journal of Managed Care*. 2011;17(10):703-10
- ⁴⁵ Karaca-Mandic P, Jena AB, Joyce GF, Goldman DP. Out-of-pocket medication costs and use of medications and health care services among children with asthma. *JAMA*. 2012;307(12):1284-91.
- ⁴⁶ Viswanathan M, Golin CE, Jones CD, et al. Interventions to improve adherence to self-administered medications for chronic diseases in the United States: a systematic review. *Annals of Internal Medicine*. 2012;157(11):785-95.
- ⁴⁷ Wilson SR, Strub P, Buist AS, et al. Shared treatment decision making improves adherence and outcomes in poorly controlled asthma. *American Journal of Respiratory and Critical Care Medicine*. 2010;181:566-77.
- ⁴⁸ Karaca-Mandic P, Jena AB, Joyce GF, Goldman DP. Out-of-pocket medication costs and use of medications and health care services among children with asthma. *JAMA*. 2012;307(12):1284-91.
- ⁴⁹ Berger Z, Kimbrough W, Gillespie C, Boscarino JA, Wood GC, Qian Z, Jones JB, Shah NR. Lower copay and oral administration: predictors of first-fill adherence to new asthma prescriptions. *American Health & Drug Benefits*. 2009;2(4):174-80.
- ⁵⁰ Campbell JD, Allen-Ramey F, Sajjan SG, Maiese EM, Sullivan SD. Increasing pharmaceutical copayments: impact on asthma medication utilization and outcomes. *American Journal of Managed Care*. 2011;17(10):703-10
- ⁵¹ Viswanathan M, Golin CE, Jones CD, et al. Interventions to improve adherence to self-administered medications for chronic diseases in the United States: a systematic review. *Annals of Internal Medicine*. 2012;157(11):785-95.
- ⁵² Wilson SR, Strub P, Buist AS, et al. Shared treatment decision making improves adherence and outcomes in poorly controlled asthma. *American Journal of Respiratory and Critical Care Medicine*. 2010;181:566-77.
- ⁵³ Viswanathan M, Golin CE, Jones CD, et al. Interventions to improve adherence to self-administered medications for chronic diseases in the United States: a systematic review. *Annals of Internal Medicine*. 2012;157(11):785-95.
- ⁵⁴ Okelo SO, Butz AM, Sharma R, et al. Interventions to modify health care provider adherence to asthma guidelines: a systematic review. *Pediatrics*. 2013; 132(3):517-34.
- ⁵⁵ Centers for Disease Control and Medicaid Services. Medicare Learning Network. Chronic Care Management Services. Available at [Centers for Disease Control and Medicaid Services. Medicare Learning Network. Chronic Care Management Services](#). Accessed 24 April 2017.
- ⁵⁶ Okelo SO, Butz AM, Sharma R, et al. Interventions to modify health care provider adherence to asthma guidelines: a systematic review. *Pediatrics*. 2013; 132(3):517-34.
- ⁵⁷ American Lung Association. State Medicaid Coverage for Self-Management Education. Available from [American Lung Association. State Medicaid Coverage for Self-Management Education](#). Accessed 3 October 2016.
- ⁵⁸ Centers for Disease Control and Prevention. National Asthma Control Program. Asthma Self-Management Education and Environmental Management: Approaches to Enhancing Reimbursement. Available at [Centers for Disease Control and Prevention. National Asthma Control Program. Asthma Self-Management Education and Environmental Management: Approaches to Enhancing Reimbursement](#).
- ⁵⁹ Gardner A, Kaplan B, Brown W, et al. National standards for asthma self-management education. *Annals of Allergy, Asthma, & Immunology*. 2015 Mar;114(3):178-186.
- ⁶⁰ Markus AR, Andres E, Gerstein MT, Lyons VS. Medicaid payment innovations to financially sustain comprehensive childhood asthma management programs at federally qualified health centers. *Journal of Allergy and Asthma Educators*. June 2013. DOI: 10.1177/2150129713486479.
- ⁶¹ Markus AR, Andres E, Gerstein MT, Lyons VS. Medicaid payment innovations to financially sustain comprehensive childhood asthma management programs at federally qualified health centers. *Journal of Allergy and Asthma Educators*. June 2013. DOI: 10.1177/2150129713486479.
- ⁶² Markus AR, Andres E, Gerstein MT, Lyons VS. Medicaid payment innovations to financially sustain comprehensive childhood asthma management programs at federally qualified health centers. *Journal of Allergy and Asthma Educators*. June 2013. DOI: 10.1177/2150129713486479.

- ⁶³ America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes. Available at [America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes](#). Accessed 17 January 2017.
- ⁶⁴ Markus AR, Andres E, Gerstein MT, Lyons VS. Medicaid payment innovations to financially sustain comprehensive childhood asthma management programs at federally qualified health centers. *Journal of Allergy and Asthma Educators*. June 2013. DOI: 10.1177/2150129713486479.
- ⁶⁵ America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes. Available at [America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes](#). Accessed 17 January 2017.
- ⁶⁶ Viswanathan M, Golin CE, Jones CD, et al. Interventions to improve adherence to self-administered medications for chronic diseases in the United States: a systematic review. *Annals of Internal Medicine*. 2012;157(11):785-95.
- ⁶⁷ Hsu J, Wilhelm N, Lewis L, Herman E. Economic evidence for U.S. asthma self-management education and home-based interventions. *Journal of Allergy and Clinical Immunology: In Practice*. 2016. DOI: 10.1016/j.jaip.2016.05.012.
- ⁶⁸ Gardner A, Kaplan B, Brown W, et al. National standards for asthma self-management education. *Annals of Allergy, Asthma, & Immunology*. 2015 Mar;114(3):178-186.
- ⁶⁹ Hsu J, Wilhelm N, Lewis L, Herman E. Economic evidence for U.S. asthma self-management education and home-based interventions. *Journal of Allergy and Clinical Immunology: In Practice*. 2016. DOI: 10.1016/j.jaip.2016.05.012.
- ⁷⁰ National Asthma Educator Certification Board Frequently Asked Questions. Available at [National Asthma Educator Certification Board Frequently Asked Questions](#). Accessed 17 January 2017.
- ⁷¹ Markus AR, Andres E, Gerstein MT, Lyons VS. Medicaid payment innovations to financially sustain comprehensive childhood asthma management programs at federally qualified health centers. *Journal of Allergy and Asthma Educators*. 2013 Jun. DOI: 10.1177/2150129713486479.
- ⁷² Childhood Asthma Leadership Coalition. Pathways to Medicaid Reimbursement for Pediatric Asthma Services. Available at [Childhood Asthma Leadership Coalition. Pathways to Medicaid Reimbursement for Pediatric Asthma Services](#). Accessed 3 October 2016.
- ⁷³ Centers for Disease Control and Prevention. National Asthma Control Program. Asthma Self-Management Education and Environmental Management: Approaches to Enhancing Reimbursement. Available at [Centers for Disease Control and Prevention. National Asthma Control Program. Asthma Self-Management Education and Environmental Management: Approaches to Enhancing Reimbursement](#).
- ⁷⁴ Markus AR, Andres E, Gerstein MT, Lyons VS. Medicaid payment innovations to financially sustain comprehensive childhood asthma management programs at federally qualified health centers. *Journal of Allergy and Asthma Educators*. 2013 Jun. DOI: 10.1177/2150129713486479.
- ⁷⁵ America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes. Available at [America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes](#). Accessed 17 January 2017.
- ⁷⁶ Hsu J, Wilhelm N, Lewis L, Herman E. Economic evidence for U.S. asthma self-management education and home-based interventions. *Journal of Allergy and Clinical Immunology: In Practice*. 2016. DOI: 10.1016/j.jaip.2016.05.012.
- ⁷⁷ Centers for Disease Control and Prevention. National Asthma Control Program. Asthma Self-Management Education and Environmental Management: Approaches to Enhancing Reimbursement. Available at [Centers for Disease Control and Prevention. National Asthma Control Program. Asthma Self-Management Education and Environmental Management: Approaches to Enhancing Reimbursement](#).
- ⁷⁸ Markus AR, Andres E, Gerstein MT, Lyons VS. Medicaid payment innovations to financially sustain comprehensive childhood asthma management programs at federally qualified health centers. *Journal of Allergy and Asthma Educators*. 2013 Jun. DOI: 10.1177/2150129713486479.
- ⁷⁹ America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes. Available at [America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes](#). Accessed 17 January 2017.
- ⁸⁰ Hsu J, Wilhelm N, Lewis L, Herman E. Economic evidence for U.S. asthma self-management education and home-based interventions. *Journal of Allergy and Clinical Immunology: In Practice*. 2016. DOI: 10.1016/j.jaip.2016.05.012.
- ⁸¹ Hsu J, Wilhelm N, Lewis L, Herman E. Economic evidence for U.S. asthma self-management education and home-based interventions. *Journal of Allergy and Clinical Immunology: In Practice*. 2016. DOI: 10.1016/j.jaip.2016.05.012.
- ⁸² Viswanathan M, Golin CE, Jones CD, et al. Interventions to improve adherence to self-administered medications for chronic diseases in the United States: a systematic review. *Annals of Internal Medicine*. 2012;157(11):785-95.
- ⁸³ Pinnock H, et al. Implementing supported self-management for asthma: a systematic review and suggested hierarchy of evidence of implementation studies. *BioMed Central*. 2015;1:13-127.
- ⁸⁴ Okelo SO, Butz AM, Sharma R, et al. Interventions to modify health care provider adherence to asthma guidelines: a systematic review. *Pediatrics*. 2013;132(3):517-34.
- ⁸⁵ American Lung Association. State Medicaid Coverage for Home Visits. Updated June 30, 2016. Available at [American Lung Association. State Medicaid Coverage for Home Visits](#).
- ⁸⁶ Markus AR, Andres E, Gerstein MT, Lyons VS. Medicaid payment innovations to financially sustain comprehensive childhood asthma management programs at federally qualified health centers. *Journal of Allergy and Asthma Educators*. 2013 Jun. DOI: 10.1177/2150129713486479.
- ⁸⁷ Markus AR, Andres E, Gerstein MT, Lyons VS. Medicaid payment innovations to financially sustain comprehensive childhood asthma management programs at federally qualified health centers. *Journal of Allergy and Asthma Educators*. 2013 Jun. DOI: 10.1177/2150129713486479.
- ⁸⁸ America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes. Available at [America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes](#). Accessed 17 January 2017.
- ⁸⁹ Hsu J, Wilhelm N, Lewis L, Herman E. Economic evidence for U.S. asthma self-management education and home-based interventions. *Journal of Allergy and Clinical Immunology: In Practice*. 2016. DOI: 10.1016/j.jaip.2016.05.012.
- ⁹⁰ Markus AR, Andres E, Gerstein MT, Lyons VS. Medicaid payment innovations to financially sustain comprehensive childhood asthma management programs at federally qualified health centers. *Journal of Allergy and Asthma Educators*. 2013 Jun. DOI: 10.1177/2150129713486479.
- ⁹¹ America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes. Available at [America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes](#). Accessed 17 January 2017.
- ⁹² Hsu J, Wilhelm N, Lewis L, Herman E. Economic evidence for U.S. asthma self-management education and home-based interventions. *Journal of Allergy and Clinical Immunology: In Practice*. 2016. DOI: 10.1016/j.jaip.2016.05.012.
- ⁹³ Hsu J, Wilhelm N, Lewis L, Herman E. Economic evidence for U.S. asthma self-management education and home-based interventions. *Journal of Allergy and Clinical Immunology: In Practice*. 2016. DOI: 10.1016/j.jaip.2016.05.012.
- ⁹⁴ Environmental Protection Agency. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs. Available at [Environmental Protection Agency. Collaborating for Better Care: Strategies for Successful Partnerships Between Health Plans and Asthma Programs](#). Accessed 17 January 2017.
- ⁹⁵ Reddy AL, Gomez M, Dixon SL. An evaluation of a state-funded healthy homes intervention on asthma outcomes in adults and children. *Journal of Public Health Management & Practice*. 23(2):219-228, March/April 2017.
- ⁹⁶ Gomez M, Reddy A, Dixon SL, et al. A cost-benefit analysis of a state-funded healthy homes program for residents with asthma: findings from the New York State Healthy Neighborhoods Program. *Journal of Public Health Management & Practice*. 23(2):229-238, March/April 2017.
- ⁹⁷ Nurmagametov TA, Barnett SBL, Jacob V, Chattopadhyay SK, Hopkins DP, Crocker DD, et al. Economic value of home-based, multi-trigger, multicomponent interventions with an environmental focus for reducing asthma morbidity: a Community Guide systematic review. *American Journal of Preventive Medicine*. 2011;41(2S1):S33-S47.
- ⁹⁸ Hsu J, Wilhelm N, Lewis L, Herman E. Economic evidence for U.S. asthma self-management education and home-based interventions. *Journal of Allergy and Clinical Immunology: In Practice*. 2016. DOI: 10.1016/j.jaip.2016.05.012.
- ⁹⁹ National Asthma Educator Certification Board Frequently Asked Questions. Available at [National Asthma Educator Certification Board Frequently Asked Questions](#). Accessed 17 January 2017.
- ¹⁰⁰ Markus AR, Andres E, Gerstein MT, Lyons VS. Medicaid payment innovations to financially sustain comprehensive childhood asthma management programs at federally qualified health centers. *Journal of Allergy and Asthma Educators*. 2013 Jun. DOI: 10.1177/2150129713486479.
- ¹⁰¹ Childhood Asthma Leadership Coalition. Pathways to Medicaid Reimbursement for Pediatric Asthma Services. Available at [Childhood Asthma Leadership Coalition. Pathways to Medicaid Reimbursement for Pediatric Asthma Services](#). Accessed 3 October 2016.
- ¹⁰² Markus AR, Andres E, Gerstein MT, Lyons VS. Medicaid payment innovations to financially sustain comprehensive childhood asthma management programs at federally qualified health centers. *Journal of Allergy and Asthma Educators*. June 2013. DOI: 10.1177/2150129713486479.
- ¹⁰³ America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes. Available at [America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes](#). Accessed 17 January 2017.
- ¹⁰⁴ Hsu J, Wilhelm N, Lewis L, Herman E. Economic evidence for U.S. asthma self-management education and home-based interventions. *Journal of Allergy and Clinical Immunology: In Practice*. 2016. DOI: 10.1016/j.jaip.2016.05.012.
- ¹⁰⁵ America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes. Available at [America's Health Insurance Plans. Next Generation Asthma Care: Integrating Clinical and Environmental Strategies to Improve Asthma Outcomes](#). Accessed 17 January 2017.
- ¹⁰⁶ Hsu J, Wilhelm N, Lewis L, Herman E. Economic evidence for U.S. asthma self-management education and home-based interventions. *Journal of Allergy and Clinical Immunology: In Practice*. 2016. DOI: 10.1016/j.jaip.2016.05.012.
- ¹⁰⁷ Hsu J, Wilhelm N, Lewis L, Herman E. Economic evidence for U.S. asthma self-management education and home-based interventions. *Journal of Allergy and Clinical Immunology: In Practice*. 2016. DOI: 10.1016/j.jaip.2016.05.012.
- ¹⁰⁸ Nurmagametov TA, Barnett SBL, Jacob V, Chattopadhyay SK, Hopkins DP, Crocker DD, et al. Economic value of home-based, multi-trigger, multicomponent interventions with an environmental focus for reducing asthma morbidity: a Community Guide systematic review. *American Journal of Preventive Medicine*. 2011;41(2S1):S33-S47.

