

The Economic Value of Home Asthma Interventions

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Asthma is a common and costly chronic illness affecting people of every economic level, demographic category, and age group. People with asthma can be disabled by their illness, especially during acute episodes, and unable to perform basic life tasks such as attend school or work.^{1–6} Properly managed, however, individuals with asthma can lead a normal life, including participating in sports and other activities, and high-cost events, such as visits to the emergency department or inpatient hospital care can be avoided. The review presented in this supplement to the *American Journal of Preventive Medicine* by Nurmagambetov et al.⁷ shows that comprehensive home environmental interventions have the potential to be cost-effective interventions for children with asthma. This is particularly true if the programs reduce the use of healthcare resources devoted to treating acute asthma exacerbations brought on by triggers in the home environments.

The National Asthma Education and Prevention Program suggests that optimal management of asthma depends on three crucial elements.^{8,9}

- Access to high-quality medical care
- Medication management
- Environmental trigger avoidance.

Environmental trigger avoidance includes taking appropriate measures to modify the environment of a person with asthma to minimize exposure to potential triggers. Because most individuals spend large portions of their lives in their homes, the home is one of the key environments that should be modified.

All seven of the reviewed RCTs of home interventions found positive effects of the interventions on asthma outcomes. This strongly suggests that home environmental interventions can be used to improve health, a necessary—although not sufficient—criterion for cost effectiveness.

The reviewed studies do show wide variations in the cost per unit of benefit. In general, the interventions with lower program cost were more cost effective. Of the three

studies reporting cost per symptom-free day (SFD) gained, the interventions that reported the **lowest** cost per SFD gained also had the lowest program cost¹⁰—\$458 per participant and a cost per SFD gained of \$12. Both the Inner City Asthma study and Healthy Homes study had a greater impact on SFD gained; however, both of those interventions were considerably more costly in terms of program cost, which yielded a higher cost per SFD gained. Indeed, the highest cost per benefit was found for interventions with the highest program cost. One key factor that determined the cost of the program was the type of provider used, most obviously due to differences in wages. This higher cost could potentially be offset by higher effectiveness if the more trained personnel were more effective. The reviewed studies generally did not show such an offset.

Overall, the reviewed research indicates that a moderate health impact can be achieved with a relatively low-cost, low-intensity home environmental intervention. Such an intervention may have a cost-effectiveness ratio on par with standard pharmaceutical interventions, such as the use of inhaled steroids as regular therapy. Studies of inhaled steroids have found that the incremental cost effectiveness of steroids is \$11 per SFD gained¹¹ (using the payer perspective, because most of the home interventions did not value indirect costs)—little different from the \$12 per SFD reported for home environmental interventions. So, asthma home interventions can compare favorably to standard pharmacologic treatments.

It appears that some effect can be achieved from even a relatively low-intensity intervention. For example, Dolinar et al.¹² provided a single asthma education session delivered in the patient's home, and reported improved parental coping and a higher perceived change in the child's asthma. This effect can also be observed in Healthy Homes, where both the high-intensity and the low-intensity arms showed improvement over baseline. A similar result is also reported in the Community Asthma Prevention Program, as well as in other asthma interventions, such as the use of pharmacists to provide education.¹³

Although there have been a number of successful randomized clinical trials examining the impact of home environmental modifications, several key research questions remain unanswered:

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- What is the persistence of the effect of home environmental interventions?

Of the reviewed studies, most have a 6- to 12-month follow-up. The evidence suggests that the benefits of the interventions decline over time, but the long-term extent of the decline is unclear. For example, the Inner City Asthma Study reported that unscheduled visits to the ED or clinic for asthma care declined by 0.35 per child per year during the first year, and by 0.26 days per year per child during the second year. This suggests that approximately one quarter of the benefits were lost during the second year. The National Cooperative Inner-City Asthma Study reported that the maximum symptom-days declined by -14.3 per child per year during the first year, and by -13.3 during the second year, suggesting that approximately 7% of the benefits were lost during the second year.

If the benefits of home interventions persist over several years, even relatively small decreases in health expenditures may be sufficient for the program to be cost neutral. Alternatively, if the benefits diminish substantially, limited follow-up programs may be effective in sustaining the effectiveness of the intervention.

- What type of professional training is most effective?

There is no consensus in the literature on appropriate training for the individuals performing the home interventions. In the published literature, studies have used medical doctors,¹² environmental counselors/interventionists,¹⁴ asthma counselors,¹⁵ community health workers,¹⁶ registered nurses,¹⁷ home health nurses,¹⁸ pharmacists,¹⁴ and peer educators.¹⁹ There is also the possibility of using respiratory therapists.

All of these different professional backgrounds have strengths and weaknesses. The key trade-off is between a superior understanding of the community—found in community health workers, asthma counselors, and peer educators—and a superior understanding of health and asthma, exemplified by medical doctors, pharmacists, and nurses. Particularly for low-income and minority communities, the ability to communicate successfully with families may be more important for effectiveness than a fuller understanding of the illness. The personnel with less medical training also typically have lower salaries, which may lead to more cost-effective treatment, even with potentially lower effectiveness.

- What is the effect of home interventions on indirect costs?

Several of the existing studies have not measured indirect costs, such as days of school missed or caregiver days of work missed. Results from studies that have included such measures, including the Healthy Homes and Disease Management Program: Asthma suggest that the ben-

efits from reduced indirect costs may be substantial. Further efforts to quantify and provide a dollar value for these indirect costs would provide a fuller measure of the financial impact of these interventions.

Although further study is clearly warranted, the scientific evidence to date is strong enough to justify the coverage of home environmental interventions by public and private third-party payers for children with moderate to severe asthma. There is little evidence, however, on the optimal design of these home environmental modifications. This lack of evidence argues both for further studies on such design issues and against any type of regulation or standardization of home environmental modifications until better evidence is available.

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