Research Article

SDC

An Evaluation of a State-Funded Healthy Homes Intervention on Asthma Outcomes in Adults and Children

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ABSTRACT

Context: Reducing exposure to environmental triggers is a critical part of asthma management.

Objective: To evaluate the impact of a healthy homes intervention on asthma outcomes and assess the impact of different targeting strategies.

Setting: The New York State (NYS) Healthy Neighborhoods Program (HNP) operates in select communities with a higher burden of housing-related illness and associated risk factors.

Participants: Residents with asthma were recruited through 3 mechanisms: door-to-door canvassing (CANVASSED), 752 residents in 457 dwellings; referrals from community partners (REFERRED), 573 residents in 307 dwellings; referrals of Medicaid enrollees with poorly controlled asthma (TARGETED), 140 residents in 140 dwellings.

Intervention: The NYS HNP provides visual assessments and low-cost interventions to identify and address asthma triggers and trigger-promoting conditions in the home environment. Conditions are reassessed during a revisit conducted 3 to 6 months after the initial visit.

Main Outcome Measure(s): The analysis compares improvements across the 3 groups for measures of asthma self-management, health care access, morbidity, and environmental conditions. An asthma trigger score characterizing the extent of multiple triggers in a dwelling was also calculated.

Results: Among 1465 adults and children, there were significant improvements in environmental conditions and self-reported self-management, health care access, and asthma morbidity outcomes for each group. The improvement was greatest in the TARGETED group for most outcomes, but selected measures of self-management and health care access were greater in the other groups. The mean improvement was significantly greater in the TARGETED group.

Conclusion: Targeting the intervention to people with poorly controlled asthma maximizes improvements in trigger avoidance and asthma morbidity; however, other recruitment strategies are effective for impacting endpoints related to health care access and self-management. This evaluation demonstrates that a low-intensity home-based environmental intervention is effective as well as practical and feasible. Health care payers, state and local health departments, and others should consider investing in these home-based services as part of a comprehensive asthma care package.

KEY WORDS: asthma intervention, asthma outcomes evaluation, healthy homes, home environments, housing

People with poorly controlled asthma often live in environments that exacerbate their symptoms and minimize their ability to gain control.[1-5] Control of environmental factors is a key component of asthma management, but education about asthma triggers is often not a routine part of clinical asthma care. Evidence-based strategies exist, such as home-based environmental interventions, but are underutilized. The effectiveness of home-based environmental interventions in reducing asthma

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morbidity is now well-established.[6-32] This approach has been effective at reducing the presence of common asthma triggers and conditions that promote triggers in the home and also for improving health outcomes. Multiple studies have reported significant reductions following completion of a home visiting program in emergency department (ED) visits, hospitalizations, days with worsening asthma, days of school or work missed because of asthma, improvements in appropriate use of medications, use of asthma action plans, knowledge of personal triggers, and how to reduce exposures to triggers. Projected costs and savings vary according to program design and intensity, but a Community Guide review concluded that home-based, multitrigger, multicomponent interventions are a good investment, with cost-benefit ratios ranging from a return of $5.30 to $14.00 for every dollar invested.[11]

However, as health care payers consider opportunities to translate this evidence into policy (eg, Medicaid coverage), several important questions remain. For example, most of the evidence has emerged both from studies conducted in urban settings and from studies focused on children with asthma. As a result, the effectiveness of home visits for rural populations and adults with asthma has not been as well characterized. Additional research gaps include the impact of targeting services to residents with poorly controlled asthma, staffing, number of visits, and remediation intensity. This article addresses several of these gaps by describing the impact of a state-funded, home-based, environmental asthma intervention for both pediatric and adult populations across a variety of geographic settings. It also describes the differential impact of 3 recruitment methods on environmental, self-management, health care access and asthma morbidity outcomes. Finally, the article contributes to the evidence base about the effectiveness of nonclinical staff in providing a low-intensity intervention and characterizes the extent of asthma triggers within a single dwelling by calculating an asthma trigger score.

Methods

The New York State (NYS) Healthy Neighborhoods Program (HNP) provides in-home assessments and interventions to reduce residential health and safety hazards in selected communities throughout NYS. Since 2006, the HNP has been funded continuously from the state's general funds. We describe the program in detail in a separate article.[33] The HNP is best classified as a minor to moderate intervention that uses a variety of lay staff (eg, sanitarians, health educators) to provide services.[34] In a separate article, we report that the HNP provides a favorable return on investment, with an estimated benefit to program cost ratio of 2.03 and a net benefit of $311 per resident with asthma.[35]

Program description

During the evaluation time frame (2007-2011), 13 counties were funded to implement the program. Each county selects high-risk areas to target based on zip codes in urban areas, towns, or regions, and within the target areas, the programs visit homes in selected neighborhoods or blocks with the greatest need (eg, older housing). Homes and residents are reached through a combination of door-to-door canvassing and referrals from other programs, local organizations, or health care providers. The program addresses 6 potential categories of health and safety hazards, including the presence of common asthma triggers. On the basis of the assessment, residents are provided with education, referrals to services, or low-cost products to address identified problems. Once inside the home, conditions are assessed and interventions are provided as needed. Three to 6 months after the initial visit, the counties are expected to conduct revisits for roughly a quarter of all homes, prioritizing those with the most serious conditions and/or with residents with asthma. During the revisit, the conditions are reassessed and any new or ongoing problems are addressed.

The HNP data are collected using a 2-part standardized form (see documents, Supplemental Digital Content 1, available at: http://links.lww.com/JPHMP/A290). The dwelling form includes demographic information about the primary respondent, characteristics of the dwelling, enumeration of the residents, physical conditions of the dwelling, and interventions provided. The asthma form is completed for each person with asthma and includes information about the presence of asthma triggers, asthma symptoms and morbidity, and self-management. No personal identifiers are collected. Completed forms are faxed to NYS Department of Health (DOH), scanned, and extracted data are saved to a database. Data fields are automatically checked for completeness and valid values, and errors are manually verified and corrected.

Analysis groups

We classified residents as having "active asthma" if they used a quick-relief asthma medicine in the past week, had a current prescription for a controller medication, had an asthma attack in the past 3 months, and/or 1 or more medical encounters in the past 12 months for an asthma attack or worsening symptoms (an ED or urgent care visit, health care

professional visit, or hospital stay).[36] To assess the impact of targeting the intervention to people with poorly controlled asthma, we evaluated outcomes for 3 groups of residents with active asthma, recruited through different methods:

TARGETED: Residents in this group had poorly controlled asthma, were enrollees of Medicaid Managed Care Plans, and lived in one of 15 high-risk urban zip codes in one of the funded counties. As part of a special initiative in this county, managed care plans identified enrollees with poorly controlled asthma on the basis of an ED visit or hospitalization for asthma within the previous 6 months or medication history indicating poor control (eg, no evidence of filled prescription for controller medication in past 6 months and 3 or more filled prescriptions for quick-relief medications during the same time period).

REFERRED: Residents in this group were referred to the HNP from other programs, local organizations, or health care providers (but not necessarily on the basis of an asthma diagnosis) and had a self-reported diagnosis of active asthma.

CANVASSED: Participants in this group were identified through door-to-door canvassing in high-risk areas and had a self-reported diagnosis of active asthma. Local county health departments define high-risk areas using census and surveillance data to identify areas with poor housing quality and high rates of housing-related illness and injury.

To make the groups more comparable, data from 2 rural counties were excluded from the analysis.

The institutional review board of NYS DOH granted exempt status to both the program evaluation of the HNP and the targeting initiative on the basis of not being research.

Analysis

Data were collected between October 1, 2007, and June 30, 2011. This analysis focuses on the asthma component of the intervention. Each environmental condition and asthma self-management strategy reported at the initial visit is coded present, absent, or unknown (ie, not assessed or not applicable). At the revisit, each is coded present, improved, absent, or unknown. The presence of an environmental condition is "bad"; the presence of an asthma self-management strategy is "good." Use of quick-relief medication and morbidity outcomes are measured as the number of occurrences within a specified time frame.[36]

For dwellings with a revisit, we present the percentage with the environmental condition at the initial visit and the change (percent improved) at the revisit, along with the exact binomial 95% confidence interval (CI) with continuity correction for the observed change. To assess improvement, we looked at dwellings where the condition was present at the initial visit and calculated the percentage of these dwellings where the condition was improved (ie, absent or still present but improved) at the revisit. We used McNemar's test to determine whether the percentage with a hazard changed significantly between visits and examined the overlap in 95% CIs for between-group comparisons. Statistical significance was defined as $P < .05$. All analyses were conducted with SAS (version 9.4; SAS Institute, Inc, Cary, North Carolina).

We analyzed 3 asthma outcomes: days with worsening asthma or attacks; days missed of school, day care, or work due to asthma; days missed of school, day care, or work by another family member. We present the mean number for children and adults separately by the recruitment method at the initial visit, revisit, and the change (initial visit − revisit) and its 95% CI.

The companion article by Reddy et al[33] describes the process used to select conditions for inclusion in the home hazard score; the same method was used to develop an asthma trigger score. Fourteen individual conditions were identified for possible inclusion in the score.[33] The final score includes 10 elements (6 individual conditions and 4 combined conditions) that were weighted equally. Scores were calculated for dwellings, not persons. One of the selected conditions, sleeping in the same room as a pet, was reported at the person level but analyzed at the dwelling level where the trigger is present if any resident with asthma reported sleeping with a pet with fur or feathers.

For a dwelling to be included in the analysis, we required nonmissing data for at least 8 of the 10 hazards for each visit. If a hazard was missing at the revisit but reported at the initial visit, the value for the hazard was assigned the conditional prevalence of that hazard at the revisit given the value (present or absent) at the initial visit. If data were missing for a hazard at both visits (if at least 8 other hazards were nonmissing), the revisit value was assigned the revisit prevalence of the hazard among the nonmissing observations.

For each of the 3 groups, we present the mean asthma trigger scores at the initial visit, revisit, and change from the initial visit to the revisit. We used an overall analysis of variance (ANOVA) *F*-test for the hypothesis that at least 2 of the 3 groups have different means. For $P < .05$, we present P values from

the ANOVA model-based *t* test that the least squares means are not equal for each pair of the groups.

Results

Table 1 presents the characteristics of the revisited dwellings and residents by recruitment group. During the evaluation period, 1465 residents with asthma in 904 dwellings completed both an initial visit and a revisit. On the basis of information provided by the primary respondents, a greater proportion of participants in the TARGETED group compared with the other groups were nonwhite (84% vs ~50%, respectively) and Hispanic/Latino (30% vs ~15%, respectively) and received public assistance (98% vs 60%-77%, respectively). Roughly half of the participants in each group were adults, and 60% to 70% of adults and children were female.

We examined the prevalence of triggers and trigger-promoting conditions at the initial visit and improvement following the intervention (see documents, Supplemental Digital Content 2, available at: http://links.lww.com/JPHMP/A291). There were notable differences in the prevalence of triggers among the groups, especially between the TARGETED and CANVASSED groups. The prevalence of mold and dust accumulation/ineffective housecleaning in the TARGETTED group was 40% and 31%, respectively (followed closely by the REFERRED group), but 10% and 18%, respectively, in the CANVASSED group. In contrast, the prevalence of smoking in the home and mice in the CANVASSED group was 43% and 20%, respectively, compared with 26% and 6%, respectively, in the TARGETED group. There were some similarities and differences in the triggers that showed significant improvement (ie, a reduction in the presence of a trigger in homes where the trigger was present at the initial visit). In the TARGETED group, there was a modest but significant (11%) reduction in smoking but was not significant in the other 2 groups. There was a significant reduction of 40% to 60% in the presence of cockroaches and mold in all groups. Rodents were reduced significantly in all 3 groups, but the magnitude ranged from 100% in the TARGETED group, 61% in the REFERRED group, and 45% in the CANVASSED group.

The mean asthma trigger score (ie, mean number of asthma triggers per home) at the initial visit was between 1.6 and 1.8 for all groups and not significantly different (Table 2). At the revisit, the mean scores were significantly different ($P < .001$) for 2 pairs: TARGETED versus REFERRED and TARGETED versus CANVASSED. The mean scores decreased significantly in all 3 groups (TARGETED, 0.8; REFERRED, 0.5; and CANVASSED, 0.4) and the same 2 pairs were significantly different: TARGETED versus REFERRED and TARGETED versus CANVASSED.

Table 3 presents the prevalence of self-reported asthma control measures and health care access endpoints at the initial visit and the change following the intervention. In the TARGETED group, 19% of individuals knew their personal triggers, 6% knew how to avoid their triggers compared with about 70% in the other 2 groups, and 21% reported that their

TABLE 1
Characteristics of Dwellings (N = 904) and Residents (N = 1 465), by Recruitment Group

Characteristic	TARGETED (140 Dwellings, 140 Residents)	REFERRED (307 Dwellings, 573 Residents)	CANVASSED (457 Dwellings, 752 Residents)
Visit interval (mean no. of days)	91	115	130
Dwelling			
Multiunit building	68%	63%	54%
Built pre-1978 (pre-1950)	94% (78%)	96% (75%)	97% (76%)
Primary respondent (1 per dwelling)			
Renter	86%	80%	73%
Nonwhite	84%	53%	52%
Hispanic/Latino	30%	16%	15%
Completed high school or equivalent	89%	79%	75%
Receives public assistance	98%	77%	60%
Receives rental assistance/Section 8	10%	32%	35%
Residents (1 or more per dwelling)			
Adults (children)	52% (48%)	51% (49%)	57% (43%)
Male (female)	30% (70%)	37% (63%)	39% (61%)

TABLE 2
Asthma Trigger Scores at Initial Visit and Revisit and Change Between Visits, by Recruitment Group

Visit(s)	Asthma Trigger Scores, Mean (95% CI)			*P*			
	TARGETED (113 Dwellings)	REFERRED (283 Dwellings)	CANVASSED (363 Dwellings)	Group Differences Overall[a]	TARGETED vs REFERRED[b]	TARGETED vs CANVASSED[b]	REFERRED vs CANVASSED[b]
Initial visit	1.6 (1.3-1.8)	1.7 (1.5-1.9)	1.8 (1.7-2.0)	.20	…	…	…
Revisit	0.7 (0.6-0.9)	1.2 (1.1-1.4)	1.4 (1.3-1.6)	<.001	<.001	<.001	.05
Change from initial visit to revisit	0.8 (0.7-1.0)	0.5 (0.3-0.6)	0.4 (0.3-0.5)	<.001	.002	<.001	.33

Abbreviations: ANOVA, analysis of variance; CI, confidence interval.
[a] *Overall ANOVA* F *test that at least 2 of the 3 groups have different means.*
[b] *ANOVA model-based* t *test that least squares means are not equal for paired groups. If the* F *test is not significant, then the paired* P *values are not presented.*

asthma was well controlled compared with 74% and 88% in the REFERRED and CANVASSED groups, respectively. A small percentage of individuals in all 3 groups used a peak flow meter (10%-17%) or had a written asthma action plan (10% in the TARGETTED group, 14% in the REFERRED group, and 19% in the CANVASSED group). Among the endpoints with the lowest percentage of participants who did not know or used strategies, the greatest significant improvements were reported for participants in the TARGETED group for knowing their personal triggers (100%), knowing how to avoid triggers (100%), and using the peak flow meter (85%). In addition, in this group, all of the individuals who were not taking their controller medication every day were taking it every day at the revisit.

Self-reported short-term asthma morbidity outcomes are summarized in Table 4. At the initial visit, children in the TARGETED group reported an average of 6.2 days with worsening asthma or attacks in the previous 3 months, 5.8 missed days of school or day care in the 3 months leading up to the initial visit, and 1.0 missed days of work by another family member because of that child's asthma. The other groups had lower means than the TARGETED group. After the intervention, children in the TARGETED group had significantly lower means: 2.8 missed days with worsening asthma, 2.0 missed days of school or day care, and 0.4 missed days of work by another family member. Adults in the TARGETED group reported an average of 7.1 missed days with worsening asthma at the initial visit, which decreased to 4.3 missed days after the intervention. The mean number of missed days of school or work and missed days of work by another family member were negligible in all 3 groups.

As noted in the "Methods" section, data from 2 rural counties were excluded from the results presented to facilitate comparison between the urban-only TARGETED group and the other groups. Among data not shown, when the rural counties were included in the CANVASSED and REFERRED groups, the magnitude of the effects differed slightly but the statistical significance of the comparisons did not change.

Discussion

Within a short follow-up period, there were improvements in health and environmental outcomes for all 3 groups. Targeting the intervention to people with poorly controlled asthma appears to result in a greater magnitude of improvement for outcomes related to trigger avoidance and asthma morbidity, but other recruitment strategies may be more effective for impacting health care access and self-management. These findings are important, but not surprising. People who are sicker at the beginning of an intervention (ie, have more poorly controlled asthma) have a greater capacity to benefit and, as a result of their illness, may also be better connected to health care systems that provide and reinforce basic self-management strategies. In addition, people in the targeted group were referred specifically for the assessment of possible triggers in the home and thus may have been motivated to implement trigger-avoidance strategies. Conversely, door-to-door canvassing may be an important way to identify residents who are not yet connected to the health care system and equip them to maintain control of their asthma.

Generally speaking, our findings are consistent with previous studies in demonstrating reductions in the presence of asthma triggers, improvements in self-management outcomes, and reductions in asthma morbidity, even with a relatively low-intensity intervention provided by nonclinical staff.[6-32] They also confirm that targeting services to patients with more poorly controlled asthma has the potential to increase

TABLE 3
Prevalence of and Improvement in Self-management Strategies and Health Care Access Outcomes, by Recruitment Group

	TARGETED (140 Residents With Asthma)			REFERRED (573 Residents With Asthma)			CANVASSED (752 Residents With Asthma)		
		Revisit			Revisit			Revisit	
Outcomes	Initial Visit	Percent Improved[a]	95% CI	Initial Visit	Percent Improved[a]	95% CI	Initial Visit	Percent Improved[a]	95% CI
Self-reported knowledge									
Told smoking is bad	43.6%	100	99.4-100	79.1%	**11.2**	6-16.4	94.2%	42.2	26.7-57.8
Knows early warning signs	100%	0	0-0	96.5%	**81.5**	65.0-98.0	94.5%	**63.6**	48.3-79.0
Knows what to do for worsening asthma	100%	0	0-0	97.6%	**79.0**	58.0-99.9	96.1%	**77.4**	61.1-94.0
Knows personal triggers	19.3%	**100**	99.6-100	70.7%	**89.3**	85.1-93.6	88.2%	**38.7**	28.3-49.2
Knows how to avoid triggers	6.4%	**100**	99.6-100	68.7%	**88.0**	83.7-92.3	86.2%	**41.3**	31.6-51.0
Self-reported asthma control measures									
Feels asthma is well controlled	20.7%	**63.1**	53.6-72.5	73.5%	**65.7**	58.9-72.5	88.1%	**38.7**	28.3-49.2
Uses a peak flow meter	17.1%	**84.5**	77.5-91.5	13.2%	**24.4**	21.0-27.7	9.5%	**6.7**	4.7-8.6
Has a written asthma action plan	10.0%	2.4	0-5.4	13.9%	**7.8**	5.7-10.0	19.3%	**9.0**	6.6-11.3
Health care access and medication use									
Has PCP	100%	0	0-0	96.4%	**57.1**	37.0-77.3	97.3%	**50.0**	26.8-73.2
Has health insurance	100%	0	0-0	96.0%	38.7	20.0-57.5	96.0%	40.6	22.1-59.2
Has QR medication	98.6%	0	0-0	92.2%	31.7	19.1-44.3	90.9%	16.7	7.4-26.0
Took QR medications twice per week	17.5%	**21.2**	13.3-29.2	55.6%	**30.0**	24.7-35.3	65.1%	**25.3**	19.7-31.0
Has controller medication	72.7%	**23.7**	8.8-38.5	60.6%	9.5	6.1-13.0	61.9%	12.2	8.4-16.1
Took it every day	85.0%	**100**	96.7-100	80.2%	**40.2**	29.4-51.1	78.2%	21.4	12.8-30.1

Abbreviations: PCP, primary care provider; QR, quick-relief.
[a]*Bold values are significant at* $P < .05$.

TABLE 4
Short-term Asthma Morbidity Outcomes, by Recruitment Group and Age (Children and Adults)

	TARGETED (n = 140 Residents With Asthma; 67 Children, 73 Adults)			REFERRED (n = 573 Residents With Asthma; 281 Children, 292 Adults)			CANVASSED (n = 752 Residents With Asthma; 323 Children, 429 Adults)		
	Mean Number			Mean Number			Mean Number		
Age Group and Asthma Morbidity Outcome	Initial Visit	Revisit	Mean Change (95% CI)	Initial Visit	Revisit	Mean Change (95% CI)	Initial Visit	Revisit	Mean Change (95% CI)
Children with asthma									
Number of days in past 3 mo									
Experienced worsening asthma or asthma attacks	6.2	2.8	3.4 (2.1-4.7)	2.6	2.2	1.2 (0.4-2.0)	0.9	0.6	0.3 (0.1-0.6)
Missed school, day care, or work due to asthma	5.8	2.0	3.9 (2.5-5.2)	1.8	0.7	1.1 (0.7-1.5)	0.6	0.3	0.3 (0.1-0.5)
Another family member missed school, day care, or work due to asthma	1.0	0.4	0.6 (0.2-1.1)	0.3	1.9	-1.6 (−1.7 to −1.5)	0.3	0.2	0.1 (0.0-0.3)
Adults with asthma									
Number of days in past 3 mo									
Experienced worsening asthma or asthma attacks	7.1	4.3	2.8 (2.0-3.7)	4.0	2.8	1.2 (0.4-2.0)	1.3	0.9	0.3 (−0.01 to 0.7)
Missed school, day care, or work due to asthma	0.4	0.2	0.2 (−0.1 to 0.6)	0.3	0.1	0.2 (0.0-0.3)	0.4	0.3	0.1 (−0.2 to 0.5)
Another family member missed school, day care, or work due to asthma	0	0	0 (0-0)	0	0	0 (0.0-0.1)	0.1	0	0.1 (−0.1 to 0.3)

Abbreviation: CI, confidence interval.

the observed impact of the intervention and that homes generally have more than 1 asthma trigger or trigger-promoting condition. However, differences in program design among published studies complicate direct comparisons. For instance, differences in geography and population can impact the observed prevalence of environmental conditions, self-management strategies, and access to health care. Likewise, differences in staffing and intervention intensity are likely to impact the magnitude of improvement observed (eg, lower-intensity interventions may have more modest improvements in environmental outcomes, and interventions that do not use clinical staff to reinforce self-management messages during the visit may show less improvement there).

This article adds new information about the impact of the intervention on adults. While programs focused on pediatric asthma are much more prevalent, strategies that reduce asthma morbidity for adults are of potentially great importance to health care payers. Not only are there more adults with asthma but in NYS, where this program operates, adults also incur higher asthma-related medical costs, thereby increasing the potential for significant health care savings.[37]

Although the information regarding the impact on children is less novel, the impact on missed school days is notable. A reduction of up to 3.9 days per 3-month period could mean a reduction of up to 11.7 fewer days of missed school in a 9-month school year period. As asthma is a leading cause of school absenteeism, with associated consequences for educational outcomes and school budgets, this suggests that partnerships between the education and health care sectors to provide services to children with poorly controlled asthma may be of mutual benefit.

Finally, this article not only reinforces previous findings that improvements can be maximized by targeting the intervention to people with poorly controlled asthma but also highlights the role for other recruitment strategies.

Limitations

While this article adds to the evidence base about the impact of low-intensity, home-based, environmental asthma interventions, there are also a number of limitations. For instance, the short follow-up period prevents an examination of longer-term sustainability of observed improvements. On the contrary, the low-intensity approach and the short follow-up period are likely more relevant for government agencies designing approaches to reach a large number of residents with asthma.

The lack of a control group, and corresponding inability to attribute observed improvements to the intervention alone, is another limitation, but the inclusion of comparison groups illustrated the expected increase in improvements for patients with more poorly controlled asthma and provided critical insights about the potential for other recruitment strategies to affect health care access and self-management endpoints.

Another challenge in addressing environmental asthma triggers is that asthma is a complex and highly individualized disease. While information about patient sensitivities would be useful in further customizing the intervention, an insistence on allergen testing would increase costs and could pose barriers for patients who lack access to specialist care or are not motivated to undergo testing. Furthermore, some triggers are irritants, not allergens. There may be a benefit of allergen testing as a prerequisite for services, but this evaluation suggests that it is not required to achieve significant reductions in health outcomes.

Sources of potential bias for this analysis include which homes allow access, which are targeted for revisit, recall bias (reporting of exposure to triggers following an ED visit), social desirability bias (reluctance to report tobacco use), and reporting bias by the outreach worker evaluating his or her own work at the revisit. The impact of social desirability bias is mitigated somewhat by a reliance on visual assessment over self-report, and the impact of other potential bias is unknown.

Implications for Policy & Practice

- Although control of environmental factors is a critical component of guideline-based asthma care, many health care providers and systems struggle to address this aspect of asthma management in the traditional context of the clinical setting.
- This article reinforces previous findings that home-based environmental interventions are an effective means for reducing exposure to triggers in the home environment and reducing asthma morbidity among children and adults.
- By highlighting the impact across many different communities using a low-intensity approach, and taken with findings from the companion article about the relatively low cost and potential for return on investment, it also contributes to the evidence base that these solutions are practical and feasible, in addition to being effective.
- Health care payers, state and local departments of public health, and other organizations that provide services to communities with high rates of asthma morbidity should consider investing in these home-based services as part of a comprehensive asthma care package.

Conclusion

A low-intensity, home-based, environmental asthma intervention using nonclinical staff can decrease the presence of asthma triggers and improve asthma self-management and morbidity outcomes for both adults and children. Targeting the intervention to people with poorly controlled asthma may result in a greater magnitude of improvement for outcomes related to trigger avoidance and short-term asthma morbidity, but other recruitment strategies may be more effective for improving health care access and selected aspects of self-management. This evaluation, and others before it, offers a practical and cost-effective solution for increasing access to evidence-based asthma care by offering home-based environmental interventions as a complement to routine clinical care for patients with poorly controlled asthma.

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