

## Solutions for Asthma Disparities

Anna Volerman, MD,<sup>a,b</sup> Marshall H. Chin, MD, MPH,<sup>a</sup> Valerie G. Press, MD, MPH<sup>a,b</sup>

Childhood asthma prevalence has plateaued and may have declined for the first time since 1980.<sup>1</sup> Although this news is promising, it is important not to lose sight of the significant disparities in asthma outcomes that remain by race, ethnicity, and socioeconomic status. We must reduce these disparities, and health care organizations' increasing focus on population health presents a prime opportunity to do so. Now is a critical time to invest in research and quality improvement initiatives that directly target the persistent disparities in childhood asthma outcomes.

Disparities in asthma outcomes have been documented since the 1980s. Children of racial or ethnic minorities face higher morbidity and mortality due to asthma when compared with white children. Non-Hispanic African American children have 2 to 3 times higher rates of hospitalization and emergency department visits compared with non-Hispanic white children. African American children face a 4.9-fold higher asthma mortality rate. In addition, Hispanic children are 2 times more likely to visit an emergency department and 1.5 times more likely to die due to asthma when compared with non-Hispanic children.<sup>2</sup>

Numerous individual- and system-level factors contribute to asthma disparities, including health care policies, health systems operations, and clinician, patient, family, and environmental factors. For example, minority children are less likely to be prescribed a controller medication when indicated and are less likely to adhere to therapy that is prescribed. Additional factors driving disparities include clinic-centric care, indoor allergen exposure, limited primary care and subspecialty access, and poor health literacy.<sup>3</sup>

Disparities may persist due to the lack of a comprehensive approach for asthma care that is scalable, sustainable, and widely disseminated. Previous programs have provided written action plans for daily management, supplies for home environment remediation, and education to children with asthma and their families. Other initiatives have used case managers or asthma educators, or alternatively partnered with schools and housing authorities. Some efforts have shown positive results on a local level or in the short-term; however, no single program has demonstrated widespread and sustainable reductions in our nation's asthma disparities.<sup>4</sup>

Solutions must comprehensively address the medical, environmental, and social drivers of disparities, which is nearly impossible when



Departments of <sup>a</sup>Medicine, and <sup>b</sup>Pediatrics, University of Chicago, Chicago, Illinois

Dr Volerman conceptualized and drafted the initial manuscript and revised the manuscript; Drs Chin and Press conceptualized, reviewed, and revised the manuscript; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

**DOI:** 10.1542/peds.2016-2546

Accepted for publication Oct 31, 2016

Address correspondence to Anna Volerman, MD, Departments of Medicine and Pediatrics, University of Chicago, 5841 S Maryland Ave, MC 2007, Chicago, IL, 60637. E-mail: avolerman@uchicago.edu

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

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**FINANCIAL DISCLOSURE:** The authors have indicated they have no financial relationships relevant to this article to disclose.

**FUNDING:** Dr Volerman is supported by the National Center for Advancing Translational Sciences of the National Institutes of Health (KL2TR000431). Dr Chin is supported by the Chicago Center for Diabetes Translation Research (P30 DK092949), a National Institute of Diabetes and Digestive and Kidney Diseases Midcareer Investigator Award in Patient-Oriented Research (K24 DK071933), and the Robert Wood Johnson Foundation Finding Answers: Solving Disparities Through Payment and Delivery System Reform Program Office. Dr Press is supported by the National Heart, Lung, and Blood Institute (K23 HL118151). Funded by the National Institutes of Health (NIH).

**To cite:** Volerman A, Chin MH, Press VG. Solutions for Asthma Disparities. *Pediatrics*. 2017;139(3):e20162546

interventions are limited to the clinic or home alone. In addition, a one-size-fits-all approach to interventions is unlikely to be generalizable. Programs must be tailored to the unique characteristics of diverse populations and local environments. Lastly, few asthma interventions, other than education curricula, have been broadly disseminated. Interventions may be resource intensive, potentially prohibiting expansion.

Therefore, to impact disparities in asthma outcomes, research must investigate promising comprehensive and sustainable programs. Systematic reviews of the disparities literature indicate characteristics of successful interventions.<sup>4-6</sup> These interventions target 6 levels of influence, patient/family, provider, microsystem, organization, community, and policy, based on a conceptual model developed by Robert Wood Johnson Foundation's Finding Answers: Disparities Research for Change Program.<sup>5</sup> This model has effectively examined and designed interventions addressing disparities across adult and pediatric diseases. The model shows it is prudent to move beyond existing interventions that target 1 level to build multilevel, well-integrated programs reaching children across multiple settings. Examples of promising pediatric asthma interventions that reduce disparities and remaining research gaps are outlined in Table 1.

To address disparities in the health care sector, evidence-based guidelines detail essential elements that providers and health care organizations should deliver for high-quality asthma care. However, traditional 15-minute primary care visits do not enable these guidelines to be implemented, contributing to providers not

routinely adhering to guidelines.<sup>3</sup> Furthermore, population health management has gained popularity to reduce disparities partly because of its potential to influence health care organizations to address care delivery in the clinic and factors traversing home and school environments. Clinics should adopt streamlined workflows, well-functioning electronic health records, clinical decision support tools, and patient registries to assess asthma control, step-up/down therapy, and ensure appropriate follow-up and preventive care. Health care organizations must also confront health literacy about triggers, symptoms, and care access; medication adherence and proper inhaler technique; and bidirectional coordination with schools. Research and quality improvement efforts should focus on evaluating pragmatic systems for children with asthma to consistently receive high-quality care.

To link asthma care across clinical and nonclinical sectors, emerging work focuses on the multidisciplinary team to reduce disparities. Nonmedical professionals, such as community health workers, play an integral role in new models that engage patients, families, and care providers in the clinic, home, school, and community. Previous studies demonstrate the efficacy of tailored approaches with patients and families to identify needs and address risk factors by using education, home assessments, and community linkages. Many questions remain about how to do this within team-based, integrated programs. Who are key team members? What adaptations are needed for disease severity, risk factors, and local environments? How can social determinants best be addressed across settings? How can these programs be financed to support broad dissemination?

Funders play a critical role in enabling asthma disparities research. The National Institutes of Health disburses \$250 million annually for asthma research and recently funded planning phase projects for a clinical trial to evaluate Asthma Care Implementation Programs in diverse populations (Creating Asthma Empowerment Collaborations to Reduce Childhood Asthma Disparities and Asthma Empowerment Collaborations to Reduce Childhood Asthma Disparities). These programs aim to integrate proven interventions from multiple settings into a comprehensive program, thus adding to the limited knowledge base about multilevel programs. Additional promising aspects include a strong emphasis on reaching children where they are (home, school, and community), rather than only in the clinical setting.

The Patient-Centered Outcomes Research Institute is also bringing evidence into action to improve outcomes for minority children with asthma<sup>23</sup>. This institute uses a novel approach: involving stakeholders in all research aspects and focusing on patient-centered outcomes. Stakeholders are directly engaged in projects from beginning to end, providing an essential and often underrepresented voice to ensure interventions align with community needs and present pragmatic solutions. In addition, the measures of project success emphasize those that are important to patients and families, such as symptom-free days and quality of life, which are complementary to the traditional metrics of emergency department visits and hospital admissions.

Research funding is critical, and health care organizations and payers are also important drivers

**TABLE 1** Application of Disparities Framework to Pediatric Asthma With Successful Interventions and Persistent Gaps

Level of Influence and Definition	Examples of Interventions That Improve Outcomes				Ref.	Gaps and Opportunities for Future Evaluation
	Key Features of Intervention	Population	Outcomes (All Statistically Significant)			
Patient/family; change in knowledge and/or behavior of children and families	<ul style="list-style-type: none"> <li>• Patient education focused on self-management skills and fostered self-monitoring and self-care.</li> <li>• Education delivered via interactive web-based computer program with immediate feedback provided.</li> </ul>	<ul style="list-style-type: none"> <li>• ~75% African American</li> <li>• ~92% public insurance</li> <li>• Pediatric primary care clinic in Oakland, CA</li> </ul>	During 90-d follow-up: <ul style="list-style-type: none"> <li>• Decreased activity limitation.</li> <li>• Decreased peak flow readings in yellow / red zone.</li> <li>• Decreased urgent calls to health provider.</li> <li>• Increased medication adherence without reminders.</li> </ul>	7	<ul style="list-style-type: none"> <li>• What are the outcomes of care delivered via video or mobile technology?</li> <li>• How can technology-based education be accessible to a broader population and in the long-term?</li> <li>• How can education consistently be culturally tailored and skill based?</li> <li>• What is the necessary frequency of home visits to demonstrate improved outcomes?</li> </ul>	
	<ul style="list-style-type: none"> <li>• Family education about allergen exposures through repeated home visits (total 5–7).</li> <li>• Resources for allergen remediation provided.</li> <li>• Intervention tailored to each child’s triggers and risk factors.</li> </ul>	<ul style="list-style-type: none"> <li>• ~40% African American</li> <li>• ~40% Hispanic</li> <li>• 7 inner-city locations around United States</li> </ul>	During 2-y follow-up: <ul style="list-style-type: none"> <li>• Fewer symptoms and days with symptoms.</li> <li>• Reduction in missed school days.</li> <li>• Reduction in disruptions in caretakers’ plans.</li> <li>• Reduction in sleep lost by children and caretakers.</li> <li>• Fewer unscheduled visits to clinic or emergency department.</li> <li>• Greater reduction in allergen levels at home.</li> </ul>	8		
	<ul style="list-style-type: none"> <li>• Comprehensive education (medication management, environment control, ongoing care) individualized to patient/family.</li> <li>• Coordination with insurance case manager and school nurse, along with linkages to primary care.</li> <li>• Education delivered after emergency department visit, representing a “teachable moment.”</li> </ul>	<ul style="list-style-type: none"> <li>• ~86% African American</li> <li>• ~9.5% Hispanic</li> <li>• ~69% public insurance</li> <li>• Pediatric medical center emergency department in Washington, DC</li> </ul>	During 6-mo follow-up: <ul style="list-style-type: none"> <li>• Increased use of inhaler corticosteroids.</li> <li>• Fewer unscheduled visits (emergency department and clinic).</li> <li>• Fewer limitations in quality of life.</li> </ul>	9		
Provider; change in knowledge and/or behavior of providers	<ul style="list-style-type: none"> <li>• Provider education about guideline-based practice, along with patient teaching and communication.</li> <li>• 2 interactive seminars with cases and patient materials.</li> </ul>	<ul style="list-style-type: none"> <li>• Primary care pediatricians caring for low-income families (annual income &lt;\$20 000)</li> <li>• New York, NY and Ann Arbor, MI</li> </ul>	During 2-y follow-up: <ul style="list-style-type: none"> <li>• Children cared for by physicians in the intervention group were less likely to have emergency department visit or hospital admission.</li> </ul>	10	<ul style="list-style-type: none"> <li>• How can programs broadly support guideline-based practice among primary care providers?</li> <li>• What is the sustainability of changes in provider practices after education and training?</li> <li>• How do provider practices change when they receive regular report cards of care and outcomes based on patient race, ethnicity, and socioeconomic status?</li> <li>• What is the impact of provider training in cultural competency and motivational interviewing on patient care delivered?</li> </ul>	
	<ul style="list-style-type: none"> <li>• Guideline-based recommendations provided to clinician at visit based on previsit assessment of patient’s current symptoms and severity.</li> </ul>	<ul style="list-style-type: none"> <li>• Primary care pediatricians caring for minority, low-income children</li> <li>• 64.2% African American, 26.1% Hispanic</li> <li>• 75.2% Medicaid Rochester, NY</li> </ul>	During 2-mo follow-up: <ul style="list-style-type: none"> <li>• Patients of physicians in intervention group were 3 times more likely to receive preventive care related to asthma during visit.</li> </ul>	11		

**TABLE 1** Continued

Level of Influence and Definition	Examples of Interventions That Improve Outcomes				Ref.	Gaps and Opportunities for Future Evaluation
	Key Features of Intervention	Population	Outcomes (All Statistically Significant)			
Microsystem; team-based care with new members or responsibility modifications	<ul style="list-style-type: none"> <li>Ongoing case management for families provided by nurse to ensure adherence with monitoring/medications/ appointments and serve as a resource and counselor.</li> </ul>	<ul style="list-style-type: none"> <li>~70% African American or Hispanic</li> <li>Urban health centers of large health maintenance organization in New England</li> </ul>	During 2-y follow-up: <ul style="list-style-type: none"> <li>Reduction in emergency department visits, hospitalizations, and outside-of-health-plan use/spending.</li> <li>Cost-effective.</li> </ul>	12	<ul style="list-style-type: none"> <li>Who are the key care team members to foster and reinforce patient and family education?</li> <li>What is the necessary level of case management needed to impact outcomes and across which settings?</li> <li>How can team-based care be used on a large scale to impact outcomes, particularly for high-risk patients?</li> <li>How can team members who are added to the care team be sustainable within new care delivery models?</li> </ul>	
	<ul style="list-style-type: none"> <li>Community health workers made several home visits to conduct assessments and deliver interactive, tailored, culturally sensitive education to child/family.</li> <li>Community health workers recruited from targeted community to foster trust.</li> <li>Linkages made to primary care providers.</li> </ul>	<ul style="list-style-type: none"> <li>100% African-American</li> <li>96% Medicaid</li> <li>Chicago, IL</li> </ul>	During 1-y follow-up: <ul style="list-style-type: none"> <li>Reduced asthma symptoms.</li> <li>Decreased health resource use and activity-limited days.</li> <li>Improved caregiver quality of life, knowledge, self-efficacy.</li> <li>Cost-savings.</li> </ul>	13		
Health care organization; change in clinical or organizational operations to enhance care delivery	<ul style="list-style-type: none"> <li>Children received asthma care in a specialty asthma clinic, as compared with usual primary care.</li> <li>Specialty clinic provided guideline-based care using team approach over several visits, including intensive education, frequent follow-up, provider availability 24/7, allergen identification, and exposure reduction.</li> </ul>	<ul style="list-style-type: none"> <li>Community is predominantly Hispanic and African American (total 95%), low-income (72% below federal poverty level)</li> <li>Harlem and Bronx, NY</li> </ul>	During 2-y follow-up: <ul style="list-style-type: none"> <li>Fewer emergency department visits and hospital admissions (despite higher asthma severity index).</li> <li>Cost-effective.</li> </ul>	14	<ul style="list-style-type: none"> <li>How can clinical and medical operations be optimized to support the appropriate balance of primary and subspecialty care?</li> <li>What delivery models can facilitate guideline-based care, particularly in communities with limited access to care?</li> <li>How can technology and electronic medical records support guideline-based care in clinics on a large-scale?</li> <li>How can effective clinical decision-support tools be disseminated broadly within electronic health records and consistently used within clinical workflows?</li> </ul>	
	<ul style="list-style-type: none"> <li>Clinical decision support alerts and reminders presented in workflow to guide clinicians to asthma management tools in electronic health record.</li> <li>Alerts provided guideline-based and patient-specific guidance (personalized for each patient based on symptoms, diagnosis, and medications).</li> </ul>	<ul style="list-style-type: none"> <li>80+% African American</li> <li>~70% Medicaid</li> <li>4 urban practices in Children's Hospital of Philadelphia Pediatric Research Consortium</li> </ul>	During 1-y follow-up: <ul style="list-style-type: none"> <li>Increased controller medications prescribed and spirometry performed.</li> </ul>	15		

**TABLE 1** Continued

Level of Influence and Definition	Examples of Interventions That Improve Outcomes				Ref.	Gaps and Opportunities for Future Evaluation
	Key Features of Intervention	Population	Outcomes (All Statistically Significant)			
Community; partner with individuals and organizations outside of health care setting	<ul style="list-style-type: none"> <li>Supervision of daily controller medication administration in school.</li> <li>Intervention fostered medication adherence and developed consistent habits among children.</li> <li>Medications provided to children.</li> </ul>	<ul style="list-style-type: none"> <li>91% African American</li> <li>36 schools in Alabama</li> </ul>	<p>During 15-mo follow-up, intervention group had:</p> <ul style="list-style-type: none"> <li>Greater improvement in asthma control (based on missed school days, increased quick-relief inhaler use, or peak flow readings).</li> </ul>	16	<ul style="list-style-type: none"> <li>How can schools effectively and consistently facilitate care that aligns with guidelines and school policies?</li> <li>How can health care teams and schools successfully coordinate care together in light of limited resources and budgets?</li> <li>How can schools simplify the documentation and processes required to identify children with asthma and provide acute and preventive care?</li> <li>How can public housing be broadly designed and redeveloped to optimize environment and minimize triggers?</li> <li>How can social determinants contributing to asthma disparities be addressed by integrating health and non-health sector assets?</li> </ul>	
	<ul style="list-style-type: none"> <li>Public housing redevelopment with homes constructed to reduce moisture, enhance ventilation systems, minimize dust and off-gassing.</li> <li>Home reconstruction remediated and reduced triggers.</li> <li>Tenants required to have no smoking or pets in home.</li> <li>Home-based education for both intervention and control group.</li> </ul>	<ul style="list-style-type: none"> <li>Housing development with 29% African or African American, 29% Asian/Pacific Islander</li> <li>85% low income</li> <li>Seattle, WA</li> </ul>	<p>During 1-y follow-up:</p> <ul style="list-style-type: none"> <li>Improvement in night-time symptoms and reduced triggers score (compared with control group).</li> <li>Improvement in symptom-free days, caretakers' quality of life, urgent clinic care, asthma control, activity-limited days, rescue medication used days, night-time symptoms, asthma attacks (pre/post-new home).</li> <li>Reduced mold, rodents, moisture exposure and reduced trigger score (pre/post new home).</li> </ul>	17		
Policy; laws and regulations adopted locally, regionally, and nationally	<ul style="list-style-type: none"> <li>Enrollment of uninsured children into state health insurance program.</li> <li>Insurance enrollment fostered usual source of care, medication attainment and compliance, and education.</li> </ul>	<ul style="list-style-type: none"> <li>Children enrolled in health insurance included 26% African American, 49.1% Hispanic</li> <li>New York state</li> </ul>	<p>During 1-y follow-up:</p> <ul style="list-style-type: none"> <li>Improved access to care.</li> <li>Fewer asthma-related attacks and medical visits.</li> <li>Improved quality of care.</li> <li>Improved quality of care and disease severity reported by parents.</li> </ul>	18	<ul style="list-style-type: none"> <li>How can insurance companies support broad access to care and medications to optimize outcomes?</li> <li>How do changes in reimbursement regulations impact care delivery across clinical and nonclinical settings?</li> <li>How can local, regional, and national laws and regulations support population level changes to improve the environment and decrease triggers?</li> <li>How do smoke-free laws impact highest-risk children with asthma, including high severity and minority populations?</li> <li>What financial and nonfinancial incentives can reduce disparities in asthma?</li> </ul>	
	<ul style="list-style-type: none"> <li>Smoking-free legislation adopted in enclosed public place and workplaces countrywide.</li> <li>Laws led to decreased exposure of children to secondhand smoke.</li> </ul>	<ul style="list-style-type: none"> <li>England</li> </ul>	<p>During 3-y follow-up:</p> <ul style="list-style-type: none"> <li>Hospital admission rates reduced for children with asthma across different ages, sex, socioeconomic status, and geography.</li> </ul>	19		

**TABLE 1** Continued

Level of Influence and Definition	Examples of Interventions That Improve Outcomes				
	Key Features of Intervention	Population	Outcomes (All Statistically Significant)	Ref.	Gaps and Opportunities for Future Evaluation
Multiple: patient/family + microsystem + community	<ul style="list-style-type: none"> <li>Asthma outreach worker coordinated care across medical, home, and community.</li> <li>Multidisciplinary asthma clinic visits (pediatrician, pharmacist, public health nurse).</li> <li>Home-based assessments and tailored asthma care plans.</li> <li>Coordination with schools and housing authority to carry out care plan.</li> <li>Asthma education for parents.</li> </ul>	<ul style="list-style-type: none"> <li>Asthma clinic in Seattle, WA</li> </ul>	During 9-mo follow-up: <ul style="list-style-type: none"> <li>Reduced emergency department visits and scheduled clinic visits.</li> </ul>	20	<ul style="list-style-type: none"> <li>What are the key components of multilevel interventions and how are they best integrated to impact outcomes?</li> <li>How can successful multilevel interventions be efficiently adapted to local communities and populations?</li> <li>How can multilevel interventions be modified to deliver care based on the disease severity and risk factors of the child and family and achieve improved outcomes for the population?</li> <li>Who are the key team members to achieve linkage across clinical and nonclinical settings at the highest value?</li> <li>How can research, government, and foundation funding support the study of multi-level interventions to determine how to achieve best outcomes in a cost-effective manner?</li> <li>How can new care delivery models and insurance reimbursement effectively support the implementation and dissemination of multi-level programs with improved outcomes?</li> </ul>
Multiple: patient/family + provider + microsystem + organization + community	<ul style="list-style-type: none"> <li>Continuous quality improvement process by multidisciplinary clinic-based team, including community health worker at clinic.</li> <li>Care process changes tailored to each clinic; examples: visit flow sheets introduction, asthma care plan use, pocket guide development, provider/staff training in guidelines, links with school and community.</li> <li>Community health worker linked medical team with home, school, community settings by providing patient/family education, making home visits for environmental assessments, and referring to community resources.</li> </ul>	<ul style="list-style-type: none"> <li>80+% African American or Hispanic</li> <li>7 community clinics in southern California</li> </ul>	During 2-y follow-up: <ul style="list-style-type: none"> <li>Clinics had improved documentation of asthma severity, review of action plans, health care use, and asthma symptoms.</li> <li>Patients had fewer acute care visits, emergency department visits, hospitalizations, daytime/nighttime symptoms, missed school days.</li> <li>More parents reported excellent/very good quality of care and confidence in self-management.</li> </ul>	21	<ul style="list-style-type: none"> <li>Who are the key team members to achieve linkage across clinical and nonclinical settings at the highest value?</li> <li>How can research, government, and foundation funding support the study of multi-level interventions to determine how to achieve best outcomes in a cost-effective manner?</li> <li>How can new care delivery models and insurance reimbursement effectively support the implementation and dissemination of multi-level programs with improved outcomes?</li> </ul>
Multiple: patient/family + microsystem + organization + community	<ul style="list-style-type: none"> <li>Nurse case management and care coordination with primary care and subspecialists.</li> <li>Nurse or community health worker made home visits for assessments and education.</li> <li>Home environment assessments and remediation, including materials.</li> <li>Culturally and linguistically competent asthma education, tailored to family's needs and health literacy. Referrals to community services.</li> </ul>	<ul style="list-style-type: none"> <li>39.6% African American, 52.3% Latino</li> <li>72.7% Medicaid</li> <li>4 urban zip codes in Boston, MA</li> </ul>	During 12-mo follow-up: <ul style="list-style-type: none"> <li>Decreased emergency department visits and hospitalizations.</li> <li>Decreased days of physical activity limitation, missed school, and parent missed work.</li> <li>Cost-effective.</li> </ul>	22	<ul style="list-style-type: none"> <li>Who are the key team members to achieve linkage across clinical and nonclinical settings at the highest value?</li> <li>How can research, government, and foundation funding support the study of multi-level interventions to determine how to achieve best outcomes in a cost-effective manner?</li> <li>How can new care delivery models and insurance reimbursement effectively support the implementation and dissemination of multi-level programs with improved outcomes?</li> </ul>

of the work to reduce disparities. With evolving care delivery and financial systems, health care organizations are increasingly facing global and bundled payments, thus incentivizing them to develop population health management strategies and form partnerships across clinical and nonclinical areas to address the social factors within asthma care. Demonstration projects can build on existing quality improvement

efforts to test care transformation models that bridge clinical and community settings. One caveat is that wide-scale payment policies may not affect all systems equally and care must be taken to avoid widening disparities if financial penalties are on the line. In fact, payment systems should be proactively designed to incentivize and reward the reduction of disparities.<sup>24</sup> As we celebrate the stabilization of childhood asthma prevalence,

we must not lose sight of the ongoing disparities in morbidity and mortality based on race, ethnicity, and socioeconomic status. Catalyzed by changes in health care payment and delivery, clinicians, researchers, health care organizations, and insurers are in a prime position to partner with those beyond the walls of the hospitals and clinics to reach children with asthma where they live, learn, and play.



**POTENTIAL CONFLICT OF INTEREST:** The authors have indicated they have no potential conflicts of interest to disclose.

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